

Prepared by:

SIEMENS

Siemens Industry, Inc.
Process Industry & Drives, Solutions, Houston, TX, USA

Prepared for:



Project Information:

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HI7008

Project Title:

TransCanada Keystone XL (KXL) Pipeline

Document Title:

**HV Transformer RFS-ITP Reporting
-PS06 - Fox Valley**

SIEMENS	
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1. Scope and Recommendations

The scope of this document is to present the findings and test data associated with the execution of the HV transformer RFS-ITP (Ready for Shipment – Inspection and Test Plan), associated with document SEI-KXL-TXF-0335-RFSITP.

2. Addendum-A: PS06-Fox Valley HV Transformer Test Results

See attached report from Shermco (248 pages) “20-S226-15” for the PS06-Fox Valley HV Transformer testing results.



Regina Service Center

1033 Kearns Cres., RM of Sherwood, SK S4K 0A2
p. (306) 949-8131 www.shermco.ca

Siemens Energy Inc
HV Transformer ITP (Items 1.0 & 2.0)
Execution Canada
Fox Valley Transformer - Rev 0
Regina, SK
Sept 10, 2020
Shermco Project No. 20-S226-15



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REVISION NOTES

Revision	Date	Description	Originator
0	September 10 th / 2020	Issued for Review	BT

DISTRIBUTION LIST

Name	Company	Title	Phone	Location
Tyson Hahn	Shermco	Key Account Manager	(306) 949-8131	Regina, SK
Brent Meier	Shermco	Technical Representative	(306) 949-8131	Regina, SK
Drake Greschner	Shermco	Field Service Technician	(306) 949-8131	Regina, SK
Brad Temple	Shermco	Electrical Engineer, EIT	(306) 949-8131	Regina, SK
Robert Ellis	Siemens Energy Canada Ltd	Project Manager, P.Eng	(289) 681-5411	Oakville, ON
Brad Wojcik	Siemens Energy Inc	Principal Engineer	(281) 795-3032	Houston, TX
Zubeyde Hodzhaoglu	Siemens Energy Inc	Project Procurment Manager	(281) 455-8468	Houston, TX



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Sept 10th, 2020

Siemens Energy Canada Inc
1577 North Service Road East
Oakville, ON L6H 0H6
Canada

Subject: HV Transformer ITP Execution – Fox Valley (Items #1 & #2)

Attention: Mr. Robert Ellis

Dear Mr. Robert Ellis:

The services of Shermco Industries were commissioned to execute the approved ITP (Rev 4) for Item #1 (Physical/Mechanical Inspection of Assembled Transformer) and Item #2 (Electrical Testing) for the Fox Valley HV Transformer. This report highlights specific details found during the execution of the ITP and shows the completion of each item.

- ITP filled out and commented
- Inspection photos
- Electrical test sheets
- Test equipment calibration certificates

We would like to take this opportunity to thank you for using the services of Shermco Industries. If you require any additional information, please contact our office at your convenience.

Sincerely,

Shermco Industries
Regina Service Center



Brad Temple
EIT | Electrical Engineer

Physical/Mechanical Inspection

The transformer underwent an inspection as per the activities outlined in item 1.0 in the inspection and test plan (HV XFMR RFS-ITP Process 1: Physical/Mechanical Inspection of Assembled Transformer).

The following is a list of deficiencies found during the inspection of the transformer,

- 1) LTC / Main Tank both missing PRD flags (Or broken). A flag was found inside the control cabinet.
- 2) Rusted bolt missing for nameplate.
- 3) Minor oil leak on HV bushing flanges.
- 4) Significant oil leaks on LV Bushing flanges, leaking into secondary cabinet and running down main tank.
- 5) LTC compartment leaking around the base, likely from the fill port on bottom of cabinet.
- 6) All around bottom of transformers there are signs of oil leaks. Likely from manhole / oil fill covers.
- 7) Radiators valves show minor oil leaks.
- 8) Paint chipping away throughout transformer, rust present where paint is worn off.
- 9) Transformer is leaking to atmosphere, does not hold pressure.
- 10) Silica gel on LTC is spent.
- 11) HV Cap Tap gaskets are deteriorated.
- 12) No transformer equipment ID tag (126-FXVLY-B0-T-01) anywhere on transformer.
- 13) LTC oil temperature gauge does not have setpoints set. Drag hand is installed on wrong side of temperature needle.

The transformer components and compartments were cleaned as outlined in the ITP.

Oil samples were taken and analyzed for the transformer and load tap changers. Lab tests determined that the oil is in good condition for both and can be used for routine operations.

Electrical Testing

The transformer was subjected to the electrical tests outlined in item 2.0 in the inspection and test plan (HV XFMR RFS-ITP Process 2: Electrical Testing).

A summary of electrical testing performed is as follows,

- 1) Insulation-resistance tests
- 2) Core insulation test
- 3) Power-factor/dissipation-factor tests on windings
- 4) Power-factor/dissipation-factor tests on bushings
- 5) Winding resistance testing on HV & LV windings
- 6) Turns-ratio test/verification on all tap positions
- 7) Excitation current tests
- 8) Sweep Frequency Response Analysis (SFRA) testing
- 9) Insulation-resistance tests on each surge arrester
- 10) Current transformer testing
 - a. Excitation test
 - b. Ratio test
 - c. Winding resistance

Test data was recorded with automatically generated datasheets or entered manually into standard Shermco test sheets. All test data has been appended to this report.



Conclusion

The results from executing the the ITP determine that the transformer for Fox Valley (126-FXVLY-B0-T-01) is not mechanically fit for service. There were thirteen (13) deficiencies found while executing Item 1.0 of the ITP.

Most significant of the deficiencies are the oil leaks found from,

- LV bushing flanges
- HV bushing flanges
- Radiator valves
- LTC compartment base (potentially from the fill port at the bottom of the cabinet)
- Around the base of the transformer (potentially from the manhole and oil-fill covers)
- Unable to hold pressure

Oil leaks in transformers are commonly caused by deteriorated gaskets & seals. It is recommended that the gaskets, seals, fill-ports, and covers in the referenced areas be evaluated and replaced/repared.

The electrical testing reported good results which conform to the acceptance criteria outlined in the ITP. The transformer is electrically fit for service.

Remediation of the transformer is recommended as it is not ready to be placed into service in its present state.



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Appendix A: Inspection & Test Plan

Prepared By: _____

Prepared for: _____



Project Information:

Project Reference:

20-S226-11

Project Title:

TC Energy Keystone XL (KXL) Pipeline

Document Title:

**High Voltage Transformer (HV XFMR)
Ready for Service – Inspection & Test Plan (RFS-ITP)**

FOX Valley: 126-FXVLY-A0-T-0

4	2April2020	Revised as per TC's comments	BT	DD	TH
3	24Feb2020	Revised as per TC's comments	BT	DD	TH
2	11Feb2020	Revised & remade by Stermco	BT	DD	TH
1	1Aug2018	Revised as per TC's comments	DD	BW	HA
0	1May2018	First Issue	BW	JM	HA
Rev	Date	Description	By	Checked	Approved
Division Stermco Engineering - Regina		Orig. Author/Department Brad Temple / Engineering	Project/Bid No. 20-S226-11		
Document Title High Voltage Transformer (HV XFMR)– Ready for Service – Inspection & Test Plan (RFS-ITP)			Document No. SEI-KXL-TXF-0335-RFSITP		Rev 4

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1. Recommendations and Scope

Due to the amount of time that the High Voltage Transformers have been sitting in storage, Siemens is wanting to hand the equipment over as trouble free as possible to TC-Energy's pre-commissioning team. The following document details the recommended "Ready for Service – Inspection & Test Plan" (RFS-ITP) that Siemens would execute at the storage facility prior to handing the equipment over to TC-Energy's pre-commissioning team. Another component of this document is to detail the preparation process for shipping and receiving the equipment.

Details of each of the processes and procedures can be found within Section-4 "HV XFMR Inspection and Test Plan Matrix". The High Voltage Transformers are not permitted to be placed into service until all "Acceptance Criteria" is met in Section-4.

This ITP document is for the three transformers stored in Canada (see section 3). However, the one stored in Soloman Kansas will follow a similar procedure.

2. Definitions

Definitions defined within the Inspection and Test Plan Matrix on the following pages:

Test Definitions:

CWT	Customer Witness Test	(Specific testing process completed with customer present)
FAT	Factory Acceptance Test	(Internal testing performed by the individual equipment supplier at their factories)
SAT	Site/Storage Acceptance Test	(Specific testing process completed at the site or storage facility)

Status Point Definitions:

H	Hold Point	(Inspection or testing point required)
R	Review Point	(Review of record/certificate only)
S	Surveillance Point	(Random attendance, no signature required)
W	Witness Point	(Attendance expected & signature to proceed only if in attendance)

3. List of Applicable Stations

Table-1 below shows the applicable stations that contain TC owned High Voltage Transformers (along with the quantity of motors/pumps used at that station) along with any status comments.

TABLE-1

#	Station Name	Station Country	Station Province/State	Number of Motors/Pumps (after expan.)	Comments/Station Status
1	PS-1 Hardisty B (for EES-10)	Canada	Alberta	3	No substation equipment at this site, no TXF RFS-ITP
2	PS-1 Hardisty B (for EES-11)	Canada	Alberta	3	No substation equipment at this site, no TXF RFS-ITP
3	PS-2 Lakesend East	Canada	Alberta	5	No substation equipment at this site, no TXF RFS-ITP
4	PS-3 Monitor South	Canada	Alberta	5	No substation equipment at this site, no TXF RFS-ITP
5	PS-4 Oyen South	Canada	Alberta	4	No substation equipment at this site, no TXF RFS-ITP
6	PS-5 Blindoss South	Canada	Alberta	5	No substation equipment at this site, no TXF RFS-ITP
7	PS-6 Fox Valley	Canada	Saskatchewan	5	Shermco – Regina Service Center, Regina, SK
8	PS-7 Piapot	Canada	Saskatchewan	5	Shermco – Regina Service Center, Regina, SK
9	PS-8 Grassy Creek	Canada	Saskatchewan	5	Shermco – Regina Service Center, Regina, SK
10	PS-9 Phillips	United States	Montana	5	No substation equipment at this site, no TXF RFS-ITP
11	PS-10 Valley	United States	Montana	5	No substation equipment at this site, no TXF RFS-ITP
12	PS-11 Fort Peck	United States	Montana	5	No substation equipment at this site, no TXF RFS-ITP
13	PS-12 Circle	United States	Montana	5	No substation equipment at this site, no TXF RFS-ITP
14	PS-13 Prairie	United States	Montana	4	No substation equipment at this site, no TXF RFS-ITP
15	PS-14 Fallon	United States	Montana	5	No substation equipment at this site, no TXF RFS-ITP
16	PS-15 Harding	United States	South Dakota	5	No substation equipment at this site, no TXF RFS-ITP
17	PS-16 Buffalo	United States	South Dakota	4	No substation equipment at this site, no TXF RFS-ITP
18	PS-17 Faith	United States	South Dakota	5	No substation equipment at this site, no TXF RFS-ITP
19	PS-18 Haakon	United States	South Dakota	4	No substation equipment at this site, no TXF RFS-ITP
20	PS-19 Murdo	United States	South Dakota	5	No substation equipment at this site, no TXF RFS-ITP
21	PS-20 Winner	United States	South Dakota	5	No substation equipment at this site, no TXF RFS-ITP
22	PS-21 Colome	United States	South Dakota	5	No substation equipment at this site, no TXF RFS-ITP
23	PS-22R O'Neill (orig Atkinson)	United States	Nebraska	5	No substation equipment at this site, no TXF RFS-ITP
24	PS-23R Oakdale (orig Ericsson)	United States	Nebraska	5	No substation equipment at this site, no TXF RFS-ITP
25	PS-23B Leigh	United States	Nebraska	3	No substation equipment at this site, no TXF RFS-ITP
26	PS-24 Bellwood (orig Central City)	United States	Nebraska	5	No substation equipment at this site, no TXF RFS-ITP
27	PS-25 Milford (orig Exter)	United States	Nebraska	5	No substation equipment at this site, no TXF RFS-ITP
28	PS-26 Steele City B	United States	Nebraska	5	No substation equipment at this site, no TXF RFS-ITP
29	PS-27 Riley	United States	Kansas	4	No substation equipment at this site, no TXF RFS-ITP
30	PS-29 Burns	United States	Kansas	4	Solomon, KS
31	PS-32 Cushing South	United States	Oklahoma	4	No substation equipment at this site, no TXF RFS-ITP
32	PS-33 Cromwell	United States	Oklahoma	4	No substation equipment at this site, no TXF RFS-ITP
33	PS-34 Tupelo	United States	Oklahoma	4	No substation equipment at this site, no TXF RFS-ITP
34	PS-35 Bryan	United States	Oklahoma	4	No substation equipment at this site, no TXF RFS-ITP
35	PS-36 Delta	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP
36	PS-37 Winnsboro	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP
37	PS-38 Lake Tyler	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP
38	PS-39 Lufkin	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP
39	PS-40 Corrigan	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP
40	PS-41 Liberty	United States	Texas	4	No substation equipment at this site, no TXF RFS-ITP

4. HV XFMR Inspection and Test Plan Matrix

Project Information:		Siemens Representative Sign-off:		Customer Representative Sign-off:	
Project Name:	HV Transformer ITP (1.0-2.0) Execution	Name:		Name:	
Project #:	20-S226-15	Title:		Title:	
Customer Project #:		Date:		Date:	
Pump Sta. #/Name:	Fox Valley (PS 06)	Signature:		Signature:	
TXF Tag # & Serial #:	126-FXVLY-AD-T-0				

Legend (for "Type" and "Verification Point")																
Test Type:		CWT=Customer Witness Point			SAT=Storage Acceptance Test			FAT=Factory Acceptance Test			(See section 2.0 of this document for description details)					
Verification Point:		H=Hold Point			R=Review Point			S=Surveillance Point			W=Witness Point					
											(See section 2.0 of this document for description details)					
Item #	Verification/Test Activity	Type			Acceptance Criteria							Verify Point				
		SAT	FAT	CWT	Requirement	Acceptance/NA/Comment							Siemens	Customer	Cust 3 rd	Factory
						"☑" Indicates complete and accepted "NA" indicates not applicable Comments struck through (ex. Comment) indicates a comment that has been resolved										
	TC Energy Keystone XL Project – High Voltage Transformer RFS-ITP Processes															
1.0	HV XFMR RFS-ITP Process 1: Physical/Mechanical Inspection of Assembled Transformer (Executed at storage facility prior to disassembly)															
1.1	Compare equipment nameplate with drawing/specification.	X			Verify that the information on the nameplate matches what is required from the specification.	No equipment tag							H	RS		
1.2	Look for any indication that Polychlorinated Biphenyls (PCBs) are present.	X			If any PCBs are present, ensure that there is appropriate labeling and signage to warn anyone working on or nearby the transformer.	✓							H	RS		
1.3	Inspect physical and mechanical condition (general inspection of transformer) - Primary/Secondary termination points - Lifting lugs - Location - Adequacy of painted components - Junction boxes, panel(s), cabinet(s), & compartments - Anchorage, alignment, and grounding	X			Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review.	Lifting lugs need to be inspected by an engineering specialist to ensure that they are capable to be lifted by a crane. ✓							H	RS		
1.4	Check the oil level and pressure indicators/gauges.	X			Determine whether the tank oil level and pressure are adequate to proceed with any electrical testing or operations.	If levels are inadequate, an oil fill processing procedure will need to be conducted. ✓							H	RS		
1.5	Thoroughly scan the entire transformer for any oil & liquid leaking out of the transformer.	X			Verify that the transformer is not leaking anywhere, and liquid levels and pressure can be maintained. Verify that oil level & pressure are capable of being maintained.	Seals and gaskets may need to be repaired if oil level and pressure cannot be maintained. If so stop this procedure and determine the best course of action to repair/salvage the transformer.							H	RS		

1.6	Take an oil sample and test for, - Dielectric Breakdown voltage - Acid neutralization - Interfacial tension - Color - Visual condition - Water in insulating liquids all in accordance with the appropriate ASTM D method/practice.	X		Verify that the oil inside the transformer is in accordance with the appropriate ASTM D method/practice. See ANSI/NETA ATS Table 100.4 for satisfactory test values.	May need to conduct an oil fill processing procedure. ✓ If monthly inspections & testing (during storage) can confirm that the oil inside the transformer meets the acceptance criteria there is no need to take an oil sample.	H	RS		
1.7	If the oil sample testing passes, continue with the procedure. If the oil sample testing failed, conduct an approved oil fill processing procedure to fill the transformer. Before starting, - Check that all valves are in the proper position - Check that all bushings and flanges are tight - If any covers have been removed reattach them and ensure the transformer is sealed - Proceed with an approved oil fill procedure	X		Confirm that the transformer is filled with oil that has passed testing for, - Dielectric Breakdown voltage - Acid neutralization - Interfacial tension - Color - Visual condition - Water in insulating liquids And is in accordance with the appropriate ASTM D method/practice. See ANSI/NETA ATS Table 100.4 for satisfactory test values. If oil fill processing was performed, ensure transformer is not leaking. Ensure oil level & pressure are capable of being maintained.	Seals and gaskets may need to be repaired if oil level and pressure cannot be maintained. If so stop this procedure and determine the best course of action to repair/salvage the transformer. XFMR Leaking atmosphere. Does not hold pressure.	H	RS		
1.8	Inspect radiators. - Noticeable damage - Condition of fins - Condition of lifting lugs - Seismic bracing	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review.	Valves show minor leak	H	RS		
1.9	Inspect cooling fans - Noticeable damage - Condition of fan blades	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review.	Power and control wiring shall be connected to fans when the radiators are on the transformer. ✓	H	RS		
1.10	Inspect, and clean the High Voltage Bushings. - Damage - Cracks - Condition of lifting lugs - Use a suitable cleaner or an alcohol-soaked swab to wipe - Wax the bushing after with collinite wax - Contacts or any current carrying surfaces should be cleaned with an abrasive cloth or fine Scotch-Brite product in combination with an approved contact cleaner and contact lubricator. - Use mobilgrease 28 if no recommended contact lubricant is specified.	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review. Verify that the bushing is clean and waxed.	If any part of the bushing is cracked or damaged, the bushing will need to be replaced. ✓ Minor oil leak from flanges	H	RS		
1.11	Check the internal oil levels of each High Voltage Bushing.	X		Validate that the oil level is adequate.	Bushing might need to be replaced if unable to be refilled (reimpregnation). ✓	H	RS		

1.12	Inspect, and clean the Low Voltage Bushings. • Damage • Cracks • Condition of termination pads • Use a suitable cleaner or an alcohol-soaked swab to wipe • Wax the bushing after with collinite wax • Contacts or any current carrying surfaces should be cleaned with an abrasive cloth or fine Scotch-Brite product in combination with an approved contact cleaner and contact lubricator.	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review. Verify that the bushing is clean and waxed.	If any part of the bushing is cracked or damaged, the bushing will need to be replaced. <i>Oil leaks on bushing flange</i>	H	RS		
1.13	Unpack, inspect, and clean the Surge Arrestors. • Damage • Cracks • Perform general cleaning • Wipe off dust Perform an insulation-resistance test on each Surge Arrestor.	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review. Ensure that any required lifting devices are accessible and accounted for. Refer to ANSI/NETA ATS Table 100.1 for insulation-resistance test voltages and minimum insulation resistance value. Repackage after inspection, testing, and cleaning.	Damaged surge arrestors will need to be replaced. <i>If the surge arrestor does not meet the minimum insulation-resistance value it will need to be replaced. watts less testing verified fit for use.</i>	H	RS		
1.14	Clean the transformer • Vacuum and wipe all enclosures & cabinets. • Wipe (dry rag) all insulation surfaces. Use of denatured alcohol is permitted if dry rag cannot clean insulation surfaces. • Contacts or any current carrying surfaces should be cleaned with an abrasive cloth or fine Scotch-Brite product in combination with an approved contact cleaner and contact lubricator. • Use mobilgrease 28 if no recommended contact lubricant is specified.	X		Validate the unit is clean • No unnecessary debris • No buildup of dirt, soil, sand, or soot is allowed inside the mechanism box or any of the enclosures & cabinets • Contact points are lubricated	Do not use any solvents that may leave residue afterwards. This step can be done at any point of the procedure in Section 1.0	H	RS		
1.15	Inspect and investigate the alarm, control, & trip functions. • Pressure/Vacuum gauge • Rapid pressure rise relay • Large pressure relief device • Oil level indicators/gauges • Oil & Winding temperature indicators	X		Confirm that all specified alarm, control, & trip functions exist and that the applicable devices are installed in the appropriate location. Verify alarm, control, and trip functions and indicators are as specified.	<i>✓</i>	H	RS		
1.16	Test the operations of alarm, control, and trip circuits. • Pressure/Vacuum gauge • Rapid pressure rise relay • Large pressure relief device • Oil level indicators • Oil & Winding temperature indicators	X		Verify that the operations of alarm, control, and trip settings are working within manufacturer's recommendations.	<i>✓</i>	H	RS		

1.17	Perform Operational testing - Fans - Breathers (silica gel or drycol) - Temperature gauges (oil & winding) - Gas actuated relays	X		Verify that each item operates correctly and has adequate overcurrent protection (if applicable).		H	RS		
1.18	Compare Load Tap-Changer equipment nameplate with drawing/specification.	X		Verify that the information on the nameplate matches what is required from the specification.	Include both High Voltage and Load Side load tap changers. 	H	RS		
1.19	Inspect physical and mechanical condition of the tap changer. - Condition of the enclosure - Overall condition of visible components - Moving parts have adequate lubrication - Anchorage, alignment, and grounding	X		Validate no physical abnormalities exist. Where abnormalities are identified, photos shall be taken for record and engineering review.	Include both High Voltage and Load Side load tap changers. 	H	RS		
1.20	Clean the LTC enclosure - Vacuum - Wipe (dry rag) all insulation surfaces. Use of denatured alcohol is permitted if dry rag cannot clean insulation surfaces. - Adequately lubricate moving parts if required	X		Validate the unit is clean - No unnecessary debris - No buildup of dirt, soil, sand, or soot is allowed inside the mechanism box or any of the enclosures & cabinets	Do not use any solvents that may leave residue afterwards.  This step can be done at any point of the procedure in Section 1.0 Include both High Voltage and Load Side load tap changers.	H	RS		
1.21	Record the "as-found" operation counter reading.	X		Write down the counter reading.	Include both High Voltage and Load Side load tap changers. 	H	RS		
1.22	Check the Load Tap-Changer oil level and pressure indicators/gauges.	X		Make the assessment and determine whether the tank oil level and pressure are adequate to proceed with any operational testing.	Include both High Voltage and Load Side load tap changers. 	H	RS		
1.23	Inspect the operation of the following, - Motor - Drive train - Cutoff at maximum raise position - Cutoff at maximum lower position	X		Verify that the motor can physically change the current tap setting. Verify that the motor does not attempt to raise beyond the maximum raise position and does not attempt to lower below the maximum lower position. Note any abnormal noises during operation.	Include both High Voltage and Load Side load tap changers. 	H	RS		
General Comments to Section 1.0 -Part of this section is to perform a complete physical/mechanical inspection to determine if the transformer(s) can be placed into service -Part of this section is to evaluate the quality of oil that has been sitting in the transformer(s), and replace it if necessary -Evaluating the condition and operations of the Load Tap-Changer(s)									

Legend (for "Type" and "Verification Point")															
Test Type:		CWT=Customer Witness Point			SAT=Storage Acceptance Test			FAT=Factory Acceptance Test			(See section 2.0 of this document for description details)				
Verification Point:		H=Hold Point			R=Review Point			S=Surveillance Point			W=Witness Point				
Item #	Verification/Test Activity	Type			Acceptance Criteria							Verify Point			
		SAT	FAT	CWT	Requirement	Acceptance/NA/Comment			Siemens	Customer	Cust 3 rd	Factory			
"☑" Indicates complete and accepted "NA" indicates not applicable Comments struck through (ex. Comment) indicates a comment that has been resolved															
TC Energy Keystone XL Project – High Voltage Transformer RFS-ITP Processes															
2.0 HV XFMR RFS-ITP Process 2: Electrical Testing (Executed at storage facility prior to disassembly)															
2.1	Perform the following insulation-resistance tests, - Winding-to-winding - Winding-to-ground	X			Reference ANSI/NETA ATS Table 100.5 for minimum applied DC test voltages. When tests are completed calculate the polarization index. Ideal polarization index is 2.0. Anything less than a polarization index of 1.0 is considered a fail and the transformer will have to be replaced or refurbished.	✓			H	RS					
2.2	Perform a core insulation test at 500VDC with respect to ground.	X			Compare the test result with manufacturer's data if available. The test value should not be less than 1MΩ.	If core ground strap is inaccessible, disregard this step. ✓			H	RS					
2.3	Perform power-factor or dissipation-factor tests on all windings.	X			Verify that the test results are in accordance to the manufactures published data or ANSI/NETA ATS Table 100.3.	✓			H	RS					
2.4	Perform power-factor or dissipation-factor tests on each bushing equipped with a potential/capacitance tap. If there is no potential/capacitance tap available, perform hot-collar tests instead.	X			Verify that the test results do not vary from the nameplate values by more than 150%. Bushing capacitance values that vary from 5% of the nameplate value are unsatisfactory. Alternatively, hot-collar test values that exceed 0.1 watts are unsatisfactory.	✓			H	RS					
2.5	Measure the resistance of each high-voltage winding in each de-energized tap-changer position.	X			Verify that there are no open connections. Ensure there are no severe differences in resistance between windings.	✓			H	RS					
2.6	Measure the resistance of each low-voltage winding in each de-energized tap-changer position.	X			Verify that there are no open connections. Ensure there are no severe differences in resistance between windings.	✓			H	RS					
2.7	Perform turns-ratio tests on all tap positions.	X			Verify that the turns-ratio of the transformer is consistent with the nameplate data. Test results should not deviate by more than 0.5 percent from either the adjacent coils or the calculated ratio.	✓			H	RS					
2.8	Perform excitation-current tests in accordance with test equipment manufacturer's published data.	X			Verify that there is no inter-turn shorting, core damage, or poor internal electrical connections. Results should have two similar current readings and one lower current reading.	✓			H	RS					
2.9	Perform sweep frequency response analysis tests (SFRA test).	X			Compare results to either the factory SFRA test results and/or previous SFRA test results.	✓			H	RS					
2.10	Record the "as-left" operation counter reading of the Load Tap-Changer.	X			Write down the counter reading.	2299 ✓			H	RS					
General Comments to Section 2.0															
-The purpose of these electrical tests is to verify whether the Transformer(s) are serviceable before they are shipped.															
-If the Transformer(s) are deemed to have failed any of the Acceptance Testing Criteria, they would be considered non-serviceable.															
- Components will need to be refurbished or be completely replaced in attempt to pass the Acceptance Testing Criteria. - Once components have been refurbished/replaced, retest the Transformer(s) with the same procedure.															



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One Line. One Company.®

Appendix B: Photos



TRAINING



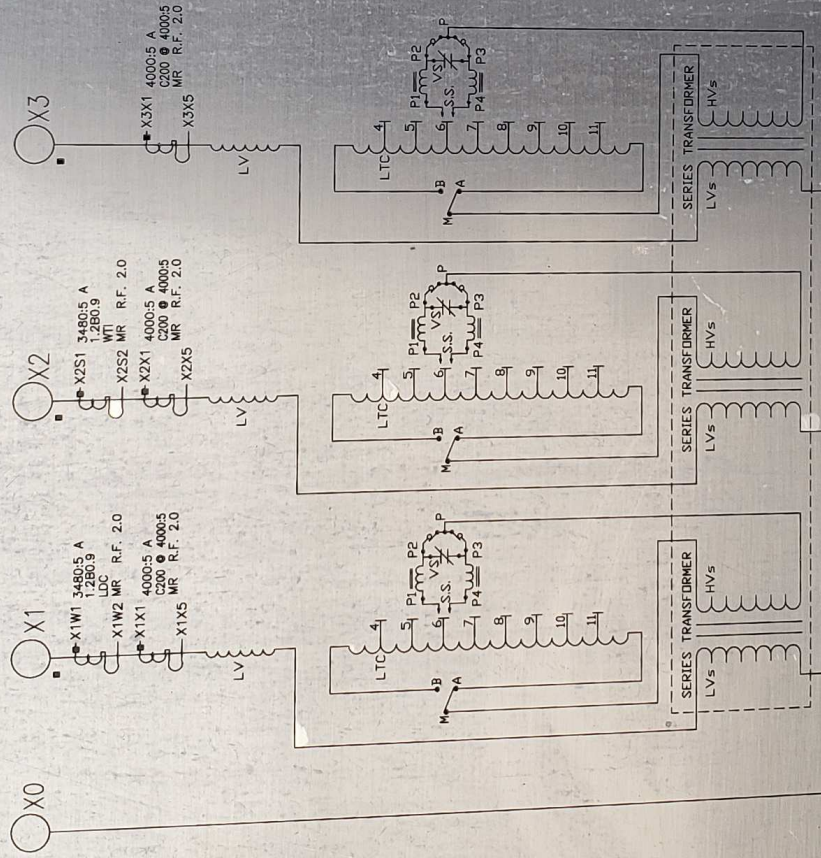
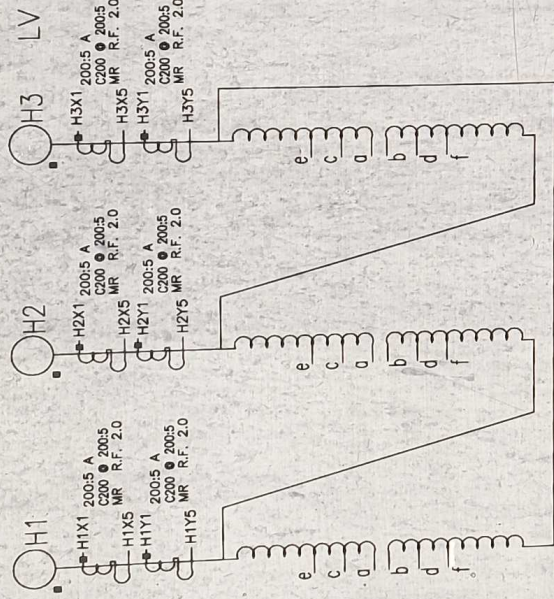
SIEMENS

SUBSTATION TRANSFORMER

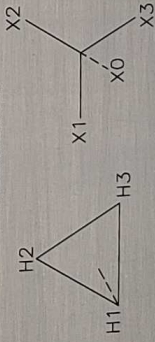
CLASS ONAN/ONAF/ONAF, 3 PHASES, 60 Hz, 55//65°C RISE
HV 230000 Δ VOLTS, 20/22.4/26.66/29.86/33.33/37.33 MVA
LV 6900 Grd Y/ 3983.7 VOLTS, 20/22.4/26.66/29.86/33.33/37.33 MVA

FULL WAVE IMPULSE LEVELS

HV WINDING 825 kV, HV BUSHINGS 1050 kV
LV WINDING 110 kV, LV BUSHINGS 110 kV
LV NEUTRAL 110 kV, LV NEUTRAL BUSHING 110 kV
H-X 7.058 % IMPEDANCE BASED ON 20 MVA ON TAP 3



PHASE RELATION



CURRENT TRANSFORMERS		
POS.	RATIO	CONNECTION
HV	50:5 A	X3-X4
	50:5 A	X1-X2
	50:5 A	X4-X5
	50:5 A	X2-X3
	100:5 A	X2-X4
	100:5 A	X1-X3
LV	150:5 A	X1-X4
	150:5 A	X2-X5
	200:5 A	X1-X5
	200:5 A	X2-X5
CURRENT TRANSFORMERS		
POS.	RATIO	CONNECTION
X1	3480:5 A	W1-W2
	3480:5 A	W1-W2
	3480:5 A	W1-W2
	3480:5 A	W1-W2
X2	3480:5 A	S1-S2
	3480:5 A	S1-S2
	3480:5 A	S1-S2
	3480:5 A	S1-S2

- NOTES :
- 1) READ INSTRUCTION BOOK BEFORE INSTALLING AND ENERGIZING TRANSFORMER.
 - 2) DO NOT OPERATE THE TRANSFORMER WHEN THE LIQUID LEVEL IS BELOW THE LOW POINT ON THE SCALE.
 - 3) DO NOT OPERATE THE "NO LOAD", DE-ENERGIZED, TAP CHANGER WHEN THE TRANSFORMER IS ENERGIZED.
 - 4) MAIN TANK, RADIATORS, DESIGNED FOR 14.7 PSI AND FULL VACUUM FILLING.
 - 5) ALL WINDINGS ARE COPPER.
 - 6) UNIT CONTAINS LUMINOL TRI OIL
 - 7) AT TIME OF MANUFACTURE, THIS TRANSFORMER CONTAINED NO DETECTABLE PCB'S.
 - 8) THE LOADING CAPACITY OF THIS TRANSFORMER IS RATED FOR SITE ALTITUDES NOT EXCEEDING 1000 METERS.
 - 9) 230 kV WINDINGS SHALL BE SUITABLE FOR 1.8 PU OVERVOLTAGE FOR 1 SECOND AND 1.15 PU CONTINUOUS OVERVOLTAGE.

NO-LOAD TAP CHANGER		WINDING VOLTAGES AND CURRENTS					
POS.	SWITCH	VOLTS	AMPERES				
	JOIN		20 MVA	26.66 MVA	33.3 MVA	37.3 MVA	
1	a-b	241500	48	64	80	89	
2	b-c	235750	49	65	82	91	
3	c-d	230000	50	67	84	94	
4	d-e	224250	51	69	86	96	
5	e-f	218500	53	70	88	99	

LOAD-TAP CHANGER REINHARDT TYPE RMV-A 600									
CONNECTION					VOLTAGES & CURRENTS				
LTC POSITION	P1 TO	P4 TO	M TO		VOLTS	20 MVA	26.66 MVA	33.3 MVA	37.3 MVA
16R	11	11	11		7590	1521	2028	2533	2840
15R	10	11	11		7547	1530	2040	2548	2856
14R	10	10	10		7504	1539	2051	2562	2872
13R	9	10	10		7461	1548	2063	2577	2889
12R	9	9	9		7418	1557	2075	2592	2906
11R	8	9	9		7374	1566	2087	2607	2923
10R	8	8	8		7331	1575	2100	2622	2940
9R	7	8	8		7288	1584	2112	2638	2957
8R	7	7	7		7245	1594	2125	2654	2975
7R	6	7	7		7202	1603	2137	2670	2993
6R	6	6	6		7159	1613	2150	2686	3011
5R	5	6	6		7116	1623	2163	2702	3029
4R	5	5	5		7073	1633	2176	2718	3047
3R	4	5	5		7029	1643	2190	2735	3066
2R	4	4	4		6986	1653	2203	2752	3085
1R	M	4	4		6943	1663	2217	2769	3104
N	M	M	M	B/A	6900	1673	2231	2786	3124
1L	11	11	11		6857	1684	2245	2804	3143
2L	11	11	11		6814	1695	2259	2822	3163
3L	10	11	11		6771	1705	2273	2840	3183
4L	10	10	10		6728	1716	2288	2858	3204
5L	9	10	10		6684	1727	2303	2876	3224
6L	9	9	9		6641	1739	2318	2895	3245
7L	8	9	9		6598	1750	2333	2914	3266
8L	8	8	8		6555	1762	2348	2933	3288
9L	7	8	8		6512	1773	2364	2952	3310
10L	7	7	7		6469	1785	2379	2972	3332
11L	6	7	7		6426	1797	2395	2992	3354
12L	6	6	6		6383	1809	2412	3012	3377
13L	5	6	6		6339	1821	2428	3033	3400
14L	5	5	5		6296	1834	2445	3054	3423
15L	4	5	5		6253	1847	2462	3075	3447
16L	4	4	4		6210	1859	2479	3096	3471

APPROXIMATE WEIGHT		LBS
CORE & WINDINGS (MAIN TRANSFORMER)		70990
CORE & WINDINGS (REACTOR)		4400
CORE & WINDINGS (SERIES)		14550
TANK & FITTINGS		42140
REMOVABLE RADIATORS		11110
LOAD TAP CHANGER & MOTOR DRIVE		2180
USG		
LIQUID IN TRANSFORMER		61445
LIQUID IN RADIATORS		443
LIQUID (LOAD TAP CHANGER)		345
TOTAL LIQUID		67101
TOTAL MASS WITH OIL		212471
TOTAL MASS WITHOUT OIL		145370
SHIPPING WEIGHT		116432

INSTRUCTION BOOK (SIEMENS)
CAN/CSA-C88-M90
SERIAL No. T.040N.001092.01
MONTH/YEAR BUILT 11/2011
CUSTOMER ORDER No. 9000017832

SIEMENS TRANSFORMADORES S.A. DE C.V.
MADE IN MEXICO

TURNING HANDWHEEL IN REQUIRED DIRECTION OF TRAVEL
RELEASES THE LEVER RE-LOCK CONTROL LINES

SEE THE OPERATION MANUAL FOR DETAILS



75110800187

SIEMENS



TransCanada

Powered By
Nektar



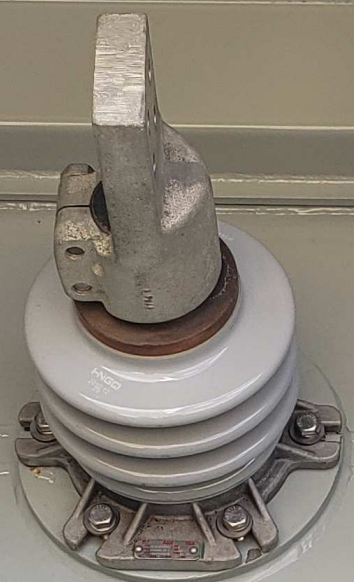








X 0



X 1



X 2



X 3







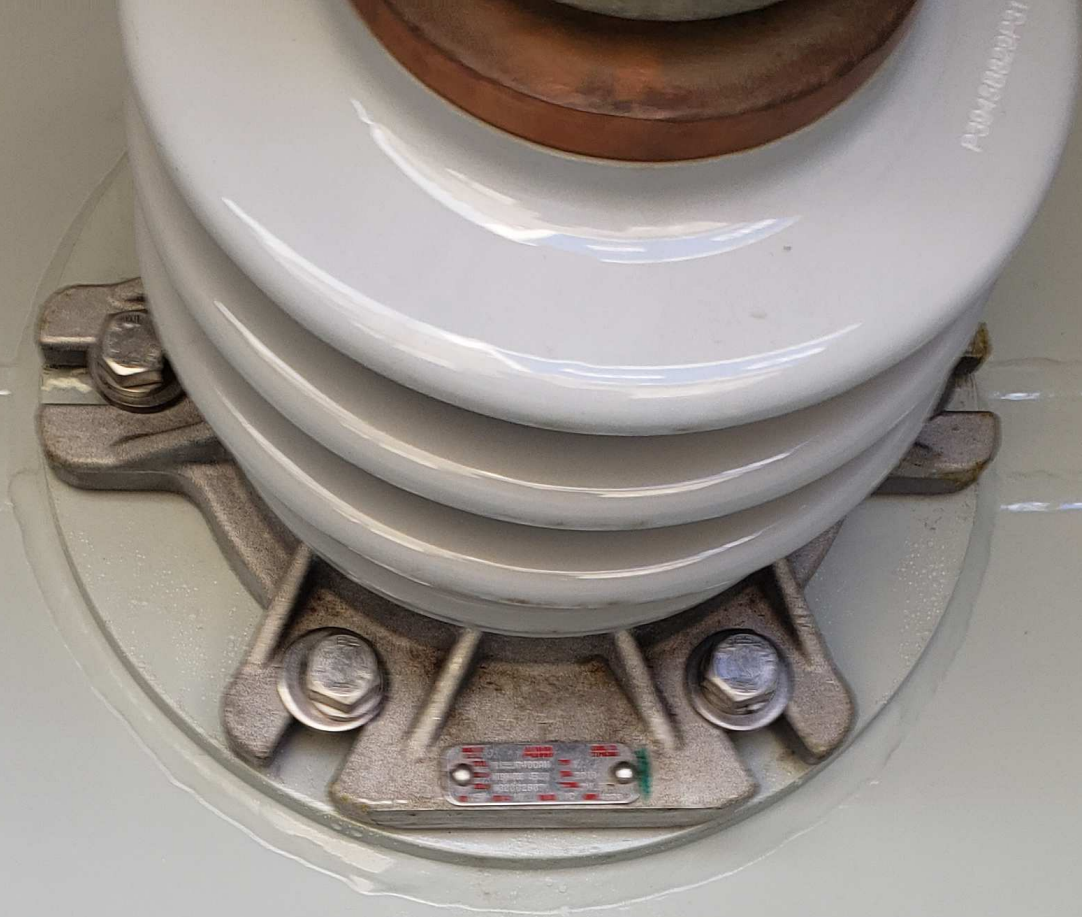


X O



0

X 1



X 2



X 3





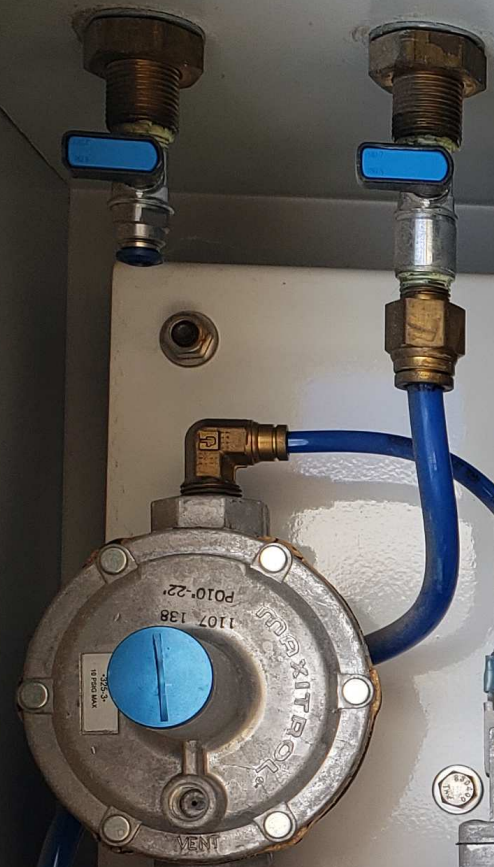


TP 1092 01

ustrie
SHERMO







ON OFF ON

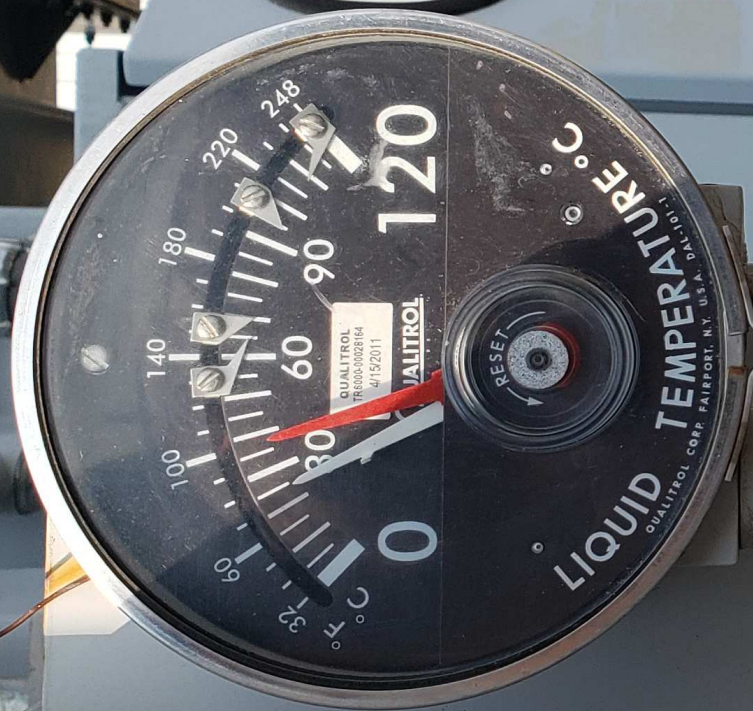
1092.03
DK
A. RE

ATON SYSTEM
0958481311
MFG 04/11
SURE REGULATOR: +5.0 PSI
SURE REGULATOR: +0.5 PSI
PRESSURE RELIEF UNIT: +6.5 PSI
PRESSURE ALARM: +8.5 PSI
PRESSURE ALARM: +0.25 PSI
ALARM: +200 PSI
Inc.
1-38001 8000 955-5399









DISASSEMBLY
1. TURN LEFT TH. CONNECTOR
2. TURN RIGHT TH. CONNECTOR

PROCEEDING
1. GEAR HAGA
2. MACHO (JUNT)

CONNECTOR QUALITY
CON-566-12

CONNECTOR
MACHO

CONNECTOR
FEMEA

CONDUIT
LIQUIDTIGHT FLEX

CABLE TPO SO
90°C 666 V

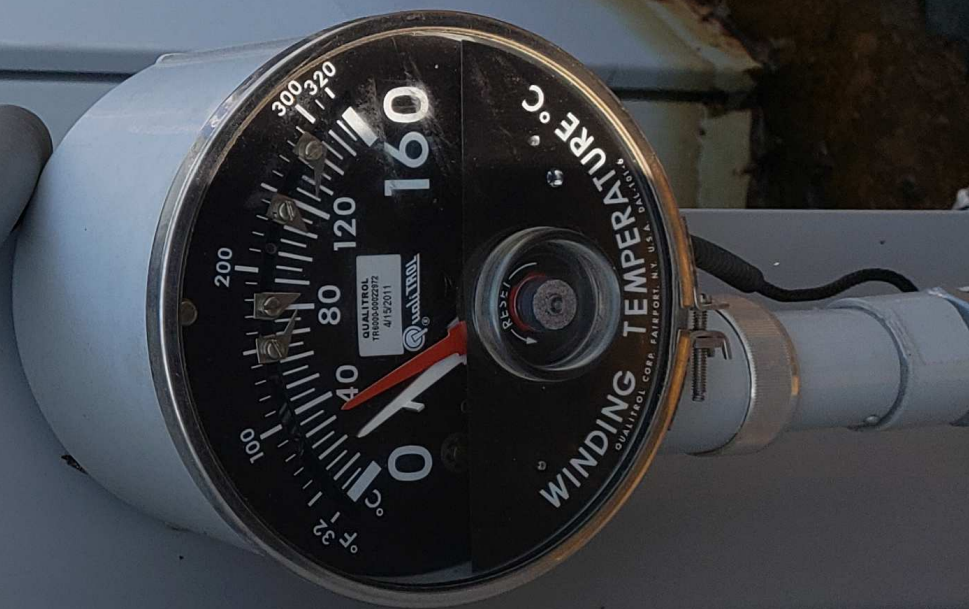
MALE
CONNECTOR

MALE
CONNECTOR

FEMALE
CONNECTOR

CONDUIT
LIQUIDTIGHT FLEX

CABLE TPO SO
90°C 666 V





LIQUIDTIGHT FLEXIBLE
CABLE TYPE 90
35°C 650 V

LIQUIDTIGHT FLEXIBLE
CONDUIT

FEMALE
CONNECTOR

CABLE TYPE 90
35°C 650 V

7
THAILAND

Label on vertical pipe









VACUTAP[®]

REINHAUSEN MFG.
2649 N. 9th AVENUE
HUMBOLDT, TN 38343
(731) 784-7681

ON LOAD TAP-CHANGER		LOCATION: SECONDARY SIDE
TYPE: RMV-II 1500		NO.: C020837
BIL PHASE TO PHASE AND TO GROUND: 400 KILOVOLTS		
MEETS STANDARD: IEC 60214-1989, ANSI C57.131-1995		
METHOD OF ARC INTERRUPTION: TAP SELECTOR WITH SEPARATE VACUUM INTERRUPTOR		
TYPE OF TRANSITION: PREVENTATIVE AUTO (REACTOR)		
LTC SWITCHING CAPACITY (STEP VOLTAGE X CURRENT) IS LIMITED TO 500 KVA AT TEMPERATURES BELOW -25°C		
MAX RATED THROUGH CURRENT [AMPS]: 1500 OIL FILL: 345 GALS		
MAX. AND MINIMUM OPERATING TEMPERATURES : 100°C/-40°C		
WITHSTAND FULL VACUUM (+/- 15 PSI) INSTRUCTION MANUAL TL 7002		
IT IS RECOMMENDED TO EQUALIZE PRESSURE WHEN VACUUM PROCESS / FILLING MAIN TANK DATE OF MANUFACTURE: MAY 2011		
TYPE OF DRIVE MECHANISM: DIRECT DRIVE		
LTC IS EQUIPPED WITH MODEL B MONITORING SYSTEM. INTERNAL EXAMINATION IS NOT REQUIRED FOR 500,000 OPERATIONS (REF: C17017 REINHAUSEN STANDARD)		

THIS TAP CHANGER MAY BE COVERED BY ONE OR MORE OF THE FOLLOWING US-PATENTS:
5,107,200; 5,128,605; 5,165,295 AND 5,266,759 - ALL DOHNAL ET AL.

WARNING

**MAXIMUM COMPRESSION
OF INSPECTION DOOR
GASKET IS 5/16" (8MM)**





PANEL "E"

BREAKER
CONTROL CIRCUIT

BREAKER
INERTIAIRE
63PV1

BREAKER
HEATERS/LIGHTS

BREAKER
OUTLET



OUTLET
15 A, 125 Vac, 60 Hz



START SWITCH
FANS STAGE # 1
MAN/OFF/AUTO



START SWITCH
FANS STAGE # 2
MAN/OFF/AUTO



FANS SELECTOR
STAGE
#1 / #2
FIRST



HEATER
SWITCH 1
ON
OFF



BREAKER
POWER SUPPLY







CO20837
05-18-11 JK



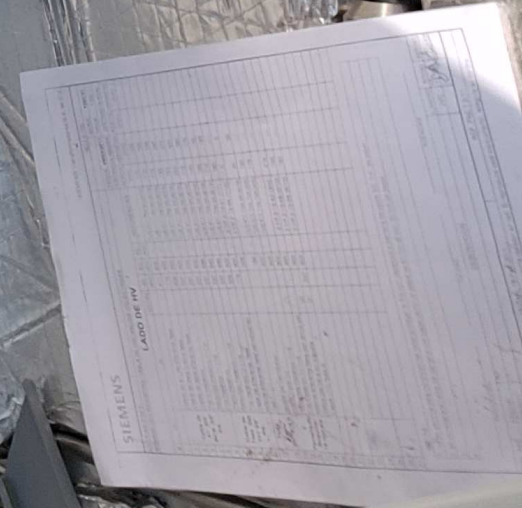
WARNING
IF RELAY OPERATES, DO NOT RESET UNTIL LOAD
IF CHARGER HAS BEEN INSPECTED AND THE
CAUSE OF TROUBLE CORRECTED.

R C L

CHANGING TAPS WITH THE
MONITORING SYSTEM.
TO THE APPROPRIATELY DISABLE
YELLOW, LESS AND HOLD THE THREE YELLOW
FOR 10 SECONDS. PROCEED WITH THE SYSTEM FOR 10 SECONDS.
TO NORMAL OPERATION.
5483890402

Terminal block with multiple colored wires (blue, green, yellow, red) connected to it. A small label 'A100' is visible.

Terminal block with multiple colored wires (blue, green, yellow, red) connected to it. A small label 'A100' is visible.



PANEL "D"

90A1

BREAKER
MOTOR DRIVE



LTC
LOCKED OUT



LTC
POWER ON



M-2001C



COM 2

BREAKER
POTENTIAL SUPPLY



LTC CONTROL
MAN/AUTO



LTC CONTROL
LOWER/RAISE



LTC CONTROL
LOCAL/REMOTE



M-2067B
TAPCHANGER CONTROL
BECKWITH-D-CO. INC.
ELECTRIC CO. INC.
MADE IN U.S.A.

VOLTAGE
25 AMP

LTC
RESET SWITCH



77R-1















MADE IN U.S.A. **ALADD** ALADD, TN 271053001
TYPE A
STYLE 015J0400AN
CAT.# W1804088 VER 2
SER.# 1000028069
YEAR 2011
"L" DIM. 24.953
KV 15 KVL-G10 BIL KV110 AMPS 4000

X

C

MADE IN
U.S.A.
STYLE
CAT.#
SER.#
NV 15
ALADD
ALADD
015J0400AN
W1804088 VER 2
1000028070
NV-L-G 10
DL IV 110
TYPE A
YEAR 2011
"L" DIM. 24.953
ALADD, TN.
271P053001
AMPS 4000

1

X



MADE IN U.S.A. **ALADD** **ALADD** **ALADD** **ALADD**
TYPE A
YEAR 2011
LTD. 24 953
SER. # 1000028071
NV 15 NV LG 10 BL IV 110 AMP 34000

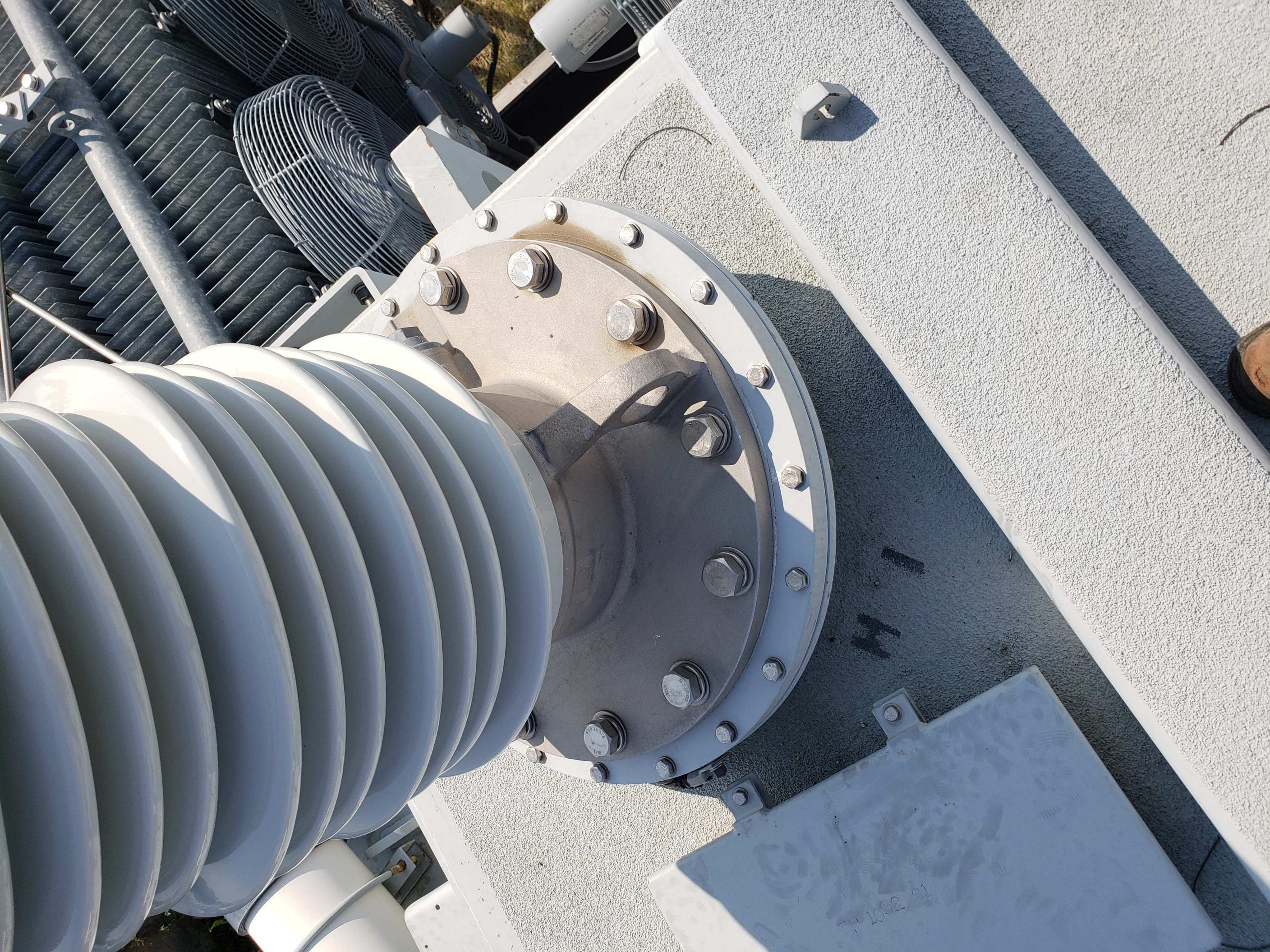
X 2



MADE IN U.S.A. **ALADD** **ALADD** ALADD, TN. 271063001
STYLE 015J0400AN TYPE A
CAT.# W18040BB VER 2 YEAR 2011
SER.# 1000028423 L'OML 24 953
IV 315 IV L-G 110 OIL IV 110 AMPS 1000

X

3



ABB

TBI®

PF% _____

CONVERTIBLE - SEE INSTRUCTION BOOK

MADE IN U.S.A. ALAMO, TN. 256P563H01F

ABB

TYPE (MODEL) 0 plus 0 YR(ANO) 2011

STYLE (ESTLO) N/A

OPTION (OPTION) N/A

SER 12UA 1000027404 SYS 230

MAX L-G 146

AMPS 800

C1 PF (FP) 34

C2 PF (FP) 31

%@20°C CAP 513

%@20°C CAP 6605

WT. 1272

DELIVERED PCB<1PPM

MADE IN USA ALAMO, TN

VER 4

kv kv

kv, 60HZ, BIL/LL

%@20°C CAP 513

%@20°C CAP 6605

WT. 1272

DELIVERED PCB<1PPM



ABB

TBI®

PF%

CONVERTIBLE - SEE INSTRUCTION BOOK
MADE IN U.S.A. ALAMO, TN. 256P563H01F

ABB

TYPE (MODELE)
STYLE (TIPO)
OPTION (OPCIÓN)

0 Plus C YR(ANO) 2011
230W0800UT
N/A

VER 4

SER 1ZUA

1000027410

SYS 230

MAX L-G

146

kV, 60HZ, BIL/LIL

1050

kV

AMPS

800

L Dim

56.25

kV

C1 PF (FP)

32

% 20°C CAP

512

pF

C2 PF (FP)

30

% 20°C CAP

6587

pF

DELIVERED PCBK1PPH

WT. 1272

LBS. MADE IN USA ALAMO, TN



371

ABB
TBI®
PF%
CONVERTIBLE - SEE INSTRUCTION BOOK
MADE IN U.S.A. ALAMO, TN. 256P563H01F

ABB TYPE (MODELE) 0 Plus C YR (AÑO) 2011
STYLE (TIPO) 230W0800UT
OPTION (OPCIÓN) N/A
SER 1ZUA 1000027405 SYS 230 VER 4
MAX L-G 146 kv, 60HZ, BIL/LIL 1050
AMPS 800 L Dim 56.25
C1 PF (FP) 33 % 20°C CAP 511 pF
C2 PF (FP) 31 % 20°C CAP 6540 pF
DELIVERED PCB<1PPM WT. 1272 LBS. MADE IN USA ALAMO, TN

052

17

S31600
THE

ABB
655030

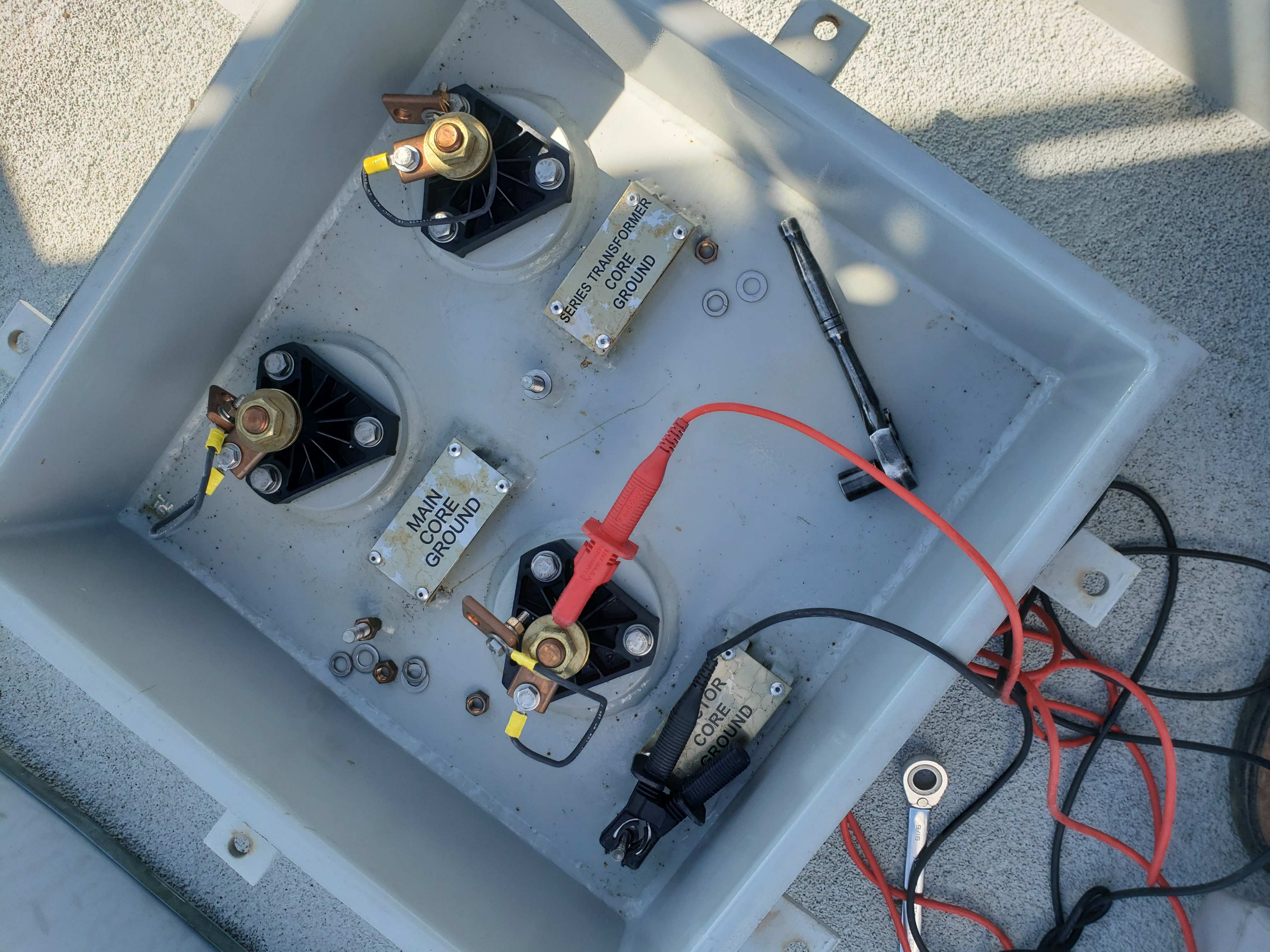






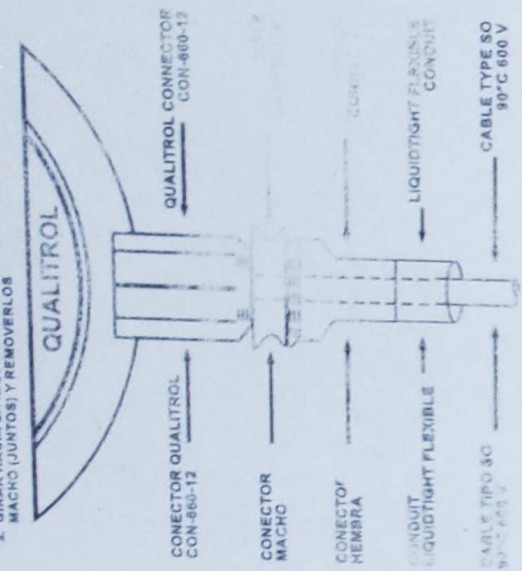






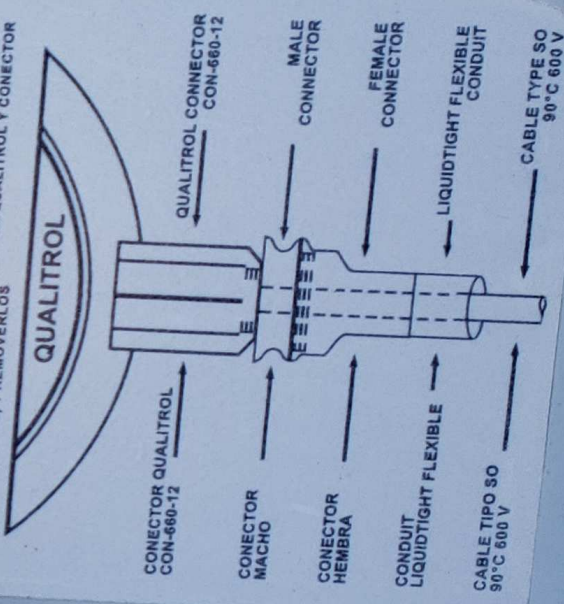


PROCEDIMIENTO DE DESENSAMBLE
1. GIRAR HACIA LA IZQUIERDA EL CONECTOR HEMBRA Y REMOVERLO
2. GIRAR HACIA LA IZQUIERDA EL CONECTOR QUALITROL Y CONECTOR MACHO (JUNTOS) Y REMOVERLOS



DISASSEMBLY PROCEDURE
1. TURN LEFT THE FEMALE CONNECTOR AND REMOVE IT.
2. TURN LEFT THE QUALITROL CONNECTOR AND THE MALE CONNECTOR TOGETHER AND REMOVE THEM

PROCEDIMIENTO DE DESENSAMBLE
1. GIRAR HACIA LA IZQUIERDA EL CONECTOR HEMBRA Y REMOVERLO
2. GIRAR HACIA LA IZQUIERDA EL CONECTOR QUALITROL Y CONECTOR MACHO (JUNTOS) Y REMOVERLOS





Shermco Industries®

One Line. One Company.®

Appendix C: Transformer & LTC Oil Analysis



OIL SAMPLE REPORT

Page 1 of 2

CUSTOMER DATA

Customer: <u>Shermco Canada - Regina</u>	Shop Order#: <u>5-6390-05</u>	Equip ID <u>126-FXVLY-A0-T-0</u>
<u>2361 Industrial Drive</u>	Customer PO#: <u>20-S226-15</u>	Location <u>TCPL - Fox Vall</u>
<u>P.O. Box 995</u>	Serial# <u>T.040N.001092.01</u>	Imp. (% Z) <u>7.05</u>
<u>Regina</u>	Received Date: <u>9/2/2020</u>	Gallons <u>6809</u>
<u>SK S4P 3B2</u>	Reported Date: <u>9/2/2020</u>	Primary Voltage kV <u>230</u>
Contact: <u>TYSON HAHN</u>	Phase <u>3 Phase</u>	KVA: <u>33333</u>
Phone: <u>(306) 949-8131</u> EXT	Tank <u>Transformer</u>	Mfg. <u>Siemens</u>
Cell: <u>(306) 535-3315</u>	Breathing <u>Free Breathe</u>	Fluid <u>Mineral Oil</u>
FAX: <u>(306) 522-9181</u>	E-Mail: <u>thahn@shermco.ca</u>	Voltage Class <u>>230kV</u>

SAMPLE DATA

	8/27/2020	11/27/2017	11/20/2015
Date Sampled:	8/27/2020	11/27/2017	11/20/2015
Oil Temp (C):	22	0	16
Hydrogen (H2):	1	0	3
Methane (CH4):	3	4	0
Ethane (C2H6):	1	1	1
Ethylene (C2H4):	2	1	1
Acetylene (C2H2):	0	0	0
Carbon Monoxide (CO):	9	15	1
Carbon Dioxide (CO2):	142	122	106
Nitrogen (N2):	74858	85006	62098
Oxygen (O2):	6180	11968	25660
Tot Dissolved Gas:	81199	97119	87873
Tot Dissolved Combustible Gas:	16	21	6
Equivalent TCG %:	0.01	0.00	0.00
Moisture PPM:	3.5	3.3	3.4
Interfacial Tension (dynes/cm):	46.2	46.5	46.3
Acid Number (mg KH/g):	.01	.01	.01
Color Number (Relative):	.5	.5	.5
Visual Exam (Relative):	CLR	CLR	CLR
Sediment Exam (Relative):	ND	ND	ND
Dielectric Breakdown (kV):			
Dielectric Breakdown 1 mm (kV mm-C):	42.2	43.1	42.9
Dielectric Breakdown 2 mm (kV mm-C):			
Power Factor @ 25C (%):	.000	.002	.009
Power Factor @ 100C (%):	0.028	0.059	0.461
Specific Gravity (Relative):	.864	.864	.865
Relative Saturation (%):	2.33		
Oxidation Inhibitor (wt. %):			



Shermco Industries

One Line. One Company.

Houston Service Center 33002 FM 2004 Angleton, Texas 77515 p. 979.848.1406 f. 979.848.0012 houston@shermco.com

Page 2 of 2

Customer: Shermco Canada - Regina

Shop Order#: 5-6390-05

Equip ID 126-FXVLY-A0-T-01

Customer PO#: 20-S226-15

Serial# T.040N.001092.01

Location TCPL - Fox Vall

Results

N2 Diagnosis - Pad gas
Total Combustible Gas - OK, Continue routine operation

Recommendations

Sample data ok. Unit is in condition 1. No action required. Continue to monitor at normal sampling schedule. See attached particle count report.

Sample - PPM

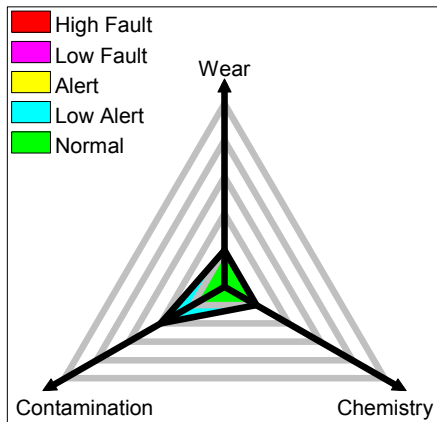
Database:	Shermco Database.rbm	Equipment:	E1 - Transformers & LTC's
Area:	A145 - SHERMCO Canada	Point:	P96 - Fox SN# T 040N 001092 01

Sample Date	8/27/2020
Sample #	82200
Unit Usage - hrs	
Oil Usage - hrs	
Oil Added - gus	

Wear	0
Aluminum	1.13
Barium	.10
Boron	.30
Cadmium	0.00
Calcium	.32
Chromium	.15
Copper	0.00
Iron	.2
Lead	0.00
Magnesium	.15
Molybdenum	0.00
Nickel	.34
Phosphorus	0.00
Potassium	.21
Silicon	1.99
Silver	.08
Sodium	.07
Tin	1.98
Titanium	.88
Vanadium	0.00
Zinc	0.00
Manganese	.74
Ferrous Idx	0.0
LCont Ferrous	
LCont NonFe	

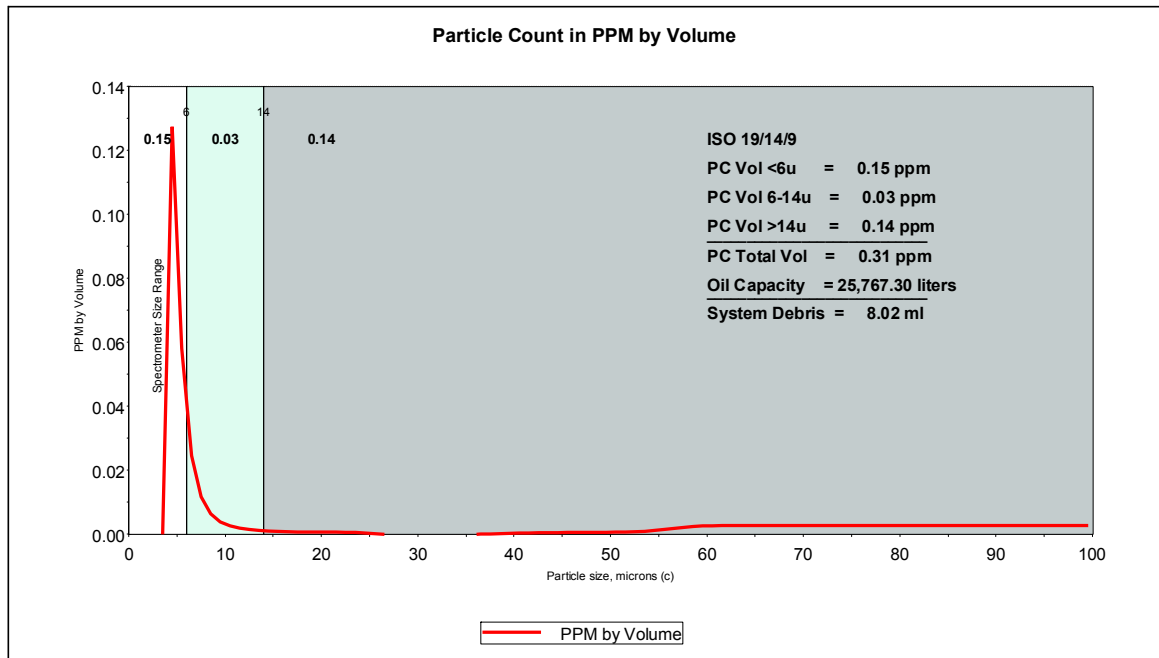
Contamination	5
Contam Idx	
% Water	
LCont Droplet	
Cnts >4	2,813
Cnts >6	101
Cnts >14	3
Cnts >22	1
Cnts >38	1
Cnts >56	.8
Cnts >70	.5
ISO >4	19
ISO >6	14
ISO >14	9
NAS 1638	8
IR Oxidation	
IR Water	
Water K.Fish	

Chemistry	0
OilLife Idx	
Chemical Idx	0.0
Dielectric	
DV Visc 40C	
DV Visc %Chng	
IR Oxidation	
Visc 40C	
Visc 100C	
Visc Idx	
Total Acid	
Total Base	



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33022 FM 2004
Angleton, Texas
(800)-219-9038
G.Sellers@Shermco.com

Ref Oil No Reference Oil



Observations
Oil is in good condition
Oil is fit for further use

Actions
Continue normal sampling

Sample data ok. Particles within limits. No action required. Continue to monitor at normal sampling schedule.

Sample Trend - All Data

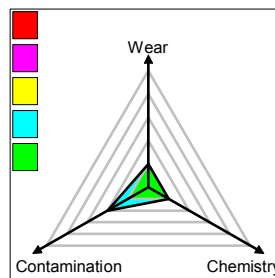
Database:	Shermco Database.rbm	Equipment:	E1 - Transformers & LTC's
Area:	A145 - Shermco Canada	Point:	P96 - Fox SN# T 040N 001092 01

Ref Oil	No Reference Oil			
Sample Date	8/27/2020	11/27/2017	12/15/2015	
Sample #	82200	47559	22542	
Unit Usage - hrs				
Oil Usage - hrs				
Oil Added - gus				

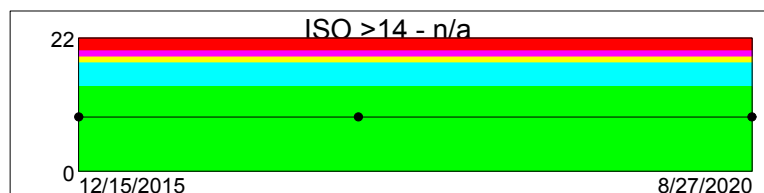
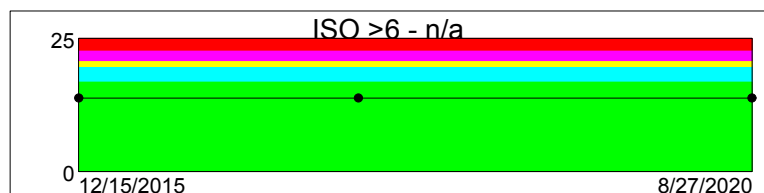
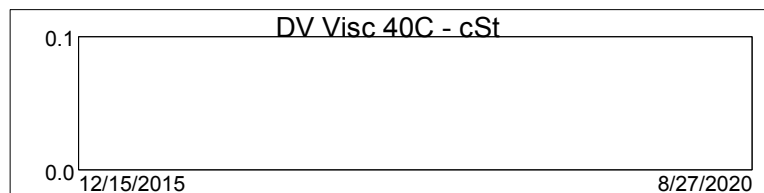
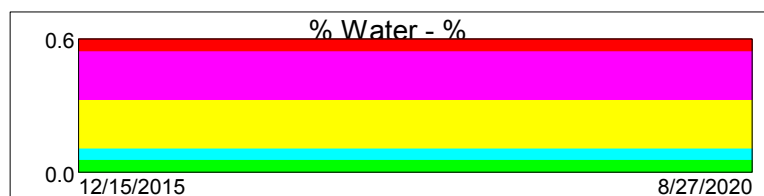
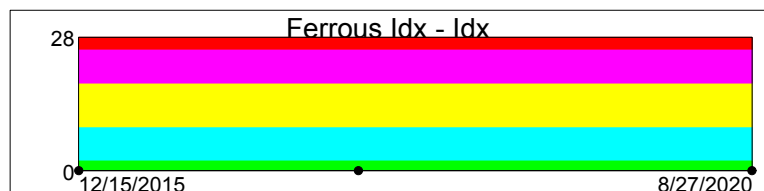
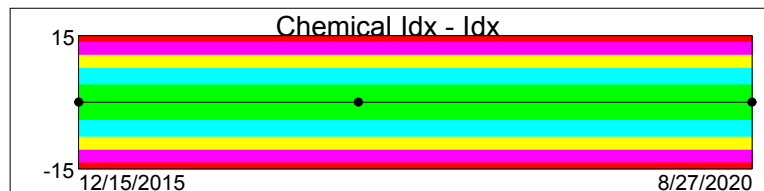
Wear	0	0	0	
Aluminum - ppm	1.13			
Barium - ppm	.10			
Boron - ppm	.30			
Cadmium - ppm	0.00			
Calcium - ppm	.32			
Chromium - ppm	.15			
Copper - ppm	0.00			
Iron - ppm	.2			
Lead - ppm	0.00			
Magnesium - ppm	.15			
Molybdenum - ppm	0.00			
Nickel - ppm	.34			
Phosphorus - ppm	0.00			
Potassium - ppm	.21			
Silicon - ppm	1.99			
Silver - ppm	.08			
Sodium - ppm	.07			
Tin - ppm	1.98			
Vanadium - ppm	0.00			
Zinc - ppm	0.00			
Manganese - ppm	.74			
Ferrous Idx - Idx	0.0	0.0	0.0	
LCont Ferrous - Idx				
LCont NonFe - Idx				
Titanium - ppm	.88			

Contamination	5	1	9	
Contam Idx - Idx				
% Water - %				
LCont Droplet - Idx				
Cnts >4 - pml	2,813	2,788	2,960	
Cnts >6 - pml	101	98	103	
Cnts >14 - pml	3	3	4	
Cnts >22 - pml	1	1	1	
Cnts >38 - pml	1	0	0	
Cnts >56 - pml	.8	.7	.1	
Cnts >70 - pml	.5	.1	0.0	
ISO >4 - n/a	19	19	19	
ISO >6 - n/a	14	14	14	
ISO >14 - n/a	9	9	9	
NAS 1638 - Idx	8	6	6	
IR Oxidation - au				
IR Water - au				
Water K.Fish - ppm				

Chemistry	0	0	0	
OilLife Idx - Idx				
Chemical Idx - Idx	0.0	0.0	0.0	
Dielectric - Idx				
DV Visc 40C - cSt				
DV Visc %Chng - %				
IR Oxidation - au				
Visc 40C - cSt				
Visc 100C - cSt				
Visc Idx - VI				
Total Acid - koh				
Total Base - koh				



Shermco Industries
 33022 FM 2004
 Angleton, Texas
 (800)-219-9038
 G.Sellers@Shermco.com



Sample data ok. Particles within limits. No action required. Continue to monitor at normal sampling schedule.



OIL SAMPLE REPORT

Page 1 of 2

CUSTOMER DATA

Customer: <u>Shermco Canada - Regina</u>	Shop Order#: <u>5-6390-05</u>	Equip ID <u>126-FXVLY-A0-T-0</u>
<u>2361 Industrial Drive</u>	Customer PO#: <u>20-S226-15</u>	Location <u>TCPL - Fox Vall</u>
<u>P.O. Box 995</u>	Serial# <u>C020837</u>	Imp. (% Z) <u>N/A</u>
<u>Regina</u>	Received Date: <u>9/2/2020</u>	Gallons <u>268</u>
<u>SK S4P 3B2</u>	Reported Date: <u>9/2/2020</u>	Primary Voltage kV <u>230</u>
Contact: <u>TYSON HAHN</u>	Phase <u>3 Phase</u>	KVA: <u>N/A</u>
Phone: <u>(306) 949-8131</u> EXT	Tank <u>Lower Tap Change</u>	Mfg. <u>Siemens</u>
Cell: <u>(306) 535-3315</u>	Breathing <u>Free Breathe</u>	Fluid <u>Mineral Oil</u>
FAX: <u>(306) 522-9181</u>	E-Mail: <u>thahn@shermco.ca</u>	Voltage Class <u>>230kV</u>

SAMPLE DATA

	8/27/2020	11/27/2017	11/20/2015
Date Sampled:	8/27/2020	11/27/2017	11/20/2015
Oil Temp (C):	22	0	16
Hydrogen (H2):	0	0	0
Methane (CH4):	0	1	3
Ethane (C2H6):	0	0	0
Ethylene (C2H4):	0	0	0
Acetylene (C2H2):	0	0	0
Carbon Monoxide (CO):	4	3	1
Carbon Dioxide (CO2):	117	104	22
Nitrogen (N2):	70191	79197	67762
Oxygen (O2):	37438	44983	24200
Tot Dissolved Gas:	107751	124289	91991
Tot Dissolved Combustible Gas:	4	4	4
Equivalent TCG %:	0.00	0.00	0.00
Moisture PPM:	5.1	4.5	2.3
Interfacial Tension (dynes/cm):	44.7	45.4	45.8
Acid Number (mg KH/g):	.01	.01	.01
Color Number (Relative):	.5	.5	.5
Visual Exam (Relative):	CLR	CLR	CLR
Sediment Exam (Relative):	ND	ND	ND
Dielectric Breakdown (kV):			
Dielectric Breakdown 1 mm (kV mm-C):	42.7	43.1	42.8
Dielectric Breakdown 2 mm (kV mm-C):			
Power Factor @ 25C (%):	.000	.004	.003
Power Factor @ 100C (%):			
Specific Gravity (Relative):	.825	.825	.825
Relative Saturation (%):			
Oxidation Inhibitor (wt. %):			



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Page 2 of 2

Customer: Shermco Canada - Regina

Shop Order#: 5-6390-05

Equip ID 126-FXVLY-A0-T-01

Customer PO#: 20-S226-15

Serial# C020837

Location TCPL - Fox Vall

Results

O2 Diagnosis - Leak to atmosphere, air vented
N2 Diagnosis - Pad gas and/or atmospheric air intrusion
Total Combustible Gas - OK, Continue routine operation

Recommendations

Sample data ok. LTC is in condition 1. No action required. Continue to monitor at normal sampling schedule. See attached dissolved metals and particle count report.

Sample - PPM

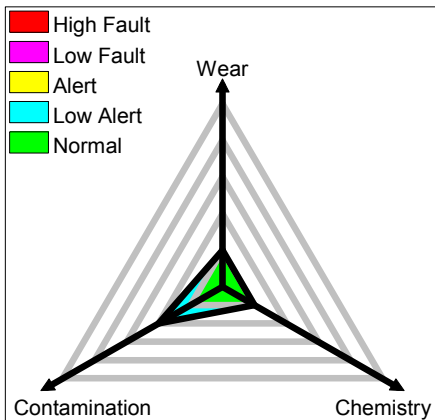
Database:	Shermco Database.rbm	Equipment:	E1 - Transformers & LTC's
Area:	A145 - SHERMCO Canada	Point:	P97 - Fox LTC SN# C020837

Sample Date	8/27/2020
Sample #	82204
Unit Usage - hrs	
Oil Usage - hrs	
Oil Added - gus	

Wear	0
Aluminum	.82
Barium	.09
Boron	.53
Cadmium	0.00
Calcium	.13
Chromium	.08
Copper	0.00
Iron	0.0
Lead	0.00
Magnesium	0.00
Molybdenum	0.00
Nickel	.25
Phosphorus	0.00
Potassium	0.00
Silicon	.28
Silver	.07
Sodium	0.00
Tin	1.54
Titanium	.81
Vanadium	0.00
Zinc	0.00
Manganese	.64
Ferrous Idx	0.0
LCont Ferrous	0
LCont NonFe	0

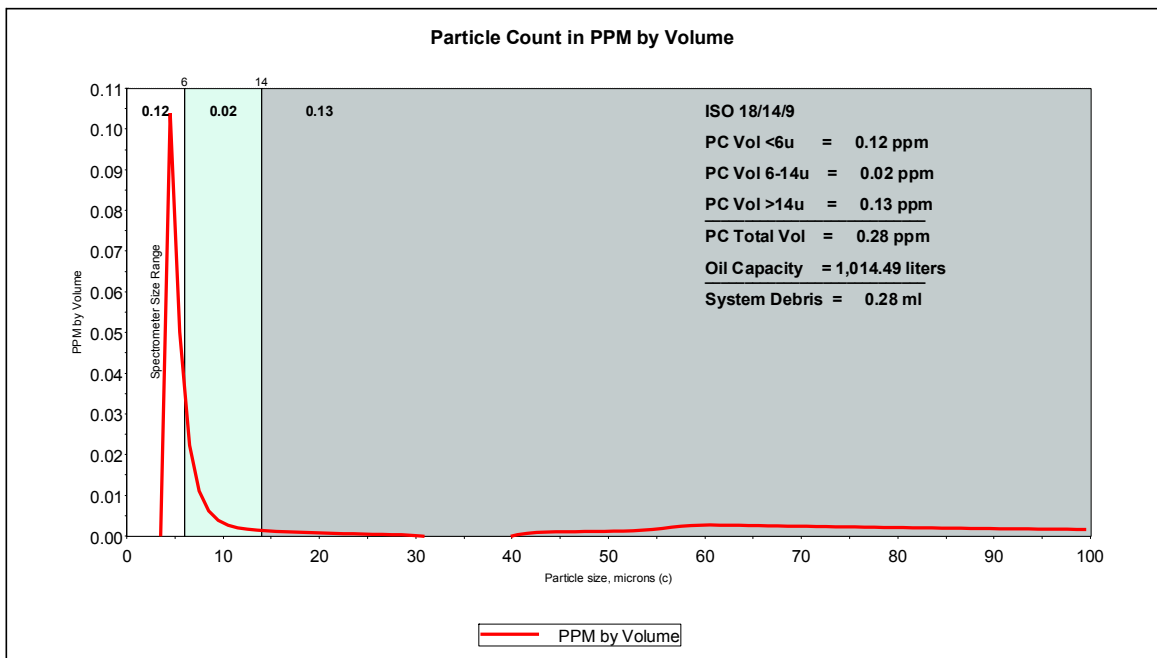
Contamination	1
Contam Idx	
% Water	
LCont Droplet	
Cnts >4	2,364
Cnts >6	97
Cnts >14	4
Cnts >22	1
Cnts >38	1
Cnts >56	.6
Cnts >70	.3
ISO >4	18
ISO >6	14
ISO >14	9
NAS 1638	7
IR Oxidation	
IR Water	
Water K.Fish	

Chemistry	0
OilLife Idx	
Chemical Idx	0.0
Dielectric	
DV Visc 40C	
DV Visc %Chng	
IR Oxidation	
Visc 40C	
Visc 100C	
Visc Idx	
Total Acid	
Total Base	



Shermco Industries
33022 FM 2004
Angleton, Texas
(800)-219-9038
G.Sellers@Shermco.com

Ref Oil: No Reference Oil



Observations
Oil is in good condition
Oil is fit for further use

Actions
Continue normal sampling

Sample data ok. Particles within limits. No action required. Continue to monitor at normal sampling schedule.

Sample Trend - All Data

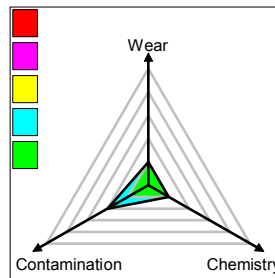
Database:	Shermco Database.rbm	Equipment:	E1 - Transformers & LTC's
Area:	A145 - Shermco Canada	Point:	P97 - Fox LTC SN# C020837

Ref Oil	No Reference Oil			
Sample Date	8/27/2020	11/27/2017	12/15/2015	
Sample #	82204	47561	22545	
Unit Usage - hrs				
Oil Usage - hrs				
Oil Added - gus				

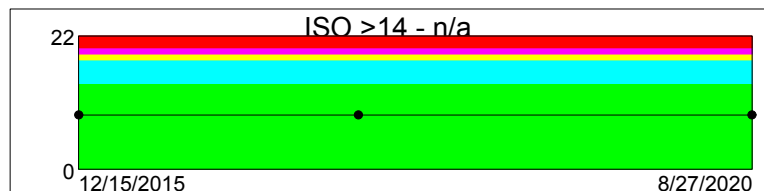
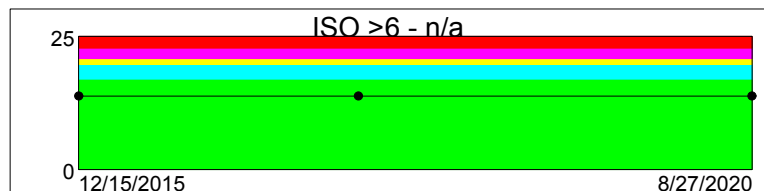
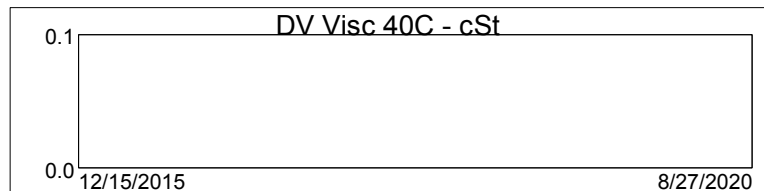
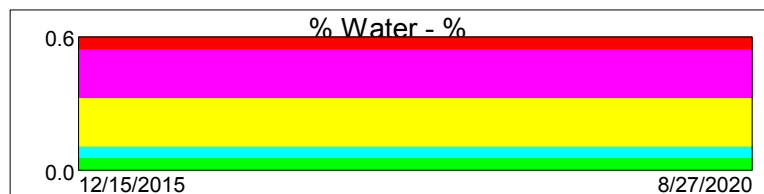
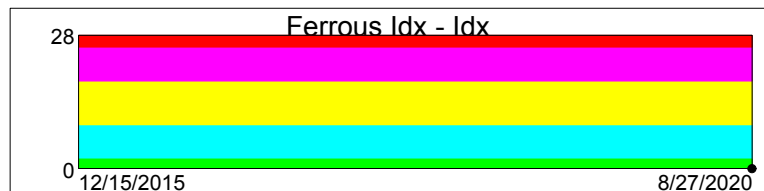
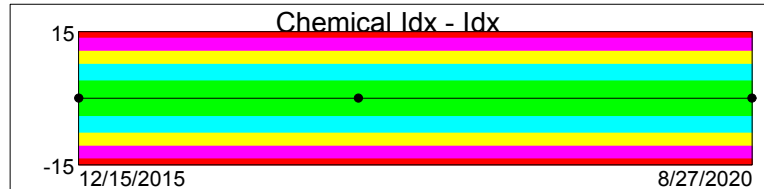
Wear	0	0	0	
Aluminum - ppm	.82	.13	0.00	
Barium - ppm	.09	0.00	.09	
Boron - ppm	.53	.03	.07	
Cadmium - ppm	0.00	.07	.14	
Calcium - ppm	.13	0.00	.27	
Chromium - ppm	.08	.03	0.00	
Copper - ppm	0.00	.05	.01	
Iron - ppm	0.0	.1	.1	
Lead - ppm	0.00	.12	1.16	
Magnesium - ppm	0.00	0.00	.09	
Molybdenum - ppm	0.00	0.00	0.00	
Nickel - ppm	.25	0.00	0.00	
Phosphorus - ppm	0.00	0.00	0.00	
Potassium - ppm	0.00	.06	1.52	
Silicon - ppm	.28	1.29	2.03	
Silver - ppm	.07	0.00	0.00	
Sodium - ppm	0.00	.01	.88	
Tin - ppm	1.54	.50	0.00	
Vanadium - ppm	0.00	0.00	.11	
Zinc - ppm	0.00	.14	.75	
Manganese - ppm	.64	0.00	.56	
Ferrous Idx - Idx	0.0			
LCont Ferrous - Idx	0			
LCont NonFe - Idx	0			
Titanium - ppm	.81	0.00	0.00	

Contamination	1	0	7	
Contam Idx - Idx				
% Water - %				
LCont Droplet - Idx				
Cnts >4 - pml	2,364	2,476	2,388	
Cnts >6 - pml	97	99	97	
Cnts >14 - pml	4	5	4	
Cnts >22 - pml	1	1	1	
Cnts >38 - pml	1	0	0	
Cnts >56 - pml	.6	.4	.2	
Cnts >70 - pml	.3	.1	.1	
ISO >4 - n/a	18	18	18	
ISO >6 - n/a	14	14	14	
ISO >14 - n/a	9	9	9	
NAS 1638 - Idx	7	6	6	
IR Oxidation - au				
IR Water - au				
Water K.Fish - ppm				

Chemistry	0	0	0	
OilLife Idx - Idx				
Chemical Idx - Idx	0.0	0.0	0.0	
Dielectric - Idx				
DV Visc 40C - cSt				
DV Visc %Chng - %				
IR Oxidation - au				
Visc 40C - cSt				
Visc 100C - cSt				
Visc Idx - VI				
Total Acid - koh				
Total Base - koh				



Shermco Industries
33022 FM 2004
Angleton, Texas
(800)-219-9038
G.Sellers@Shermco.com



Sample data ok. Particles within limits. No action required. Continue to monitor at normal sampling schedule.



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Appendix D: Test Sheets – Inspection & Test Plan



3 PHASE LIQUID-FILLED TRANSFORMERS VISUAL & MECHANICAL INSPECTION



CUSTOMER Siemens Canada Ltd. PAGE 1 OF 8
 USER TransCanada Pipelines Ltd. JOB # S226-15
 ADDRESS _____ TESTED BY BM
 PLANT OIL - KeystoneXL - PSXX - Fox Valley DD / MM / YYYY
 PLANT AREA Substation DATE 26/08/2020
 EQUIPMENT ID 126-FXVLY-B0-T-01 TEMP. 25 °C HUMIDITY H %

NAMEPLATE DATA

MANUFACTURER Siemens SERIAL NO. T.040N.001092.01
 SPECIFICATION NO. 9000017832 MVA 20/22.4 / 26.6/29.9 / 33.3/37.3 TYPE SEE COMMENT CLASS C200
 TEMPERATURE RISE 55/65 °C IMPEDANCE 7.058 % B.I.L. RATING 1050 KV PRI. 110 KV SEC - KV TER.
 INSULATING FLUID TYPE Mineral Oil CAPACITY 8,561 USG TOTAL WEIGHT 212,471 LBS
 TANK TYPE SEALED WINDING MATERIAL CU YEAR 2011
 PRIMARY VOLTAGE 230,000 / ☒ DELTA ☐ WYE RATED CURRENT / / / AMPERES
 SECONDARY VOLTAGE 6,900 / 3,984 ☐ DELTA ☒ WYE RATED CURRENT / / / AMPERES
 TERTIARY VOLTAGE / ☐ DELTA ☐ WYE RATED CURRENT / / / AMPERES
 TAP SETTING N 69 VOLTS # FANS 12 TAP CHANGER SIDE: ☐ PRIMARY ☒ SECONDARY SURGE ARRESTORS ☒

DESCRIPTION	INSPECTED	N/A	COMMENTS
* XFMR DATA COMPARES WITH DRAWINGS & SPECIFICATIONS	☒	☐	INSTALLED NAMEPLATE AND MANUAL NAMEPLATE DIFFERENT.
PHYSICAL & MECHANICAL CONDITION	☒	☐	PAINT WEARING OFF AND MINOR RUST THROUGHOUT TANK.
LEAKS	☒	☐	LEAKING AROUND MANHOLES, FILL VALVES AND SECONDARY BUSHINGS.
BREATHERS	☒	☐	LTC SILICA GEL SPENT.
ANCHORAGE & ALIGNMENT	☐	☒	
GROUNDING	☐	☒	
PCB CONTENT LABELLING	☒	☐	NOTE 7 ON NAMEPLATE - NON PCB OIL.
BUSHINGS	☒	☐	INSPECTED, CLEANED AND TESTED.
* ALARM, CONTROL & TRIP SETTINGS ARE AS SPECIFIED	☒	☐	ALL DEVICES OPERATE.
OPERATION OF COOLING FANS / PUMPS	☒	☐	ALL FANS OPERATED. ROTATION IS BACKWARDS WHEN WIRED ACCORDING TO SCHEMATIC.
TANK & BUSHING LIQUID LEVEL	☒	☐	LIQUID LEVEL OF MAIN TANK, BUSHINGS AND LTC GOOD.

* ACCEPTANCE TESTING ONLY

ELECTRICAL CONNECTIONS VERIFIED BY:

☐ CONNECTION TIGHTNESS ☐ THERMOGRAPHIC SURVEY ☐ MEASURED RESISTANCE

GAUGES

LIQUID TEMPERATURE 24 °C MAX 39 °C GAUGE RESET ☒
 WINDING TEMPERATURE 24 °C MAX 31 °C GAUGE RESET ☒
 GAS PRESSURE -0.5 PSI

COMMENTS: TYPE: ONAN/ONAF/ONAF
 DEFICIENCIES:

TEST EQUIPMENT USED _____



LOAD TAP-CHANGER INSPECTION & TESTING



CUSTOMER Siemens Canada Ltd. PAGE 2 OF 8
USER TransCanada Pipelines Ltd. JOB # S226-15
ADDRESS _____ TESTED BY BM
PLANT OIL - KeystoneXL - PSXX - Fox Valley DD / MM / YYYY
PLANT AREA Substation DATE 26/08/2020
EQUIPMENT ID 126-FXVLY-B0-T-01 TEMP. 24 °C HUMIDITY M %

NAMEPLATE DATA

MANUFACTURER REINHAUSEN MFG. SERIAL NUMBER C020837
NUMBER OF TAPS 32 TAP CHANGER SIDE ☐ PRIMARY ☒ SECONDARY

DESCRIPTION	INSPECTED	N/A	COMMENTS
* LTC DATA COMPARES WITH DRAWINGS & SPECIFICATIONS	☐	☒	
PHYSICAL & MECHANICAL CONDITION	☒	☐	OIL LEAK ON THE BASE OF THE LTC COMPARTMENT.
ANCHORAGE & ALIGNMENT	☒	☐	GOOD.
GROUNDING	☐	☒	
CLEANLINESS	☒	☐	OIL LEAK ON THE BASE OF THE LTC COMPARTMENT. CONTROL CABINET CLEAN.
AUXILIARY DEVICE OPERATION	☒	☐	GOOD.
OPERATION OF MOTOR & DRIVE TRAIN	☒	☐	VERIFIED DURING TESTING.
MOTOR CUTOFF AT MAX LOWER & MAX RAISE POSITION	☒	☐	VERIFIED DURING TESTING.
LIQUID LEVEL(S)	☒	☐	LIQUID LEVEL ACCEPTABLE.
MOTOR COMPONENT LUBRICATION	☒	☐	GOOD.
HEATERS	☒	☐	OPERATIONAL.
CONTACTS (INTERNAL INSPECTION)	☐	☒	
PHYSICAL & MECHANICAL CONDITION (INTERNAL INSPECTION)	☐	☒	
GASKETS (INTERNAL INSPECTION)	☐	☒	

* ACCEPTANCE TESTING ONLY

ELECTRICAL CONNECTIONS VERIFIED BY:

☐ CONNECTION TIGHTNESS ☐ THERMOGRAPHIC SURVEY ☐ MEASURED RESISTANCE COUNTER READING: BEG. 002104
END 002299

COMMENTS:
DEFICIENCIES:

TEST EQUIPMENT USED _____



3 PHASE LIQUID-FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER Siemens Canada Ltd. PAGE 3 OF 8
 USER TransCanada Pipelines Ltd. JOB # S226-15
 ADDRESS _____ TESTED BY BM
 PLANT OIL - KeystoneXL - PSXX - Fox Valley DD / MM / YYYY
 PLANT AREA Substation DATE 26/08/2020
 EQUIPMENT ID 126-FXVLY-B0-T-01 TEMP. 25 °C HUMIDITY M %

NAMEPLATE DATA

MANUFACTURER Siemens SERIAL NO. T.040N.001092.01

INSULATION TESTS

☒ MEG-OHMS ☐ MICRO-AMPS WINDING TEMPERATURE 24 °C INSULATION TCF 1.32

TIME (MIN)	PRIMARY TO SECONDARY + GROUND		SECONDARY TO PRIMARY + GROUND	
	5 KV		5 KV	
0.25	50,400	66,528	77,200	101,904
0.50	64,900	85,668	93,100	122,892
0.75	78,600	103,752	111,000	146,520
1.00	88,100	116,292	120,000	158,400
1.25	97,300	128,436	123,000	162,360
1.50	109,000	143,880	128,000	168,960
1.75	116,000	153,120	130,000	171,600
2.00	124,000	163,680	160,000	211,200
3.00	140,000	184,800	198,000	261,360
4.00	140,000	184,800	213,000	281,160
5.00	148,000	195,360	225,000	297,000
6.00	169,000	223,080	243,000	320,760
7.00	180,000	237,600	249,000	328,680
8.00	181,000	238,920	262,000	345,840
9.00	188,000	248,160	270,000	356,400
10.00	190,000	250,800	273,000	360,360
P.I.	2.157		2.275	

POLARIZATION INDEX = 10 MIN READING / 1 MIN READING

CORE GROUND-GROUND _____ MEG-OHMS @ 500V FOR 1 MIN
 CORE CLAMP-GROUND _____ MEG-OHMS @ 500V FOR 1 MIN
 CORE-CORE CLAMP _____ MEG-OHMS @ 500V FOR 1 MIN

COMMENTS: MAIN CORE GROUND - 33,700 Mohms @ 500V FOR 1 MINUTE.
SERIES TRANSFORMER CORE GROUND - 67,100 Mohms @ 500V FOR 1 MINUTE.
REACTOR CORE GROUND - 60,400 Mohms @ 500V FOR 1 MINUTE.
 DEFICIENCIES: _____

TEST EQUIPMENT USED RF66



3 PHASE LIQUID-FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER Siemens Canada Ltd.
 USER TransCanada Pipelines Ltd.
 ADDRESS _____
 PLANT OIL - KeystoneXL - PSXX - Fox Valley
 PLANT AREA Substation
 EQUIPMENT ID 126-FXVLY-B0-T-01

PAGE 4 OF 8
 JOB # S226-15
 TESTED BY BM
 DATE 26/08/2020
 TEMP. 25 °C HUMIDITY M %

NAMEPLATE DATA

MANUFACTURER Siemens SERIAL NO. T.040N.001092.01

PRIMARY - SECONDARY TURNS RATIO

TAP POSITION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CALCULATED RATIO	H 3 - H 1 X 1 - X 0		H 1 - H 2 X 2 - X 0		H 2 - H 3 X 3 - X 0	
				RATIO	EXCITATION (mA)	RATIO	EXCITATION (mA)	RATIO	EXCITATION (mA)
1 - DETC	241,500	6,900 / 3,983.7	60.622	60.729	0.3	60.732	0.3	60.73	0.4
2 - DETC	235,750	6,900 / 3,983.7	59.1787	59.265	0.3	59.262	0.3	59.268	0.4
3 - DETC	230,000	6,900 / 3,983.7	57.7353	57.836	0.3	57.831	0.3	57.827	0.5
4 - DETC	224,250	6,900 / 3,983.7	56.2919	56.372	0.4	56.363	0.3	56.366	0.4
5 - DETC	218,500	6,900 / 3,983.7	54.8485	54.934	0.4	54.934	0.3	54.937	0.4
16R	230,000	7,590 / 4,382	52.4874	52.609	0.4	52.601	0.3	52.606	0.4
15R	230,000	7,547 / 4,357.3	52.785	52.94	0.5	52.941	0.3	52.942	0.5
14R	230,000	7,504 / 4,332	53.0933	53.208	0.4	53.192	0.3	53.206	0.4
13R	230,000	7,461 / 4,307.6	53.394	53.547	0.5	53.544	0.3	53.542	0.4
12R	230,000	7,418 / 4,282.8	53.7032	53.811	0.3	53.81	0.3	53.809	0.5
11R	230,000	7,374 / 4,257.4	54.0236	54.17	0.5	54.166	0.3	54.165	0.3
10R	230,000	7,331 / 4,232.6	54.3401	54.445	0.4	54.438	0.3	54.436	0.4
9R	230,000	7,288 / 4,207.7	54.6617	54.807	0.4	54.807	0.3	54.804	0.4
8R	230,000	7,245 / 4,182.9	54.9858	55.093	0.3	55.091	0.3	55.087	0.4
7R	230,000	7,202 / 4,161	55.2752	55.467	0.5	55.463	0.3	55.461	0.4
6R	230,000	7,159 / 4,133.3	55.6456	55.749	0.3	55.747	0.2	55.748	0.4
5R	230,000	7,116 / 4,108.4	55.9829	56.135	0.4	56.128	0.3	56.13	0.4
4R	230,000	7,073 / 4,083.6	56.3229	56.421	0.3	56.424	0.2	56.431	0.4
3R	230,000	7,029 / 4,058.2	56.6754	56.81	0.5	56.805	0.3	56.806	0.4
2R	230,000	6,986 / 4,033.4	57.0239	57.115	0.3	57.114	0.3	57.124	0.4
1R	230,000	6,943 / 4,008.5	57.3781	57.505	0.4	57.498	0.3	57.504	0.4
N	230,000	6,900 / 3,983.7	57.7353	57.833	0.3	57.828	0.3	57.831	0.4
1L	230,000	6,857 / 3,958.9	58.0969	58.24	0.4	58.239	0.3	58.243	0.4
2L	230,000	6,814 / 3,934.1	58.4632	58.562	0.3	58.566	0.3	58.558	0.3
3L	230,000	6,771 / 3,909.2	58.8356	58.965	0.5	58.972	0.3	58.975	0.4
4L	230,000	6,728 / 3,884.4	59.2112	59.295	0.4	59.302	0.3	59.301	0.4
5L	230,000	6,684 / 3,859	59.6009	59.721	0.4	59.726	0.3	59.732	0.4
6L	230,000	6,641 / 3,834.2	59.9864	60.076	0.3	60.072	0.3	60.067	0.4
7L	230,000	6,598 / 3,809.4	60.377	60.511	0.5	60.512	0.3	60.516	0.4
8L	230,000	6,555 / 3,784.5	60.7742	60.857	0.4	60.852	0.3	60.86	0.4
9L	230,000	6,512 / 3,759.7	61.1751	61.601	0.5	61.307	0.3	61.308	0.4
10L	230,000	6,469 / 3,734.9	61.5813	61.664	0.4	61.669	0.3	61.667	0.3
11L	230,000	6,426 / 3,710.1	61.9929	62.138	0.5	62.133	0.4	62.136	0.4

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED RF23



3 PHASE LIQUID-FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER	<u>Siemens Canada Ltd.</u>	PAGE	<u>5</u>	OF	<u>8</u>
USER	<u>TransCanada Pipelines Ltd.</u>	JOB #	<u>S226-15</u>		
ADDRESS	<u></u>	TESTED BY	<u>BM</u>		
PLANT	<u>OIL - KeystoneXL - PSXX - Fox Valley</u>		DD / MM / YYYY		
PLANT AREA	<u>Substation</u>	DATE	<u>26/08/2020</u>		
EQUIPMENT ID	<u>126-FXVLY-B0-T-01</u>	TEMP.	<u>25</u> °C	HUMIDITY	<u>M</u> %

PRIMARY - SECONDARY TURNS RATIO

TAP POSITION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CALCULATED RATIO	H 3 - H 1 X 1 - X 0		H 1 - H 2 X 2 - X 0		H 2 - H 3 X 3 - X 0	
				RATIO	EXCITATION (mA)	RATIO	EXCITATION (mA)	RATIO	EXCITATION (mA)
12L	230,000	6,383 / 3,685.2	62.4118	62.508	0.4	62.496	0.3	62.5	0.4
13L	230,000	6,339 / 3,659.8	62.845	62.978	0.5	62.965	0.3	62.969	0.4
14L	230,000	6,296 / 3,635	63.2737	63.356	0.4	63.35	0.3	63.364	0.4
15L	230,000	6,253 / 3,610.2	63.7084	63.839	0.5	63.829	0.3	63.83	0.4
16L	230,000	6,210 / 3,585.4	64.149	64.234	0.4	64.225	0.4	64.233	0.4



3 PHASE LIQUID-FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER Siemens Canada Ltd. PAGE 6 OF 8
 USER TransCanada Pipelines Ltd. JOB # S226-15
 ADDRESS _____ TESTED BY BM
 PLANT OIL - KeystoneXL - PSXX - Fox Valley DD / MM / YYYY
 PLANT AREA Substation DATE 26/08/2020
 EQUIPMENT ID 126-FXVLY-B0-T-01 TEMP. 24 °C HUMIDITY M %

NAMEPLATE DATA

MANUFACTURER Siemens SERIAL NO. T.040N.001092.01

WINDING TEMPERATURE 15 °C RESISTANCE TCF 1.02004

PRIMARY WINDING RESISTANCE

☒ OHMS ☐ MILLI-OHMS

TAP POSITION	RESISTANCE					
	H 3	-	H 1	H 1	-	H 2
1	6.79		6.926	6.782		6.918
2	6.626		6.759	6.622		6.755
3	6.468		6.598	6.46		6.589
4	6.304		6.43	6.297		6.423
5	6.134		6.257	6.138		6.261

☐ OHMS ☒ MILLI-OHMS

SECONDARY WINDING RESISTANCE

TAP POSITION	RESISTANCE					
	X 1	-	X 0	X 2	-	X 0
16L	4.312		4.398	2.296		2.342
15L	4.266		4.352	2.296		2.342
14L	4.24		4.325	2.296		2.342
13L	4.22		4.305	2.296		2.342
12L	4.18		4.264	2.297		2.343
11L	4.161		4.244	2.298		2.344
10L	4.151		4.234	2.299		2.345
9L	4.126		4.209	2.3		2.346
8L	4.115		4.197	2.301		2.347
7L	4.107		4.189	2.304		2.35
6L	4.078		4.16	2.309		2.355
5L	4.079		4.161	2.315		2.361
4L	4.07		4.152	2.323		2.37
3L	4.065		4.146	2.342		2.389
2L	4.061		4.142	3.459		3.528
1L	4.055		4.136	3.607		3.679
N	4.051		4.132	3.745		3.82
1R	4.042		4.123	3.807		3.883
2R	4.04		4.121	3.856		3.933
3R	4.033		4.114	3.882		3.96
4R	4.037		4.118	3.909		3.987
5R	4.026		4.107	3.932		4.011
6R	4.017		4.098	3.953		4.032
7R	3.993		4.073	3.969		4.049

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED RF13



3 PHASE LIQUID-FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER	Siemens Canada Ltd.	PAGE	7	OF	8
USER	TransCanada Pipelines Ltd.	JOB #	S226-15		
ADDRESS		TESTED BY	BM		
PLANT	OIL - KeystoneXL - PSXX - Fox Valley	DATE	DD / MM / YYYY 26/08/2020		
PLANT AREA	Substation	TEMP.	24 °C	HUMIDITY	M %
EQUIPMENT ID	126-FXVLY-B0-T-01				

SECONDARY WINDING RESISTANCE

TAP POSITION	RESISTANCE					
	X 1	-	X 0	X 2	-	X 0
8R	3.993		4.073	3.989		4.069
9R	3.987		4.067	4.057		4.138
10R	3.982		4.062	4.061		4.142
11R	3.967		4.047	4.063		4.144
12R	3.965		4.044	4.078		4.16
13R	3.949		4.028	4.077		4.159
14R	3.943		4.022	4.074		4.156
15R	3.936		4.015	4.071		4.153
16R	3.925		4.004	4.094		4.176



LIQUID FILLED TRANSFORMERS ELECTRICAL TESTING



CUSTOMER Siemens Canada Ltd. PAGE 8 OF 8
USER TransCanada Pipelines Ltd. JOB # S226-15
ADDRESS _____ TESTED BY BM
PLANT OIL - KeystoneXL - PSXX - Fox Valley DD / MM / YYYY
PLANT AREA Substation DATE 26/08/2020
EQUIPMENT ID 126-FXVLY-B0-T-01 TEMP. 24 °C HUMIDITY M %

NAMEPLATE DATA

MANUFACTURER Siemens SERIAL NO. T.040N.001092.01

TRANSFORMER ALARMS

DESCRIPTION	TESTED	N/A	COMMENTS
RAPID PRESSURE RELAY	☒	☐	DEVICE TESTED AND OPERATED.
WINDING TEMPERATURE	☒	☐	WINDING TEMPERATURE DEVICE TESTED AND OPERATED.
LIQUID TEMPERATURE (MAIN TANK)	☒	☐	LIQUID TEMPERATURE DEVICE TESTED AND OEPRATED.
LIQUID TEMPERATURE (LTC)	☒	☐	LIQUID LTC SETPOINTS NOT SET. THE GAUGE DRAGHAND IS ON THE WRONG SIDE OF THE TEMPERATURE NEEDLE.
PRESSURE RELIEF DEVICE (MAIN TANK)	☒	☐	CONTROL WIRING FOUND DISCONNECT. CONNECTED AND DEVICE TESTED AND OPERATED
PRESSURE RELIEF DEVICE (LTC)	☒	☐	DEVICE TESTED AND OPERATED.
GAS ACCUMULATION	☐	☒	
OIL LEVEL	☒	☐	OIL LEVEL ON MAIN TANK AND LTC TESTED AND OPERATED.

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED _____

Surge Arrester Testing

Test List												
Surge Arrester												
Administration												
History												
Notes (By Session)												
Setup									Results			
#	Phase	Position	Manufacturer	Serial Number	Rated V [kV]	Test Mode		Test kV	V [kV]	I [mA]	Loss [W]	Ask FRANK™
1	H1	1	Hubbell/Kerite Co. Inc.	S-96862	230.000	GAR RB	▼	10.000	10.001	0.247	0.037	U Unrated
2	H2	1		S-96861	230.000	GAR RB	▼	10.000	10.000	0.243	0.035	U Unrated
3	H3	1		S-96857	230.000	GAR RB	▼	10.000	10.000	0.244	0.033	U Unrated
4	X1	1		S-96858	230.000	GAR RB	▼	10.000	10.000	0.247	0.034	U Unrated
5	X2	1		S-96860	230.000	GAR RB	▼	10.000	10.000	0.248	0.035	U Unrated
6	X3	1		S-96859	230.000	GAR RB	▼	10.000	10.000	0.245	0.033	U Unrated



Shermco Industries®

One Line. One Company.®

Appendix E: Doble M4000 – Power Factor Test Data

T040N00109201_X2 (Siemens)



Report Source TwoWindingTransformer

Session Test Date 2020-08-26 11:37:49 AM

Nameplate - Two-winding Transformer

Company	SIEMENS	Serial Number	T.040N.001092.01
Location	Regina, SK	Special ID	126-FXVLY-B0-T-01
Division	TC Energy - KXL	Circuit Designation	9000017832
Manufacturer	Siemens	Configuration	D_Y
Year Manufactured	2011	Tank Type	Sealed
Mfr Location	Mexico	Coolant	Oil
Phases	Three	Class	ONAN/ONAF/ONAF
Oil Volume	8561 UG	BIL	1050 kV
Weight	212471 LB		
kV	230, 6.9	VA Rating	20, 26.7, 33.3, 37.3, MVA

Administration

Test Date	2020-08-26	Test Time:	11:37 AM	Weather	Cloudy
Air Temperature	22.9°C	Apparatus Temperature	25°C	Humidity	32.991 %
Tester	BM	Work Order		Date Last Tested	2015-11-19
Verified		Test Set Type	M4100	Date Retested	
Verification Date		Set Top Serial #	11120768	Reason	
Last Sheet #		Test Set Model	M4100	Travel Time	
Purchase Order		Ins. Book #		Duration	
Copies		Sheet #		Crew Size	

Bushing Nameplate

Designation	Serial #	Manufacturer	Type	C1 %PF	C1 Cap	C2 %PF	C2 Cap	Rated kV	Amps
H1	1ZUA 1000027404	ABB (ASEA-Brown Boveri)	O+C	0.34	513	0.31	6605	230	800
H2	1ZUA 1000027410	ABB (ASEA-Brown Boveri)	O+C	0.32	512	0.3	6587	230	800
H3	1ZUA 1000027405	ABB (ASEA-Brown Boveri)	O+C	0.33	511	0.31	6540	230	800
X0	1000028069	ABB (ASEA-Brown Boveri)	A	*	*	*	*	15	4000
X1	1000028070	ABB (ASEA-Brown Boveri)	A	*	*	*	*	15	4000
X2	1000028071	ABB (ASEA-Brown Boveri)	A	*	*	*	*	15	4000
X3	1000028423	ABB (ASEA-Brown Boveri)	A	*	*	*	*	15	4000

Bushing Additional Details -H1

Designation H1	Voltage Primary	Serial # 1ZUA 1000027404	
Catalog # N/A	Amps 800 A	BIL 1050 kV	Tap Y
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 56.25	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight 1272.00	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -H2

Designation H2	Voltage Primary	Serial # 1ZUA 1000027410	
Catalog # N/A	Amps 800 A	BIL 1050 kV	Tap Y
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 56.25	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight 1272.00	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -H3

Designation H3	Voltage Primary	Serial # 1ZUA 1000027405	
Catalog # N/A	Amps 800 A	BIL 1050 kV	Tap Y
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 56.25	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight 1272.00	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -X0

Designation X0	Voltage Secondary	Serial # 1000028069	
Catalog # W1B040BB VER 2	Amps 4000 A	BIL 110 kV	Tap N
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 24.95	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -X1

Designation X1	Voltage Secondary	Serial # 1000028070	
Catalog # W1B040BB VER 2	Amps 4000 A	BIL 110 kV	Tap N
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 24.95	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -X2

Designation X2	Voltage Secondary	Serial # 1000028071	
Catalog # W1B040BB VER 2	Amps 4000 A	BIL 110 kV	Tap N
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 24.95	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details -X3

Designation X3	Voltage Secondary	Serial # 1000028423	
Catalog # W1B040BB VER 2	Amps 4000 A	BIL 110 kV	Tap N
Class N/A	Year 2011	Drawing	
Style	Other N/A	S.O. Number N/A	
Physical Dimensions			
Creep Distance *	Overall Length 24.95	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units in			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Overall Tests

	Insulation	Test kV	mA	Watts	PF*TCF [%]	Corr Fctr	Cap (pF)	FRANK™	Manual
1	CH+CHL	10.001	23.714	0.508	0.209	0.976	6290.260		
2	CH	10.000	10.588	0.245	0.226	0.976	2808.605	Good	
3	CHL	10.000	13.116	0.260	0.195	0.976	3479.050	Good	
	(Measured)								
4	CHL	*	13.125	0.264	0.196	0.976	3481.655	Good	
5	CL+CHL	3.999	44.474	1.095	0.240	0.976	11797.250		
6	CL	4.000	31.350	0.828	0.257	0.976	8315.800	Good	
7	CHL	4.000	13.122	0.264	0.196	0.976	3480.645	Good	
	(Measured)								
8	CHL	*	13.124	0.268	0.199	0.976	3481.450	Good	
Winding without Attached Bushing Calculation									
	CH-C1	CH'	10.588	0.245	0.226	0.976	2808.605		
	CL-C1	CL'	31.350	0.828	0.257	0.976	8315.800		

C1

ID	Serial #	Test kV	mA	Watts	Corr Fctr	PF*TCF [%]	NP %PF	Cap (pF)	NP Cap	FRANK™	Manual
H1	1ZUA 1000027404	10.001	1.902	0.060	1.042	0.330	0.34	504.598	513	Good	
H2	1ZUA 1000027410	10.000	1.897	0.060	1.042	0.329	0.32	503.273	512	Good	
H3	1ZUA 1000027405	10.001	1.899	0.060	1.042	0.328	0.33	503.713	511	Good	

C2

ID	Serial #	Test kV	mA	Watts	Corr Fctr	PF*TCF [%]	NP %PF	Cap (pF)	NP Cap	FRANK™	Manual
H1	1ZUA 1000027404	2.000	24.729	0.670	1	0.271		6559.635	6605	Good	
H2	1ZUA 1000027410	2.000	24.675	0.669	1	0.271		6545.290	6587	Good	
H3	1ZUA 1000027405	2.000	24.538	0.662	1	0.269		6508.680	6540	Good	

Hot Collar Tests

ID	Serial #	Test Mode	Skirt #	Standard			Legacy (GST, optional)			FRANK™	Manual
				Test kV	mA	Watts	Test kV	mA	Watts		
X0	1000028069	UST RB	1	10.000	0.105	0.040	*	0.105	*		
X1	1000028070	UST RB	1	10.001	0.106	0.040	*	0.106	*		
X2	1000028071	UST RB	1	10.000	0.103	0.045	*	0.103	*		
X3	1000028423	UST RB	1	10.001	0.097	0.041	*	0.097	*		

FRANK™ Message 1 (Unrated) - Current evaluation is based on the means of all currents at the same skirt. This line will be rerated testing at least three similar bushings at this same skirt position.

The watts losses are within the acceptable range.

2 (Unrated) - Current evaluation is based on the means of all currents at the same skirt. This line will be rerated testing at least three similar bushings at this same skirt position.

The watts losses are within the acceptable range.

3 (Unrated) - Current evaluation is based on the means of all currents at the same skirt. This line will be rerated testing at least three similar bushings at this same skirt position.

The watts losses are within the acceptable range.

4 (Unrated) - Current evaluation is based on the means of all currents at the same skirt. This line will be rerated testing at least three similar bushings at this same skirt position.

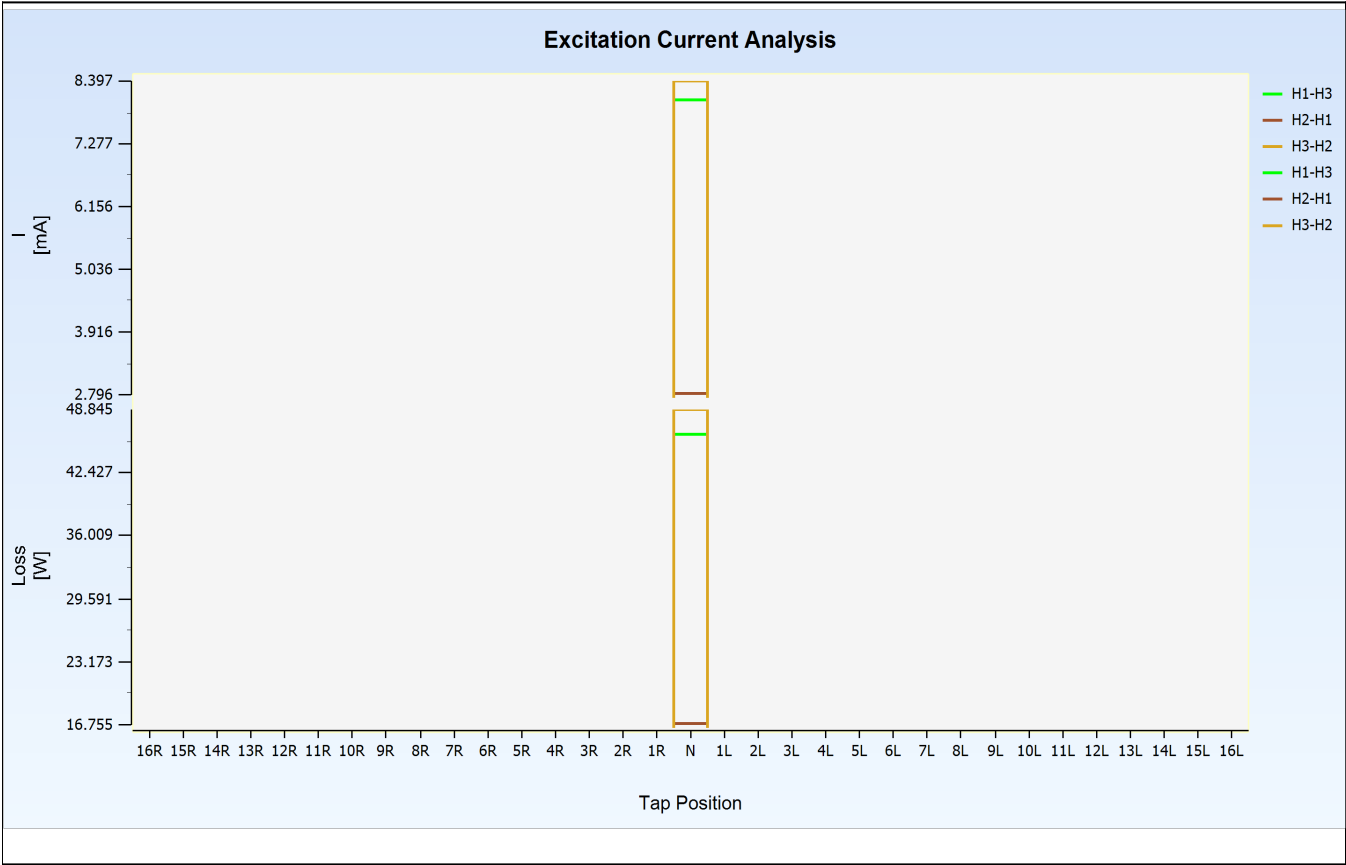
The watts losses are within the acceptable range.

Excitation Current & Losses Tests

Manufacturer		Type	Steps	Boost %	Buck %	Position Found	Position Left	Oil Volume
DETC			5	*	*	1	1	*
DETC			5	*	*	2	2	*
DETC			5	*	*	3	3	*
DETC			5	*	*	4	4	*
DETC			5	*	*	5	5	*
OnLine	Reinhausen	RMV-II 1500	33	*	*			*

Winding : Tap	Test kV	H1 H3			H2 H1			H3 H2			FRANK™	Manual
		mA	Watts	X	mA	Watts	X	mA	Watts	X		
HV: 1 (Max V) LV: N	10	8.049	46.389	L	2.824	16.924	L	8.397	48.845	L	Good	
HV: 2 LV: N	10	8.121	47.280	L	2.941	17.693	L	8.765	51.008	L	Good	
HV: 3 LV: N	10	8.360	48.954	L	3.057	18.495	L	9.135	53.441	L	Good	
HV: 4 LV: N	10	8.663	51.000	L	3.179	19.341	L	9.532	55.947	L	Good	
HV: 5 (Min V) LV: N	10	8.989	53.224	L	3.305	20.234	L	9.939	58.602	L	Good	

Excitation Current Plot





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Appendix F: Sweep Frequency Response Analysis (SFRA) Data



Transformer Count: 1
Total Test Count: 9

1. Manufacturer: Siemens, Serial Number: T.040N.001092.01, Special ID: 126-FXVLY-A0-T-01

TestDate: 2020-08-27 9:46 AM, Trace Name: H1-H3_2020-08-27_09-46-05
TestDate: 2020-08-27 9:54 AM, Trace Name: H2-H1_2020-08-27_09-54-14
TestDate: 2020-08-27 10:01 AM, Trace Name: H3-H2_2020-08-27_10-01-22
TestDate: 2020-08-27 10:08 AM, Trace Name: H3-H2_2020-08-27_10-08-38
TestDate: 2020-08-27 10:17 AM, Trace Name: H1-H3_2020-08-27_10-17-19
TestDate: 2020-08-27 10:25 AM, Trace Name: H2-H1_2020-08-27_10-25-14
TestDate: 2020-08-27 10:33 AM, Trace Name: X1-X0_2020-08-27_10-33-37
TestDate: 2020-08-27 10:39 AM, Trace Name: X2-X0_2020-08-27_10-39-02
TestDate: 2020-08-27 10:44 AM, Trace Name: X3-X0_2020-08-27_10-44-07

Nameplate Details

1. Manufacturer: Siemens, Serial Number: T.040N.001092.01, Special ID: 126-FXVLY-A0-T-01

TestTemplate: 3-Ph 2-Wind D-Y

Serial Number: T.040N.001092.01
Manufacturer: Siemens
Year of Manufacture: 2011
Special ID: 126-FXVLY-A0-T-01
Current: 50
Phases: 3
Windings: 2
Type: DIST
HV: 230
LV1: 6.9
LV2: 0
Tertiary: 0
Impedance HV-LV1: 7.05
Impedance HV-LV2: 0
Impedance HV-Tertiary: 0
Impedance LV-Tertiary: 0

MVA Maximum: 37.33
MVA1: 20
MVA2: 26.66
MVA3: 33.3
Notes:
Template: 3-Ph 2-Wind D-Y
LTC Serial Number: C020837
LTC Manufacturer: Reinhausen
LTC Year of Mfr: 2011
LTC Range: 16L-16L
LTC Notes:
DETC Serial Number: T.040N.001092.01
DETC Manufacturer: Siemens
DETC Year of Mfr: 2011
DETC Range: 1-5
DETC Notes:

Instrument Details

1. Manufacturer: Siemens, Serial Number: T.040N.001092.01, Special ID: 126-FXVLY-A0-T-01

TestDate: 2020-08-27 9:46 AM, Trace Name: H1-H3_2020-08-27_09-46-05

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 9:54 AM, Trace Name: H2-H1_2020-08-27_09-54-14

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:01 AM, Trace Name: H3-H2_2020-08-27_10-01-22

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:08 AM, Trace Name: H3-H2_2020-08-27_10-08-38

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:17 AM, Trace Name: H1-H3_2020-08-27_10-17-19

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:25 AM, Trace Name: H2-H1_2020-08-27_10-25-14

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:33 AM, Trace Name: X1-X0_2020-08-27_10-33-37

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

TestDate: 2020-08-27 10:39 AM, Trace Name: X2-X0_2020-08-27_10-39-02

Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

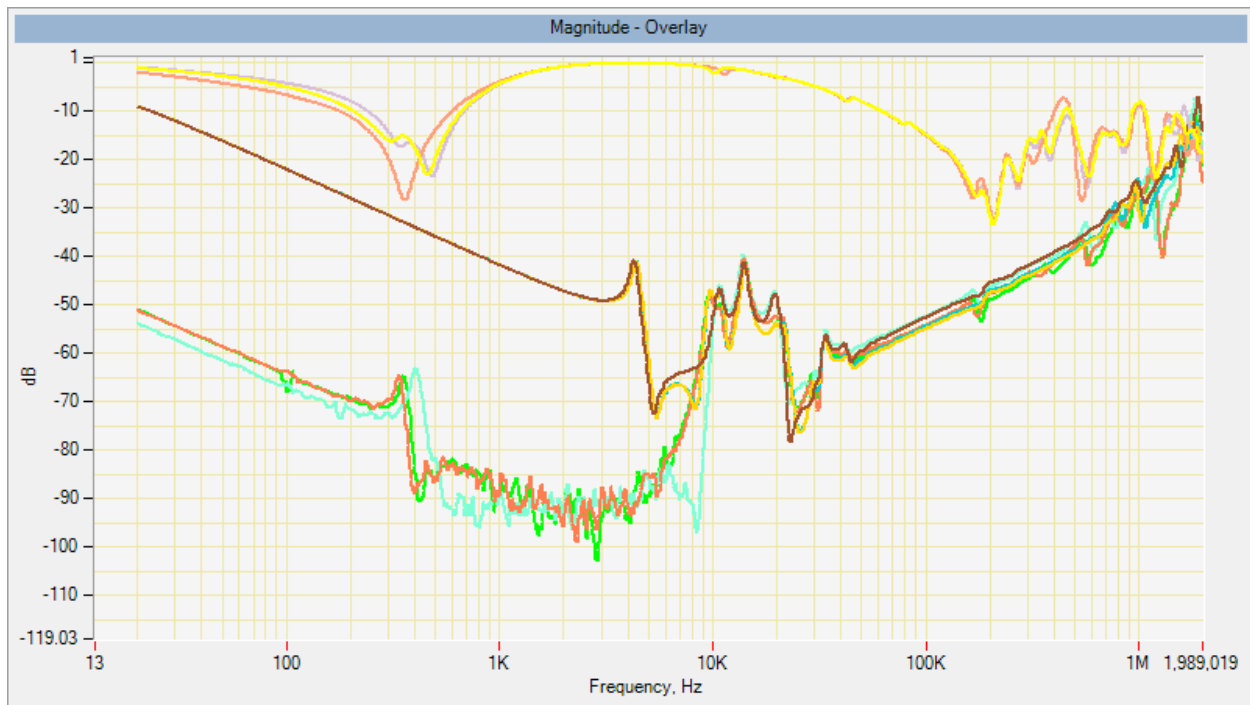
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Tested by: BM

Instrument serial number: T.040N.001092.01

Notes:

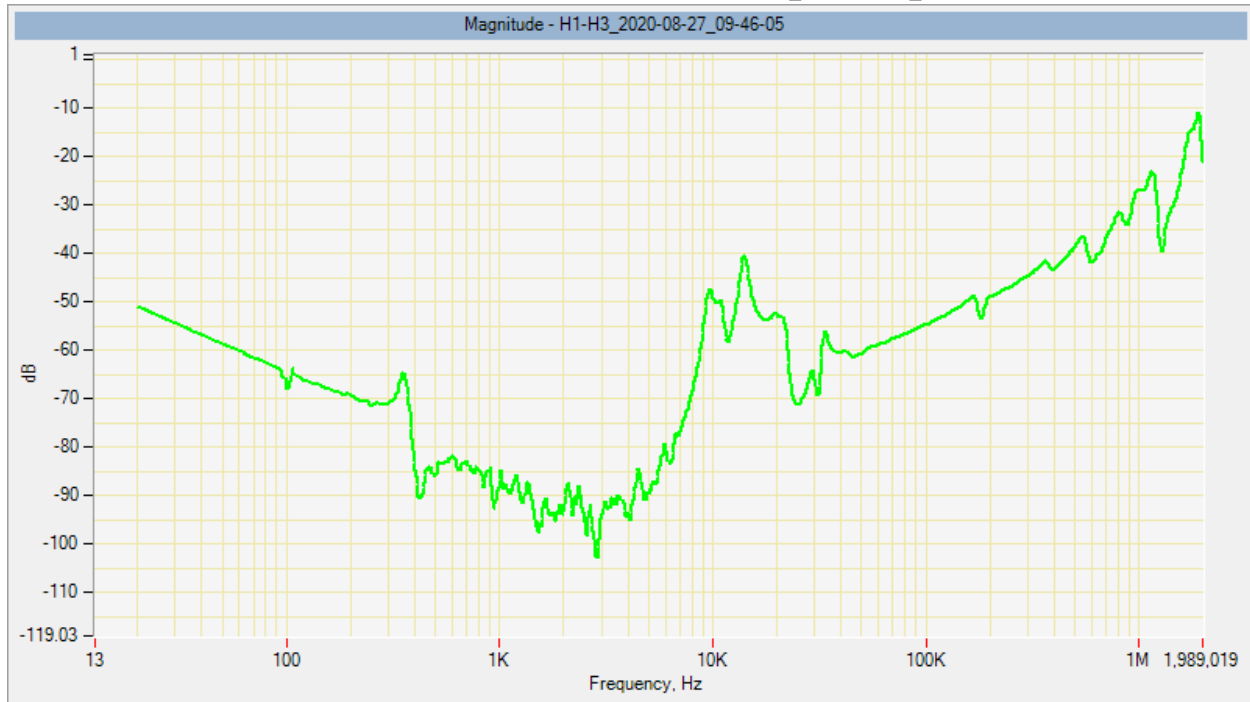
Sweep Frequency Response Analyzer Test Report



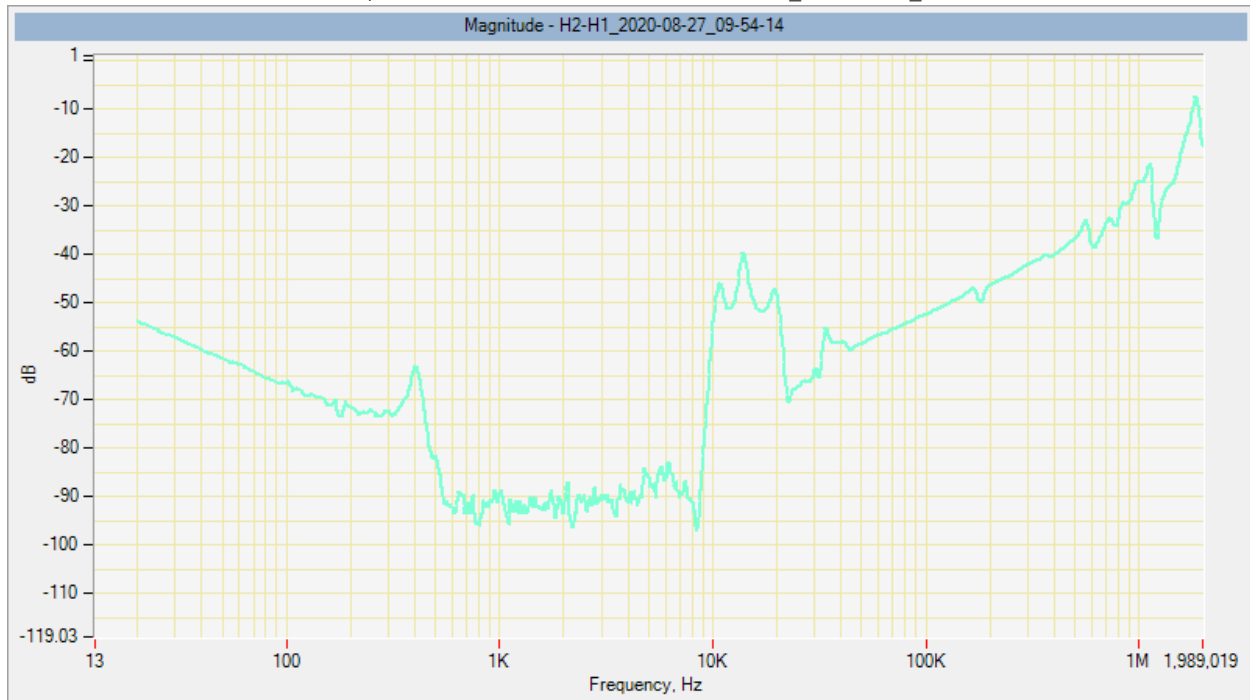
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	H2-H1_2020-08-27_09-54-14 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 9:54:14 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	H3-H2_2020-08-27_10-01-22 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:01:22 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	H3-H2_2020-08-27_10-08-38 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:08:38 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	H1-H3_2020-08-27_10-17-19 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:17:19 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	H2-H1_2020-08-27_10-25-14 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:25:14 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	X1-X0_2020-08-27_10-33-37 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:33:37 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	X2-X0_2020-08-27_10-39-02 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:39:02 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9
	X3-X0_2020-08-27_10-44-07 -	Manufacturer: SiemensSerial Number: T.040N.001092.01Date: 2020-08-27 10:44:07 AM LTC: NDETC: 3MVA Maximum: 37.33KV: 230/6.9

Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H1-H3_2020-08-27_09-46-05

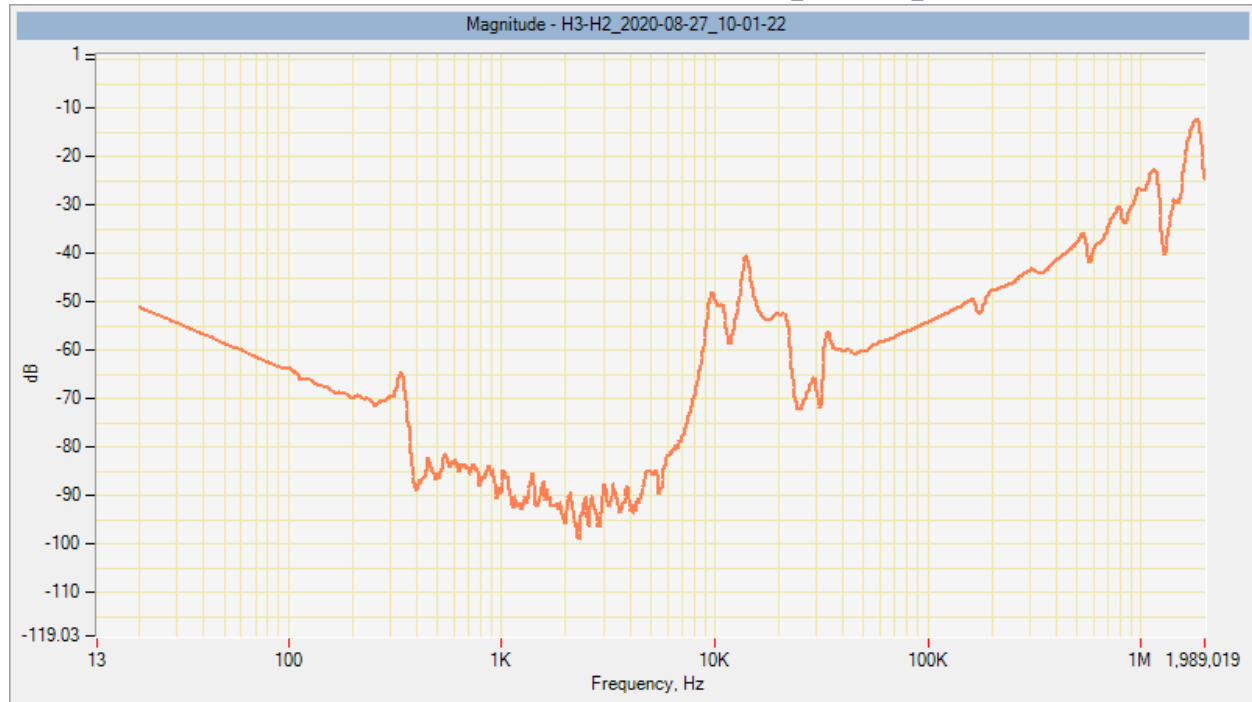


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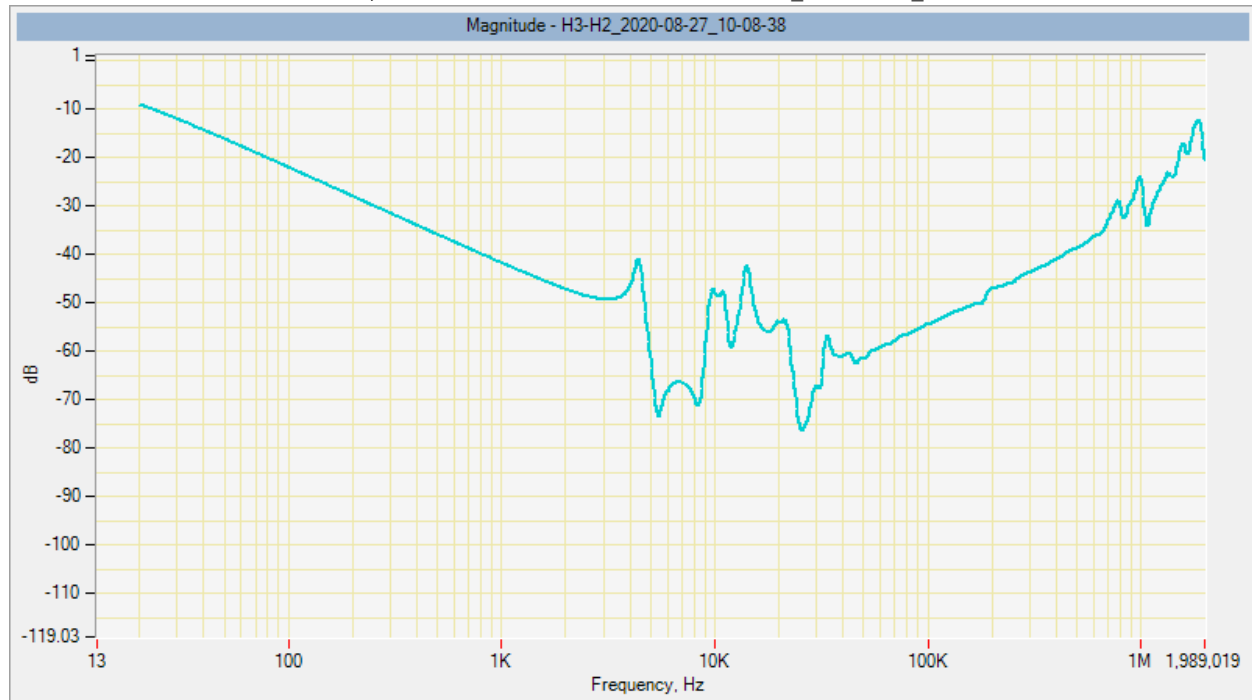


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H3-H2_2020-08-27_10-01-22

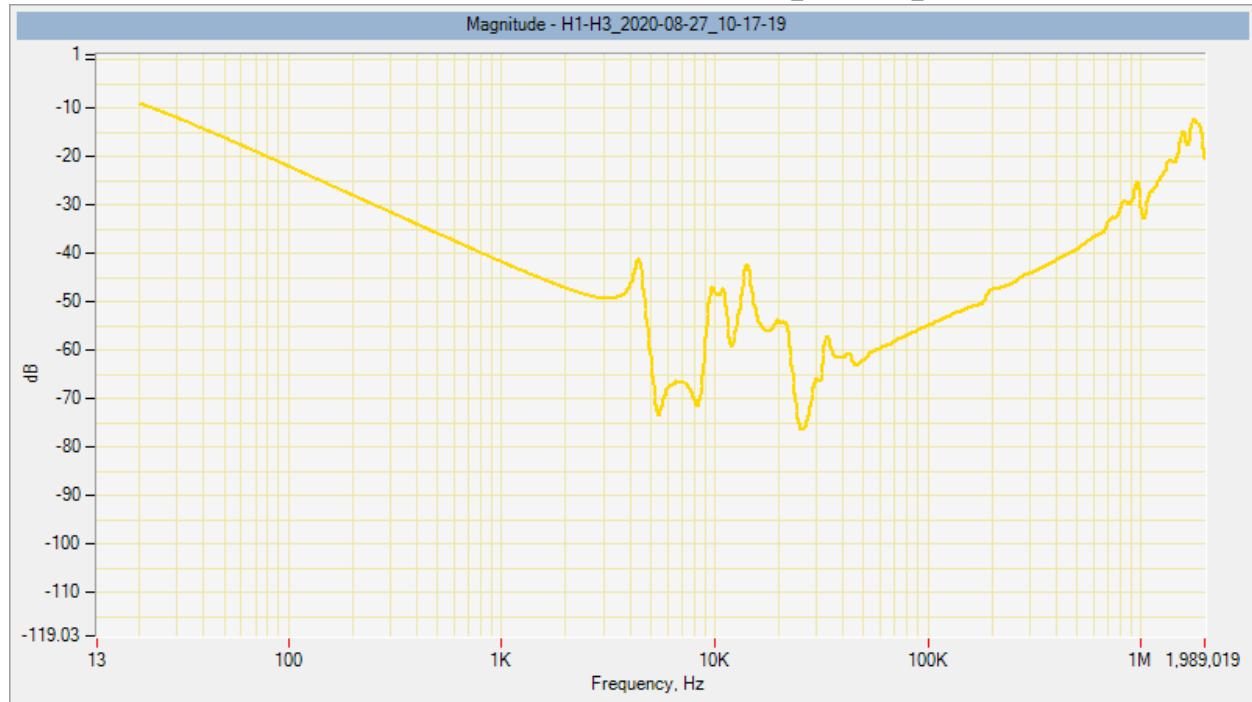


Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H3-H2_2020-08-27_10-08-38

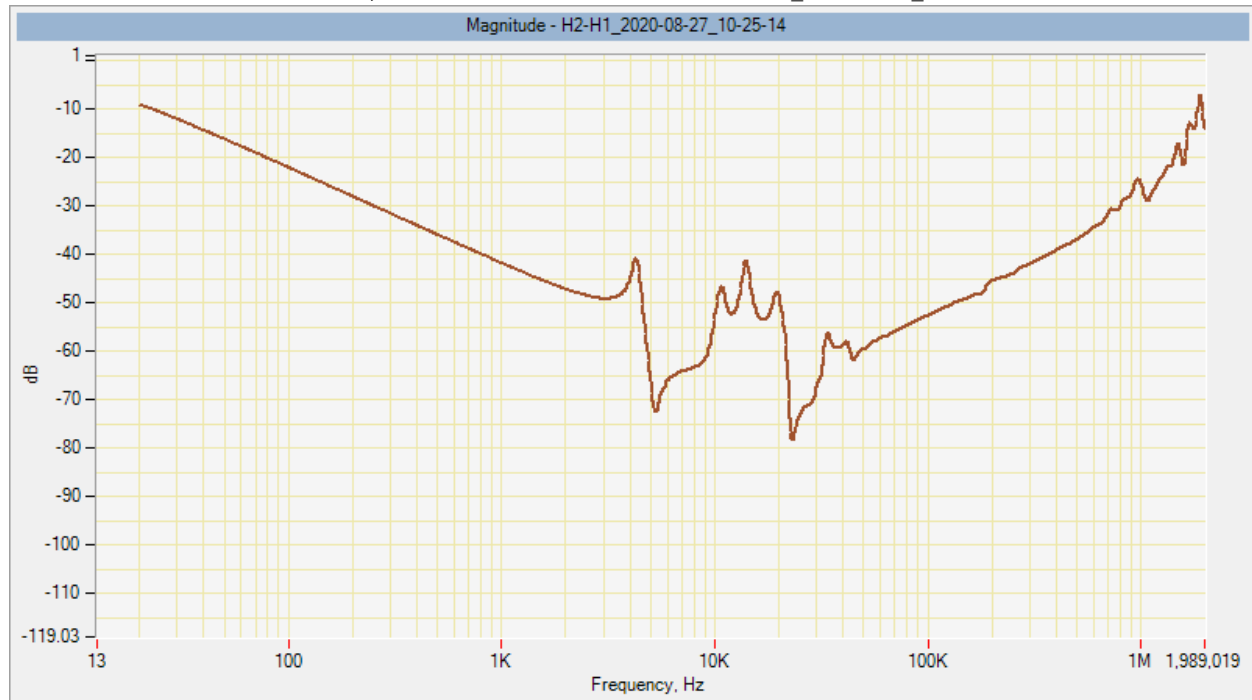


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H1-H3_2020-08-27_10-17-19

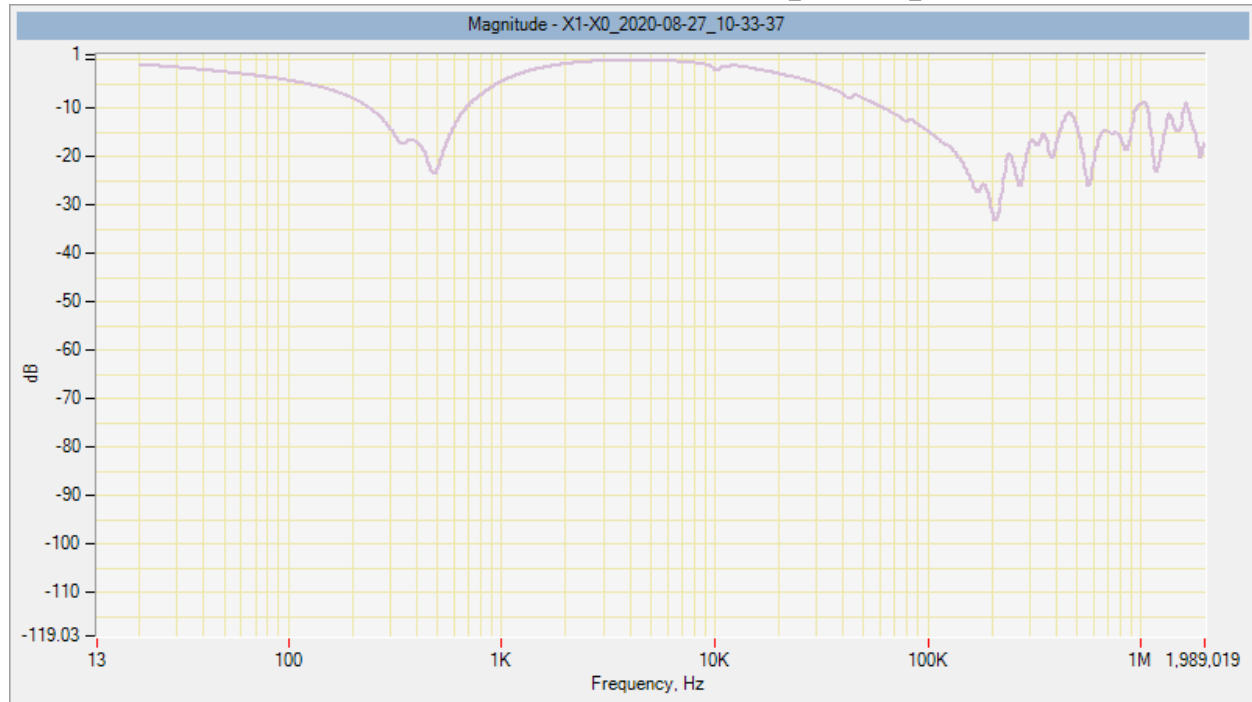


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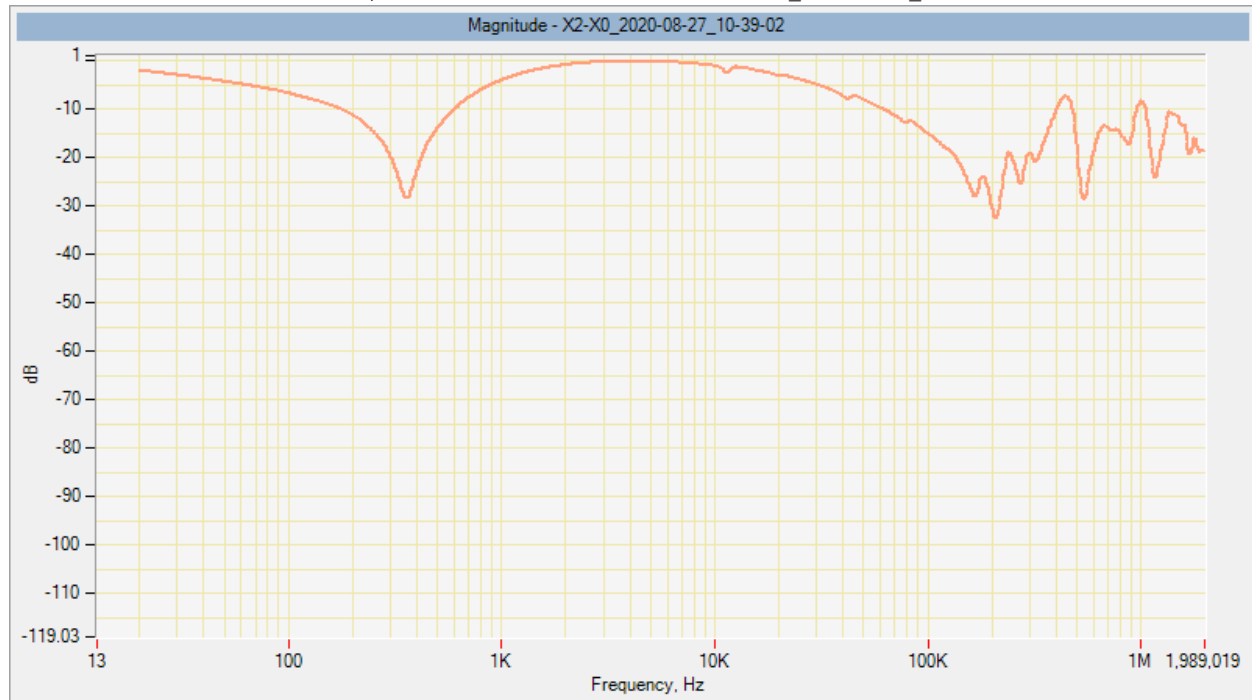


Sweep Frequency Response Analyzer Test Report

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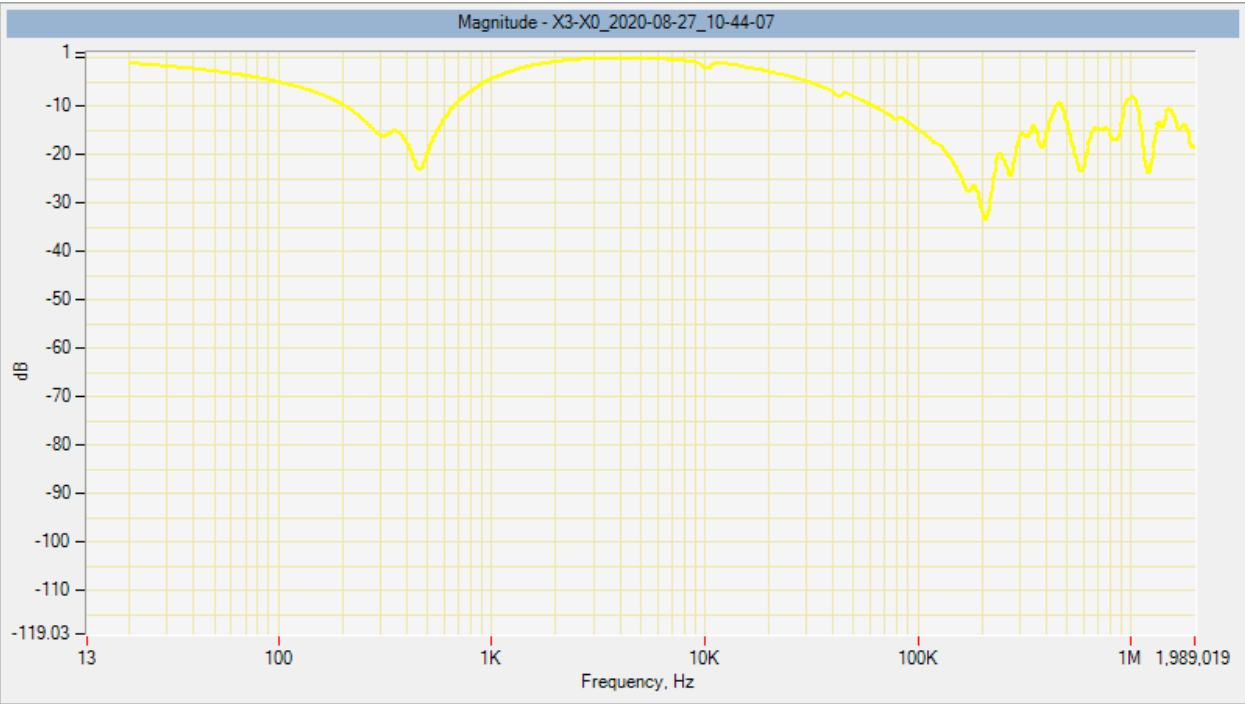


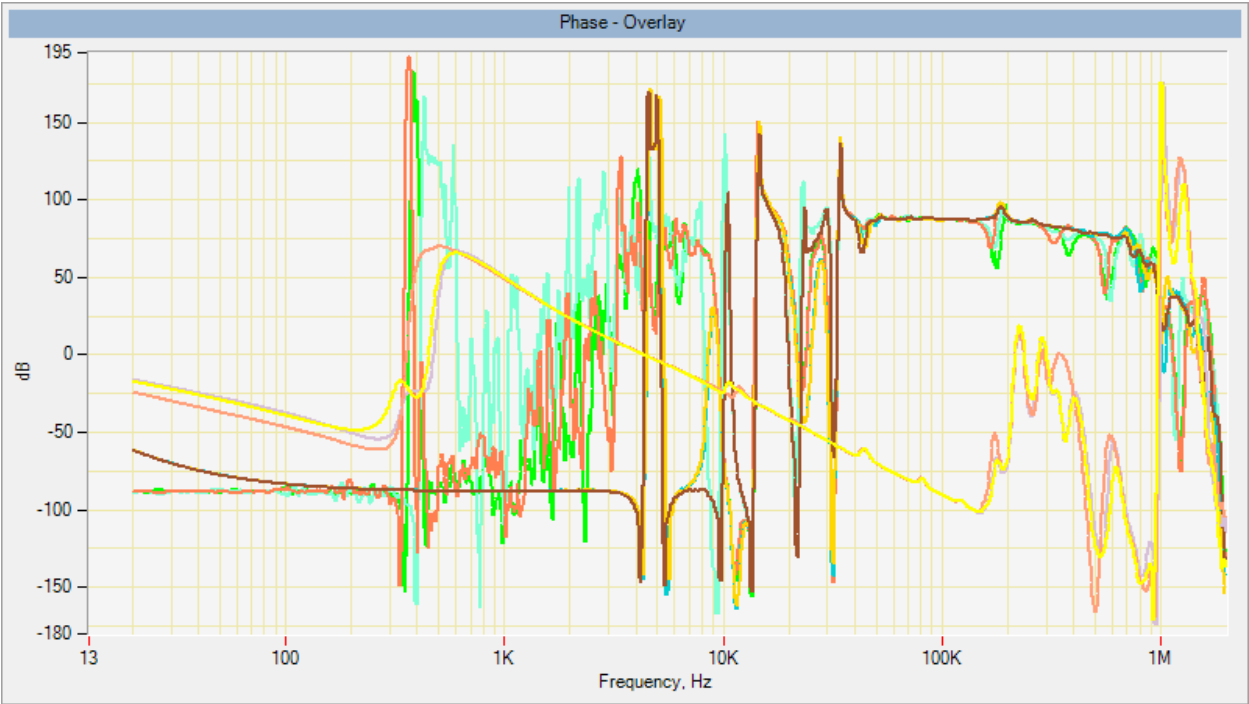
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Sweep Frequency Response Analyzer Test Report

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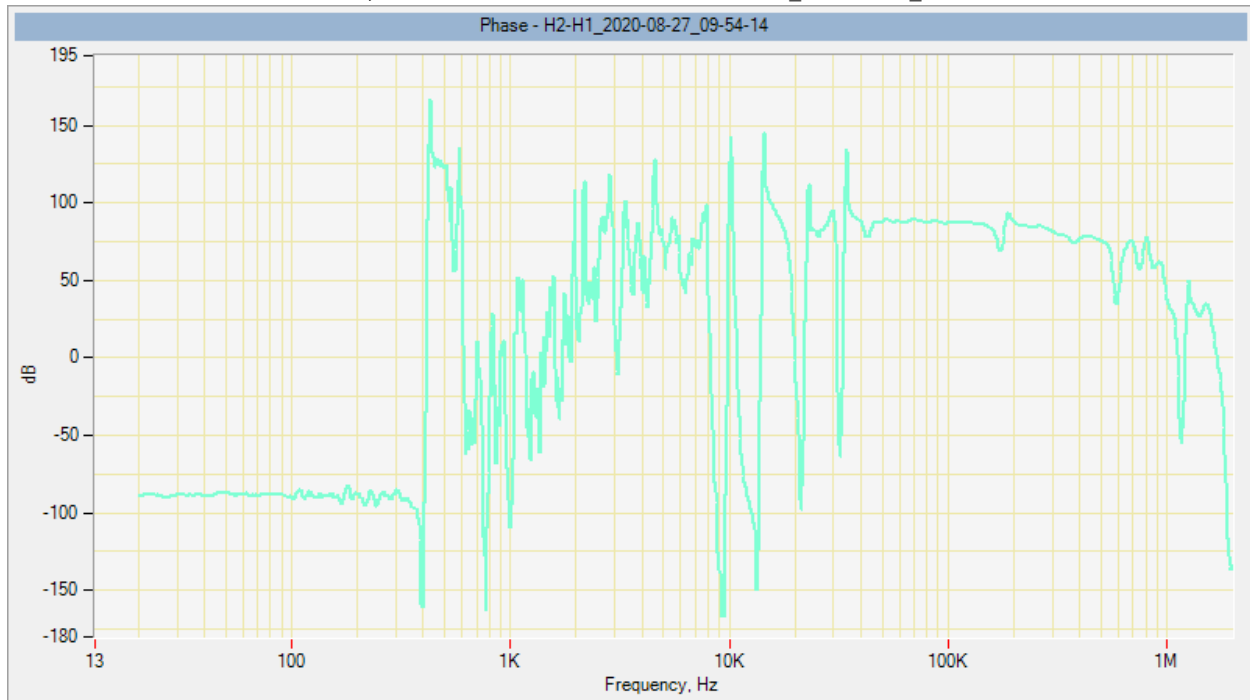


Sweep Frequency Response Analyzer Test Report

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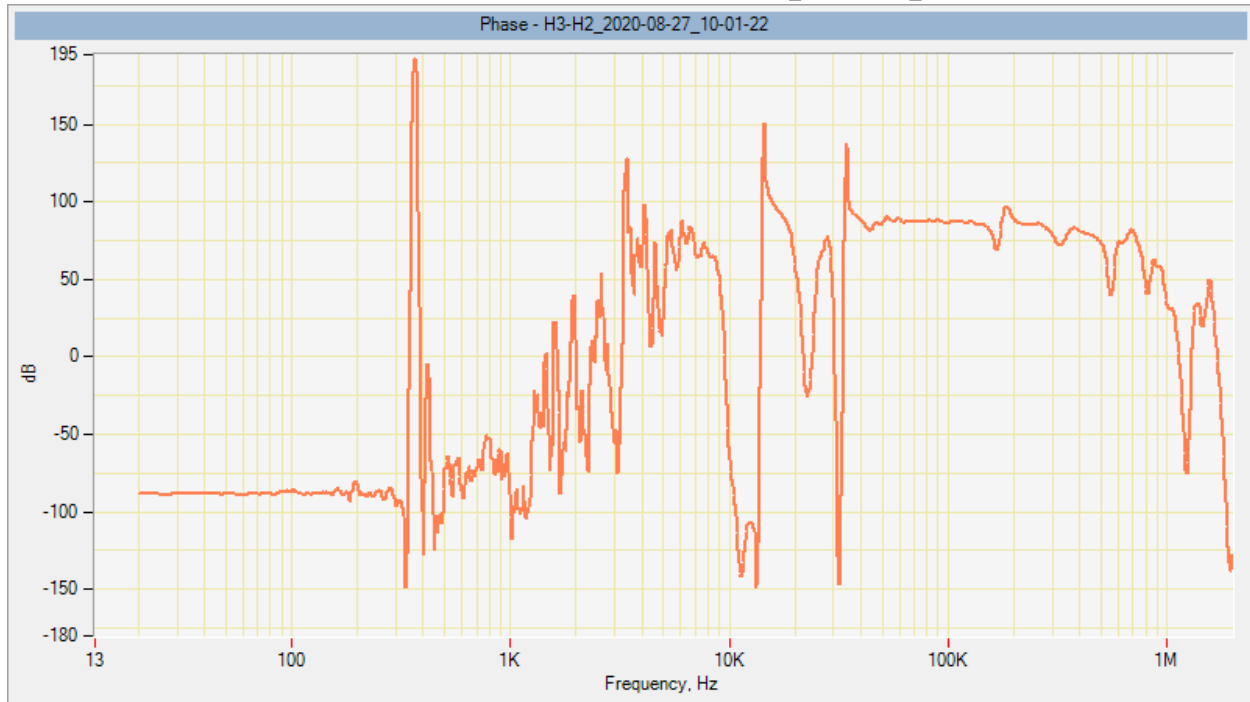


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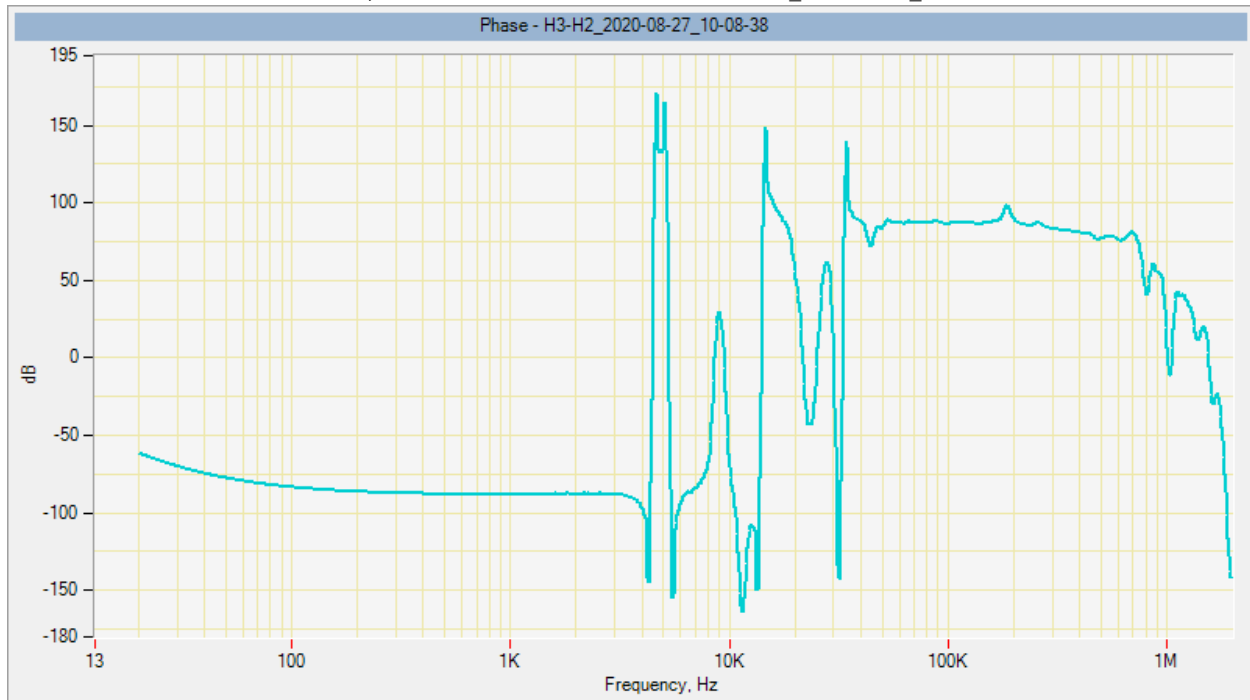


Sweep Frequency Response Analyzer Test Report

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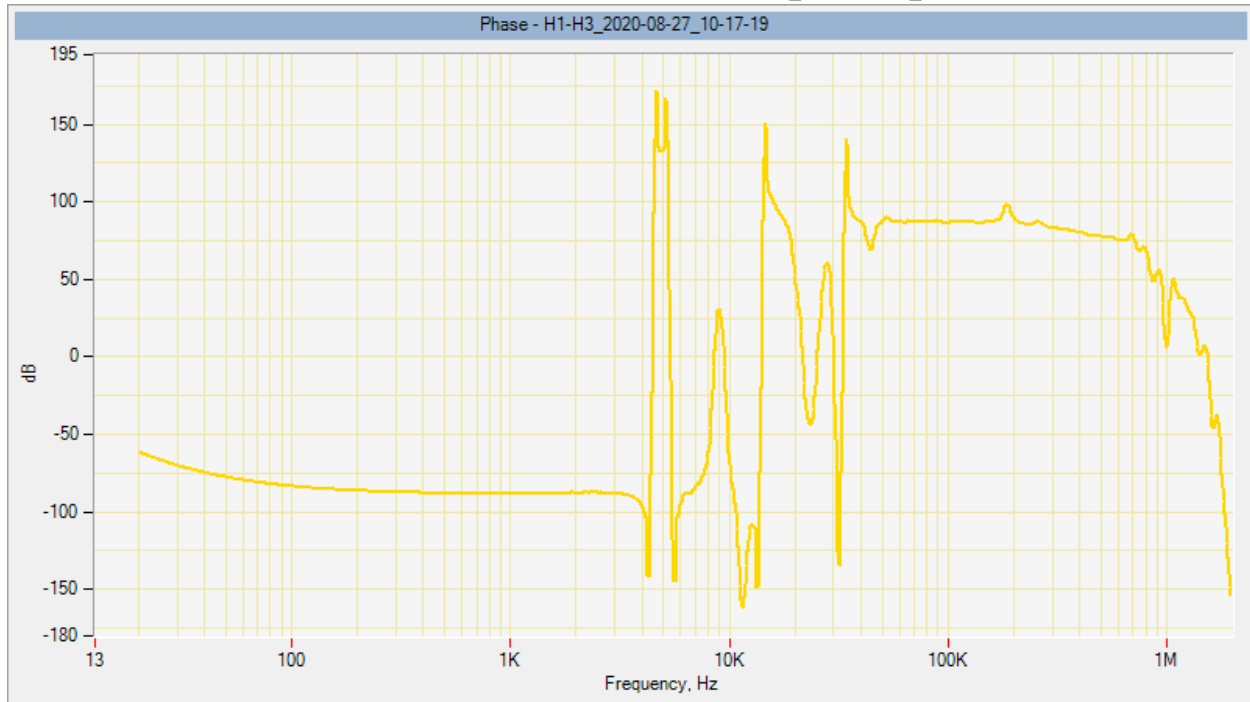


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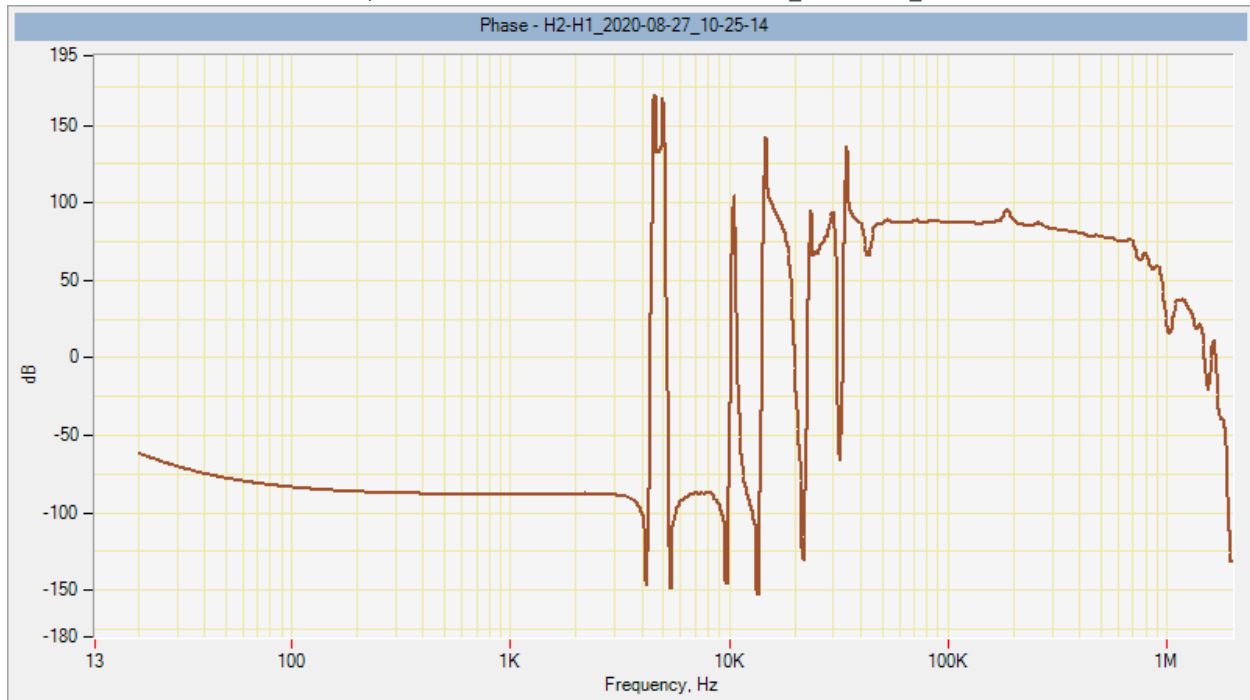


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H1-H3_2020-08-27_10-17-19

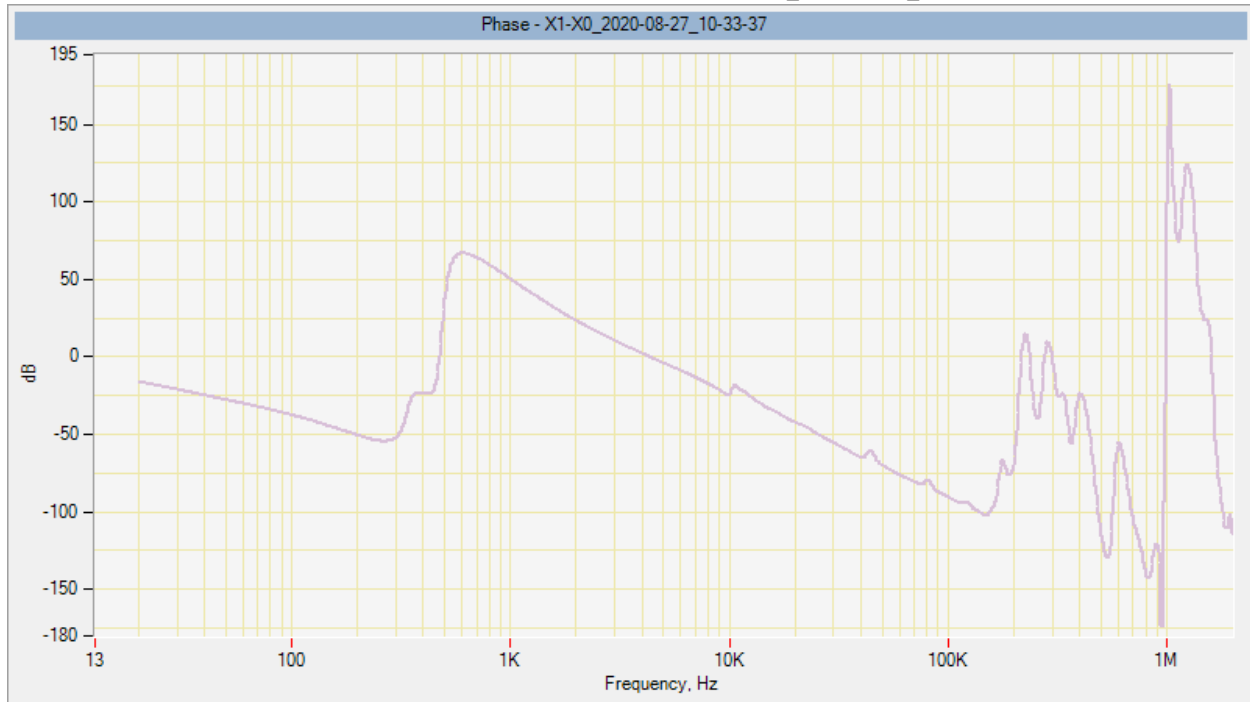


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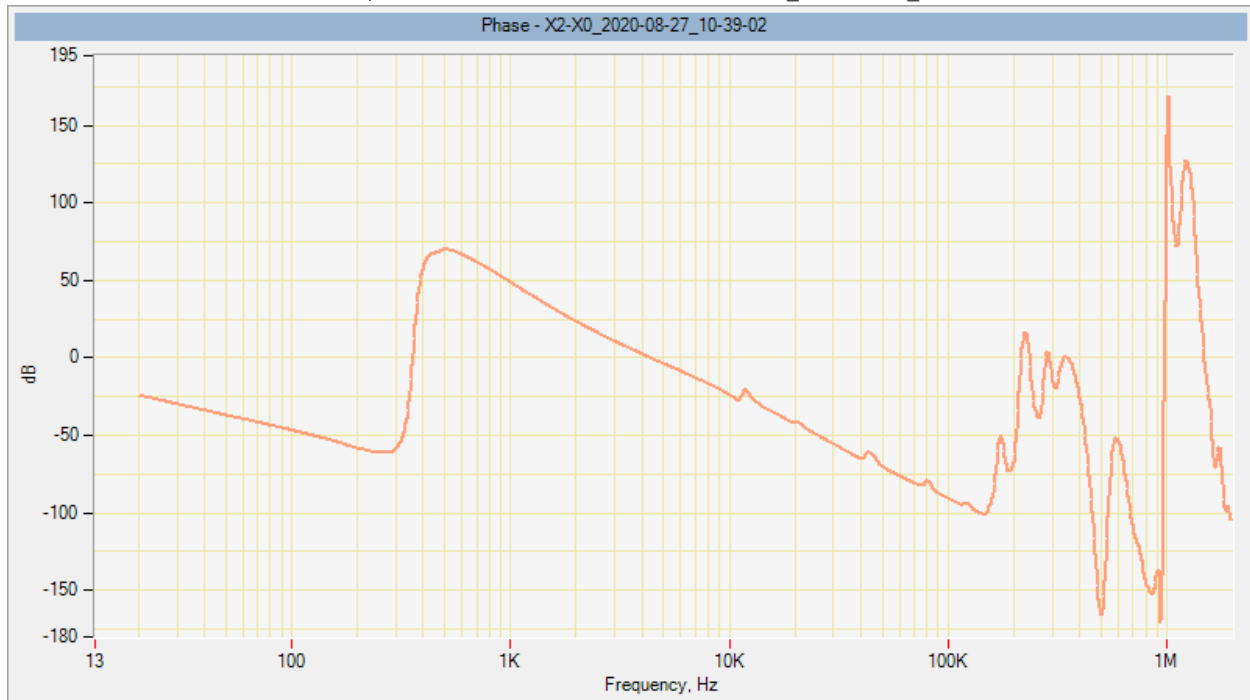


Sweep Frequency Response Analyzer Test Report

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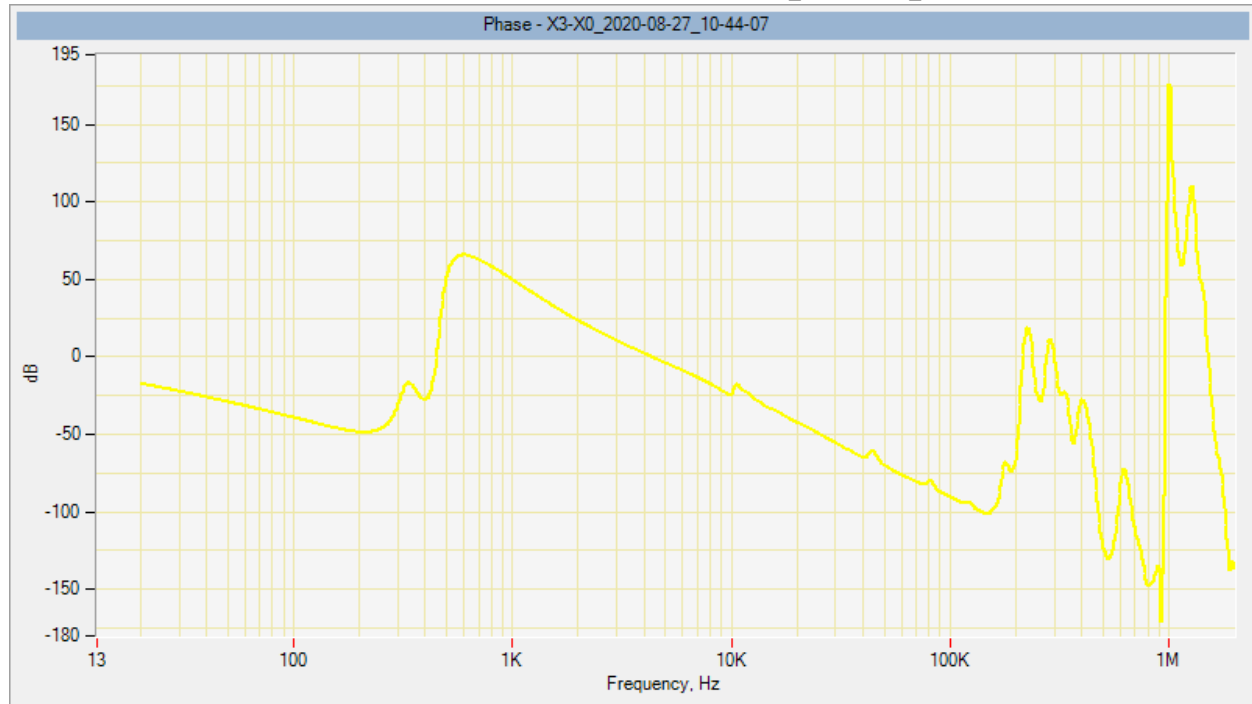


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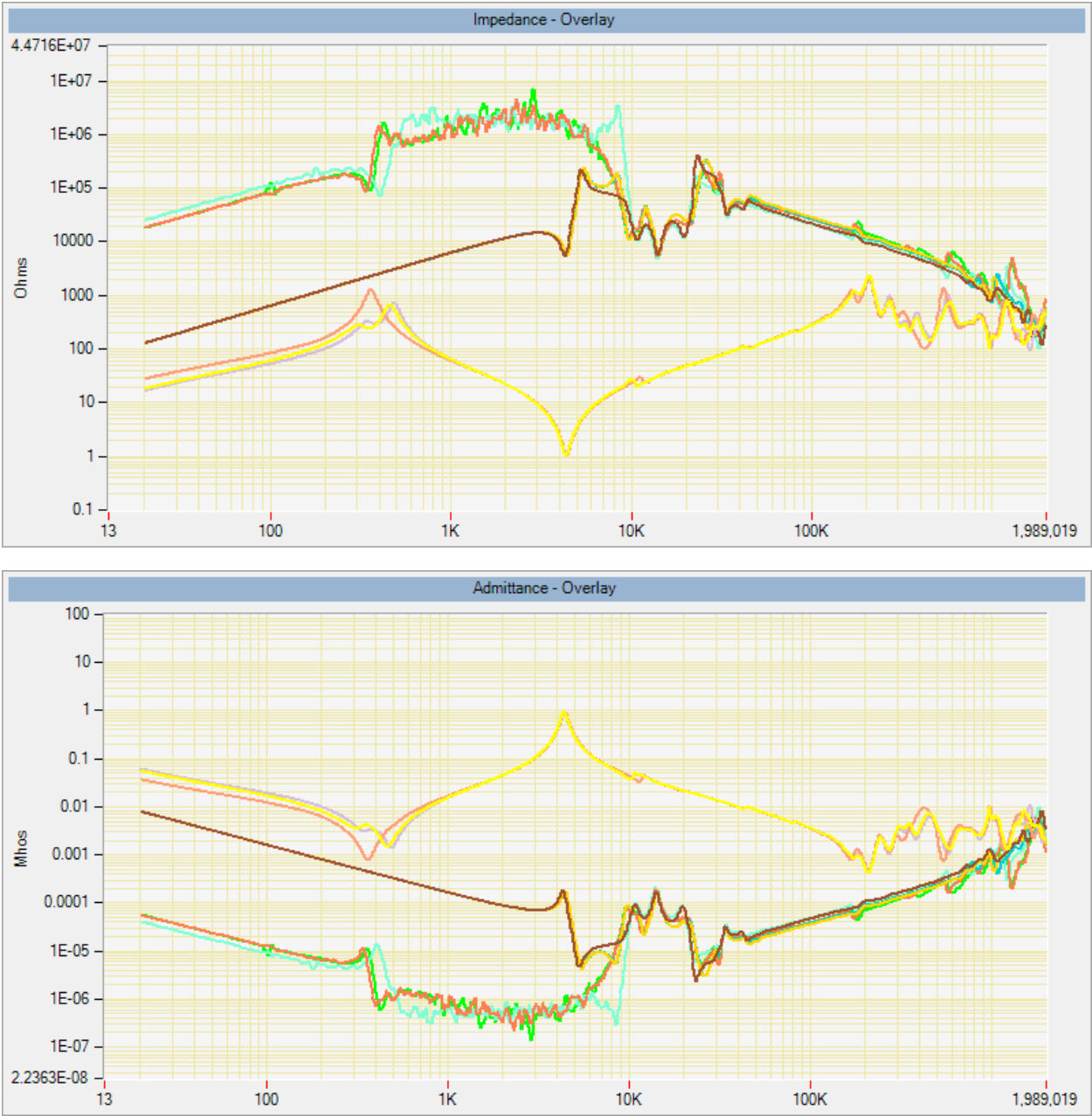


Sweep Frequency Response Analyzer Test Report

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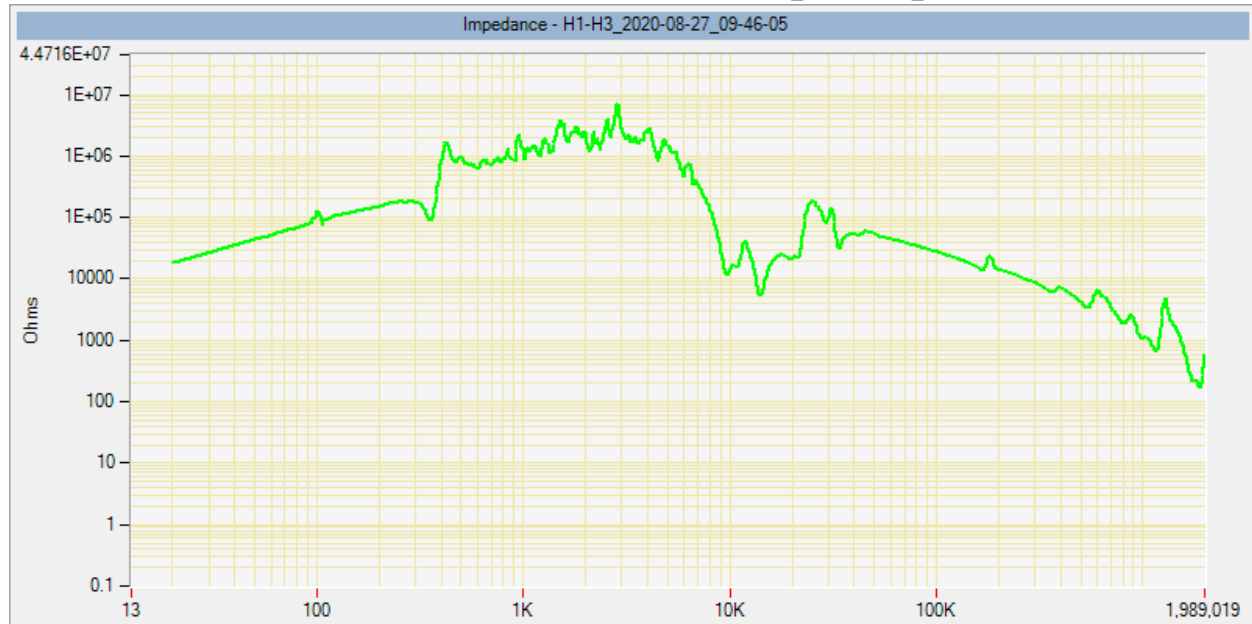


Sweep Frequency Response Analyzer Test Report

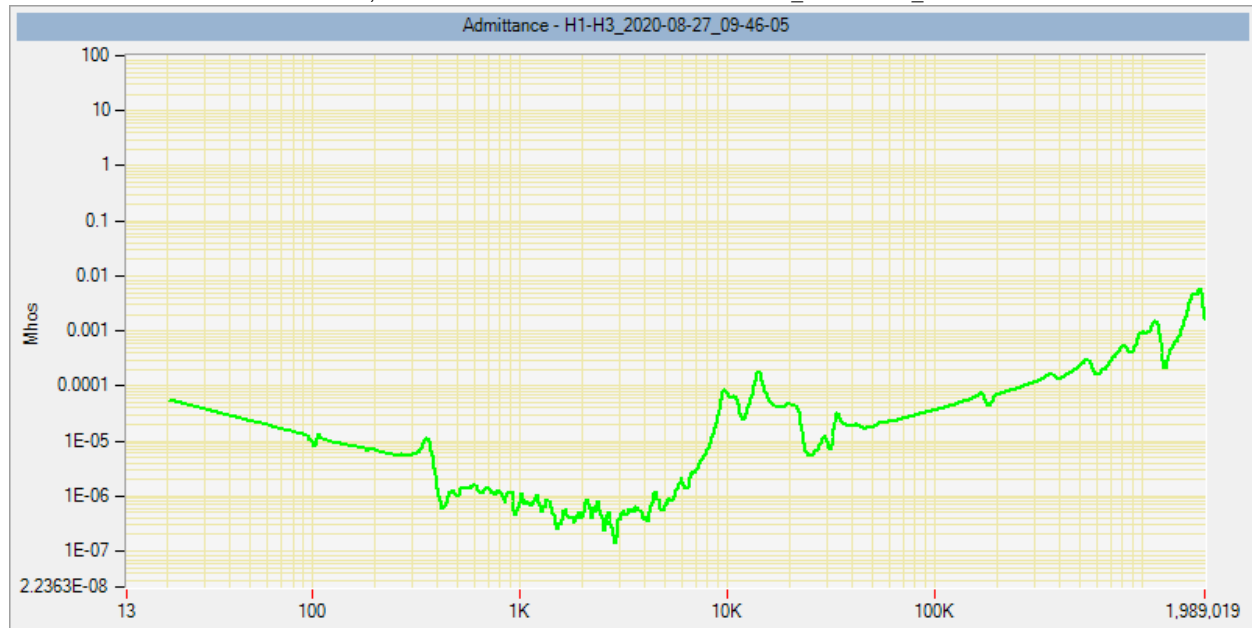


Sweep Frequency Response Analyzer Test Report

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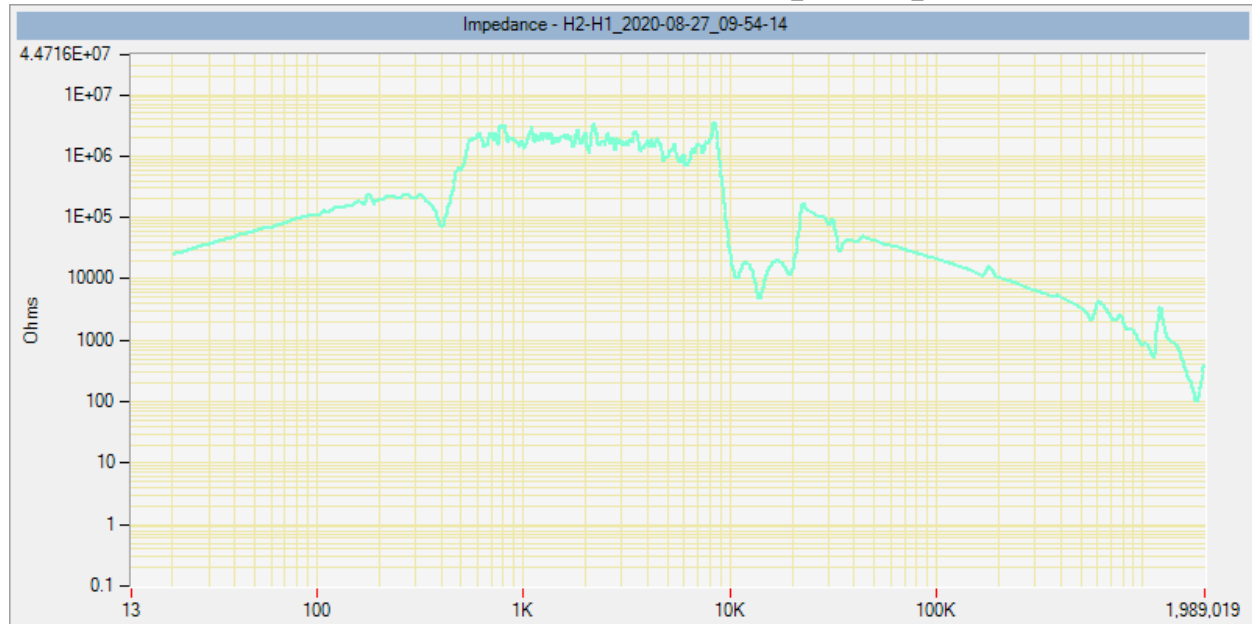


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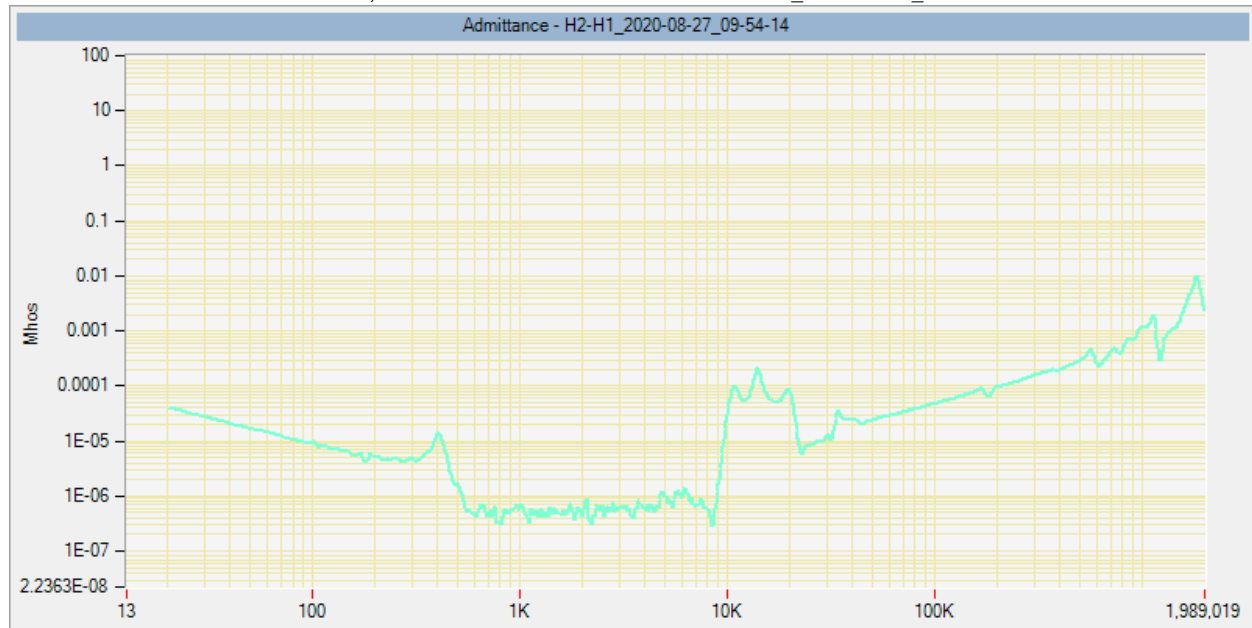


Sweep Frequency Response Analyzer Test Report

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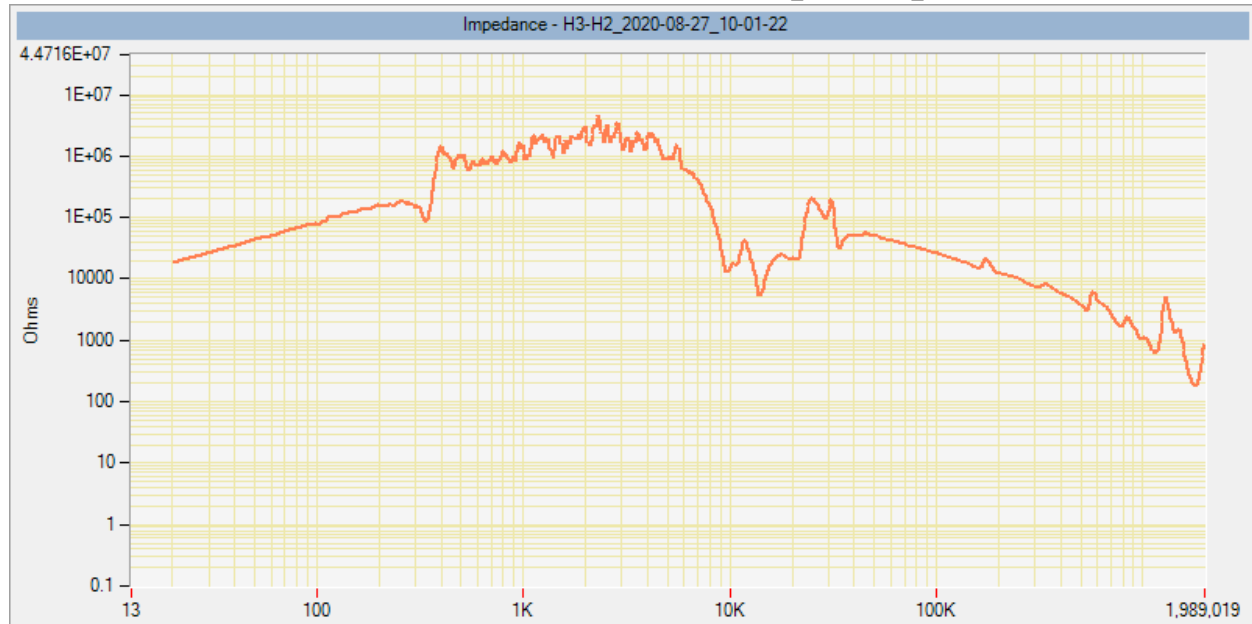


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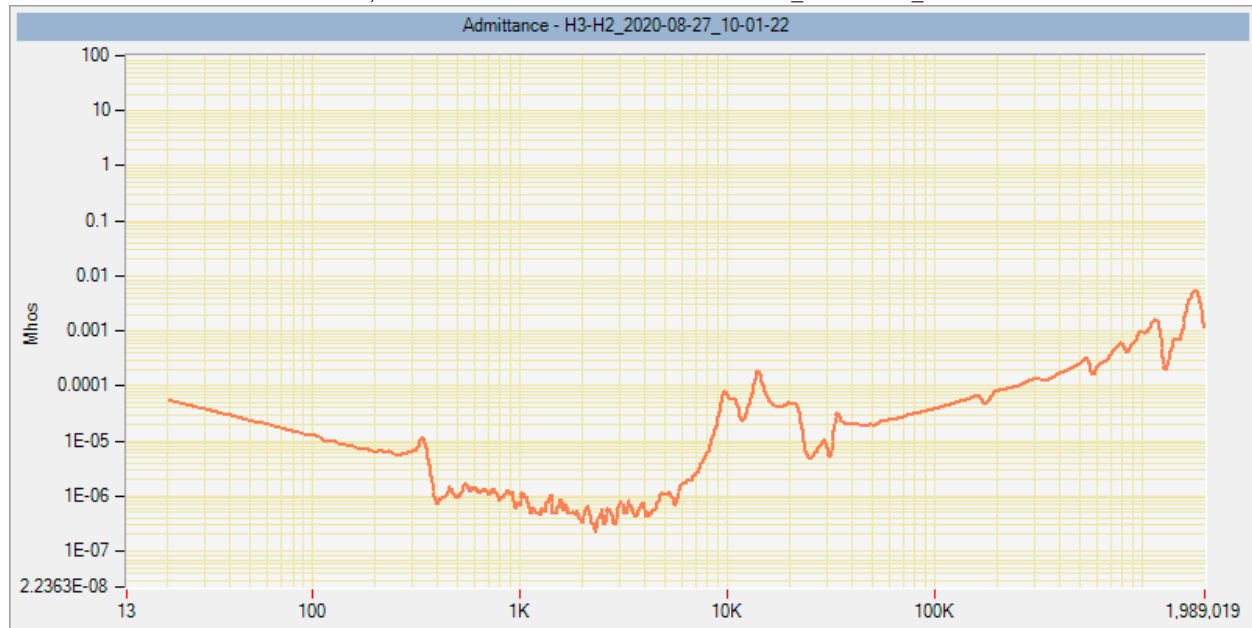


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H3-H2_2020-08-27_10-01-22

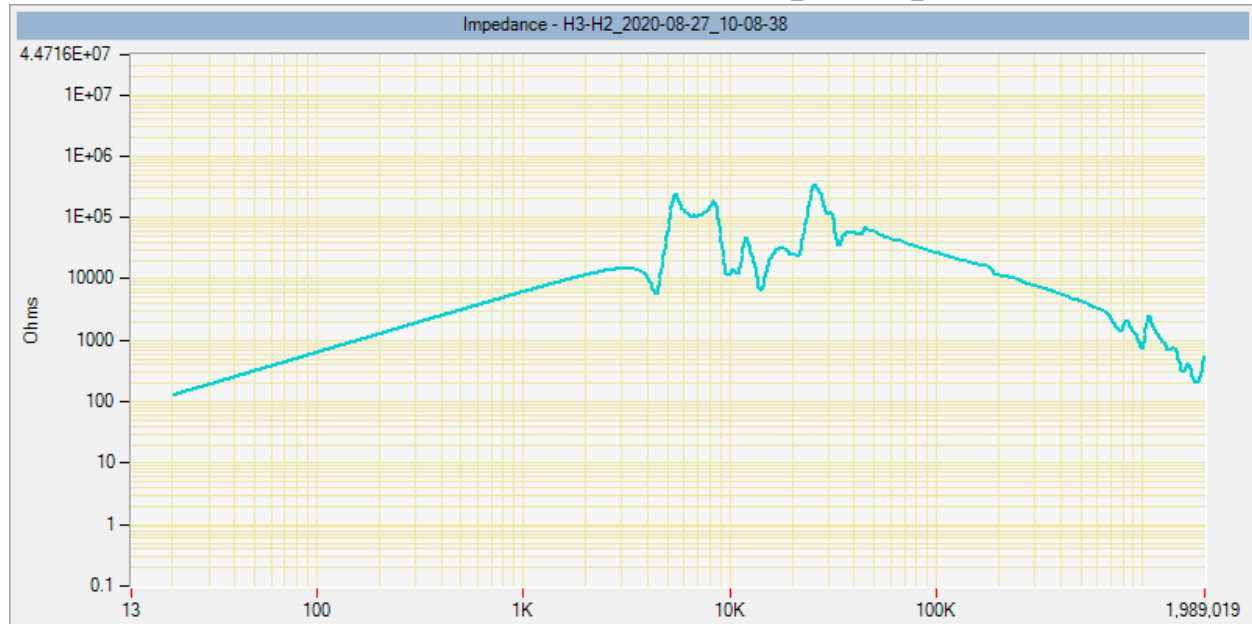


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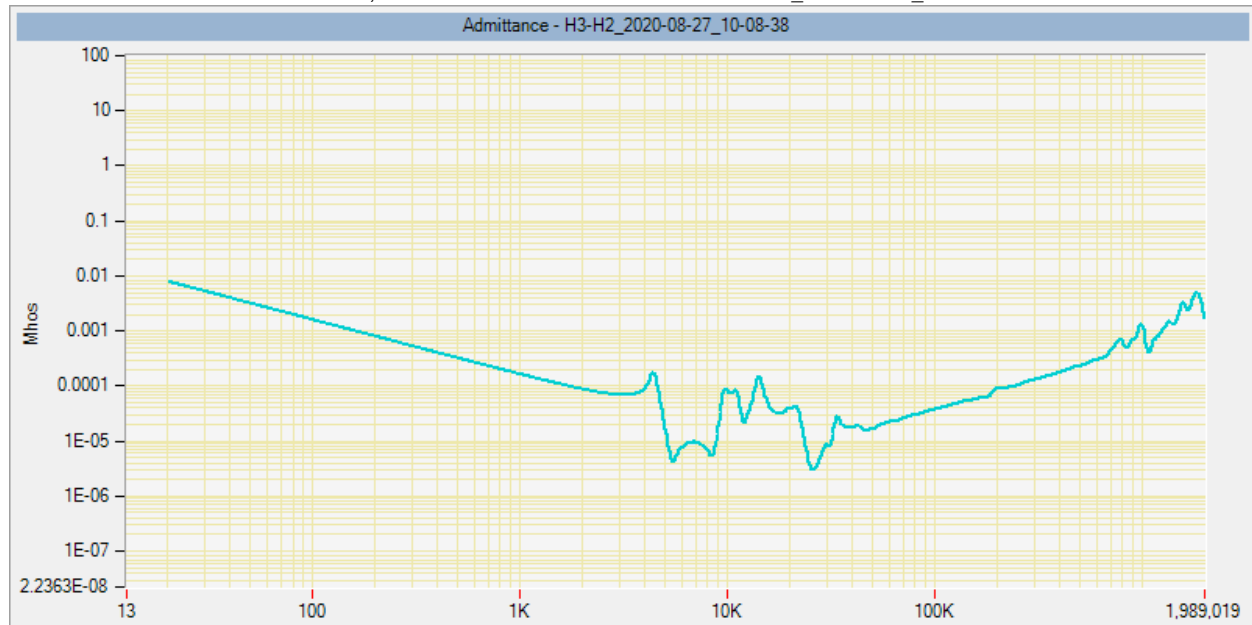


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H3-H2_2020-08-27_10-08-38

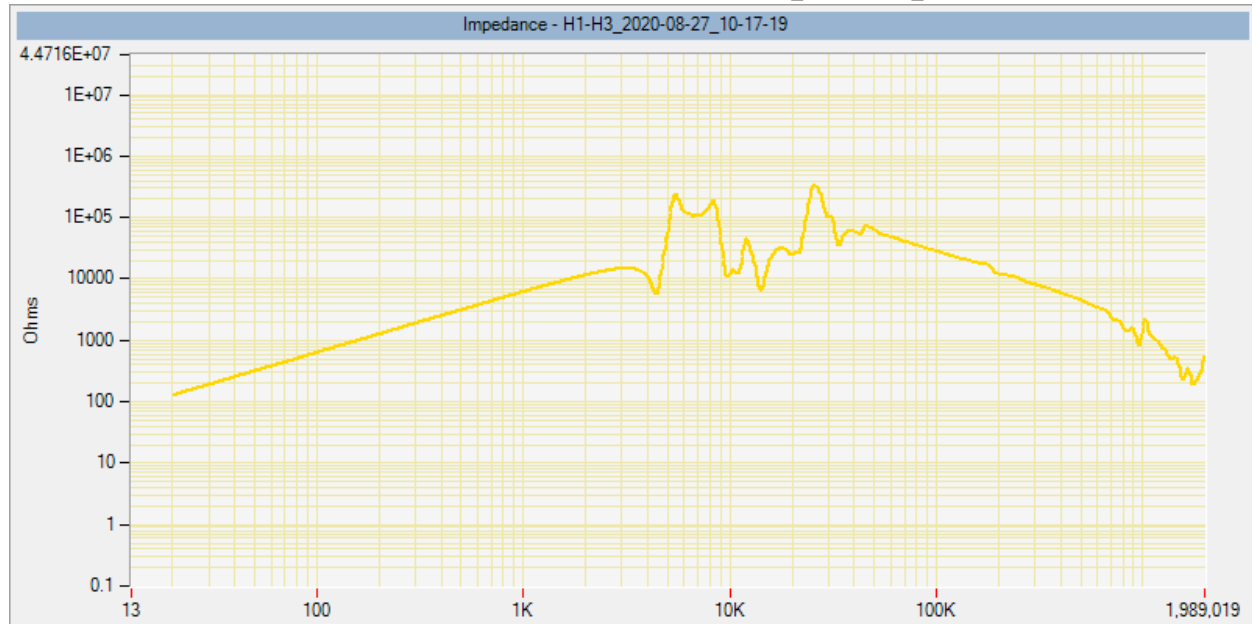


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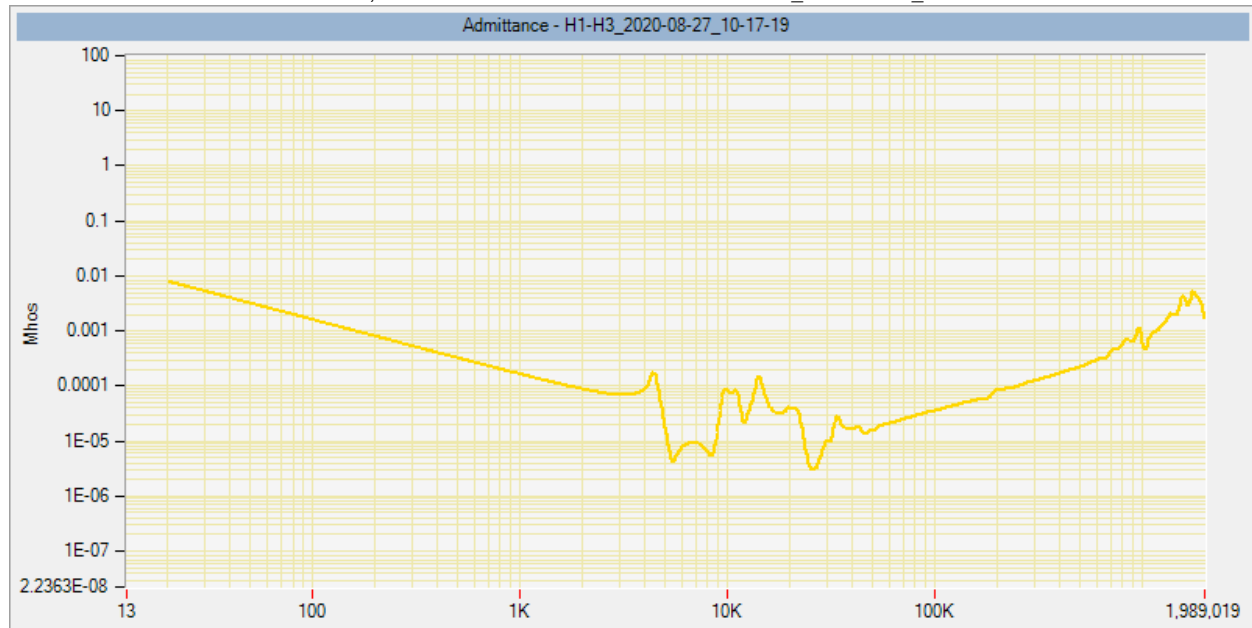


Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - H1-H3_2020-08-27_10-17-19

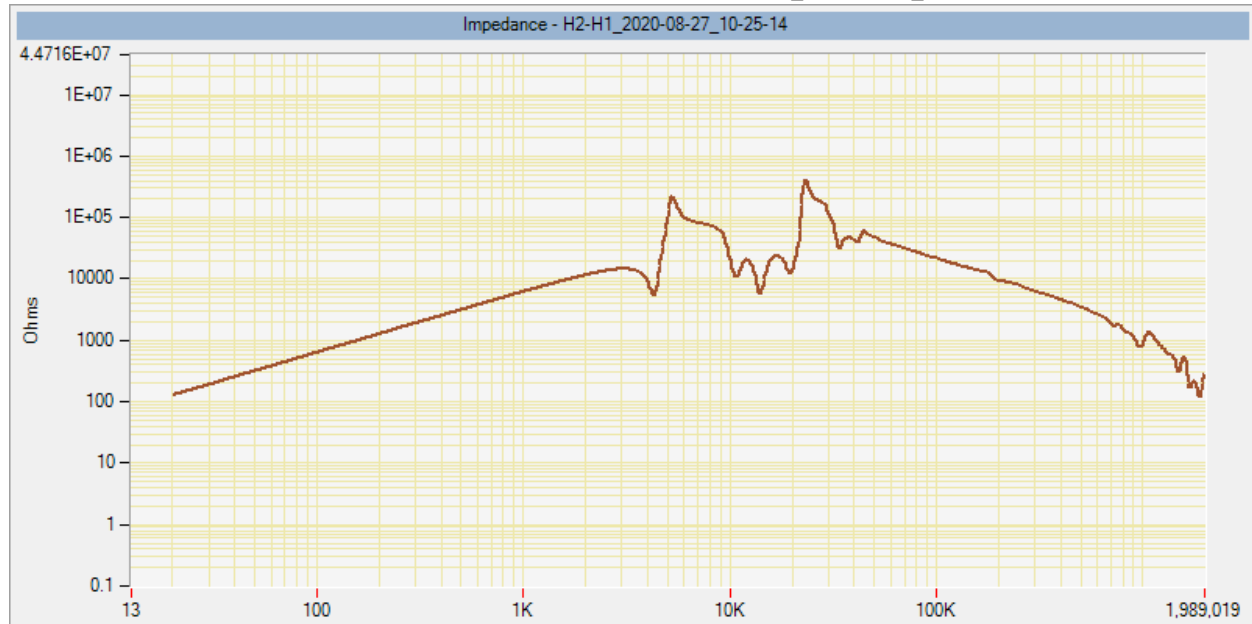


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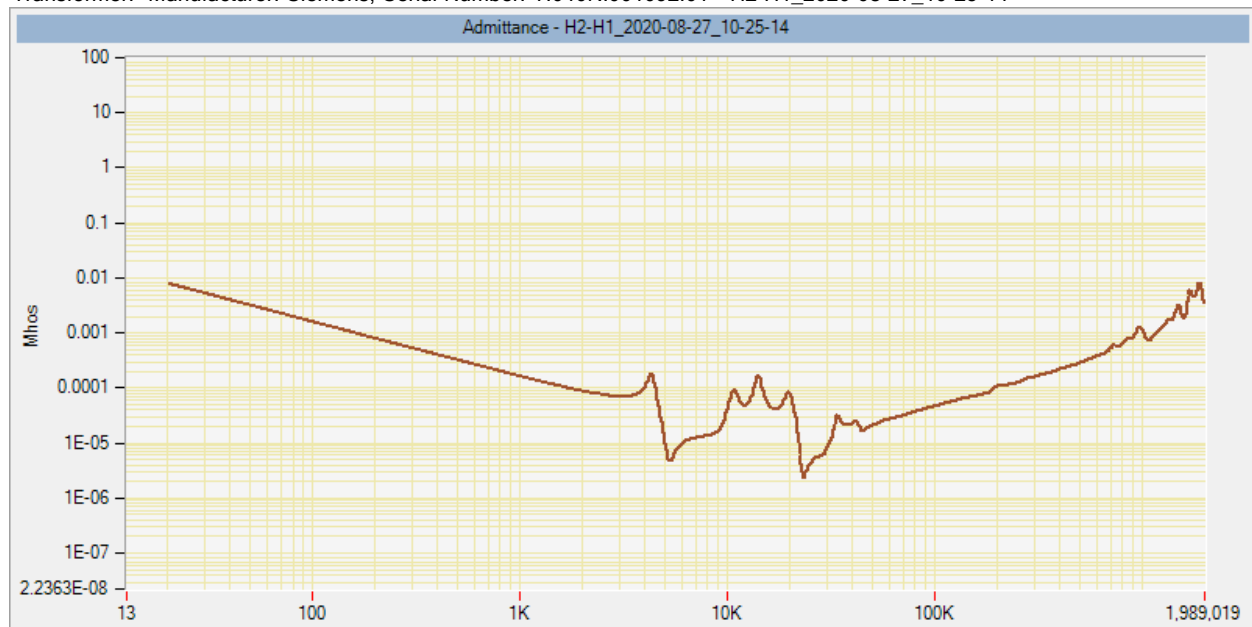


Sweep Frequency Response Analyzer Test Report

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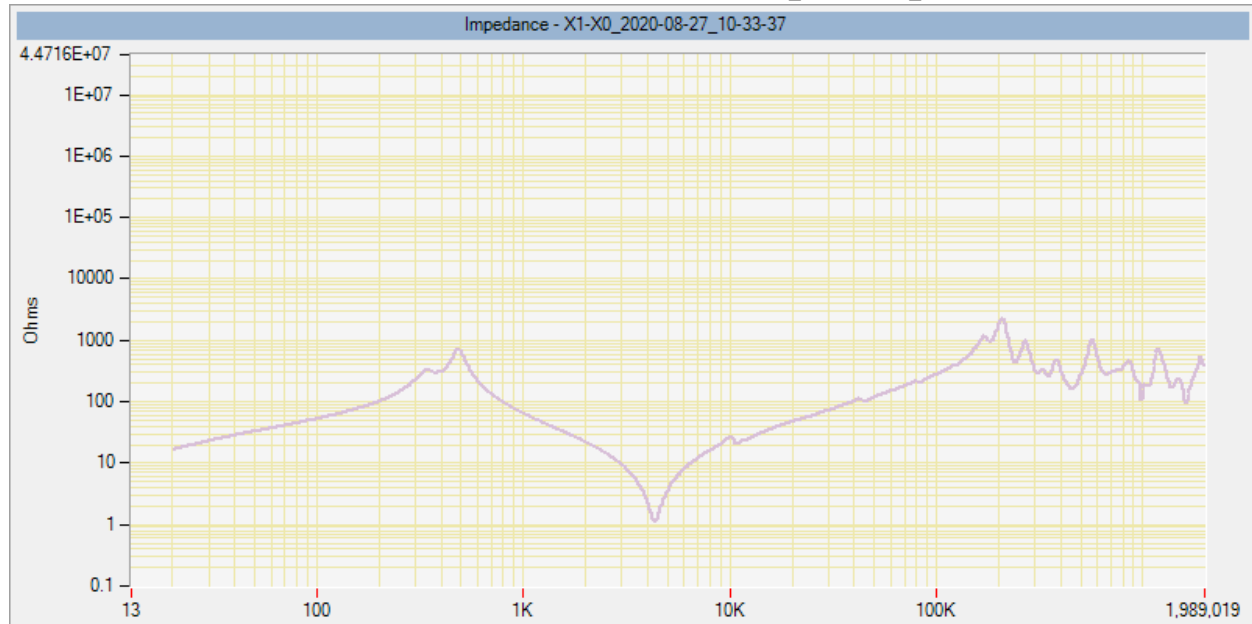


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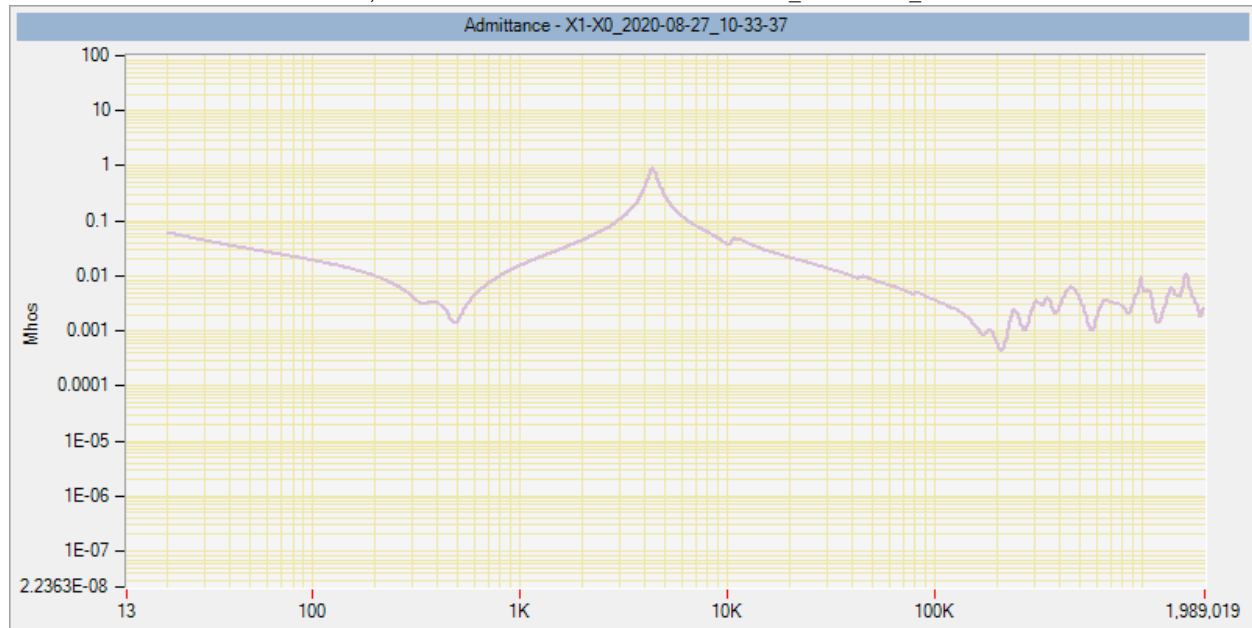


Sweep Frequency Response Analyzer Test Report

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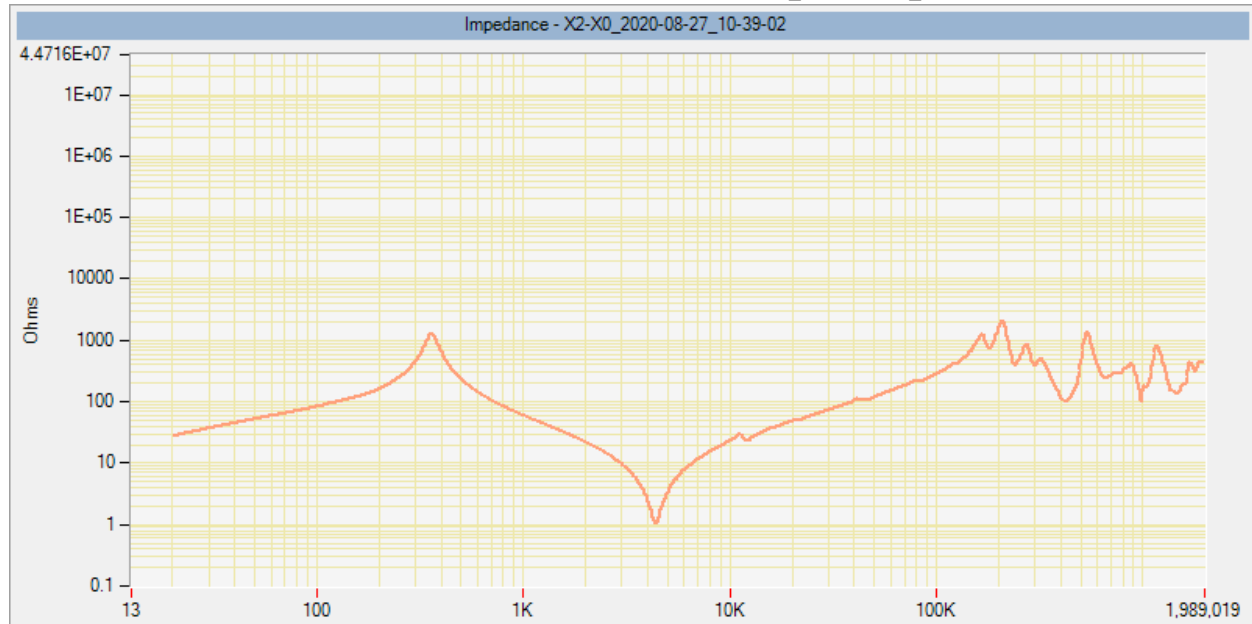


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Sweep Frequency Response Analyzer Test Report

Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - X2-X0_2020-08-27_10-39-02

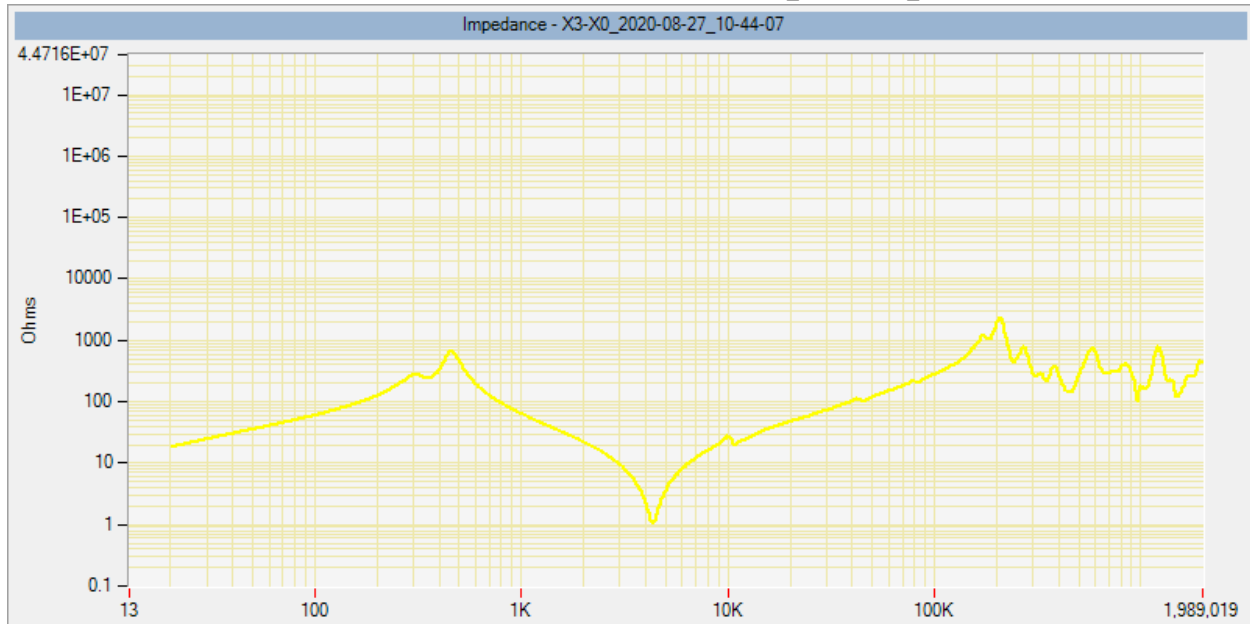


Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - X2-X0_2020-08-27_10-39-02

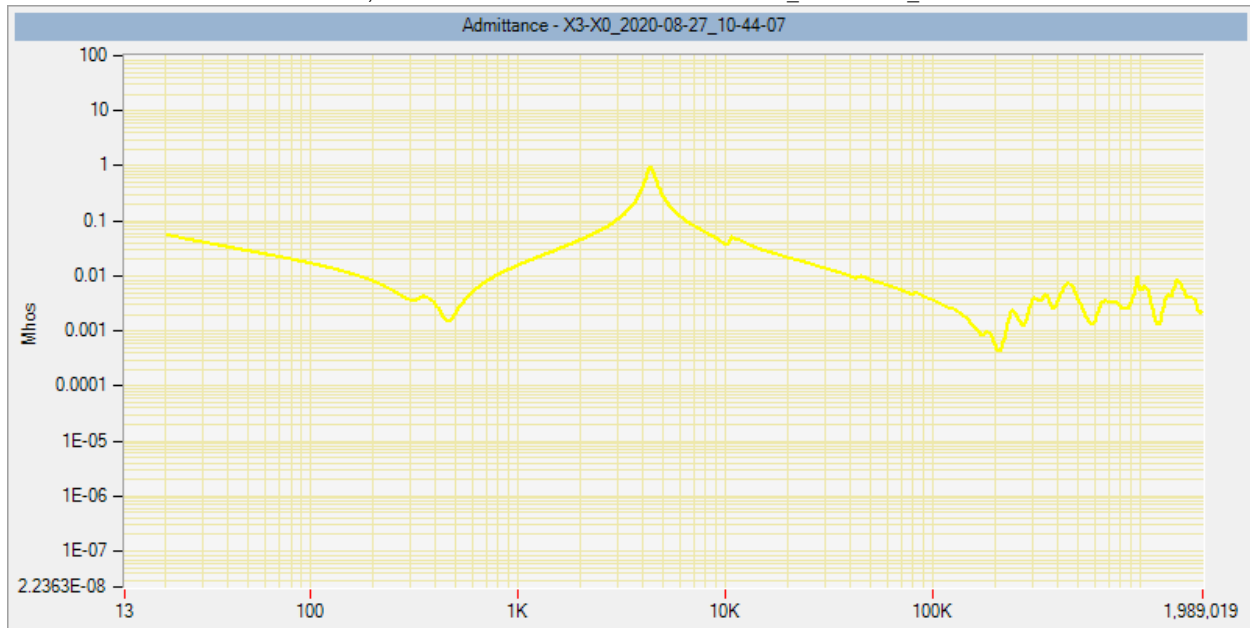


Sweep Frequency Response Analyzer Test Report

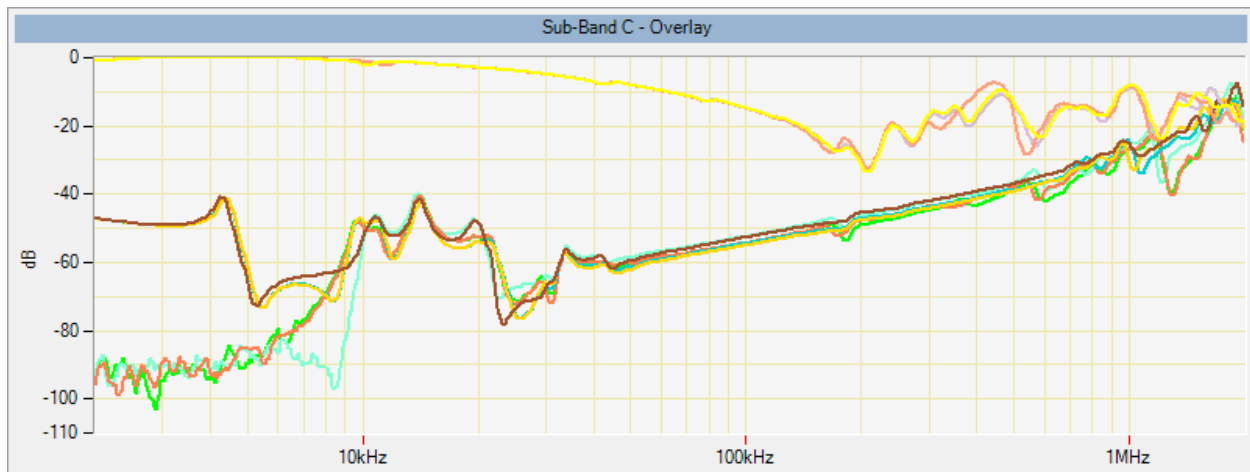
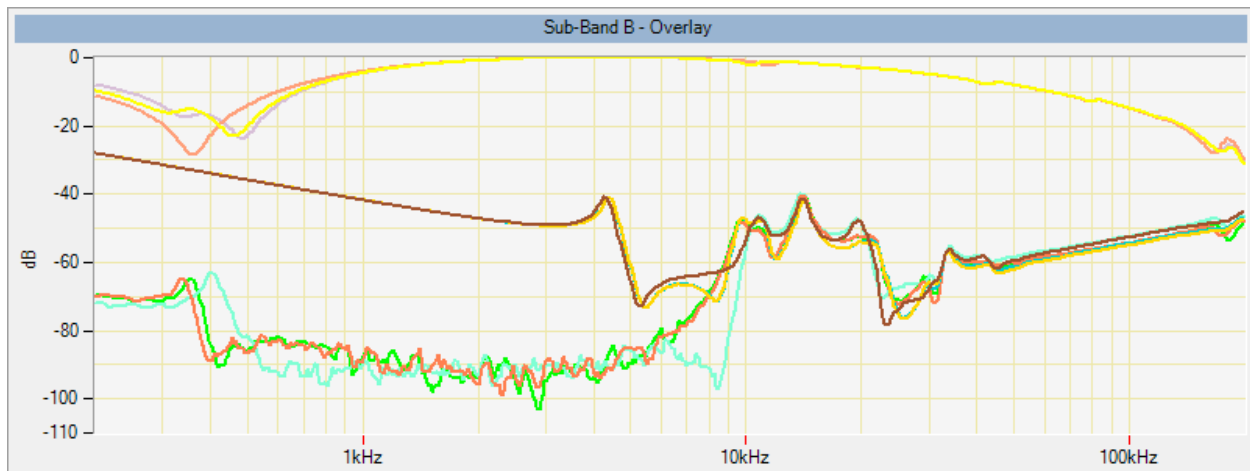
Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - X3-X0_2020-08-27_10-44-07



Transformer: Manufacturer: Siemens, Serial Number: T.040N.001092.01 - X3-X0_2020-08-27_10-44-07



Sweep Frequency Response Analyzer Test Report





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Appendix G: Current Transformer Test Data



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 1: X1-X5

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

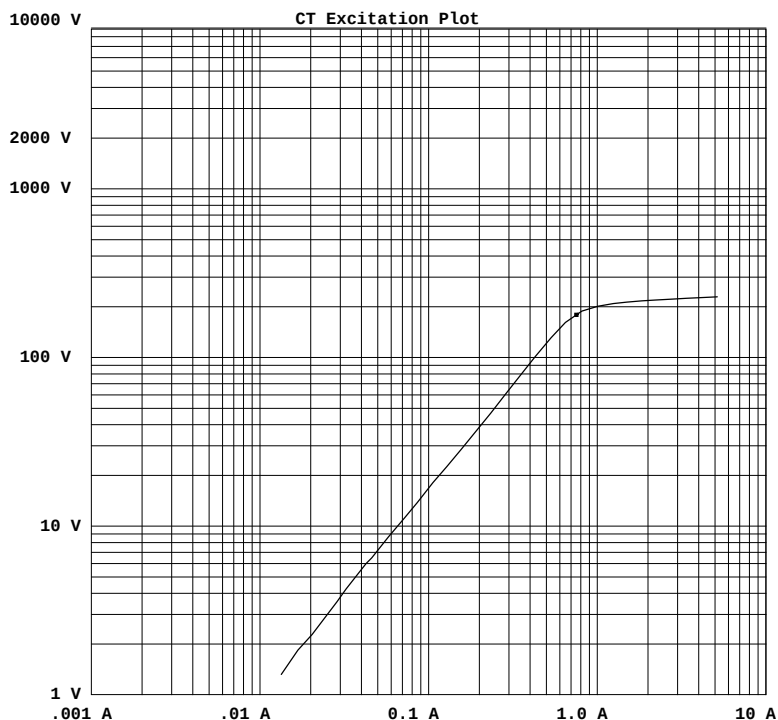
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.200	Phase Angle:0.12°
Vkp[Volts]: 179.12	Vkp[Volts]: 150.36	Vkp[Volts]: 188.80	M-RATIO: 40.005	Ex I[Amps]: 0.417	In Phase
Ikp[Amps]: 0.7544	Ikp[Amps]: 0.6054	Ikp[Amps]: 0.8150	% ERROR: 0.0135	Winding Res: 183.29 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0134	1.32	98.51	17	0.3502	78.36	223.76
2	0.0168	1.84	109.52	18	0.4284	101.08	235.95
3	0.0204	2.28	111.76	19	0.5326	130.92	245.81
4	0.0286	3.56	124.48	20	0.6476	161.60	249.54
5	0.0324	4.24	130.86	21	0.8124	188.64	232.20
6	0.0426	6.00	140.85	22	1.0070	201.60	200.20
7	0.0460	6.48	140.87	23	1.2474	208.92	167.48
8	0.0578	8.64	149.48	24	1.5008	213.24	142.08
9	0.0714	11.08	155.18	25	1.8436	216.76	117.57
10	0.0858	13.80	160.84	26	2.2104	219.44	99.28
11	0.1062	18.12	170.62	27	2.8110	222.40	79.12
12	0.1280	22.48	175.63	28	3.3920	224.56	66.20
13	0.1560	28.52	182.82	29	4.0964	226.48	55.29
14	0.1892	36.08	190.70	30	5.1546	228.92	44.41
15	0.2344	46.88	200.00				
16	0.2878	61.16	212.51				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	38.70	193.50
2	0.0020	0.20	100.00	13	0.4000	92.80	232.00
3	0.0040	0.40	100.00	14	0.5000	121.60	243.20
4	0.0050	0.50	100.00	15	0.8000	186.60	233.25
5	0.0080	0.80	100.00	16	1.0000	201.10	201.10
6	0.0100	1.00	100.00	17	2.0000	217.90	108.95
7	0.0200	2.20	110.00	18	4.0000	226.20	56.55
8	0.0400	5.60	140.00	19	5.0000	228.60	45.72
9	0.0500	7.20	144.00				
10	0.0800	12.70	158.75				
11	0.1000	16.80	168.00				



FILENAME: H1-CTX.test

DATE: 08/27/20 14:54:32

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H1-CTX

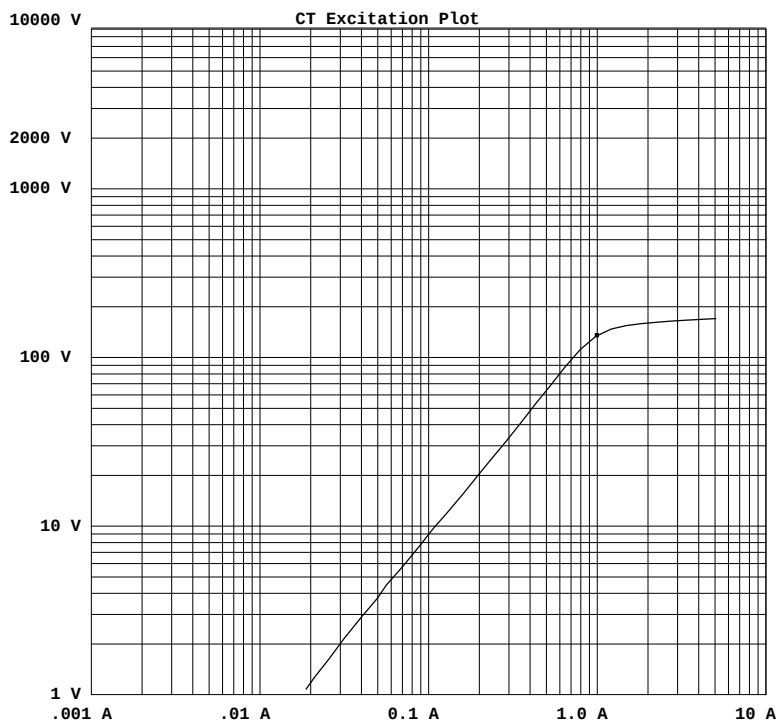
TEST # 2: X1-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 91.400	Phase Angle:0.14°
Vkp[Volts]: 135.68	Vkp[Volts]: 109.80	Vkp[Volts]: 140.96	M-RATIO: 30.019	Ex I[Amps]: 0.664	In Phase
Ikp[Amps]: 0.9978	Ikp[Amps]: 0.7834	Ikp[Amps]: 1.0996	% ERROR: 0.0620	Winding Res: 134.01 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0188	1.08	57.45	17	0.4344	53.76	123.76
2	0.0212	1.28	60.38	18	0.5264	68.04	129.26
3	0.0258	1.64	63.57	19	0.6456	87.96	136.25
4	0.0316	2.16	68.35	20	0.7948	111.60	140.41
5	0.0394	2.84	72.08	21	0.9828	133.92	136.26
6	0.0500	3.76	75.20	22	1.2140	147.84	121.78
7	0.0562	4.48	79.72	23	1.4818	154.60	104.33
8	0.0698	5.72	81.95	24	1.8046	158.64	87.91
9	0.0870	7.48	85.98	25	2.2462	161.88	72.07
10	0.1066	9.68	90.81	26	2.7104	164.32	60.63
11	0.1276	11.88	93.10	27	3.3562	166.48	49.60
12	0.1600	15.52	97.00	28	4.0996	168.36	41.07
13	0.1930	19.56	101.35	29	5.0506	170.24	33.71
14	0.2328	24.64	105.84				
15	0.2866	31.56	110.12				
16	0.3524	40.96	116.23				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.40	102.00
2	0.0020	0.10	50.00	13	0.4000	48.40	121.00
3	0.0040	0.20	50.00	14	0.5000	64.00	128.00
4	0.0050	0.30	60.00	15	0.8000	112.20	140.25
5	0.0080	0.50	62.50	16	1.0000	135.00	135.00
6	0.0100	0.60	60.00	17	2.0000	160.10	80.05
7	0.0200	1.20	60.00	18	4.0000	168.10	42.02
8	0.0400	2.90	72.50	19	5.0000	170.20	34.04
9	0.0500	3.80	76.00				
10	0.0800	6.80	85.00				
11	0.1000	8.90	89.00				



FILENAME: H1-CTX.test

DATE: 08/27/20 14:54:32

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H1-CTX

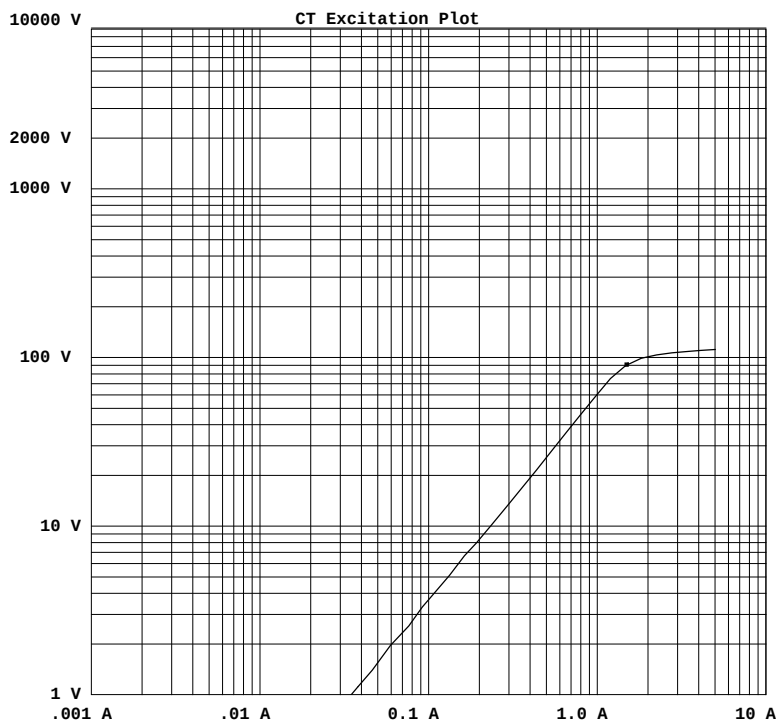
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 44.200	Phase Angle:0.24°
Vkp[Volts]: 90.68	Vkp[Volts]: 74.76	Vkp[Volts]: 94.36	M-RATIO: 20.032	Ex I[Amps]: 0.767	In Phase
Ikp[Amps]: 1.4952	Ikp[Amps]: 1.1948	Ikp[Amps]: 1.6538	% ERROR: 0.1580	Winding Res: 97.17 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0282	0.76	26.95	17	0.6550	35.96	54.90
2	0.0324	0.92	28.40	18	0.8042	46.36	57.65
3	0.0382	1.12	29.32	19	0.9796	59.04	60.27
4	0.0464	1.40	30.17	20	1.1980	75.00	62.60
5	0.0594	1.96	33.00	21	1.4750	89.60	60.75
6	0.0764	2.56	33.51	22	1.8274	99.04	54.20
7	0.0920	3.32	36.09	23	2.2494	103.76	46.13
8	0.1042	3.84	36.85	24	2.7720	106.76	38.51
9	0.1334	5.12	38.38	25	3.3888	108.64	32.06
10	0.1634	6.68	40.88	26	4.0834	110.28	27.01
11	0.1914	7.92	41.38	27	5.0248	111.76	22.24
12	0.2352	10.12	43.03				
13	0.2904	13.04	44.90				
14	0.3588	16.92	47.16				
15	0.4358	21.48	49.29				
16	0.5396	28.16	52.19				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.60	51.20
4	0.0050	0.10	20.00	15	0.8000	46.10	57.63
5	0.0080	0.20	25.00	16	1.0000	60.50	60.50
6	0.0100	0.30	30.00	17	2.0000	101.00	50.50
7	0.0200	0.50	25.00	18	4.0000	110.10	27.52
8	0.0400	1.20	30.00	19	5.0000	111.70	22.34
9	0.0500	1.60	32.00				
10	0.0800	2.70	33.75				
11	0.1000	3.70	37.00				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 4: X1-X2

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

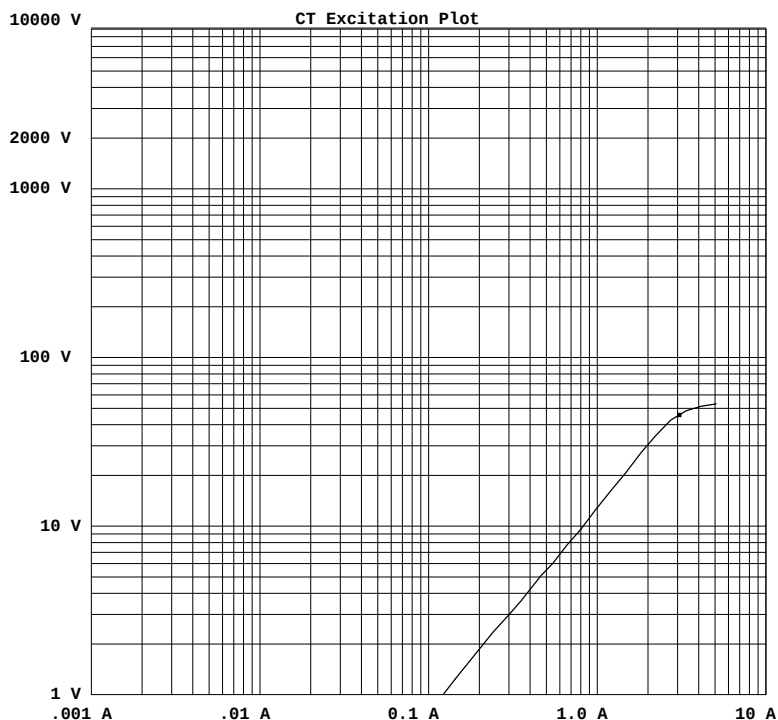
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -1.10°
Vkp[Volts]: 45.64	Vkp[Volts]: 38.92	Vkp[Volts]: 48.16	M-RATIO: 10.033	Ex I[Amps]: 0.773	In Phase
Ikp[Amps]: 3.0692	Ikp[Amps]: 2.4988	Ikp[Amps]: 3.3498	% ERROR: 0.3320	Winding Res: 63.44 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0402	0.28	6.97	17	0.9734	12.44	12.78
2	0.0472	0.32	6.78	18	1.1992	16.16	13.48
3	0.0582	0.40	6.87	19	1.4848	20.88	14.06
4	0.0828	0.64	7.73	20	1.8274	27.40	14.99
5	0.0956	0.76	7.95	21	2.2104	34.24	15.49
6	0.1104	0.88	7.97	22	2.7232	42.56	15.63
7	0.1440	1.24	8.61	23	3.3724	48.36	14.34
8	0.1588	1.40	8.82	24	4.1320	51.40	12.44
9	0.1978	1.84	9.30	25	5.0734	53.16	10.48
10	0.2422	2.36	9.74				
11	0.2936	2.92	9.95				
12	0.3532	3.60	10.19				
13	0.4628	5.08	10.98				
14	0.5446	6.00	11.02				
15	0.6608	7.72	11.68				
16	0.8016	9.60	11.98				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.50	15.25
5	0.0200	0.10	5.00	16	4.0000	50.90	12.72
6	0.0400	0.30	7.50	17	5.0000	53.00	10.60
7	0.0500	0.40	8.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.20	10.50				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 5: X2-X5

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

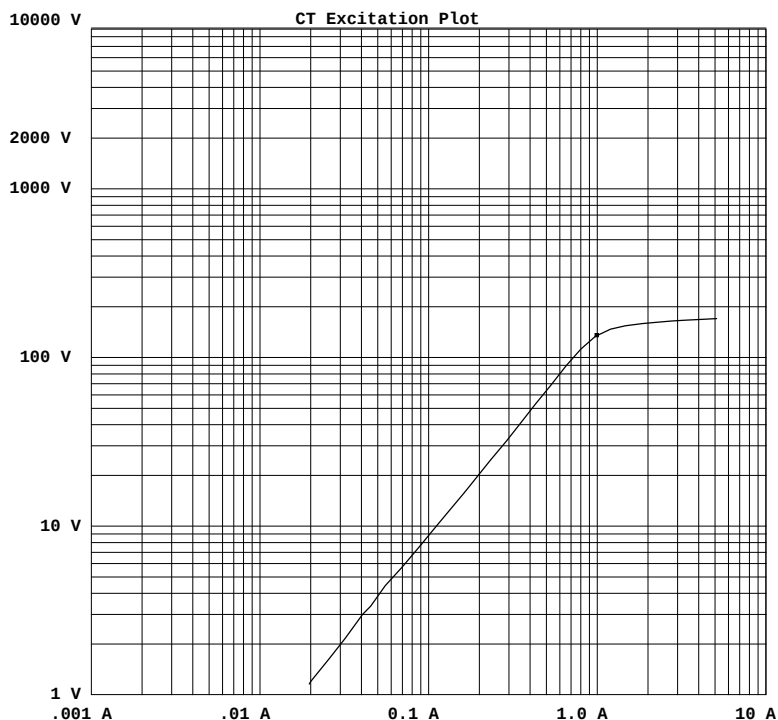
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 90.300	Phase Angle:0.24°
Vkp[Volts]: 135.72	Vkp[Volts]: 110.48	Vkp[Volts]: 140.44	M-RATIO: 30.016	Ex I[Amps]: 0.657	In Phase
Ikp[Amps]: 0.9940	Ikp[Amps]: 0.7886	Ikp[Amps]: 1.0894	% ERROR: 0.0547	Winding Res: 113.73 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0196	1.16	59.18	17	0.4292	52.76	122.93
2	0.0200	1.20	60.00	18	0.5278	68.04	128.91
3	0.0258	1.64	63.57	19	0.6546	89.60	136.88
4	0.0320	2.16	67.50	20	0.8012	112.44	140.34
5	0.0406	3.00	73.89	21	0.9758	133.52	136.83
6	0.0454	3.36	74.01	22	1.2006	147.28	122.67
7	0.0554	4.44	80.14	23	1.4670	154.32	105.19
8	0.0694	5.68	81.84	24	1.8566	159.16	85.73
9	0.0882	7.56	85.71	25	2.2040	161.60	73.32
10	0.1026	9.08	88.50	26	2.7622	164.60	59.59
11	0.1256	11.60	92.36	27	3.3206	166.48	50.14
12	0.1630	15.80	96.93	28	4.1450	168.36	40.62
13	0.1950	19.76	101.33	29	5.1058	170.24	33.34
14	0.2328	24.64	105.84				
15	0.2886	31.84	110.33				
16	0.3506	40.76	116.26				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.40	102.00
2	0.0020	0.10	50.00	13	0.4000	48.30	120.75
3	0.0040	0.20	50.00	14	0.5000	63.70	127.40
4	0.0050	0.30	60.00	15	0.8000	112.20	140.25
5	0.0080	0.50	62.50	16	1.0000	135.00	135.00
6	0.0100	0.60	60.00	17	2.0000	160.20	80.10
7	0.0200	1.20	60.00	18	4.0000	168.00	42.00
8	0.0400	3.00	75.00	19	5.0000	170.00	34.00
9	0.0500	3.80	76.00				
10	0.0800	6.80	85.00				
11	0.1000	8.80	88.00				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 6: X2-X4

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

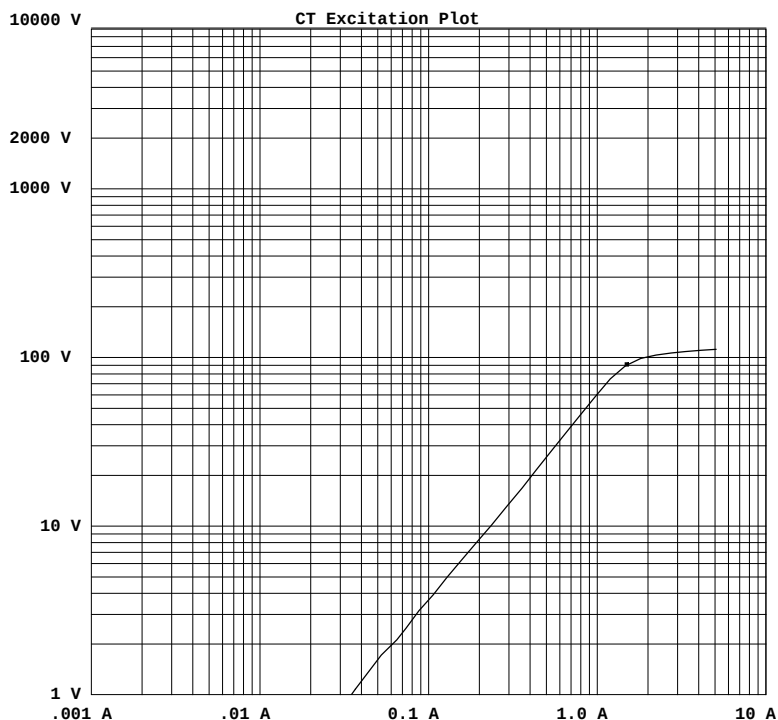
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 44.300	Phase Angle:0.34°
Vkp[Volts]: 90.88	Vkp[Volts]: 74.48	Vkp[Volts]: 94.24	M-RATIO: 20.027	Ex I[Amps]: 0.769	In Phase
Ikp[Amps]: 1.4982	Ikp[Amps]: 1.1916	Ikp[Amps]: 1.6500	% ERROR: 0.1330	Winding Res: 83.87 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0294	0.76	25.85	17	0.6580	36.16	54.95
2	0.0308	0.84	27.27	18	0.8046	46.40	57.67
3	0.0368	1.08	29.35	19	0.9746	58.76	60.29
4	0.0524	1.72	32.82	20	1.1948	74.72	62.54
5	0.0648	2.12	32.72	21	1.4692	89.32	60.79
6	0.0734	2.48	33.79	22	1.8144	98.76	54.43
7	0.0878	3.16	35.99	23	2.2300	103.52	46.42
8	0.1066	3.92	36.77	24	2.7460	106.48	38.78
9	0.1284	4.96	38.63	25	3.3368	108.64	32.56
10	0.1568	6.28	40.05	26	4.1288	110.40	26.74
11	0.1942	8.08	41.61	27	5.0734	111.88	22.05
12	0.2356	10.12	42.95				
13	0.2916	13.12	44.99				
14	0.3598	16.92	47.03				
15	0.4328	21.40	49.45				
16	0.5412	28.32	52.33				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.70	51.40
4	0.0050	0.10	20.00	15	0.8000	46.10	57.63
5	0.0080	0.20	25.00	16	1.0000	60.60	60.60
6	0.0100	0.20	20.00	17	2.0000	100.90	50.45
7	0.0200	0.50	25.00	18	4.0000	110.10	27.52
8	0.0400	1.20	30.00	19	5.0000	111.80	22.36
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 7: X2-X3

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

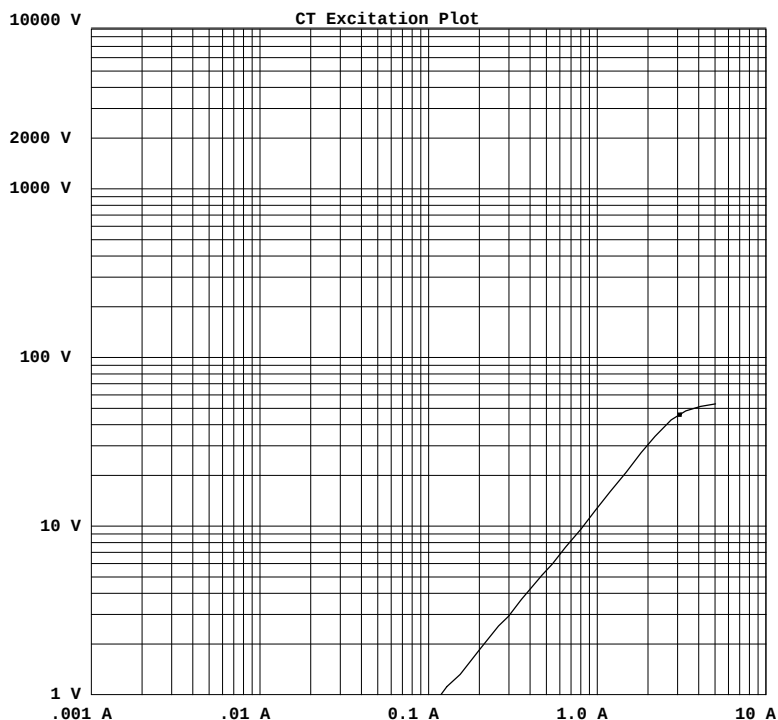
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.92°
Vkp[Volts]: 45.80	Vkp[Volts]: 38.64	Vkp[Volts]: 0.00	M-RATIO: 10.024	Ex I[Amps]: 0.773	In Phase
Ikp[Amps]: 3.0866	Ikp[Amps]: 2.4902	Ikp[Amps]: 0.0000	% ERROR: 0.2360	Winding Res: 50.19 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0398	0.28	7.04	17	0.9784	12.48	12.76
2	0.0476	0.32	6.72	18	1.1944	16.04	13.43
3	0.0558	0.40	7.17	19	1.4868	20.92	14.07
4	0.0706	0.56	7.93	20	1.8210	27.28	14.98
5	0.0920	0.72	7.83	21	2.2040	34.08	15.46
6	0.1042	0.84	8.06	22	2.7460	42.68	15.54
7	0.1284	1.12	8.72	23	3.3498	48.24	14.40
8	0.1540	1.32	8.57	24	4.0996	51.28	12.51
9	0.2028	1.88	9.27	25	5.0280	53.16	10.57
10	0.2600	2.56	9.85				
11	0.2976	2.92	9.81				
12	0.3556	3.68	10.35				
13	0.4706	5.12	10.88				
14	0.5416	5.96	11.00				
15	0.6492	7.52	11.58				
16	0.8008	9.60	11.99				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.10	10.00	15	2.0000	30.40	15.20
5	0.0200	0.20	10.00	16	4.0000	50.90	12.72
6	0.0400	0.30	7.50	17	5.0000	53.10	10.62
7	0.0500	0.40	8.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 8: X3-X4

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

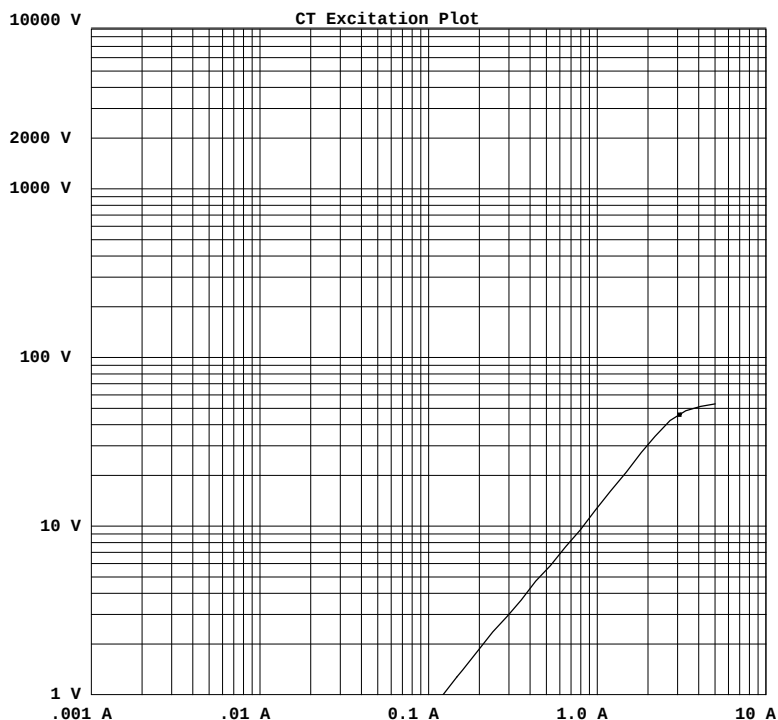
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.74°
Vkp[Volts]: 45.76	Vkp[Volts]: 38.92	Vkp[Volts]: 0.00	M-RATIO: 10.025	Ex I[Amps]: 0.777	In Phase
Ikp[Amps]: 3.0738	Ikp[Amps]: 2.4962	Ikp[Amps]: 0.0000	% ERROR: 0.2480	Winding Res: 54.66 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0406	0.28	6.90	17	1.1984	16.12	13.45
2	0.0464	0.32	6.90	18	1.4906	20.96	14.06
3	0.0612	0.44	7.19	19	1.8274	27.36	14.97
4	0.0878	0.68	7.74	20	2.2040	34.12	15.48
5	0.1104	0.88	7.97	21	2.7070	42.36	15.65
6	0.1474	1.28	8.68	22	3.3498	48.32	14.42
7	0.1592	1.40	8.79	23	4.0932	51.36	12.55
8	0.1974	1.84	9.32	24	5.0052	53.12	10.61
9	0.2406	2.36	9.81				
10	0.2928	2.92	9.97				
11	0.3536	3.64	10.29				
12	0.4316	4.72	10.94				
13	0.5282	5.84	11.06				
14	0.6492	7.56	11.65				
15	0.7930	9.48	11.95				
16	0.9778	12.48	12.76				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.10	10.00	15	2.0000	30.40	15.20
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.30	7.50	17	5.0000	53.10	10.62
7	0.0500	0.40	8.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.30	10.75				



FILENAME: H1-CTX.test

MFR: Siemens

TEST # 9: X4-X5

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

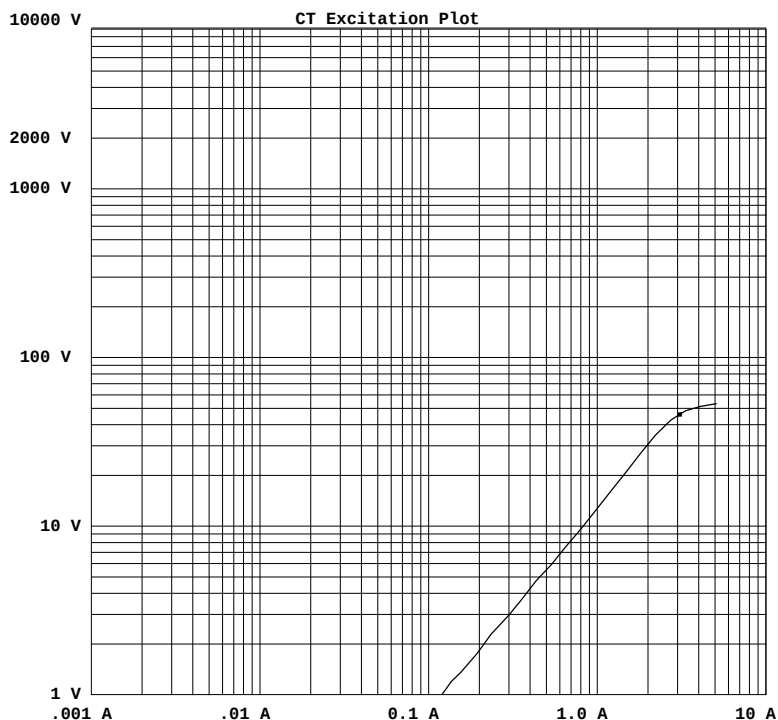
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.68°
Vkp[Volts]: 45.88	Vkp[Volts]: 37.68	Vkp[Volts]: 48.20	M-RATIO: 10.028	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0846	Ikp[Amps]: 2.1134	Ikp[Amps]: 3.3350	% ERROR: 0.2830	Winding Res: 53.67 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0406	0.28	6.90	17	0.9952	12.64	12.70
2	0.0484	0.32	6.61	18	1.2162	16.32	13.42
3	0.0582	0.40	6.87	19	1.4728	20.76	14.10
4	0.0808	0.64	7.92	20	1.8176	27.24	14.99
5	0.0960	0.76	7.92	21	2.2136	34.64	15.65
6	0.1096	0.88	8.03	22	2.7362	42.64	15.58
7	0.1366	1.20	8.78	23	3.3466	48.32	14.44
8	0.1552	1.36	8.76	24	4.0898	51.36	12.56
9	0.1942	1.76	9.06	25	5.0702	53.24	10.50
10	0.2344	2.28	9.73				
11	0.2982	2.96	9.93				
12	0.3510	3.60	10.26				
13	0.4328	4.72	10.91				
14	0.5388	5.96	11.06				
15	0.6480	7.52	11.60				
16	0.7988	9.60	12.02				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.70	12.70
4	0.0100	0.10	10.00	15	2.0000	30.60	15.30
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.30	7.50	17	5.0000	53.10	10.62
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.30	10.75				



FILENAME: H1-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 14:54:32

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

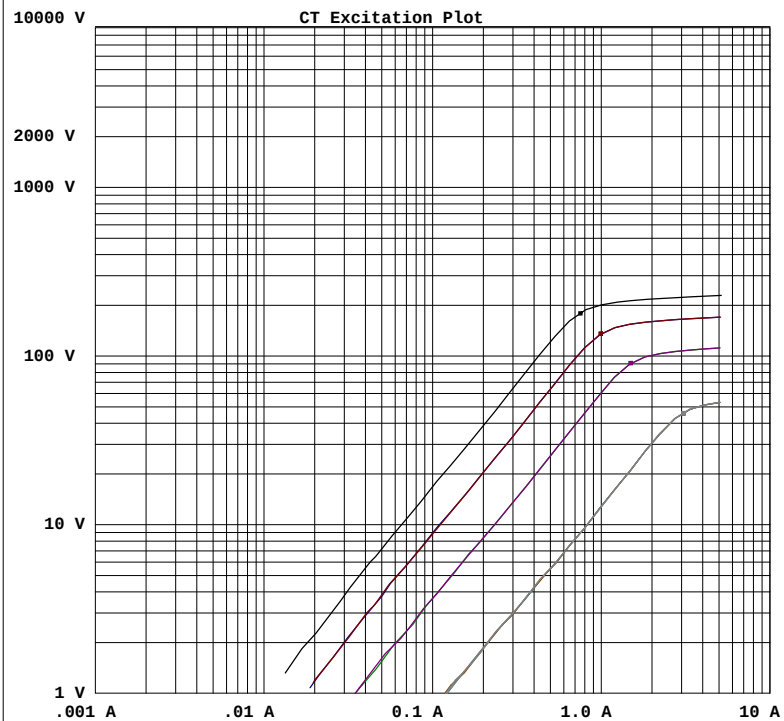
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	45.64/3.0692	38.92/2.4988	48.16/3.3498	50/5.0	10.033	0.332 %	-1.10° [In Ø]	63.44 m-ohms
2	X1-X3	90.68/1.4952	74.76/1.1948	94.36/1.6538	100/5.0	20.032	0.158 %	0.24° [In Ø]	97.17 m-ohms
3	X1-X4	135.68/0.9978	109.80/0.7834	140.96/1.0996	150/5.0	30.019	0.062 %	0.14° [In Ø]	134.01 m-ohms
4	X1-X5	179.12/0.7544	150.36/0.6054	188.80/0.8150	200/5.0	40.005	0.014 %	0.12° [In Ø]	183.29 m-ohms
5	X2-X3	45.80/3.0866	38.64/2.4902	0.00/0.0000	50/5.0	10.024	0.236 %	-0.92° [In Ø]	50.19 m-ohms
6	X2-X4	90.88/1.4982	74.48/1.1916	94.24/1.6500	100/5.0	20.027	0.133 %	0.34° [In Ø]	83.87 m-ohms
7	X2-X5	135.72/0.9940	110.48/0.7886	140.44/1.0894	150/5.0	30.016	0.055 %	0.24° [In Ø]	113.73 m-ohms
8	X3-X4	45.76/3.0738	38.92/2.4962	0.00/0.0000	50/5.0	10.025	0.248 %	-0.74° [In Ø]	54.66 m-ohms
10	X4-X5	45.88/3.0846	37.68/2.1134	48.20/3.3350	50/5.0	10.028	0.283 %	-0.68° [In Ø]	53.67 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: H1-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 14:54:32

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1833 Ohm Rct75: 0.2186 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.31	Vsec: 31.17
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.41	Vsec: 40.80
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.70	Vsec: 70.32
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.13	Vsec: 112.53
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.12	Vsec: 211.78
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.11	Vsec: 411.37
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.11	Vsec: 811.15



FILENAME: H1-CTY.test

DATE: 08/27/20 14:41:40

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H1 - CTY

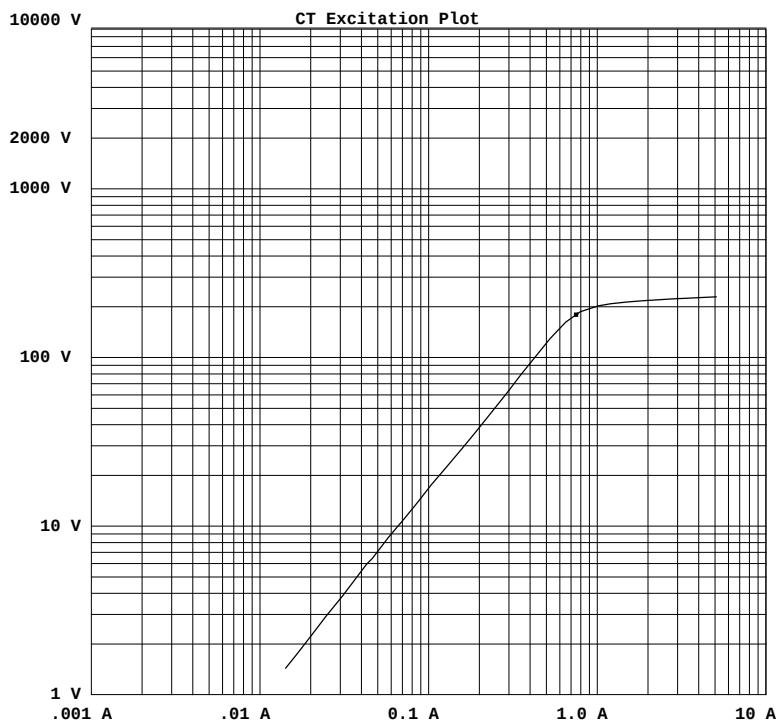
TEST # 1: X1-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.600	Phase Angle:0.12°
Vkp[Volts]: 179.36	Vkp[Volts]: 149.72	Vkp[Volts]: 188.56	M-RATIO: 40.003	Ex I[Amps]: 0.418	In Phase
Ikp[Amps]: 0.7498	Ikp[Amps]: 0.6032	Ikp[Amps]: 0.8160	% ERROR: 0.0065	Winding Res: 158.80 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0142	1.44	101.41	17	0.3510	78.52	223.70
2	0.0164	1.72	104.88	18	0.4324	101.88	235.62
3	0.0204	2.28	111.76	19	0.5260	129.44	246.08
4	0.0246	2.92	118.70	20	0.6506	162.16	249.25
5	0.0308	3.84	124.68	21	0.7938	187.00	235.58
6	0.0430	5.96	138.60	22	1.0178	202.68	199.14
7	0.0464	6.44	138.79	23	1.2050	208.36	172.91
8	0.0578	8.60	148.79	24	1.5118	213.48	141.21
9	0.0714	11.00	154.06	25	1.8924	217.56	114.97
10	0.0858	13.76	160.37	26	2.2592	220.00	97.38
11	0.1042	17.68	169.67	27	2.7622	222.68	80.62
12	0.1268	22.24	175.39	28	3.3628	224.84	66.86
13	0.1584	28.96	182.83	29	4.1840	227.28	54.32
14	0.1904	36.16	189.92	30	5.0896	229.16	45.03
15	0.2332	46.60	199.83				
16	0.2898	61.28	211.46				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	38.50	192.50
2	0.0020	0.20	100.00	13	0.4000	92.60	231.50
3	0.0040	0.40	100.00	14	0.5000	121.80	243.60
4	0.0050	0.50	100.00	15	0.8000	187.40	234.25
5	0.0080	0.80	100.00	16	1.0000	201.40	201.40
6	0.0100	1.00	100.00	17	2.0000	218.30	109.15
7	0.0200	2.20	110.00	18	4.0000	226.70	56.67
8	0.0400	5.40	135.00	19	5.0000	229.00	45.80
9	0.0500	7.10	142.00				
10	0.0800	12.60	157.50				
11	0.1000	16.80	168.00				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 2: X1-X4

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

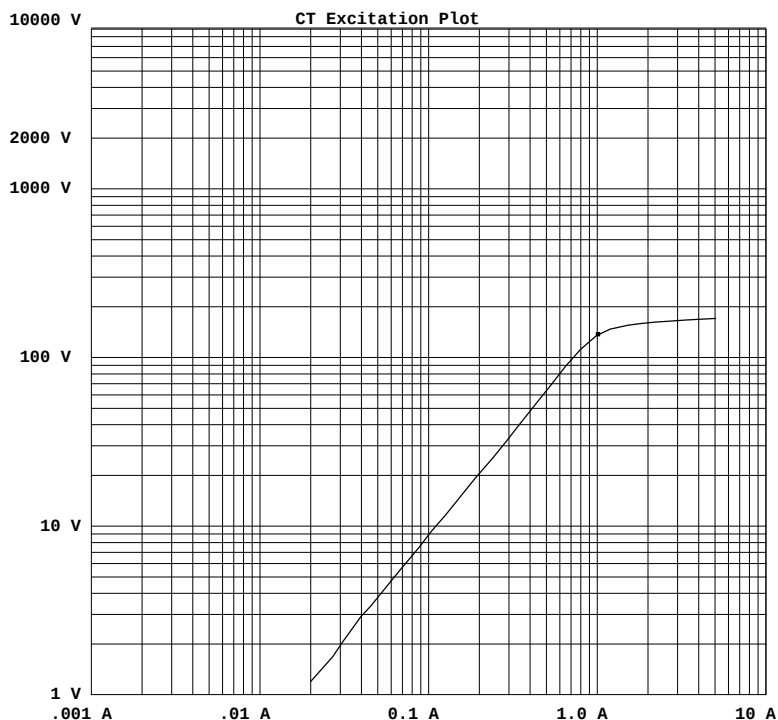
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 93.200	Phase Angle:0.12°
Vkp[Volts]: 137.40	Vkp[Volts]: 109.56	Vkp[Volts]: 140.80	M-RATIO: 30.016	Ex I[Amps]: 0.675	In Phase
Ikp[Amps]: 1.0126	Ikp[Amps]: 0.7834	Ikp[Amps]: 1.0894	% ERROR: 0.0520	Winding Res: 126.44 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0200	1.20	60.00	17	0.5256	67.76	128.92
2	0.0270	1.68	62.22	18	0.6488	88.64	136.62
3	0.0312	2.08	66.67	19	0.7984	111.88	140.13
4	0.0398	2.92	73.37	20	0.9890	134.60	136.10
5	0.0454	3.36	74.01	21	1.1932	147.28	123.43
6	0.0632	5.04	79.75	22	1.5300	155.68	101.75
7	0.0684	5.56	81.29	23	1.8436	159.44	86.48
8	0.0870	7.40	85.06	24	2.2040	162.16	73.58
9	0.1046	9.40	89.87	25	2.7688	164.84	59.53
10	0.1268	11.72	92.43	26	3.3466	167.00	49.90
11	0.1556	15.12	97.17	27	4.0898	168.64	41.23
12	0.1888	19.20	101.69	28	5.0442	170.52	33.81
13	0.2378	25.08	105.47				
14	0.2858	31.40	109.87				
15	0.3502	40.68	116.16				
16	0.4358	53.64	123.08				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	48.20	120.50
3	0.0040	0.20	50.00	14	0.5000	63.70	127.40
4	0.0050	0.30	60.00	15	0.8000	112.10	140.12
5	0.0080	0.50	62.50	16	1.0000	135.30	135.30
6	0.0100	0.60	60.00	17	2.0000	160.60	80.30
7	0.0200	1.20	60.00	18	4.0000	168.40	42.10
8	0.0400	2.90	72.50	19	5.0000	170.40	34.08
9	0.0500	3.80	76.00				
10	0.0800	6.70	83.75				
11	0.1000	8.90	89.00				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 3: X1-X3

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

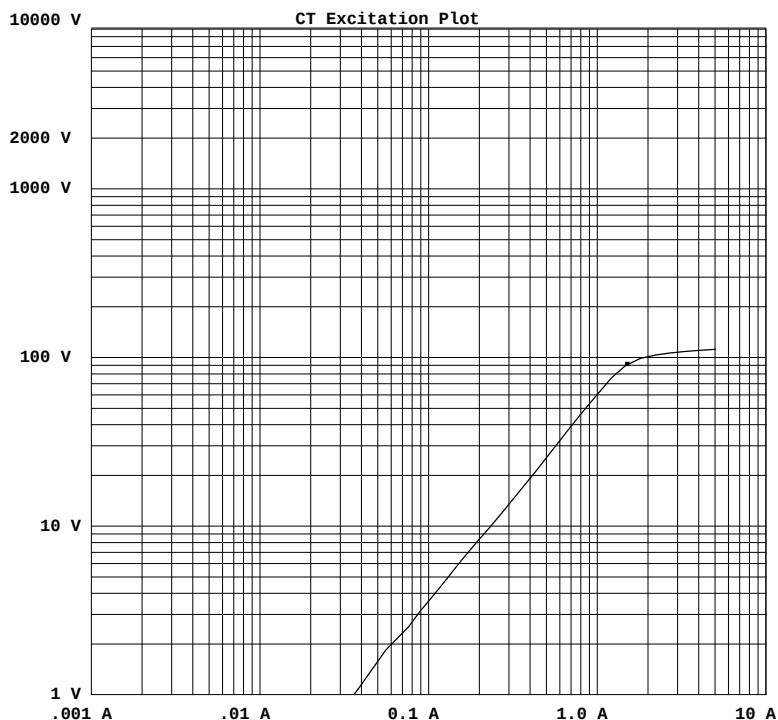
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.300	Phase Angle: -0.04°
Vkp[Volts]: 91.56	Vkp[Volts]: 75.28	Vkp[Volts]: 94.44	M-RATIO: 20.033	Ex I[Amps]: 0.783	In Phase
Ikp[Amps]: 1.5108	Ikp[Amps]: 1.2088	Ikp[Amps]: 1.6504	% ERROR: 0.1670	Winding Res: 96.83 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0294	0.76	25.85	17	0.8050	46.60	57.89
2	0.0316	0.84	26.58	18	0.9812	59.04	60.17
3	0.0382	1.08	28.27	19	1.2162	75.80	62.33
4	0.0558	1.84	32.97	20	1.4688	89.32	60.81
5	0.0758	2.52	33.25	21	1.8014	98.76	54.82
6	0.0898	3.16	35.19	22	2.2364	103.76	46.40
7	0.1076	3.92	36.43	23	2.7460	106.76	38.88
8	0.1284	4.88	38.01	24	3.3562	108.76	32.41
9	0.1560	6.24	40.00	25	4.0866	110.52	27.04
10	0.1934	8.04	41.57	26	5.0410	112.00	22.22
11	0.2340	10.00	42.74				
12	0.2870	12.80	44.60				
13	0.3602	16.92	46.97				
14	0.4362	21.40	49.06				
15	0.5438	28.36	52.15				
16	0.6530	35.76	54.76				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.30	48.25
3	0.0040	0.10	25.00	14	0.5000	25.50	51.00
4	0.0050	0.10	20.00	15	0.8000	46.20	57.75
5	0.0080	0.20	25.00	16	1.0000	60.40	60.40
6	0.0100	0.20	20.00	17	2.0000	101.00	50.50
7	0.0200	0.50	25.00	18	4.0000	110.30	27.57
8	0.0400	1.20	30.00	19	5.0000	111.90	22.38
9	0.0500	1.60	32.00				
10	0.0800	2.70	33.75				
11	0.1000	3.60	36.00				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 4: X1-X2

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

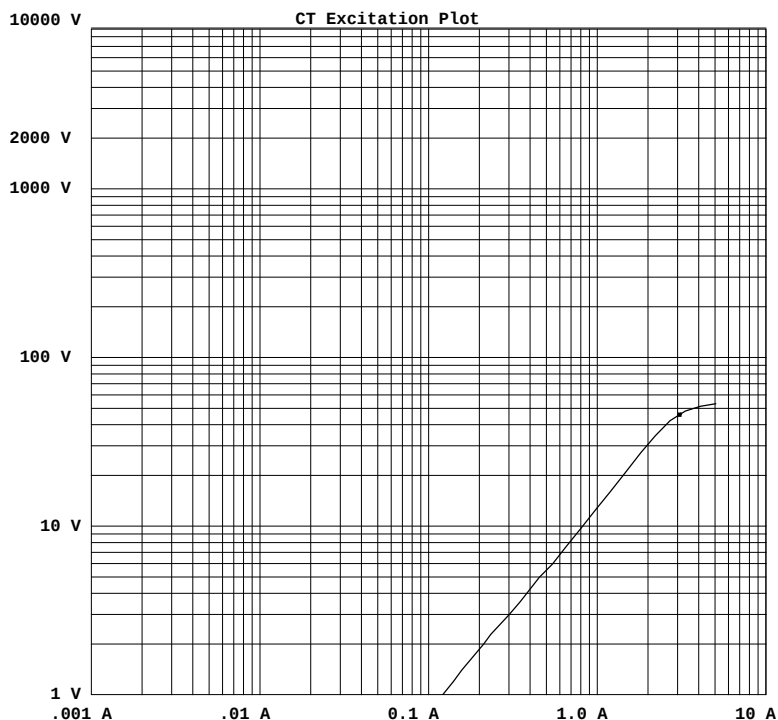
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.70°
Vkp[Volts]: 45.76	Vkp[Volts]: 38.68	Vkp[Volts]: 0.00	M-RATIO: 10.028	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0746	Ikp[Amps]: 2.4820	Ikp[Amps]: 0.0000	% ERROR: 0.2840	Winding Res: 58.23 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0418	0.28	6.70	17	0.9812	12.56	12.80
2	0.0476	0.32	6.72	18	1.1968	16.04	13.40
3	0.0566	0.36	6.36	19	1.4680	20.76	14.14
4	0.0772	0.60	7.77	20	1.8176	27.32	15.03
5	0.0914	0.72	7.88	21	2.2136	34.36	15.52
6	0.1096	0.88	8.03	22	2.7070	42.28	15.62
7	0.1404	1.20	8.55	23	3.3302	48.16	14.46
8	0.1572	1.40	8.91	24	4.0964	51.40	12.55
9	0.2122	2.00	9.43	25	5.0506	53.24	10.54
10	0.2336	2.28	9.76				
11	0.2976	2.96	9.95				
12	0.3494	3.56	10.19				
13	0.4534	4.96	10.94				
14	0.5426	5.96	10.98				
15	0.6514	7.52	11.54				
16	0.7996	9.68	12.11				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.70	12.12
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.60	15.30
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.30	7.50	17	5.0000	53.20	10.64
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.20	10.50				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 5: X2-X5

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

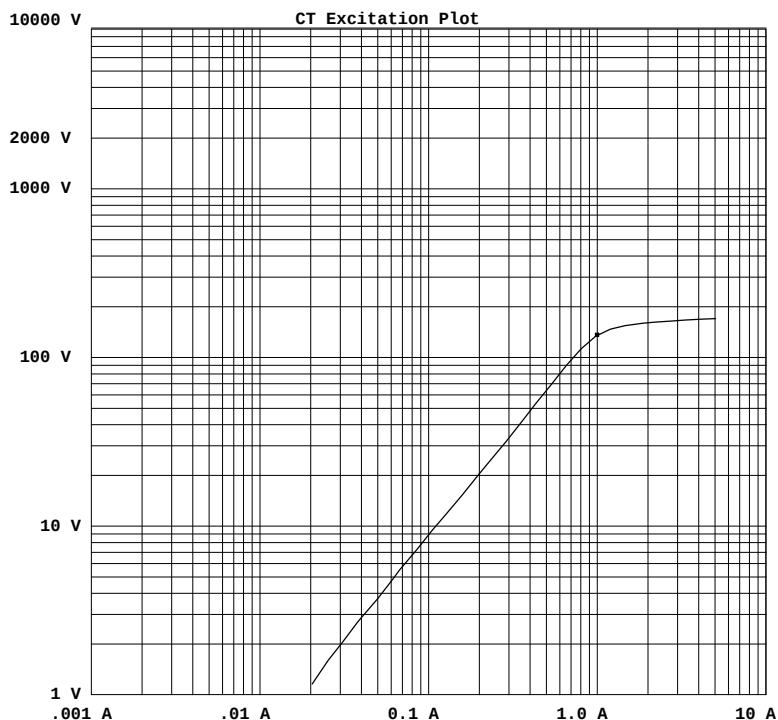
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 90.800	Phase Angle:0.32°
Vkp[Volts]: 136.32	Vkp[Volts]: 111.04	Vkp[Volts]: 140.96	M-RATIO: 30.025	Ex I[Amps]: 0.660	In Phase
Ikp[Amps]: 0.9996	Ikp[Amps]: 0.7928	Ikp[Amps]: 1.0942	% ERROR: 0.0833	Winding Res: 114.30 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0204	1.16	56.86	17	0.5278	68.16	129.14
2	0.0254	1.60	62.99	18	0.6542	89.44	136.72
3	0.0308	2.04	66.23	19	0.8034	112.68	140.25
4	0.0382	2.72	71.20	20	0.9796	133.92	136.71
5	0.0500	3.72	74.40	21	1.1968	147.28	123.06
6	0.0616	4.88	79.22	22	1.4634	154.60	105.64
7	0.0676	5.52	81.66	23	1.8598	159.72	85.88
8	0.0854	7.28	85.25	24	2.2104	162.16	73.36
9	0.1058	9.52	89.98	25	2.7818	164.84	59.26
10	0.1276	11.84	92.79	26	3.3302	167.00	50.15
11	0.1596	15.44	96.74	27	4.0802	168.64	41.33
12	0.1950	19.84	101.74	28	5.0280	170.24	33.86
13	0.2352	24.88	105.78				
14	0.2870	31.56	109.97				
15	0.3524	41.00	116.35				
16	0.4336	53.64	123.71				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.50	102.50
2	0.0020	0.10	50.00	13	0.4000	48.40	121.00
3	0.0040	0.20	50.00	14	0.5000	63.90	127.80
4	0.0050	0.30	60.00	15	0.8000	112.20	140.25
5	0.0080	0.40	50.00	16	1.0000	135.20	135.20
6	0.0100	0.60	60.00	17	2.0000	160.70	80.35
7	0.0200	1.10	55.00	18	4.0000	168.50	42.13
8	0.0400	2.90	72.50	19	5.0000	170.20	34.04
9	0.0500	3.70	74.00				
10	0.0800	6.80	85.00				
11	0.1000	8.90	89.00				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 6: X2-X4

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

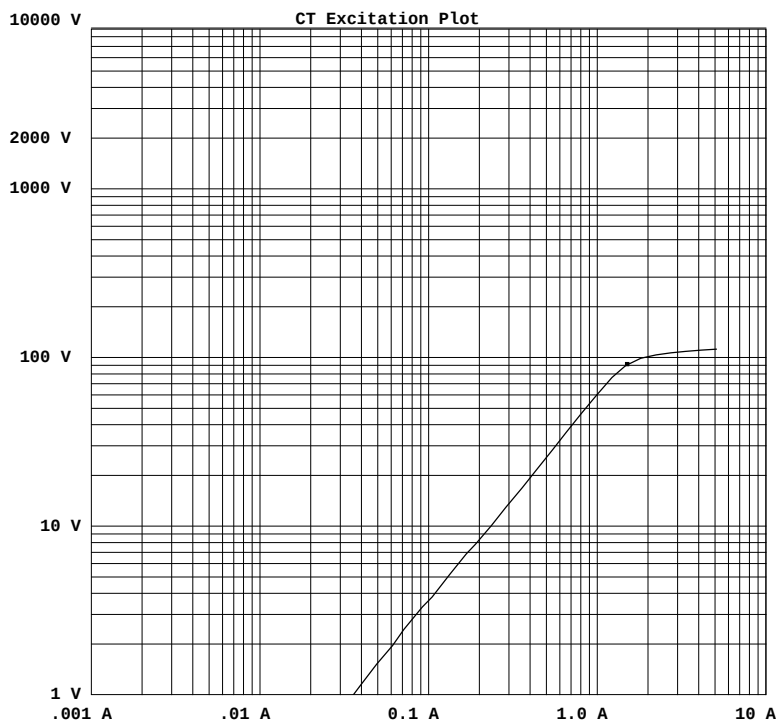
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.100	Phase Angle:0.40°
Vkp[Volts]: 91.28	Vkp[Volts]: 75.92	Vkp[Volts]: 94.44	M-RATIO: 20.031	Ex I[Amps]: 0.779	In Phase
Ikp[Amps]: 1.5058	Ikp[Amps]: 1.2194	Ikp[Amps]: 1.6492	% ERROR: 0.1550	Winding Res: 83.65 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0292	0.76	26.03	17	0.8082	46.84	57.96
2	0.0390	1.12	28.72	18	0.9832	59.24	60.25
3	0.0492	1.52	30.89	19	1.2232	76.20	62.30
4	0.0612	1.96	32.03	20	1.4744	89.60	60.77
5	0.0714	2.44	34.17	21	1.8144	99.04	54.59
6	0.0920	3.32	36.09	22	2.2300	103.76	46.53
7	0.1050	3.80	36.19	23	2.7330	106.60	39.00
8	0.1334	5.16	38.68	24	3.3336	108.76	32.63
9	0.1674	6.84	40.86	25	4.1386	110.68	26.74
10	0.1896	7.80	41.14	26	5.0994	112.16	21.99
11	0.2356	10.08	42.78				
12	0.2874	12.96	45.09				
13	0.3602	16.96	47.08				
14	0.4370	21.64	49.52				
15	0.5470	28.56	52.21				
16	0.6538	35.96	55.00				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.30	41.50
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.60	51.20
4	0.0050	0.10	20.00	15	0.8000	46.30	57.87
5	0.0080	0.20	25.00	16	1.0000	60.40	60.40
6	0.0100	0.20	20.00	17	2.0000	101.20	50.60
7	0.0200	0.50	25.00	18	4.0000	110.40	27.60
8	0.0400	1.20	30.00	19	5.0000	112.00	22.40
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 7: X2-X3

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

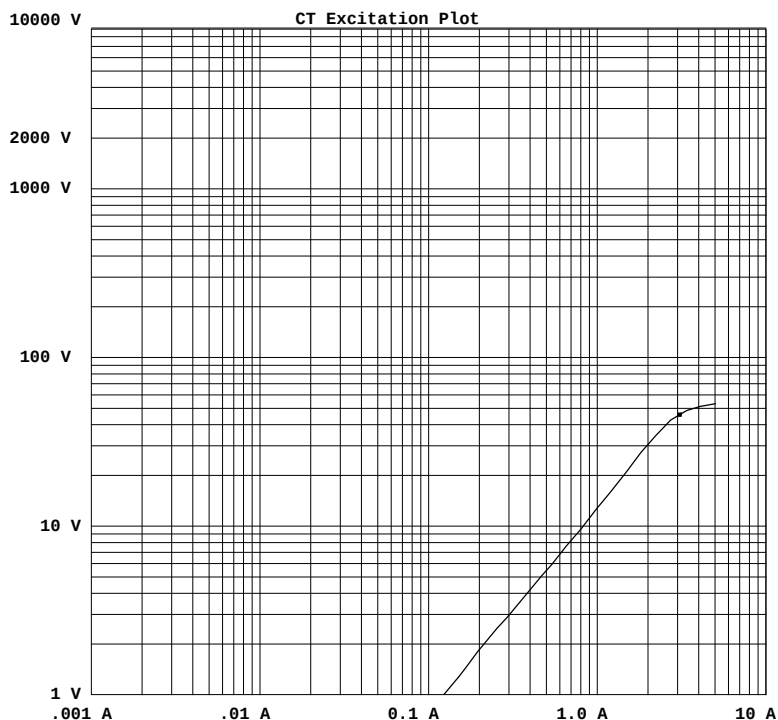
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.300	Phase Angle: -0.68°
Vkp[Volts]: 45.80	Vkp[Volts]: 38.88	Vkp[Volts]: 0.00	M-RATIO: 10.028	Ex I[Amps]: 0.771	In Phase
Ikp[Amps]: 3.0842	Ikp[Amps]: 2.4968	Ikp[Amps]: 0.0000	% ERROR: 0.2770	Winding Res: 53.71 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0414	0.28	6.76	17	0.9858	12.60	12.78
2	0.0488	0.32	6.56	18	1.1940	15.88	13.30
3	0.0606	0.40	6.60	19	1.4930	21.04	14.09
4	0.0676	0.52	7.69	20	1.8112	27.24	15.04
5	0.0850	0.64	7.53	21	2.2104	34.24	15.49
6	0.1022	0.80	7.83	22	2.7298	42.64	15.62
7	0.1510	1.28	8.48	23	3.3854	48.52	14.33
8	0.1654	1.44	8.71	24	4.0768	51.36	12.60
9	0.1954	1.80	9.21	25	5.0150	53.24	10.62
10	0.2542	2.48	9.76				
11	0.2928	2.88	9.84				
12	0.3556	3.64	10.24				
13	0.4682	5.08	10.85				
14	0.5412	5.96	11.01				
15	0.6542	7.60	11.62				
16	0.7976	9.56	11.99				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.10	10.00	15	2.0000	30.60	15.30
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.30	7.50	17	5.0000	53.20	10.64
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 8: X3-X4

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

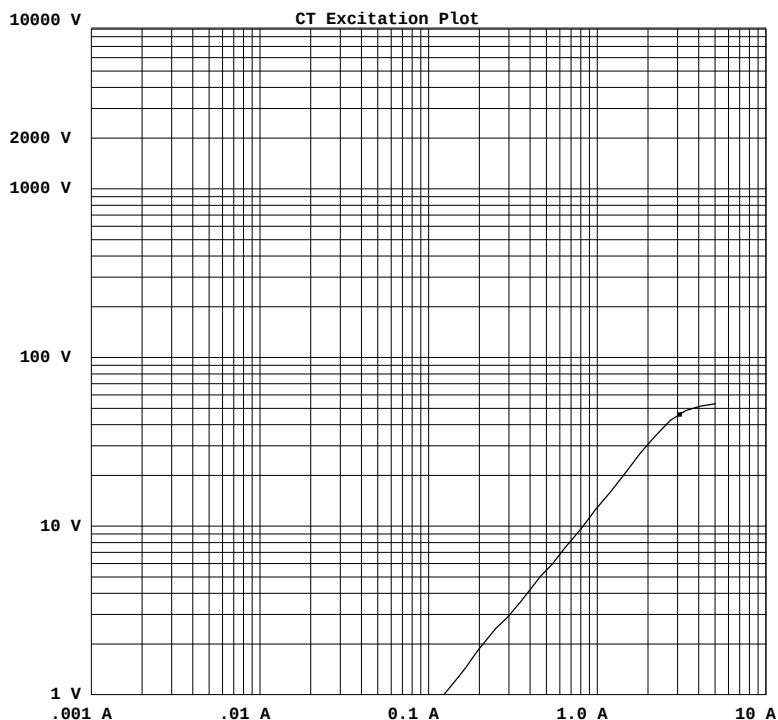
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.90°
Vkp[Volts]: 45.92	Vkp[Volts]: 38.88	Vkp[Volts]: 48.28	M-RATIO: 10.031	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0862	Ikp[Amps]: 2.4972	Ikp[Amps]: 3.3386	% ERROR: 0.3110	Winding Res: 57.59 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0402	0.24	5.97	17	0.9734	12.48	12.82
2	0.0488	0.32	6.56	18	1.1944	15.92	13.33
3	0.0612	0.40	6.54	19	1.4942	21.12	14.13
4	0.0680	0.52	7.65	20	1.7982	27.04	15.04
5	0.0842	0.64	7.60	21	2.2170	34.36	15.50
6	0.1026	0.80	7.80	22	2.7200	42.48	15.62
7	0.1506	1.28	8.50	23	3.3530	48.44	14.45
8	0.1650	1.44	8.73	24	4.1060	51.48	12.54
9	0.1966	1.84	9.36	25	5.0312	53.24	10.58
10	0.2504	2.48	9.90				
11	0.2936	2.88	9.81				
12	0.3544	3.60	10.16				
13	0.4612	5.04	10.93				
14	0.5420	5.96	11.00				
15	0.6464	7.48	11.57				
16	0.8082	9.72	12.03				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	30.60	15.30
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.20	5.00	17	5.0000	53.20	10.64
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.20	10.50				



FILENAME: H1-CTY.test

MFR: Siemens

TEST # 9: X4-X5

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

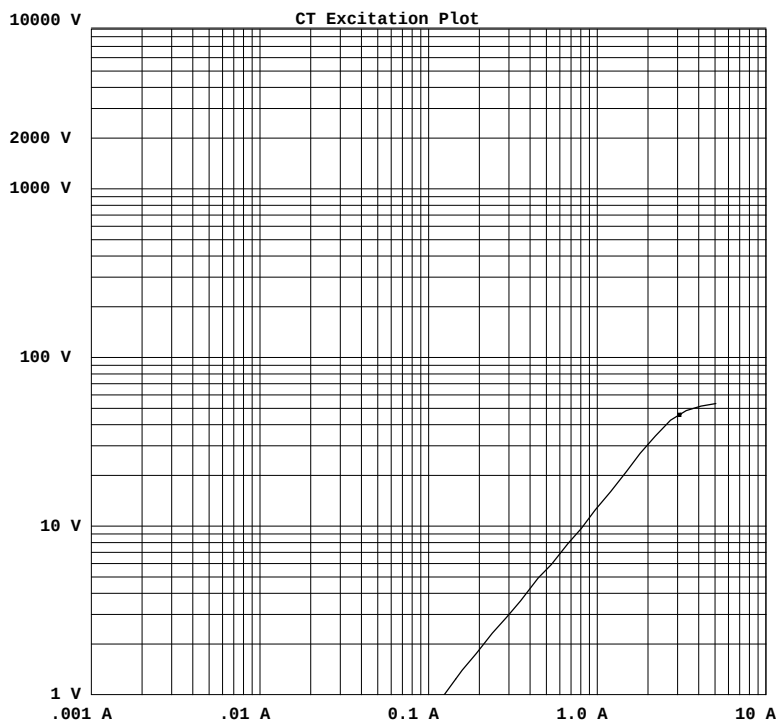
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.42°
Vkp[Volts]: 45.72	Vkp[Volts]: 38.92	Vkp[Volts]: 0.00	M-RATIO: 10.029	Ex I[Amps]: 0.774	In Phase
Ikp[Amps]: 3.0716	Ikp[Amps]: 2.4974	Ikp[Amps]: 0.0000	% ERROR: 0.2910	Winding Res: 54.50 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0406	0.24	5.91	17	0.9734	12.48	12.82
2	0.0472	0.32	6.78	18	1.2030	16.04	13.33
3	0.0602	0.40	6.64	19	1.4938	21.12	14.14
4	0.0828	0.60	7.25	20	1.7982	27.04	15.04
5	0.0952	0.76	7.98	21	2.2104	34.24	15.49
6	0.1092	0.84	7.69	22	2.7200	42.56	15.65
7	0.1448	1.24	8.56	23	3.3724	48.44	14.36
8	0.1584	1.40	8.84	24	4.1256	51.48	12.48
9	0.1918	1.76	9.18	25	5.0506	53.32	10.56
10	0.2386	2.32	9.72				
11	0.2898	2.88	9.94				
12	0.3506	3.60	10.27				
13	0.4464	4.92	11.02				
14	0.5352	5.92	11.06				
15	0.6694	7.88	11.77				
16	0.8042	9.68	12.04				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	30.60	15.30
5	0.0200	0.10	5.00	16	4.0000	51.00	12.75
6	0.0400	0.20	5.00	17	5.0000	53.20	10.64
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.30	10.75				



FILENAME: H1-CTY.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 14:41:40

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

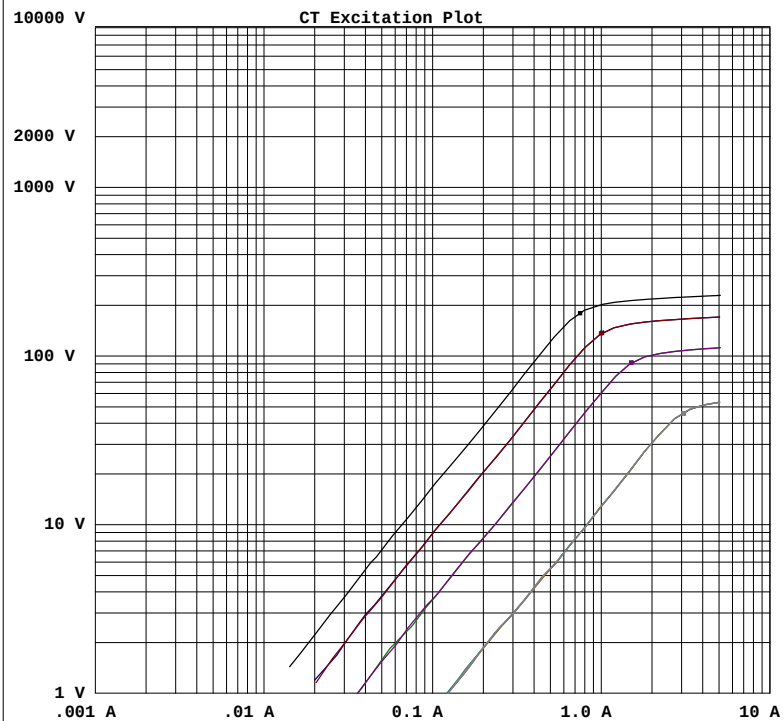
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	45.76/3.0746	38.68/2.4820	0.00/0.0000	50/5.0	10.028	0.284 %	-0.70° [In Ø]	58.23 m-ohms
2	X1-X3	91.56/1.5108	75.28/1.2088	94.44/1.6504	100/5.0	20.033	0.167 %	-0.04° [In Ø]	96.83 m-ohms
3	X1-X4	137.40/1.0126	109.56/0.7834	140.80/1.0894	150/5.0	30.016	0.052 %	0.12° [In Ø]	126.44 m-ohms
4	X1-X5	179.36/0.7498	149.72/0.6032	188.56/0.8160	200/5.0	40.003	0.007 %	0.12° [In Ø]	158.80 m-ohms
5	X2-X3	45.80/3.0842	38.88/2.4968	0.00/0.0000	50/5.0	10.028	0.277 %	-0.68° [In Ø]	53.71 m-ohms
6	X2-X4	91.28/1.5058	75.92/1.2194	94.44/1.6492	100/5.0	20.031	0.155 %	0.40° [In Ø]	83.65 m-ohms
7	X2-X5	136.32/0.9996	111.04/0.7928	140.96/1.0942	150/5.0	30.025	0.083 %	0.32° [In Ø]	114.30 m-ohms
8	X3-X4	45.92/3.0862	38.88/2.4972	48.28/3.3386	50/5.0	10.031	0.311 %	-0.90° [In Ø]	57.59 m-ohms
10	X4-X5	45.72/3.0716	38.92/2.4974	0.00/0.0000	50/5.0	10.029	0.291 %	-0.42° [In Ø]	54.50 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: H1-CTY.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 14:41:40

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H1 - CTY

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1588 Ohm Rct75: 0.1894 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.28	Vsec: 28.28
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.38	Vsec: 37.95
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.68	Vsec: 67.55
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.11	Vsec: 110.69
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.10	Vsec: 210.11
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.10	Vsec: 409.80
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.10	Vsec: 809.64



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 1: X1-X5

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

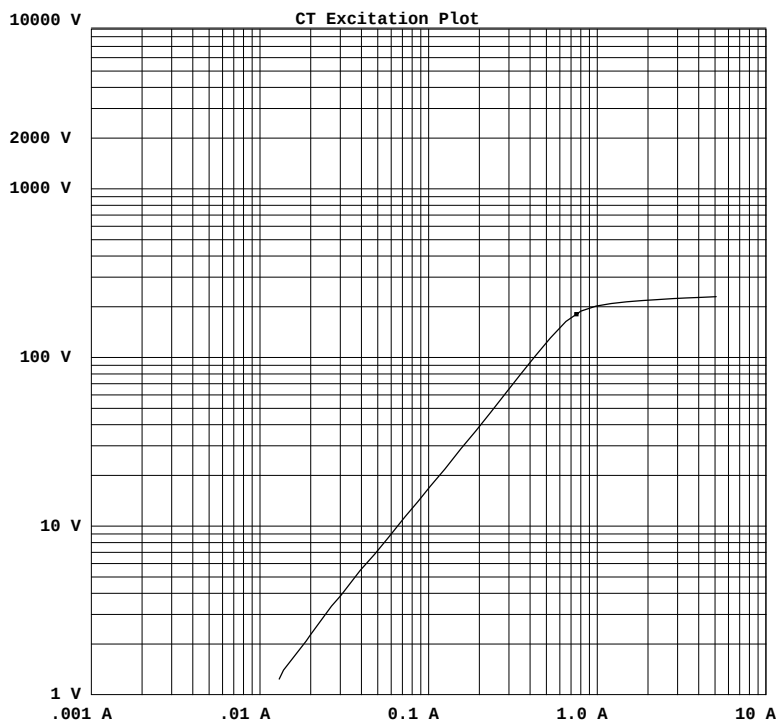
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.500	Phase Angle:0.26°
Vkp[Volts]: 180.64	Vkp[Volts]: 150.88	Vkp[Volts]: 189.80	M-RATIO: 40.008	Ex I[Amps]: 0.415	In Phase
Ikp[Amps]: 0.7528	Ikp[Amps]: 0.6036	Ikp[Amps]: 0.8166	% ERROR: 0.0210	Winding Res: 174.78 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0130	1.24	95.38	17	0.2862	61.36	214.40
2	0.0138	1.40	101.45	18	0.3502	79.20	226.16
3	0.0188	2.08	110.64	19	0.4304	102.56	238.29
4	0.0200	2.28	114.00	20	0.5274	130.80	248.01
5	0.0266	3.36	126.32	21	0.6526	163.76	250.93
6	0.0302	3.88	128.48	22	0.8004	188.64	235.68
7	0.0394	5.48	139.09	23	0.9848	201.88	205.00
8	0.0480	6.84	142.50	24	1.2080	209.16	173.15
9	0.0582	8.64	148.45	25	1.4980	214.32	143.07
10	0.0726	11.40	157.02	26	1.8664	218.08	116.85
11	0.0862	13.96	161.95	27	2.2266	220.52	99.04
12	0.1026	17.28	168.42	28	2.8110	223.48	79.50
13	0.1252	21.84	174.44	29	3.3628	225.40	67.03
14	0.1556	28.80	185.09	30	4.2002	227.84	54.25
15	0.1908	36.76	192.66	31	5.0798	229.72	45.22
16	0.2332	47.24	202.57				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	39.00	195.00
2	0.0020	0.20	100.00	13	0.4000	93.70	234.25
3	0.0040	0.40	100.00	14	0.5000	122.80	245.60
4	0.0050	0.50	100.00	15	0.8000	188.60	235.75
5	0.0080	0.80	100.00	16	1.0000	202.40	202.40
6	0.0100	1.00	100.00	17	2.0000	219.00	109.50
7	0.0200	2.30	115.00	18	4.0000	227.20	56.80
8	0.0400	5.60	140.00	19	5.0000	229.60	45.92
9	0.0500	7.20	144.00				
10	0.0800	12.80	160.00				
11	0.1000	16.80	168.00				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 2: X1-X4

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

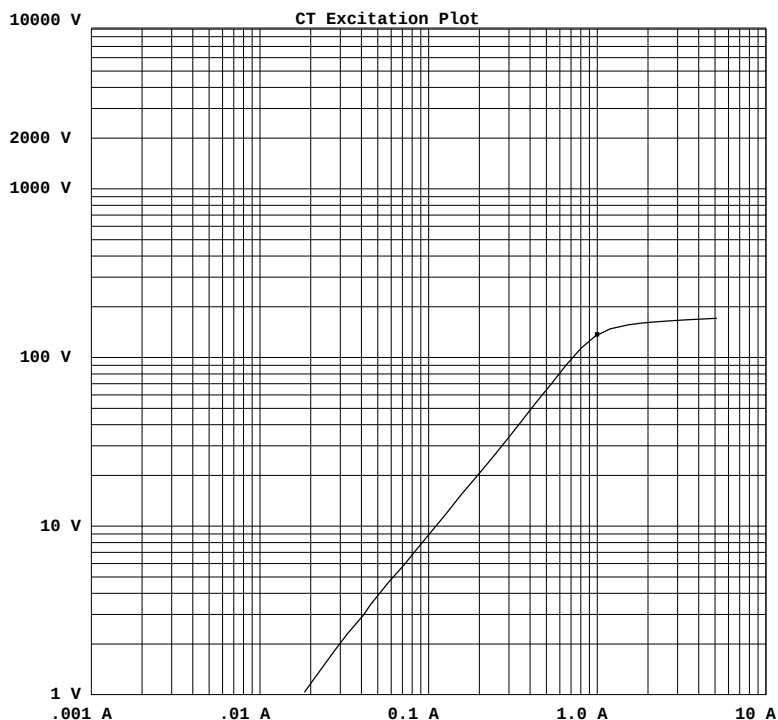
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 92.400	Phase Angle:0.10°
Vkp[Volts]: 137.08	Vkp[Volts]: 111.36	Vkp[Volts]: 140.76	M-RATIO: 30.014	Ex I[Amps]: 0.665	In Phase
Ikp[Amps]: 0.9988	Ikp[Amps]: 0.7892	Ikp[Amps]: 1.0792	% ERROR: 0.0450	Winding Res: 143.83 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0184	1.04	56.52	17	0.4324	54.00	124.88
2	0.0204	1.20	58.82	18	0.5286	68.84	130.23
3	0.0274	1.80	65.69	19	0.6538	90.12	137.84
4	0.0328	2.28	69.51	20	0.8020	113.36	141.35
5	0.0410	2.96	72.20	21	0.9746	134.16	137.66
6	0.0454	3.44	75.77	22	1.1948	148.08	123.94
7	0.0582	4.68	80.41	23	1.5296	156.20	102.12
8	0.0706	5.80	82.15	24	1.8338	160.00	87.25
9	0.0854	7.32	85.71	25	2.2428	162.96	72.66
10	0.1072	9.64	89.93	26	2.7980	165.40	59.11
11	0.1272	11.88	93.40	27	3.3336	167.28	50.18
12	0.1560	15.36	98.46	28	4.1418	169.16	40.84
13	0.1908	19.44	101.89	29	5.0962	170.80	33.52
14	0.2386	25.44	106.62				
15	0.2862	31.84	111.25				
16	0.3502	41.08	117.30				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	48.90	122.25
3	0.0040	0.20	50.00	14	0.5000	64.40	128.80
4	0.0050	0.30	60.00	15	0.8000	113.00	141.25
5	0.0080	0.40	50.00	16	1.0000	135.80	135.80
6	0.0100	0.60	60.00	17	2.0000	161.20	80.60
7	0.0200	1.20	60.00	18	4.0000	168.80	42.20
8	0.0400	2.90	72.50	19	5.0000	170.60	34.12
9	0.0500	3.90	78.00				
10	0.0800	6.80	85.00				
11	0.1000	8.90	89.00				



FILENAME: H2-CTX.test

DATE: 08/27/20 15:38:45

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H2-CTX

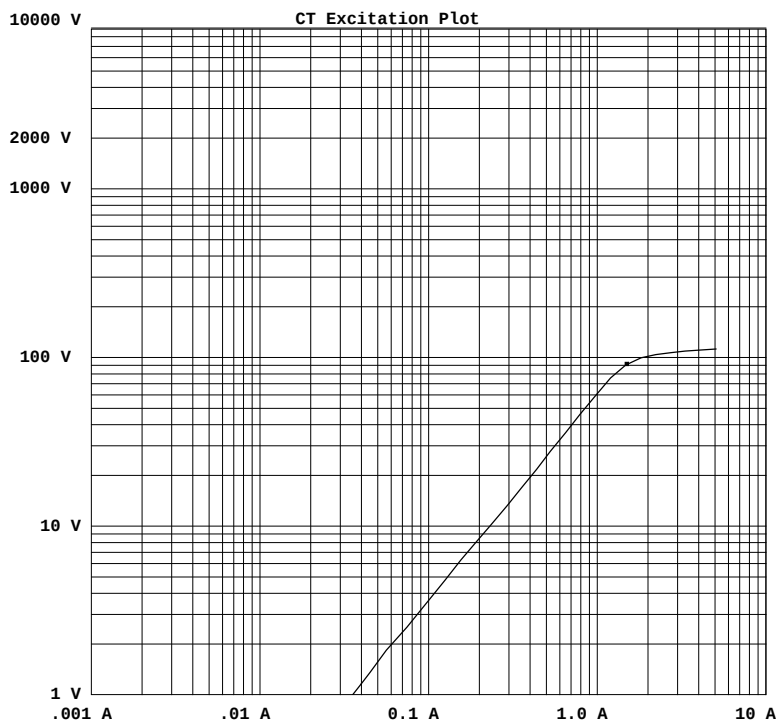
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 44.400	Phase Angle:0.10°
Vkp[Volts]: 91.44	Vkp[Volts]: 75.24	Vkp[Volts]: 94.80	M-RATIO: 20.033	Ex I[Amps]: 0.765	In Phase
Ikp[Amps]: 1.4990	Ikp[Amps]: 1.1944	Ikp[Amps]: 1.6440	% ERROR: 0.1665	Winding Res: 109.90 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0266	0.68	25.56	17	0.6506	35.96	55.27
2	0.0298	0.80	26.85	18	0.7926	46.16	58.24
3	0.0398	1.16	29.15	19	0.9746	59.20	60.74
4	0.0450	1.36	30.22	20	1.2006	75.68	63.04
5	0.0562	1.84	32.74	21	1.4770	90.28	61.12
6	0.0746	2.52	33.78	22	1.8210	99.60	54.70
7	0.0914	3.24	35.45	23	2.2266	104.20	46.80
8	0.1084	4.00	36.90	24	2.7362	107.00	39.11
9	0.1256	4.80	38.22	25	3.3238	109.20	32.85
10	0.1556	6.32	40.62	26	4.1612	110.92	26.66
11	0.1904	8.00	42.02	27	5.0766	112.44	22.15
12	0.2332	10.12	43.40				
13	0.2928	13.24	45.22				
14	0.3556	16.88	47.47				
15	0.4378	21.72	49.61				
16	0.5282	27.80	52.63				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.50	42.50
2	0.0020	0.00	0.00	13	0.4000	19.50	48.75
3	0.0040	0.10	25.00	14	0.5000	25.90	51.80
4	0.0050	0.10	20.00	15	0.8000	46.70	58.38
5	0.0080	0.20	25.00	16	1.0000	61.00	61.00
6	0.0100	0.20	20.00	17	2.0000	101.60	50.80
7	0.0200	0.50	25.00	18	4.0000	110.60	27.65
8	0.0400	1.20	30.00	19	5.0000	112.30	22.46
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 4: X1-X2

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

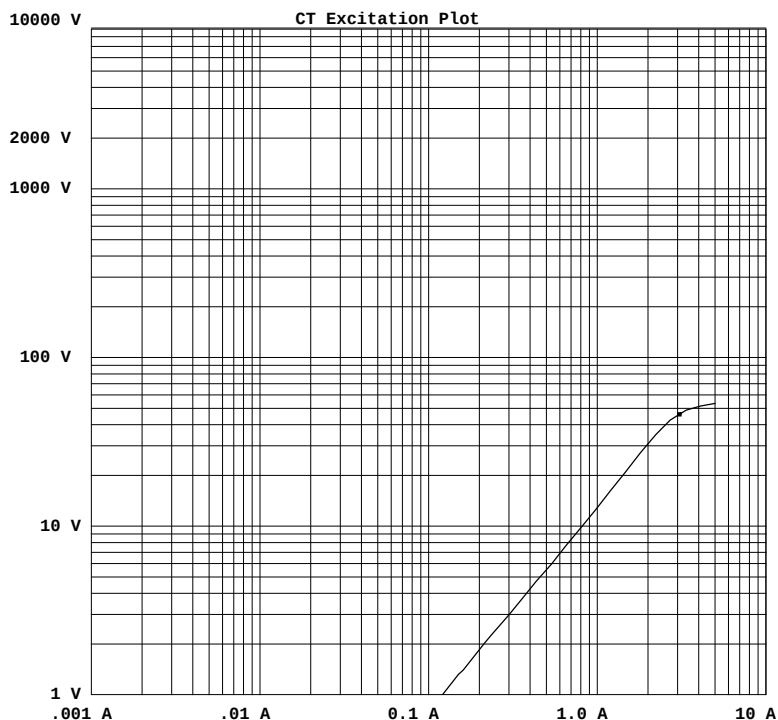
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.600	Phase Angle: -0.56°
Vkp[Volts]: 46.04	Vkp[Volts]: 38.68	Vkp[Volts]: 48.52	M-RATIO: 10.038	Ex I[Amps]: 0.780	In Phase
Ikp[Amps]: 3.0796	Ikp[Amps]: 2.1920	Ikp[Amps]: 3.3482	% ERROR: 0.3810	Winding Res: 75.32 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0366	0.24	6.56	17	1.1980	16.24	13.56
2	0.0488	0.32	6.56	18	1.4638	20.80	14.21
3	0.0562	0.36	6.41	19	1.8046	27.28	15.12
4	0.0874	0.68	7.78	20	2.2202	34.88	15.71
5	0.1096	0.88	8.03	21	2.7104	42.64	15.73
6	0.1502	1.32	8.79	22	3.3758	48.80	14.46
7	0.1606	1.40	8.72	23	4.1158	51.68	12.56
8	0.2160	2.04	9.44	24	5.0118	53.44	10.66
9	0.2374	2.28	9.60				
10	0.2976	2.96	9.95				
11	0.3564	3.68	10.33				
12	0.4358	4.72	10.83				
13	0.5360	5.96	11.12				
14	0.6476	7.60	11.74				
15	0.8300	10.24	12.34				
16	0.9836	12.60	12.81				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.80	15.40
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H2-CTX.test

DATE: 08/27/20 15:38:45

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H2-CTX

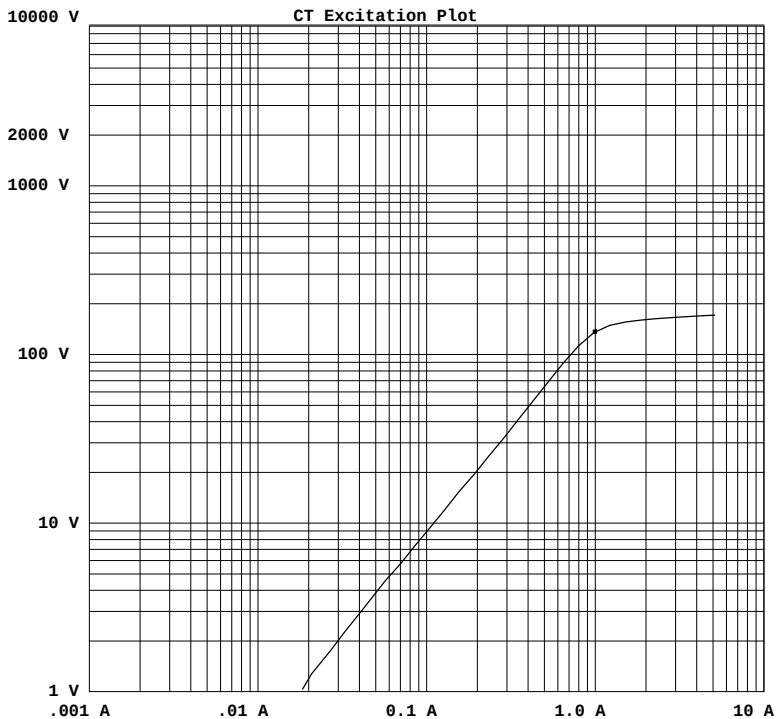
TEST # 5: X2-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 92.300	Phase Angle:0.22°
Vkp[Volts]: 136.40	Vkp[Volts]: 110.20	Vkp[Volts]: 141.12	M-RATIO: 30.022	Ex I[Amps]: 0.664	In Phase
Ikp[Amps]: 0.9966	Ikp[Amps]: 0.7820	Ikp[Amps]: 1.0872	% ERROR: 0.0720	Winding Res: 128.53 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0184	1.04	56.52	17	0.4344	54.04	124.40
2	0.0208	1.28	61.54	18	0.5368	70.52	131.37
3	0.0270	1.76	65.19	19	0.6502	89.60	137.80
4	0.0324	2.24	69.14	20	0.7988	112.84	141.26
5	0.0418	3.08	73.68	21	0.9848	135.00	137.08
6	0.0460	3.48	75.65	22	1.2174	148.92	122.33
7	0.0574	4.60	80.14	23	1.5164	155.92	102.82
8	0.0702	5.76	82.05	24	1.8338	159.72	87.10
9	0.0846	7.28	86.05	25	2.2428	162.96	72.66
10	0.1066	9.60	90.06	26	2.8012	165.40	59.05
11	0.1268	11.84	93.38	27	3.3368	167.28	50.13
12	0.1568	15.48	98.72	28	4.1256	169.44	41.07
13	0.1926	19.64	101.97	29	5.1188	171.32	33.47
14	0.2324	24.84	106.88				
15	0.2866	31.84	111.10				
16	0.3510	41.36	117.83				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	48.80	122.00
3	0.0040	0.20	50.00	14	0.5000	64.60	129.20
4	0.0050	0.30	60.00	15	0.8000	113.00	141.25
5	0.0080	0.40	50.00	16	1.0000	135.90	135.90
6	0.0100	0.60	60.00	17	2.0000	161.00	80.50
7	0.0200	1.20	60.00	18	4.0000	169.10	42.27
8	0.0400	2.90	72.50	19	5.0000	171.10	34.22
9	0.0500	3.90	78.00				
10	0.0800	6.80	85.00				
11	0.1000	8.90	89.00				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 6: X2-X4

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

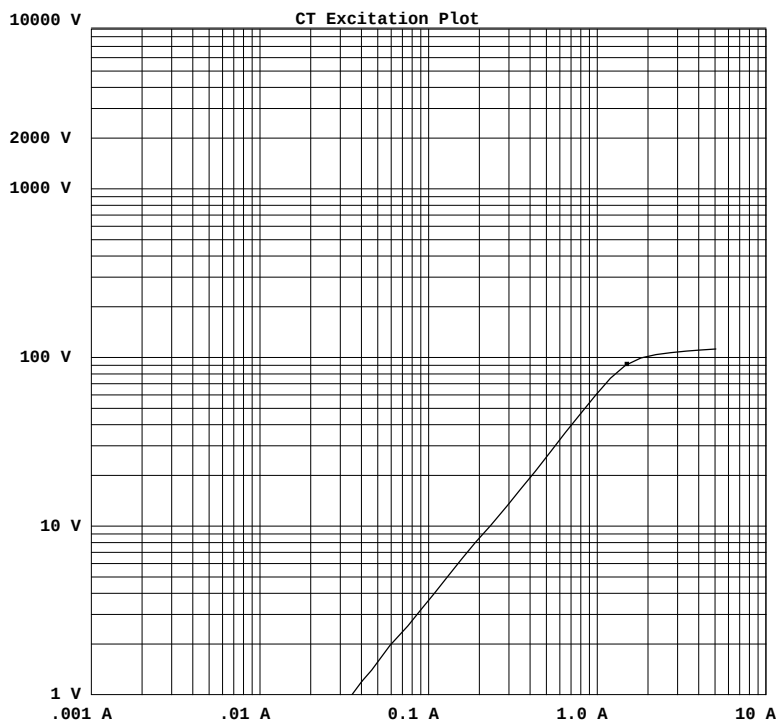
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 44.800	Phase Angle:0.14°
Vkp[Volts]: 91.44	Vkp[Volts]: 74.52	Vkp[Volts]: 94.92	M-RATIO: 20.030	Ex I[Amps]: 0.770	In Phase
Ikp[Amps]: 1.4990	Ikp[Amps]: 1.1864	Ikp[Amps]: 1.6530	% ERROR: 0.1480	Winding Res: 98.66 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0262	0.68	25.95	17	0.6460	35.76	55.36
2	0.0298	0.80	26.85	18	0.8046	47.04	58.46
3	0.0402	1.20	29.85	19	0.9738	59.44	61.04
4	0.0460	1.40	30.43	20	1.1972	75.28	62.88
5	0.0590	1.96	33.22	21	1.4720	90.00	61.14
6	0.0754	2.56	33.95	22	1.8176	99.44	54.71
7	0.0920	3.28	35.65	23	2.2300	104.20	46.73
8	0.1084	4.00	36.90	24	2.7266	107.00	39.24
9	0.1268	4.88	38.49	25	3.3854	109.20	32.26
10	0.1572	6.40	40.71	26	4.1450	110.92	26.76
11	0.1904	8.04	42.23	27	5.0506	112.28	22.23
12	0.2320	10.04	43.28				
13	0.2924	13.20	45.14				
14	0.3502	16.52	47.17				
15	0.4300	21.20	49.30				
16	0.5334	27.96	52.42				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.50	42.50
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.80	51.60
4	0.0050	0.10	20.00	15	0.8000	46.70	58.38
5	0.0080	0.20	25.00	16	1.0000	61.30	61.30
6	0.0100	0.20	20.00	17	2.0000	101.60	50.80
7	0.0200	0.50	25.00	18	4.0000	110.60	27.65
8	0.0400	1.20	30.00	19	5.0000	112.20	22.44
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 7: X2-X3

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

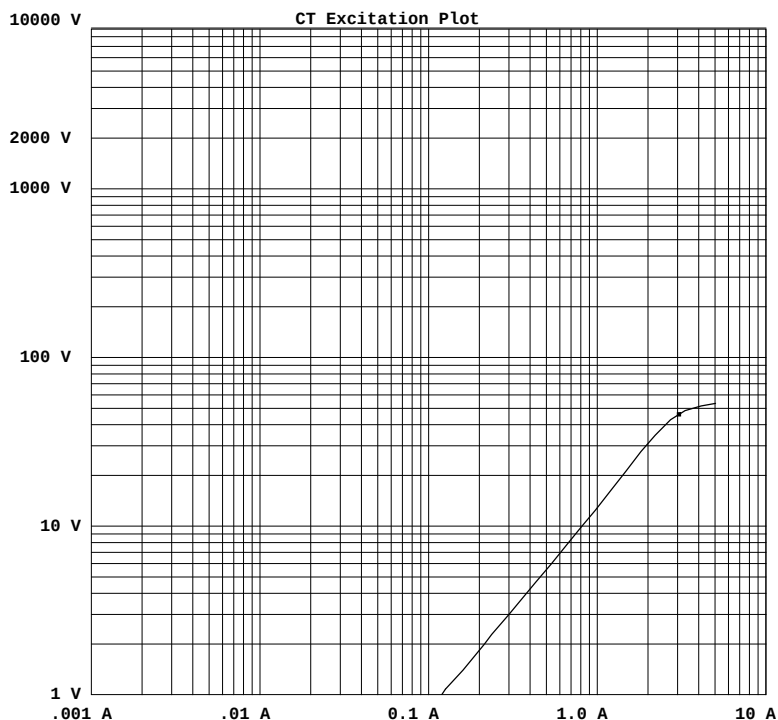
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.500	Phase Angle: -0.34°
Vkp[Volts]: 46.00	Vkp[Volts]: 39.08	Vkp[Volts]: 48.40	M-RATIO: 10.033	Ex I[Amps]: 0.777	In Phase
Ikp[Amps]: 3.0572	Ikp[Amps]: 2.4850	Ikp[Amps]: 3.3180	% ERROR: 0.3250	Winding Res: 65.00 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0368	0.24	6.52	17	1.2006	16.24	13.53
2	0.0492	0.32	6.50	18	1.4806	21.16	14.29
3	0.0566	0.36	6.36	19	1.8176	27.68	15.23
4	0.0894	0.72	8.05	20	2.2072	34.60	15.68
5	0.1100	0.88	8.00	21	2.7200	42.84	15.75
6	0.1260	1.08	8.57	22	3.3206	48.44	14.59
7	0.1600	1.40	8.75	23	4.1320	51.68	12.51
8	0.2144	2.00	9.33	24	5.0344	53.44	10.61
9	0.2370	2.28	9.62				
10	0.2968	2.96	9.97				
11	0.3556	3.68	10.35				
12	0.4304	4.64	10.78				
13	0.5338	5.96	11.17				
14	0.6658	7.84	11.78				
15	0.8058	9.92	12.31				
16	0.9726	12.40	12.75				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.90	15.45
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 8: X3-X4

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

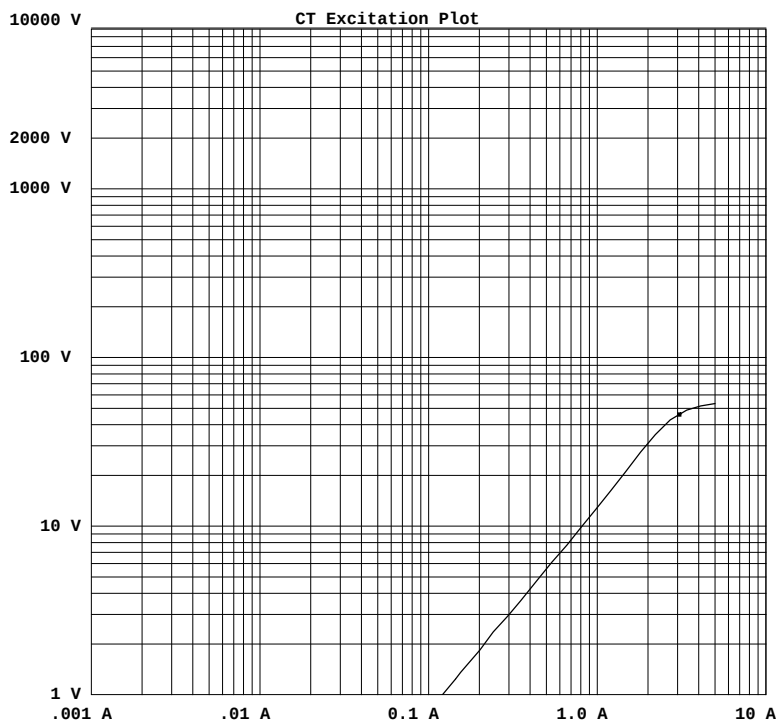
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.500	Phase Angle: -0.26°
Vkp[Volts]: 45.92	Vkp[Volts]: 38.20	Vkp[Volts]: 48.60	M-RATIO: 10.039	Ex I[Amps]: 0.778	In Phase
Ikp[Amps]: 3.0712	Ikp[Amps]: 2.1696	Ikp[Amps]: 3.3718	% ERROR: 0.3920	Winding Res: 69.36 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0372	0.24	6.45	17	1.2018	16.24	13.51
2	0.0450	0.32	7.11	18	1.4662	20.92	14.27
3	0.0578	0.40	6.92	19	1.8112	27.52	15.19
4	0.0906	0.72	7.95	20	2.2136	34.92	15.78
5	0.1088	0.88	8.09	21	2.7104	42.68	15.75
6	0.1444	1.24	8.59	22	3.3952	48.84	14.39
7	0.1548	1.36	8.79	23	4.1094	51.68	12.58
8	0.2012	1.84	9.15	24	5.0020	53.36	10.67
9	0.2422	2.36	9.74				
10	0.2936	2.92	9.95				
11	0.3510	3.60	10.26				
12	0.4390	4.76	10.84				
13	0.5360	6.08	11.34				
14	0.6616	7.72	11.67				
15	0.8042	9.88	12.29				
16	0.9808	12.60	12.85				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.60	11.20
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	31.00	15.50
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.40	10.68
7	0.0500	0.40	8.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H2-CTX.test

MFR: Siemens

TEST # 9: X4-X5

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

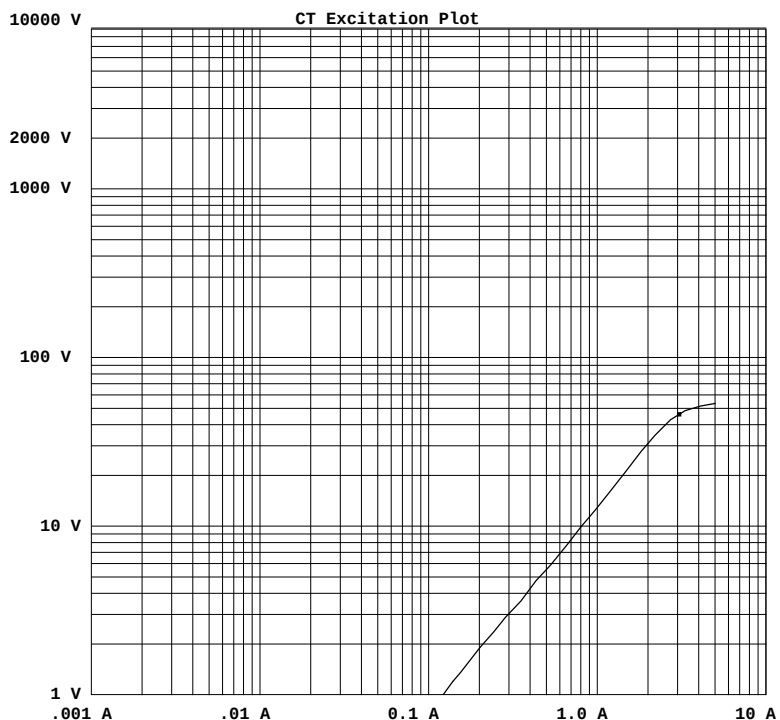
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.500	Phase Angle: -0.38°
Vkp[Volts]: 46.04	Vkp[Volts]: 38.96	Vkp[Volts]: 48.48	M-RATIO: 10.038	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0648	Ikp[Amps]: 2.4768	Ikp[Amps]: 3.3276	% ERROR: 0.3830	Winding Res: 68.87 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0364	0.24	6.59	17	0.8050	9.96	12.37
2	0.0368	0.20	5.43	18	0.9750	12.48	12.80
3	0.0468	0.32	6.84	19	1.2046	16.28	13.51
4	0.0558	0.36	6.45	20	1.4724	21.04	14.29
5	0.0804	0.64	7.96	21	1.8274	27.80	15.21
6	0.0940	0.76	8.09	22	2.2040	34.60	15.70
7	0.1076	0.84	7.81	23	2.7200	42.84	15.75
8	0.1392	1.20	8.62	24	3.3302	48.52	14.57
9	0.1548	1.36	8.79	25	4.1256	51.68	12.53
10	0.2028	1.92	9.47	26	5.0150	53.44	10.66
11	0.2438	2.36	9.68				
12	0.2854	2.88	10.09				
13	0.3528	3.60	10.20				
14	0.4348	4.76	10.95				
15	0.5256	5.84	11.11				
16	0.6678	7.84	11.74				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.90	12.38
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.90	15.45
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.20	5.00	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.30	10.75				



FILENAME: H2-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 15:38:45

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

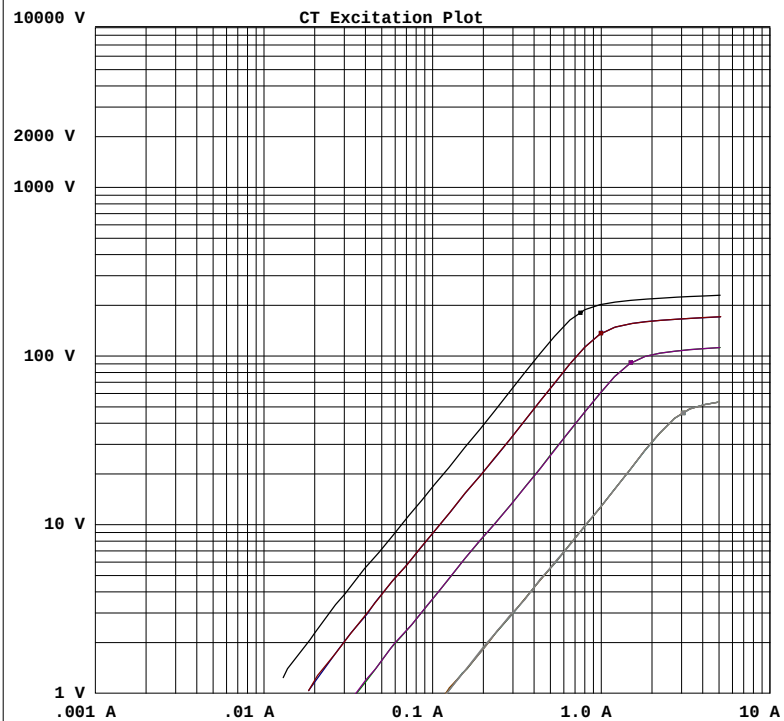
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	46.04/3.0796	38.68/2.1920	48.52/3.3482	50/5.0	10.038	0.381 %	-0.56° [In Ø]	75.32 m-ohms
2	X1-X3	91.44/1.4990	75.24/1.1944	94.80/1.6440	100/5.0	20.033	0.167 %	0.10° [In Ø]	109.90 m-ohms
3	X1-X4	137.08/0.9988	111.36/0.7892	140.76/1.0792	150/5.0	30.014	0.045 %	0.10° [In Ø]	143.83 m-ohms
4	X1-X5	180.64/0.7528	150.88/0.6036	189.80/0.8166	200/5.0	40.008	0.021 %	0.26° [In Ø]	174.78 m-ohms
5	X2-X3	46.00/3.0572	39.08/2.4850	48.40/3.3180	50/5.0	10.033	0.325 %	-0.34° [In Ø]	65.00 m-ohms
6	X2-X4	91.44/1.4990	74.52/1.1864	94.92/1.6530	100/5.0	20.030	0.148 %	0.14° [In Ø]	98.66 m-ohms
7	X2-X5	136.40/0.9966	110.20/0.7820	141.12/1.0872	150/5.0	30.022	0.072 %	0.22° [In Ø]	128.53 m-ohms
8	X3-X4	45.92/3.0712	38.20/2.1696	48.60/3.3718	50/5.0	10.039	0.392 %	-0.26° [In Ø]	69.36 m-ohms
10	X4-X5	46.04/3.0648	38.96/2.4768	48.48/3.3276	50/5.0	10.038	0.383 %	-0.38° [In Ø]	68.87 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: H2-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 15:38:45

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1748 Ohm Rct75: 0.2085 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.30	Vsec: 30.16
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.40	Vsec: 39.81
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.69	Vsec: 69.36
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.12	Vsec: 111.89
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.11	Vsec: 211.20
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.11	Vsec: 410.82
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.11	Vsec: 810.62



FILENAME: H2-CTY.test

DATE: 08/27/20 15:49:12

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H2-CTY

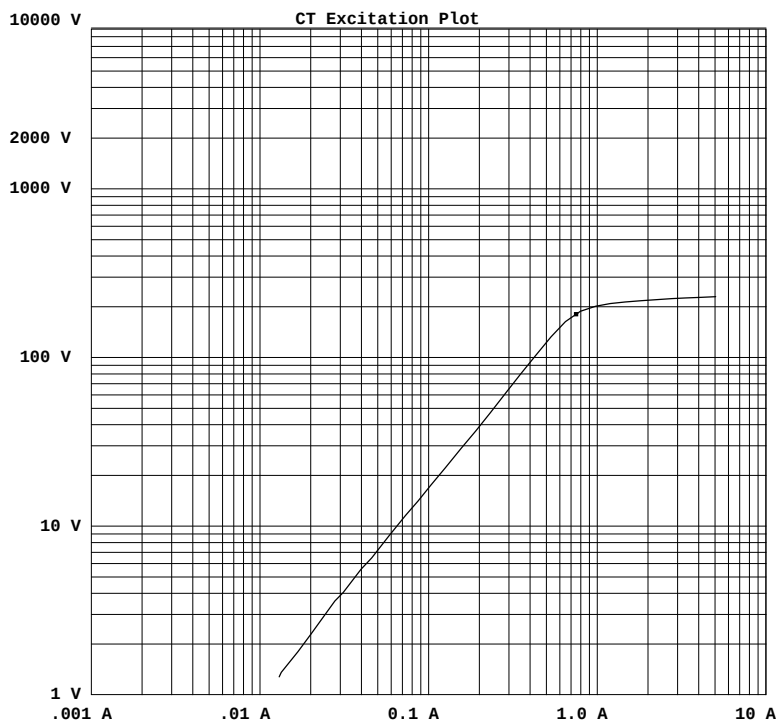
TEST # 1: X1-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.800	Phase Angle:0.28°
Vkp[Volts]: 180.56	Vkp[Volts]: 151.36	Vkp[Volts]: 189.68	M-RATIO: 40.011	Ex I[Amps]: 0.414	In Phase
Ikp[Amps]: 0.7500	Ikp[Amps]: 0.6036	Ikp[Amps]: 0.8140	% ERROR: 0.0267	Winding Res: 167.15 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0130	1.28	98.46	17	0.2862	61.56	215.09
2	0.0134	1.36	101.49	18	0.3490	79.20	226.93
3	0.0168	1.80	107.14	19	0.4336	103.52	238.75
4	0.0200	2.28	114.00	20	0.5326	132.56	248.89
5	0.0278	3.60	129.50	21	0.6484	163.24	251.76
6	0.0312	4.04	129.49	22	0.7956	188.36	236.75
7	0.0398	5.56	139.70	23	0.9766	201.60	206.43
8	0.0460	6.48	140.87	24	1.1952	208.92	174.80
9	0.0582	8.76	150.52	25	1.4696	213.76	145.45
10	0.0730	11.56	158.36	26	1.8338	217.56	118.64
11	0.0866	14.12	163.05	27	2.2980	220.80	96.08
12	0.1030	17.48	169.71	28	2.7818	223.48	80.34
13	0.1256	22.16	176.43	29	3.3336	225.40	67.61
14	0.1564	29.00	185.42	30	4.1678	227.56	54.60
15	0.1904	36.68	192.65	31	5.0376	229.72	45.60
16	0.2328	47.16	202.58				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	39.00	195.00
2	0.0020	0.20	100.00	13	0.4000	93.90	234.75
3	0.0040	0.40	100.00	14	0.5000	123.00	246.00
4	0.0050	0.50	100.00	15	0.8000	188.70	235.87
5	0.0080	0.80	100.00	16	1.0000	202.40	202.40
6	0.0100	1.00	100.00	17	2.0000	218.70	109.35
7	0.0200	2.30	115.00	18	4.0000	227.10	56.77
8	0.0400	5.60	140.00	19	5.0000	229.60	45.92
9	0.0500	7.20	144.00				
10	0.0800	12.90	161.25				
11	0.1000	16.90	169.00				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 2: X1-X4

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

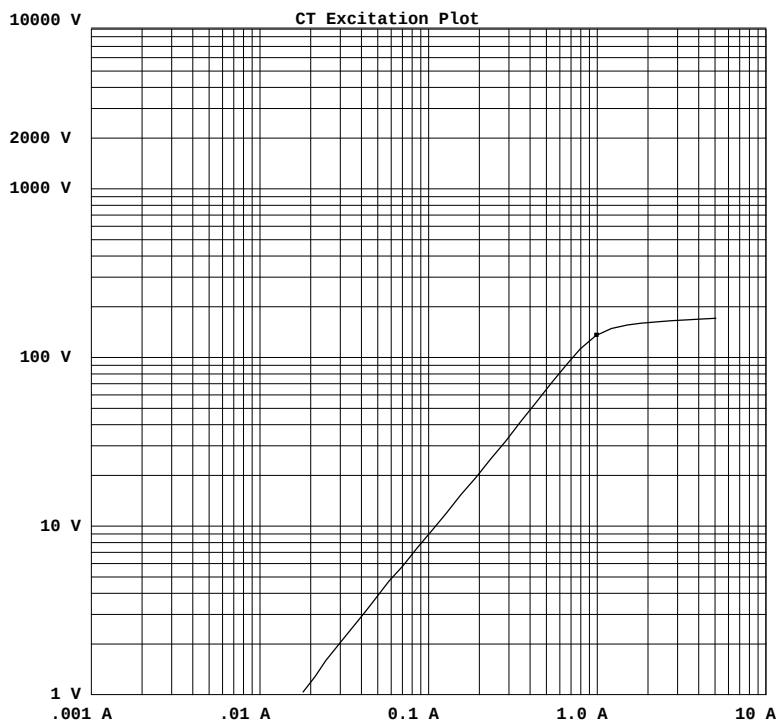
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 92.000	Phase Angle:0.22°
Vkp[Volts]: 136.12	Vkp[Volts]: 110.92	Vkp[Volts]: 141.56	M-RATIO: 30.017	Ex I[Amps]: 0.661	In Phase
Ikp[Amps]: 0.9912	Ikp[Amps]: 0.7838	Ikp[Amps]: 1.0932	% ERROR: 0.0567	Winding Res: 135.47 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0180	1.04	57.78	17	0.4328	53.92	124.58
2	0.0212	1.28	60.38	18	0.5342	70.40	131.79
3	0.0246	1.60	65.04	19	0.6576	90.68	137.90
4	0.0328	2.28	69.51	20	0.7922	112.28	141.73
5	0.0422	3.12	73.93	21	0.9804	134.84	137.54
6	0.0460	3.48	75.65	22	1.2120	148.64	122.64
7	0.0582	4.72	81.10	23	1.5082	155.92	103.38
8	0.0702	5.80	82.62	24	1.8144	159.72	88.03
9	0.0854	7.40	86.65	25	2.2202	162.68	73.27
10	0.1072	9.68	90.30	26	2.7688	165.40	59.74
11	0.1272	11.92	93.71	27	3.3984	167.28	49.22
12	0.1560	15.44	98.97	28	4.0996	169.16	41.26
13	0.1926	19.68	102.18	29	5.0540	170.80	33.80
14	0.2316	24.80	107.08				
15	0.2854	31.80	111.42				
16	0.3524	41.76	118.50				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	49.00	122.50
3	0.0040	0.20	50.00	14	0.5000	64.80	129.60
4	0.0050	0.30	60.00	15	0.8000	113.20	141.50
5	0.0080	0.50	62.50	16	1.0000	136.00	136.00
6	0.0100	0.60	60.00	17	2.0000	161.10	80.55
7	0.0200	1.20	60.00	18	4.0000	168.90	42.23
8	0.0400	2.90	72.50	19	5.0000	170.70	34.14
9	0.0500	3.90	78.00				
10	0.0800	6.80	85.00				
11	0.1000	8.90	89.00				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 3: X1-X3

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

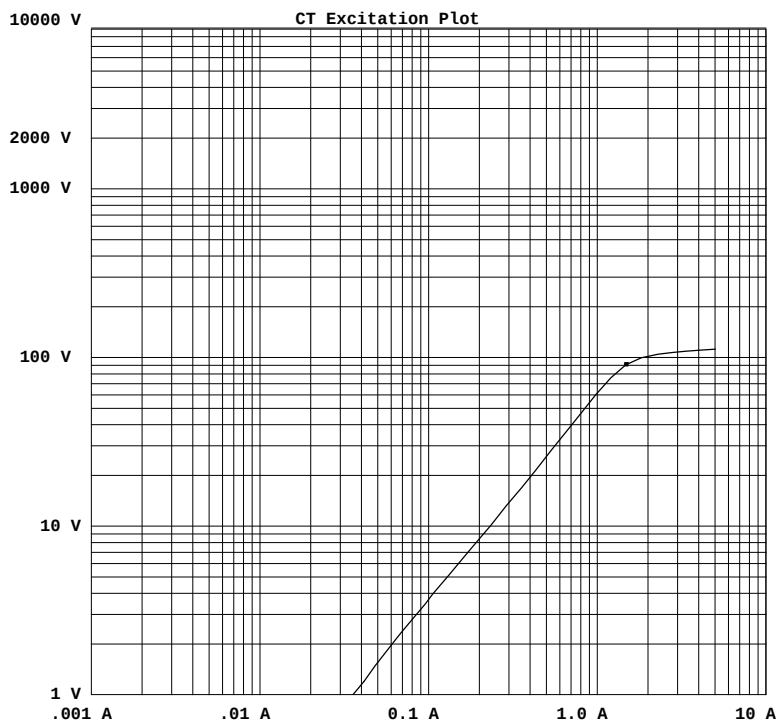
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.900	Phase Angle:0.18°
Vkp[Volts]: 91.20	Vkp[Volts]: 74.48	Vkp[Volts]: 94.48	M-RATIO: 20.030	Ex I[Amps]: 0.782	In Phase
Ikp[Amps]: 1.4906	Ikp[Amps]: 1.1850	Ikp[Amps]: 1.6300	% ERROR: 0.1480	Winding Res: 112.41 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0266	0.68	25.56	17	0.6488	35.88	55.30
2	0.0320	0.88	27.50	18	0.7942	46.20	58.17
3	0.0414	1.20	28.99	19	0.9824	60.32	61.40
4	0.0480	1.48	30.83	20	1.2042	75.80	62.95
5	0.0636	2.12	33.33	21	1.4778	90.52	61.25
6	0.0694	2.36	34.01	22	1.8242	99.60	54.60
7	0.0960	3.48	36.25	23	2.2850	104.60	45.78
8	0.1058	3.96	37.43	24	2.7818	107.16	38.52
9	0.1318	5.12	38.85	25	3.3466	109.04	32.58
10	0.1638	6.64	40.54	26	4.1028	110.68	26.98
11	0.1978	8.32	42.06	27	5.0150	112.16	22.36
12	0.2340	10.12	43.25				
13	0.2890	13.20	45.67				
14	0.3572	16.96	47.48				
15	0.4316	21.44	49.68				
16	0.5346	28.24	52.82				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.50	48.75
3	0.0040	0.10	25.00	14	0.5000	26.00	52.00
4	0.0050	0.10	20.00	15	0.8000	46.60	58.25
5	0.0080	0.20	25.00	16	1.0000	61.60	61.60
6	0.0100	0.20	20.00	17	2.0000	101.50	50.75
7	0.0200	0.50	25.00	18	4.0000	110.40	27.60
8	0.0400	1.20	30.00	19	5.0000	112.10	22.42
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.70	37.00				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 4: X1-X2

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

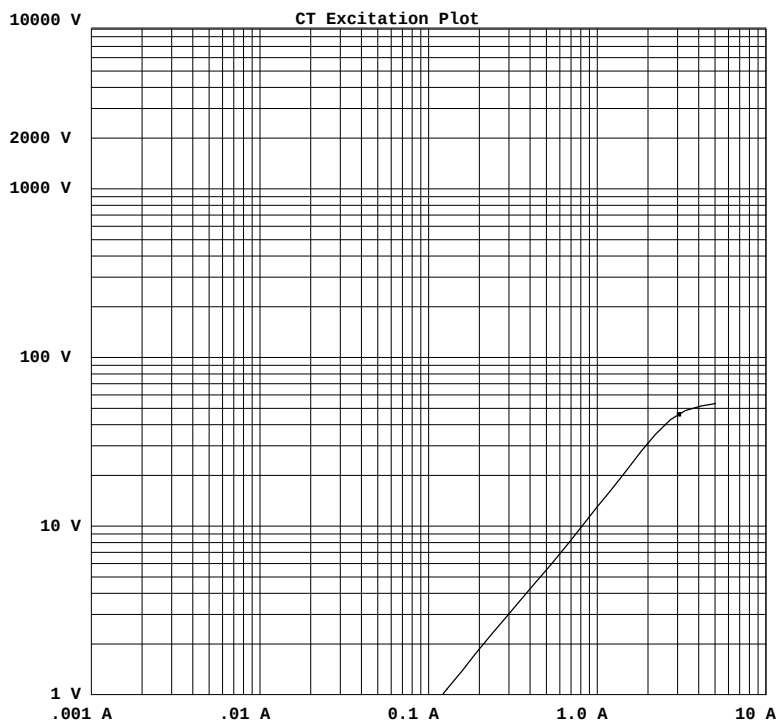
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.600	Phase Angle: -0.52°
Vkp[Volts]: 46.00	Vkp[Volts]: 38.04	Vkp[Volts]: 48.24	M-RATIO: 10.034	Ex I[Amps]: 0.779	In Phase
Ikp[Amps]: 3.0564	Ikp[Amps]: 2.1562	Ikp[Amps]: 3.3038	% ERROR: 0.3380	Winding Res: 68.75 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0360	0.20	5.56	17	0.9988	13.00	13.02
2	0.0372	0.24	6.45	18	1.1932	16.12	13.51
3	0.0488	0.32	6.56	19	1.4658	20.96	14.30
4	0.0574	0.40	6.97	20	1.8176	27.72	15.25
5	0.0866	0.68	7.85	21	2.2202	35.12	15.82
6	0.1092	0.88	8.06	22	2.7168	42.84	15.77
7	0.1284	1.08	8.41	23	3.3302	48.52	14.57
8	0.1596	1.40	8.77	24	4.1418	51.68	12.48
9	0.1904	1.76	9.24	25	5.0312	53.36	10.61
10	0.2394	2.32	9.69				
11	0.2948	2.96	10.04				
12	0.3536	3.68	10.41				
13	0.4374	4.72	10.79				
14	0.5256	5.84	11.11				
15	0.6632	7.76	11.70				
16	0.8038	9.88	12.29				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	13.00	13.00
4	0.0100	0.00	0.00	15	2.0000	31.10	15.55
5	0.0200	0.10	5.00	16	4.0000	51.10	12.78
6	0.0400	0.20	5.00	17	5.0000	53.30	10.66
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.20	10.50				



FILENAME: H2-CTY.test

DATE: 08/27/20 15:49:12

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H2-CTY

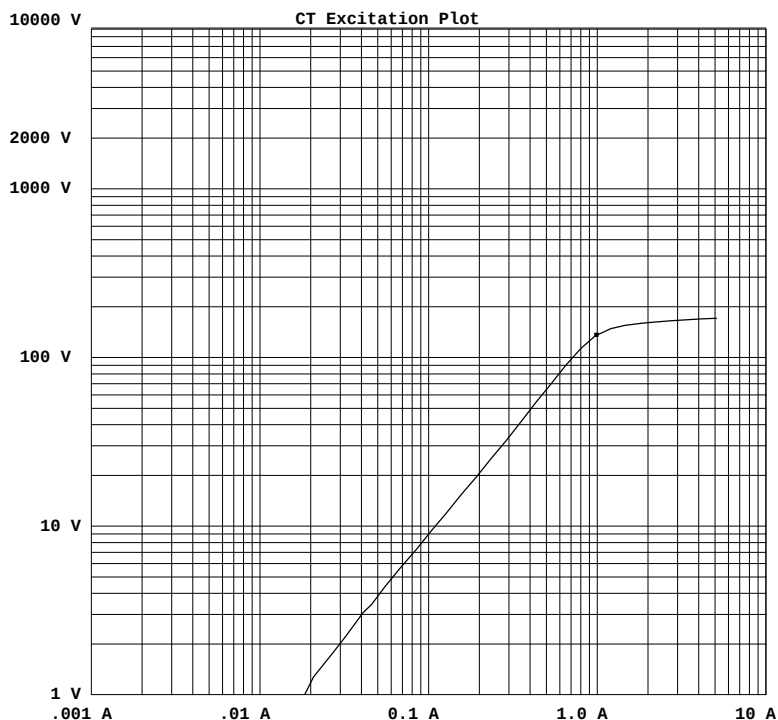
TEST # 5: X2-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 90.700	Phase Angle:0.30°
Vkp[Volts]: 136.28	Vkp[Volts]: 111.60	Vkp[Volts]: 141.08	M-RATIO: 30.022	Ex I[Amps]: 0.653	In Phase
Ikp[Amps]: 0.9894	Ikp[Amps]: 0.7890	Ikp[Amps]: 1.0842	% ERROR: 0.0730	Winding Res: 127.96 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0184	1.00	54.35	17	0.4340	54.32	125.16
2	0.0208	1.28	61.54	18	0.5274	69.00	130.83
3	0.0274	1.80	65.69	19	0.6518	90.12	138.26
4	0.0320	2.20	68.75	20	0.7996	113.24	141.62
5	0.0410	3.08	75.12	21	0.9718	134.16	138.05
6	0.0460	3.44	74.78	22	1.2026	148.36	123.37
7	0.0558	4.44	79.57	23	1.4676	155.40	105.89
8	0.0690	5.76	83.48	24	1.8372	159.72	86.94
9	0.0846	7.28	86.05	25	2.2332	162.68	72.85
10	0.1062	9.64	90.77	26	2.7914	165.40	59.25
11	0.1264	11.84	93.67	27	3.3302	167.28	50.23
12	0.1556	15.32	98.46	28	4.1190	169.44	41.14
13	0.1922	19.60	101.98	29	5.0994	171.08	33.55
14	0.2352	25.20	107.14				
15	0.2870	31.96	111.36				
16	0.3506	41.28	117.74				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	49.00	122.50
3	0.0040	0.20	50.00	14	0.5000	64.70	129.40
4	0.0050	0.30	60.00	15	0.8000	113.30	141.63
5	0.0080	0.40	50.00	16	1.0000	135.90	135.90
6	0.0100	0.60	60.00	17	2.0000	160.90	80.45
7	0.0200	1.20	60.00	18	4.0000	169.10	42.27
8	0.0400	3.00	75.00	19	5.0000	170.90	34.18
9	0.0500	3.80	76.00				
10	0.0800	6.80	85.00				
11	0.1000	9.00	90.00				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 6: X2-X4

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

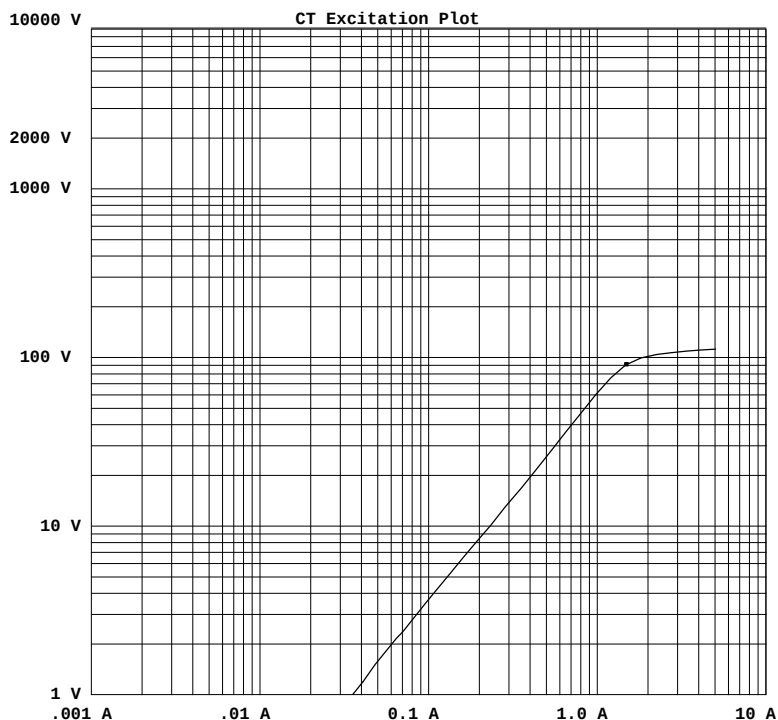
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.800	Phase Angle:0.00°
Vkp[Volts]: 91.16	Vkp[Volts]: 74.36	Vkp[Volts]: 94.56	M-RATIO: 20.034	Ex I[Amps]: 0.781	In Phase
Ikp[Amps]: 1.4906	Ikp[Amps]: 1.1838	Ikp[Amps]: 1.6344	% ERROR: 0.1695	Winding Res: 96.29 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0258	0.64	24.81	17	0.6514	36.16	55.51
2	0.0320	0.88	27.50	18	0.7934	46.28	58.33
3	0.0410	1.20	29.27	19	0.9804	60.20	61.40
4	0.0484	1.52	31.40	20	1.2030	75.68	62.91
5	0.0644	2.16	33.54	21	1.4740	90.28	61.25
6	0.0702	2.36	33.62	22	1.8176	99.44	54.71
7	0.0948	3.44	36.29	23	2.2624	104.32	46.11
8	0.1054	3.92	37.19	24	2.7558	107.00	38.83
9	0.1306	5.08	38.90	25	3.4018	109.20	32.10
10	0.1630	6.64	40.74	26	4.1482	110.92	26.74
11	0.1950	8.20	42.05	27	5.0344	112.16	22.28
12	0.2336	10.12	43.32				
13	0.2854	13.08	45.83				
14	0.3576	17.00	47.54				
15	0.4304	21.40	49.72				
16	0.5404	28.52	52.78				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.60	49.00
3	0.0040	0.10	25.00	14	0.5000	25.90	51.80
4	0.0050	0.10	20.00	15	0.8000	46.80	58.50
5	0.0080	0.20	25.00	16	1.0000	61.60	61.60
6	0.0100	0.20	20.00	17	2.0000	101.40	50.70
7	0.0200	0.50	25.00	18	4.0000	110.60	27.65
8	0.0400	1.20	30.00	19	5.0000	112.10	22.42
9	0.0500	1.60	32.00				
10	0.0800	2.80	35.00				
11	0.1000	3.70	37.00				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 7: X2-X3

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

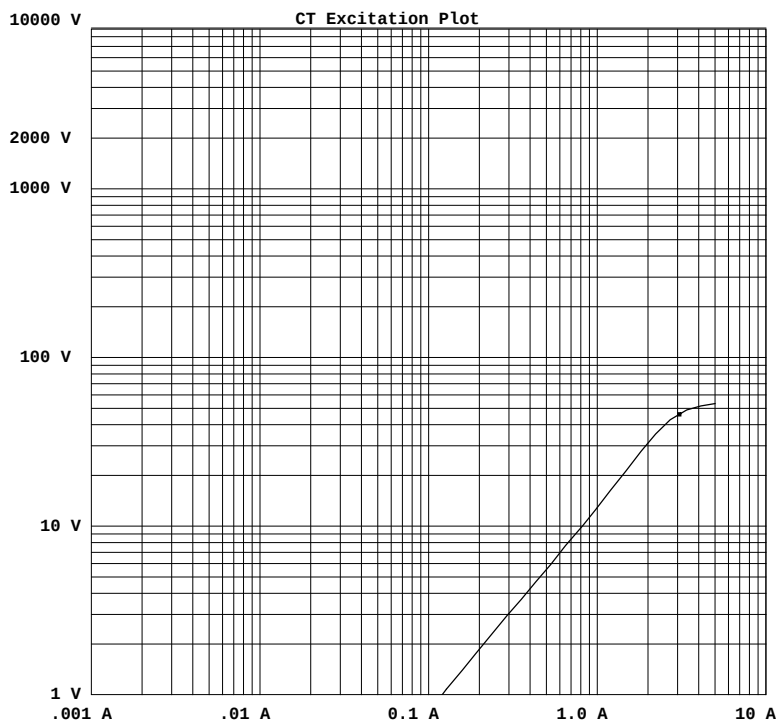
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.600	Phase Angle:0.08°
Vkp[Volts]: 46.00	Vkp[Volts]: 38.16	Vkp[Volts]: 48.40	M-RATIO: 10.038	Ex I[Amps]: 0.779	In Phase
Ikp[Amps]: 3.0678	Ikp[Amps]: 2.1440	Ikp[Amps]: 3.3374	% ERROR: 0.3810	Winding Res: 72.64 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0352	0.20	5.68	17	0.9770	12.52	12.81
2	0.0386	0.24	6.22	18	1.1984	16.28	13.58
3	0.0484	0.32	6.61	19	1.4778	21.20	14.35
4	0.0574	0.40	6.97	20	1.8210	27.80	15.27
5	0.0878	0.72	8.20	21	2.2202	35.20	15.85
6	0.1096	0.88	8.03	22	2.7136	42.84	15.79
7	0.1276	1.08	8.46	23	3.3952	48.92	14.41
8	0.1588	1.40	8.82	24	4.1158	51.68	12.56
9	0.1908	1.76	9.22	25	5.0118	53.36	10.65
10	0.2364	2.28	9.64				
11	0.2928	2.96	10.11				
12	0.3548	3.68	10.37				
13	0.4324	4.68	10.82				
14	0.5302	5.92	11.17				
15	0.6492	7.68	11.83				
16	0.8250	10.12	12.27				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	31.10	15.55
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.20	5.00	17	5.0000	53.30	10.66
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.30	10.75				



FILENAME: H2-CTY.test

MFR: Siemens

TEST # 8: X3-X4

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

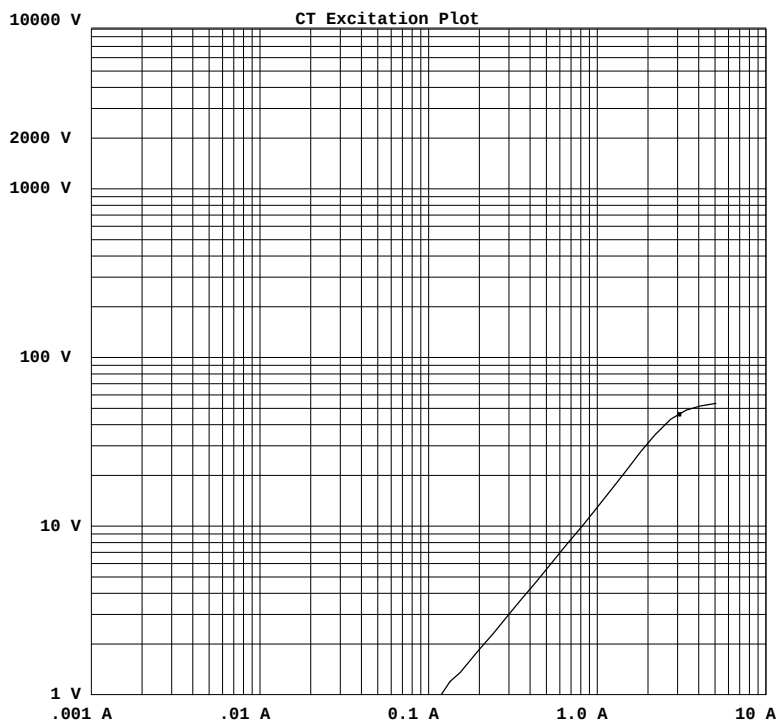
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.500	Phase Angle: -1.14°
Vkp[Volts]: 46.04	Vkp[Volts]: 37.88	Vkp[Volts]: 48.28	M-RATIO: 10.041	Ex I[Amps]: 0.777	In Phase
Ikp[Amps]: 3.0626	Ikp[Amps]: 2.1438	Ikp[Amps]: 3.3212	% ERROR: 0.4130	Winding Res: 75.12 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0352	0.20	5.68	17	0.8222	10.12	12.31
2	0.0376	0.24	6.38	18	0.9726	12.48	12.83
3	0.0464	0.32	6.90	19	1.1972	16.24	13.56
4	0.0558	0.36	6.45	20	1.4680	21.00	14.31
5	0.0758	0.60	7.92	21	1.8144	27.72	15.28
6	0.0952	0.76	7.98	22	2.2104	35.00	15.83
7	0.1058	0.84	7.94	23	2.7362	43.16	15.77
8	0.1342	1.20	8.94	24	3.3758	48.80	14.46
9	0.1544	1.36	8.81	25	4.0932	51.60	12.61
10	0.1982	1.84	9.28	26	5.0540	53.44	10.57
11	0.2430	2.32	9.55				
12	0.2990	3.00	10.03				
13	0.3544	3.68	10.38				
14	0.4382	4.72	10.77				
15	0.5610	6.40	11.41				
16	0.6542	7.72	11.80				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.60	11.20
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	31.10	15.55
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.30	10.66
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H2-CTY.test

DATE: 08/27/20 15:49:12

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H2-CTY

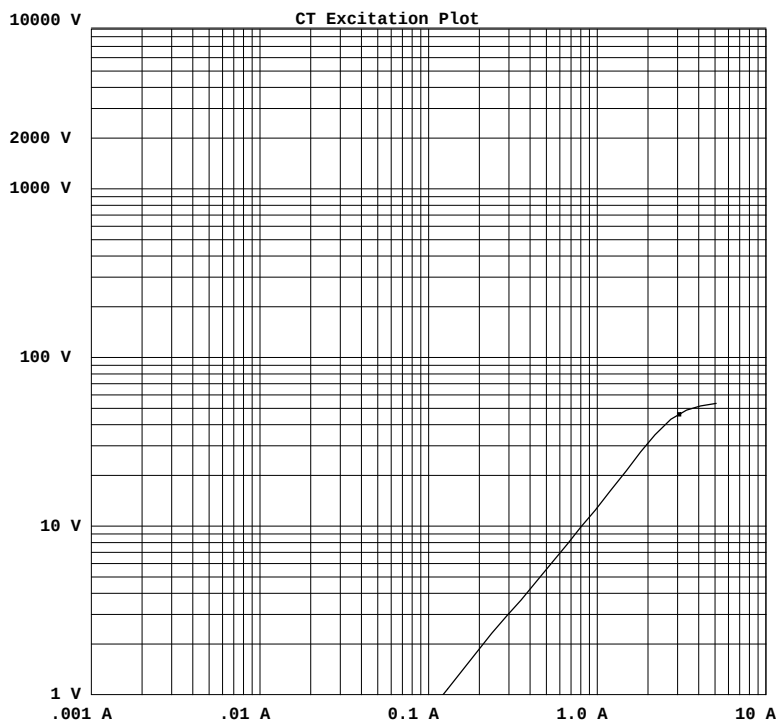
TEST # 9: X4-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.500	Phase Angle: -1.32°
Vkp[Volts]: 46.00	Vkp[Volts]: 37.80	Vkp[Volts]: 48.40	M-RATIO: 10.035	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0626	Ikp[Amps]: 2.1264	Ikp[Amps]: 3.3364	% ERROR: 0.3490	Winding Res: 66.55 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0364	0.20	5.49	17	0.9726	12.44	12.79
2	0.0368	0.24	6.52	18	1.1952	16.20	13.55
3	0.0488	0.32	6.56	19	1.4860	21.28	14.32
4	0.0582	0.40	6.87	20	1.8080	27.56	15.24
5	0.0898	0.72	8.02	21	2.2040	34.88	15.83
6	0.1100	0.88	8.00	22	2.7330	43.12	15.78
7	0.1296	1.08	8.33	23	3.3854	48.84	14.43
8	0.1592	1.40	8.79	24	4.0932	51.60	12.61
9	0.1942	1.80	9.27	25	5.0734	53.52	10.55
10	0.2374	2.32	9.77				
11	0.2928	2.96	10.11				
12	0.3532	3.64	10.31				
13	0.4374	4.72	10.79				
14	0.5680	6.48	11.41				
15	0.6678	7.88	11.80				
16	0.8000	9.88	12.35				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.60	11.20
2	0.0050	0.00	0.00	13	0.8000	9.90	12.38
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	31.10	15.55
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.90	9.50				
11	0.4000	4.20	10.50				



FILENAME: H2-CTY.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 15:49:12

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

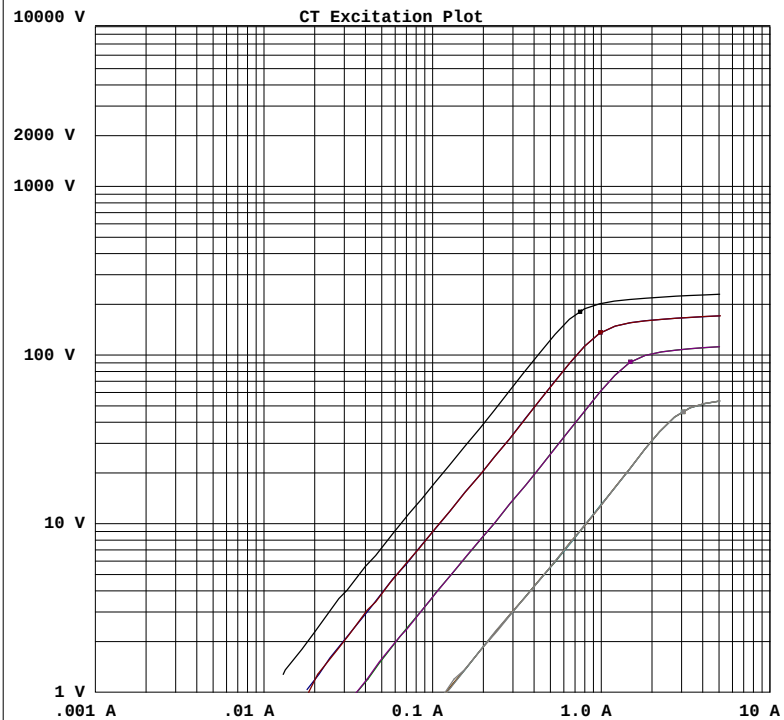
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	46.00/3.0564	38.04/2.1562	48.24/3.3038	50/5.0	10.034	0.338 %	-0.52° [In Ø]	68.75 m-ohms
2	X1-X3	91.20/1.4906	74.48/1.1850	94.48/1.6300	100/5.0	20.030	0.148 %	0.18° [In Ø]	112.41 m-ohms
3	X1-X4	136.12/0.9912	110.92/0.7838	141.56/1.0932	150/5.0	30.017	0.057 %	0.22° [In Ø]	135.47 m-ohms
4	X1-X5	180.56/0.7500	151.36/0.6036	189.68/0.8140	200/5.0	40.011	0.027 %	0.28° [In Ø]	167.15 m-ohms
5	X2-X3	46.00/3.0678	38.16/2.1440	48.40/3.3374	50/5.0	10.038	0.381 %	0.08° [In Ø]	72.64 m-ohms
6	X2-X4	91.16/1.4906	74.36/1.1838	94.56/1.6344	100/5.0	20.034	0.169 %	0.00° [In Ø]	96.29 m-ohms
7	X2-X5	136.28/0.9894	111.60/0.7890	141.08/1.0842	150/5.0	30.022	0.073 %	0.30° [In Ø]	127.96 m-ohms
8	X3-X4	46.04/3.0626	37.88/2.1438	48.28/3.3212	50/5.0	10.041	0.413 %	-1.14° [In Ø]	75.12 m-ohms
10	X4-X5	46.00/3.0626	37.80/2.1264	48.40/3.3364	50/5.0	10.035	0.349 %	-1.32° [In Ø]	66.55 m-ohms

Test Notepad





FILENAME: H2-CTY.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 15:49:12

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H2-CTY

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1672 Ohm Rct75: 0.1994 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.29	Vsec: 29.26
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.39	Vsec: 38.92
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.68	Vsec: 68.50
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.11	Vsec: 111.32
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.11	Vsec: 210.68
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.10	Vsec: 410.33
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.10	Vsec: 810.15



FILENAME: H3-CTX.test

MFR: Siemens

TEST # 1: X1-X5

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

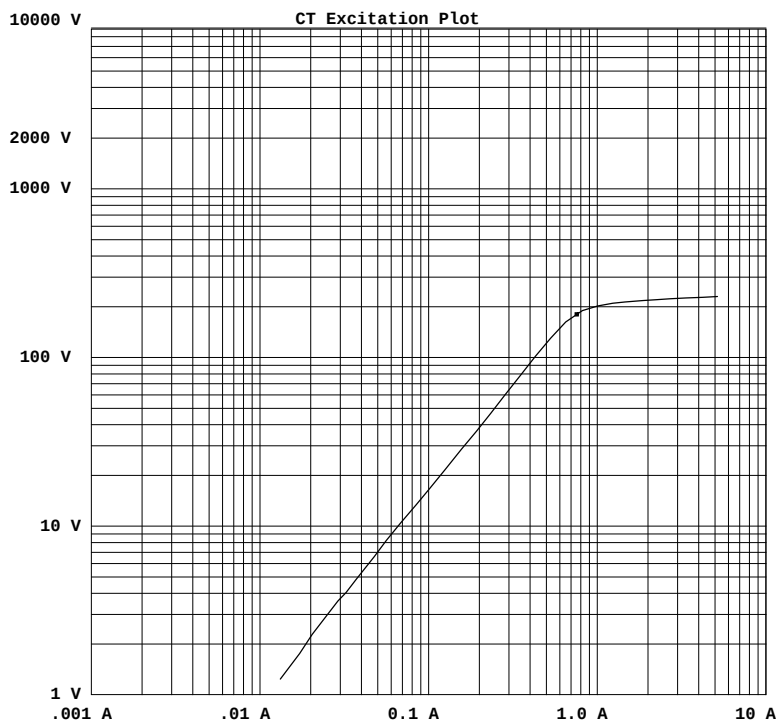
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.600	Phase Angle:0.00°
Vkp[Volts]: 180.00	Vkp[Volts]: 150.60	Vkp[Volts]: 190.08	M-RATIO: 40.008	Ex I[Amps]: 0.418	In Phase
Ikp[Amps]: 0.7576	Ikp[Amps]: 0.6060	Ikp[Amps]: 0.8226	% ERROR: 0.0212	Winding Res: 191.60 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0132	1.24	93.94	17	0.3520	78.92	224.20
2	0.0172	1.76	102.33	18	0.4300	101.60	236.28
3	0.0204	2.28	111.76	19	0.5290	130.12	245.97
4	0.0290	3.60	124.14	20	0.6514	162.68	249.74
5	0.0324	4.04	124.69	21	0.8172	189.72	232.16
6	0.0372	4.84	130.11	22	1.0066	202.40	201.07
7	0.0476	6.60	138.66	23	1.2370	209.72	169.54
8	0.0562	8.24	146.62	24	1.4662	213.48	145.60
9	0.0684	10.48	153.22	25	1.8794	217.84	115.91
10	0.0842	13.36	158.67	26	2.2364	220.24	98.48
11	0.1022	16.84	164.77	27	2.7136	222.96	82.16
12	0.1252	21.60	172.52	28	3.3596	225.40	67.09
13	0.1572	28.76	182.95	29	4.2360	227.84	53.79
14	0.1922	36.56	190.22	30	5.1642	230.00	44.54
15	0.2340	46.84	200.17				
16	0.2862	60.68	212.02				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	38.50	192.50
2	0.0020	0.20	100.00	13	0.4000	92.90	232.25
3	0.0040	0.40	100.00	14	0.5000	121.80	243.60
4	0.0050	0.50	100.00	15	0.8000	186.90	233.63
5	0.0080	0.80	100.00	16	1.0000	202.00	202.00
6	0.0100	0.90	90.00	17	2.0000	218.60	109.30
7	0.0200	2.20	110.00	18	4.0000	227.20	56.80
8	0.0400	5.30	132.50	19	5.0000	229.60	45.92
9	0.0500	7.00	140.00				
10	0.0800	12.60	157.50				
11	0.1000	16.40	164.00				



FILENAME: H3-CTX.test

MFR: Siemens

TEST # 2: X1-X4

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

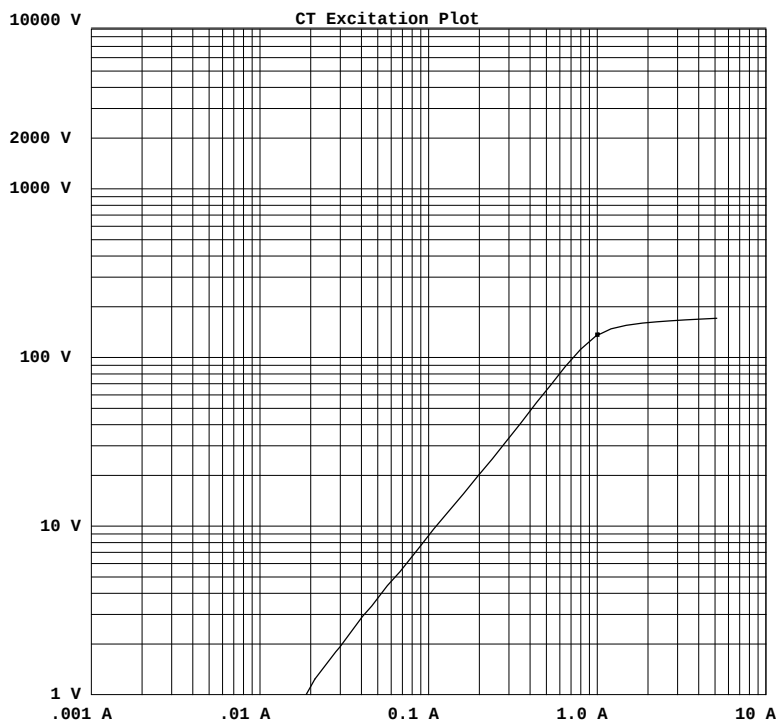
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 91.900	Phase Angle: -0.14°
Vkp[Volts]: 136.60	Vkp[Volts]: 110.40	Vkp[Volts]: 141.24	M-RATIO: 30.017	Ex I[Amps]: 0.666	In Phase
Ikp[Amps]: 1.0022	Ikp[Amps]: 0.7866	Ikp[Amps]: 1.0974	% ERROR: 0.0583	Winding Res: 162.66 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0188	1.00	53.19	17	0.4366	54.04	123.77
2	0.0212	1.24	58.49	18	0.5274	68.32	129.54
3	0.0282	1.80	63.83	19	0.6452	88.12	136.58
4	0.0298	1.92	64.43	20	0.7968	112.00	140.56
5	0.0406	2.92	71.92	21	0.9820	134.16	136.62
6	0.0460	3.36	73.04	22	1.2092	148.08	122.46
7	0.0570	4.44	77.89	23	1.4864	155.40	104.55
8	0.0676	5.36	79.29	24	1.8566	160.00	86.18
9	0.0874	7.40	84.67	25	2.2624	162.96	72.03
10	0.1072	9.60	89.55	26	2.7104	165.12	60.92
11	0.1280	11.84	92.50	27	3.3368	167.28	50.13
12	0.1610	15.52	96.40	28	4.1224	169.16	41.03
13	0.1938	19.52	100.72	29	5.1156	171.08	33.44
14	0.2386	25.08	105.11				
15	0.2870	31.60	110.10				
16	0.3528	40.96	116.10				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.30	101.50
2	0.0020	0.10	50.00	13	0.4000	48.30	120.75
3	0.0040	0.20	50.00	14	0.5000	64.00	128.00
4	0.0050	0.30	60.00	15	0.8000	112.40	140.50
5	0.0080	0.40	50.00	16	1.0000	135.20	135.20
6	0.0100	0.50	50.00	17	2.0000	161.00	80.50
7	0.0200	1.10	55.00	18	4.0000	168.90	42.23
8	0.0400	2.90	72.50	19	5.0000	170.80	34.16
9	0.0500	3.80	76.00				
10	0.0800	6.60	82.50				
11	0.1000	8.80	88.00				



FILENAME: H3-CTX.test

MFR: Siemens

TEST # 3: X1-X3

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

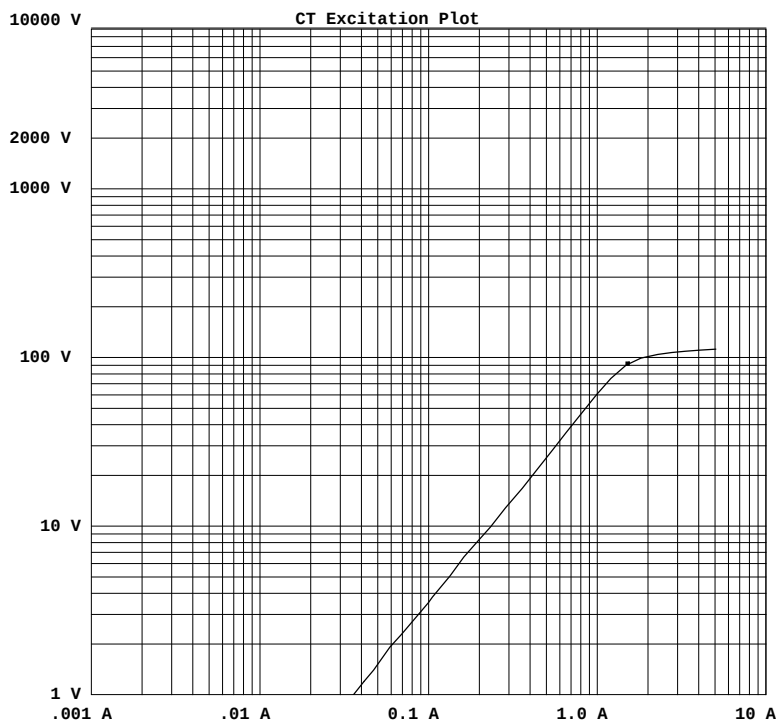
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.100	Phase Angle: -0.02°
Vkp[Volts]: 91.92	Vkp[Volts]: 74.36	Vkp[Volts]: 94.64	M-RATIO: 20.041	Ex I[Amps]: 0.778	In Phase
Ikp[Amps]: 1.5164	Ikp[Amps]: 1.1938	Ikp[Amps]: 1.6478	% ERROR: 0.2030	Winding Res: 141.19 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0270	0.68	25.19	17	0.6530	35.80	54.82
2	0.0336	0.92	27.38	18	0.7976	45.96	57.62
3	0.0414	1.20	28.99	19	0.9898	60.12	60.74
4	0.0472	1.40	29.66	20	1.2050	75.12	62.34
5	0.0590	1.92	32.54	21	1.4832	90.12	60.76
6	0.0690	2.28	33.04	22	1.8176	99.32	54.64
7	0.0998	3.52	35.27	23	2.2850	104.44	45.71
8	0.1054	3.80	36.05	24	2.7720	107.16	38.66
9	0.1342	5.08	37.85	25	3.3336	109.04	32.71
10	0.1618	6.56	40.54	26	4.0768	110.68	27.15
11	0.1970	8.20	41.62	27	5.0474	112.16	22.22
12	0.2328	9.88	42.44				
13	0.2866	12.88	44.94				
14	0.3598	16.80	46.69				
15	0.4332	21.28	49.12				
16	0.5430	28.24	52.01				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.20	48.00
3	0.0040	0.10	25.00	14	0.5000	25.50	51.00
4	0.0050	0.10	20.00	15	0.8000	46.10	57.63
5	0.0080	0.20	25.00	16	1.0000	60.80	60.80
6	0.0100	0.20	20.00	17	2.0000	101.30	50.65
7	0.0200	0.50	25.00	18	4.0000	110.50	27.63
8	0.0400	1.20	30.00	19	5.0000	112.10	22.42
9	0.0500	1.50	30.00				
10	0.0800	2.70	33.75				
11	0.1000	3.50	35.00				



FILENAME: H3-CTX.test

DATE: 08/27/20 16:04:00

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTX

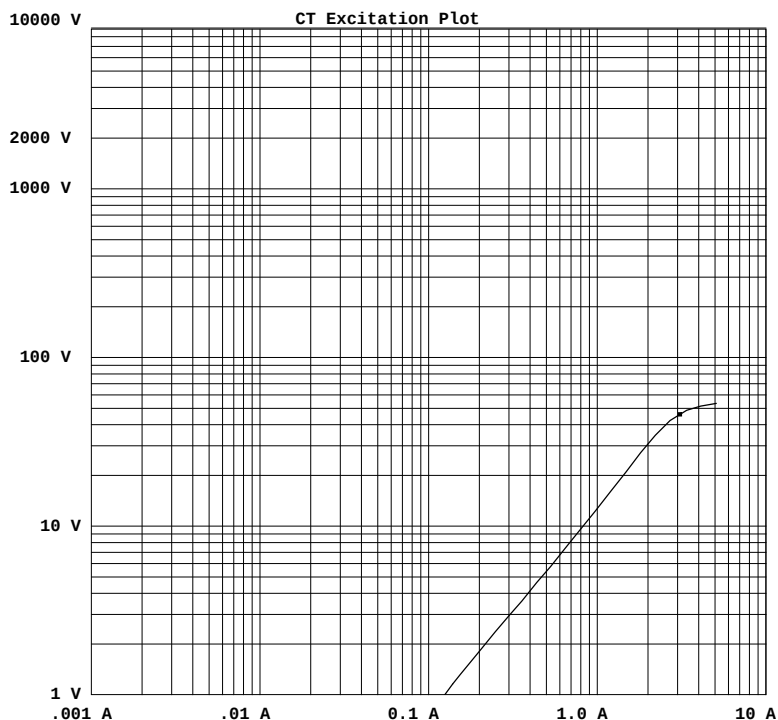
TEST # 4: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.68°
Vkp[Volts]: 45.96	Vkp[Volts]: 37.92	Vkp[Volts]: 48.64	M-RATIO: 10.051	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0946	Ikp[Amps]: 2.1664	Ikp[Amps]: 3.3898	% ERROR: 0.5080	Winding Res: 92.55 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0372	0.24	6.45	17	1.1980	16.00	13.36
2	0.0468	0.32	6.84	18	1.4856	21.04	14.16
3	0.0586	0.36	6.14	19	1.8080	27.28	15.09
4	0.0898	0.72	8.02	20	2.2104	34.64	15.67
5	0.1100	0.84	7.64	21	2.7070	42.36	15.65
6	0.1388	1.16	8.36	22	3.3952	48.72	14.35
7	0.1544	1.32	8.55	23	4.1028	51.56	12.57
8	0.1992	1.80	9.04	24	5.0832	53.52	10.53
9	0.2484	2.36	9.50				
10	0.3046	3.00	9.85				
11	0.3576	3.60	10.07				
12	0.4382	4.64	10.59				
13	0.5290	5.76	10.89				
14	0.6682	7.72	11.55				
15	0.8194	9.92	12.11				
16	0.9714	12.24	12.60				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.40	10.80
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.70	12.70
4	0.0100	0.10	10.00	15	2.0000	30.80	15.40
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.30	7.50	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTX.test

MFR: Siemens

TEST # 5: X2-X5

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

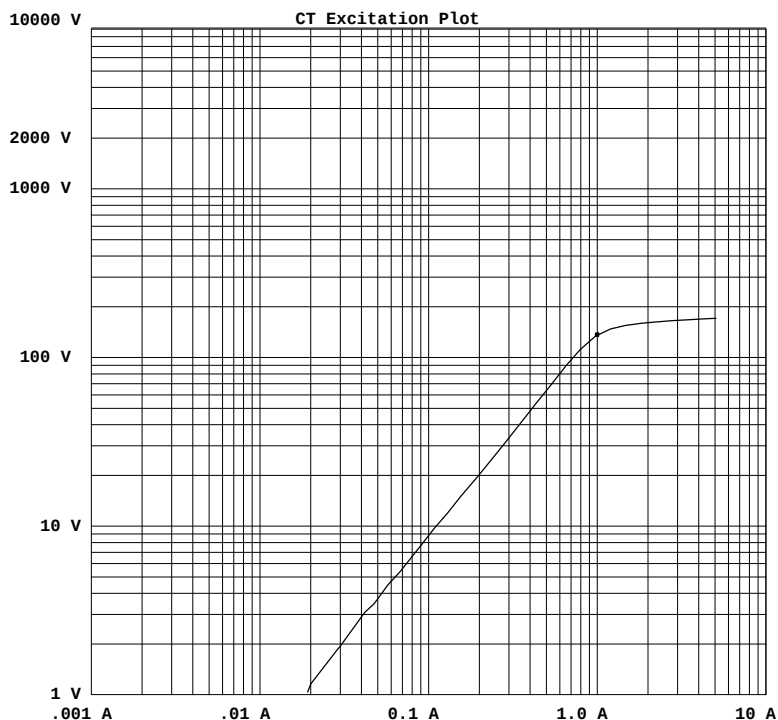
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 91.700	Phase Angle:0.08°
Vkp[Volts]: 136.52	Vkp[Volts]: 110.60	Vkp[Volts]: 141.28	M-RATIO: 30.023	Ex I[Amps]: 0.665	In Phase
Ikp[Amps]: 0.9982	Ikp[Amps]: 0.7878	Ikp[Amps]: 1.0978	% ERROR: 0.0777	Winding Res: 145.36 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0192	1.04	54.17	17	0.4308	53.04	123.12
2	0.0200	1.16	58.00	18	0.5274	68.12	129.16
3	0.0286	1.84	64.34	19	0.6558	89.84	136.99
4	0.0302	1.96	64.90	20	0.7926	111.36	140.50
5	0.0418	3.08	73.68	21	0.9738	133.52	137.11
6	0.0476	3.48	73.11	22	1.1980	147.56	123.17
7	0.0574	4.48	78.05	23	1.4680	155.12	105.67
8	0.0680	5.40	79.41	24	1.8372	159.72	86.94
9	0.0882	7.48	84.81	25	2.2332	162.68	72.85
10	0.1084	9.72	89.67	26	2.7784	165.40	59.53
11	0.1292	11.92	92.26	27	3.3822	167.28	49.46
12	0.1548	15.00	96.90	28	4.0802	169.16	41.46
13	0.1950	19.64	100.72	29	5.0670	170.80	33.71
14	0.2370	24.88	104.98				
15	0.2870	31.60	110.10				
16	0.3510	40.76	116.13				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.30	101.50
2	0.0020	0.10	50.00	13	0.4000	48.30	120.75
3	0.0040	0.20	50.00	14	0.5000	63.80	127.60
4	0.0050	0.30	60.00	15	0.8000	112.30	140.38
5	0.0080	0.40	50.00	16	1.0000	135.20	135.20
6	0.0100	0.60	60.00	17	2.0000	160.90	80.45
7	0.0200	1.20	60.00	18	4.0000	169.00	42.25
8	0.0400	2.90	72.50	19	5.0000	170.70	34.14
9	0.0500	3.70	74.00				
10	0.0800	6.60	82.50				
11	0.1000	8.80	88.00				



FILENAME: H3-CTX.test

DATE: 08/27/20 16:04:00

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTX

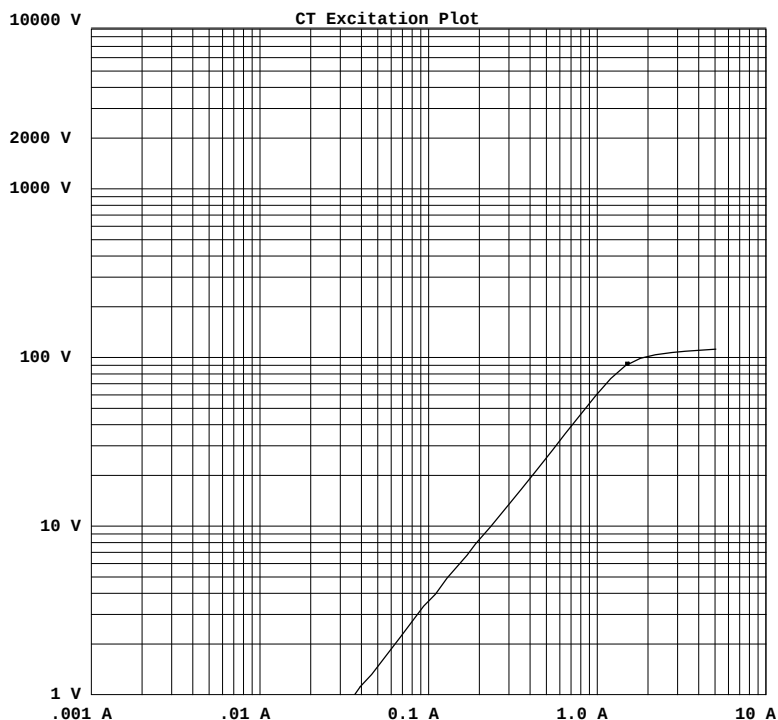
TEST # 6: X2-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.000	Phase Angle:0.34°
Vkp[Volts]: 91.64	Vkp[Volts]: 74.72	Vkp[Volts]: 94.72	M-RATIO: 20.035	Ex I[Amps]: 0.778	In Phase
Ikp[Amps]: 1.5086	Ikp[Amps]: 1.1980	Ikp[Amps]: 1.6540	% ERROR: 0.1760	Winding Res: 116.52 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0270	0.68	25.19	17	0.7980	46.00	57.64
2	0.0312	0.80	25.64	18	0.9800	59.44	60.65
3	0.0394	1.12	28.43	19	1.2018	75.00	62.41
4	0.0460	1.32	28.70	20	1.4708	89.60	60.92
5	0.0680	2.20	32.35	21	1.8046	98.92	54.82
6	0.0936	3.36	35.90	22	2.2136	103.92	46.95
7	0.1100	3.96	36.00	23	2.7784	107.16	38.57
8	0.1288	4.92	38.20	24	3.3336	108.92	32.67
9	0.1692	6.72	39.72	25	4.1646	110.80	26.61
10	0.1904	7.88	41.39	26	5.0506	112.16	22.21
11	0.2332	9.92	42.54				
12	0.2932	13.12	44.75				
13	0.3568	16.68	46.75				
14	0.4348	21.32	49.03				
15	0.5454	28.40	52.07				
16	0.6456	35.28	54.65				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.30	41.50
2	0.0020	0.00	0.00	13	0.4000	19.20	48.00
3	0.0040	0.10	25.00	14	0.5000	25.50	51.00
4	0.0050	0.10	20.00	15	0.8000	46.20	57.75
5	0.0080	0.20	25.00	16	1.0000	60.80	60.80
6	0.0100	0.20	20.00	17	2.0000	101.30	50.65
7	0.0200	0.50	25.00	18	4.0000	110.40	27.60
8	0.0400	1.10	27.50	19	5.0000	112.10	22.42
9	0.0500	1.50	30.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H3-CTX.test

DATE: 08/27/20 16:04:00

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTX

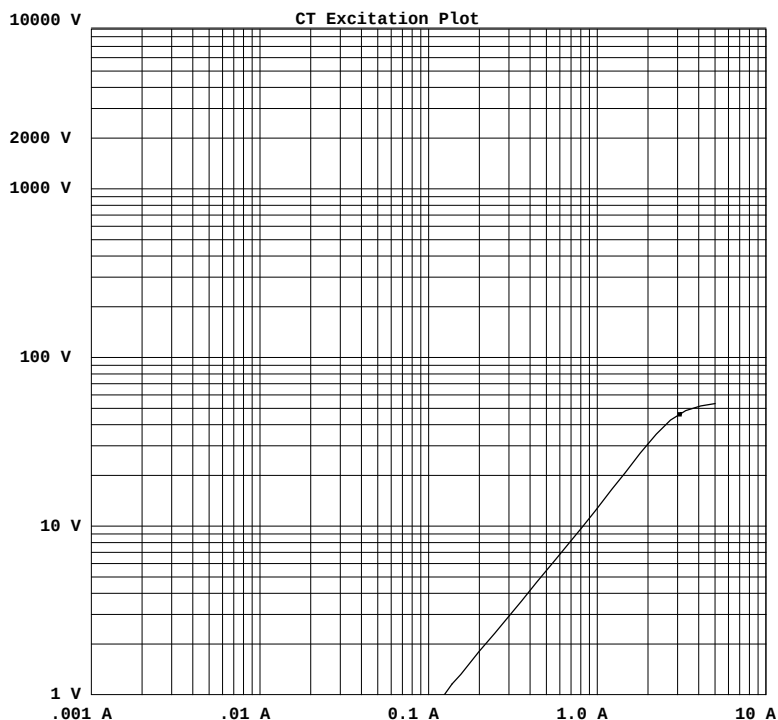
TEST # 7: X2-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.82°
Vkp[Volts]: 46.00	Vkp[Volts]: 39.12	Vkp[Volts]: 0.00	M-RATIO: 10.049	Ex I[Amps]: 0.776	In Phase
Ikp[Amps]: 3.0840	Ikp[Amps]: 2.0440	Ikp[Amps]: 0.0000	% ERROR: 0.4930	Winding Res: 91.19 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0372	0.20	5.38	17	0.9750	12.36	12.68
2	0.0492	0.32	6.50	18	1.2190	16.52	13.55
3	0.0590	0.36	6.10	19	1.4634	20.72	14.16
4	0.0690	0.48	6.96	20	1.8014	27.16	15.08
5	0.0936	0.72	7.69	21	2.2428	35.12	15.66
6	0.1022	0.76	7.44	22	2.7232	42.64	15.66
7	0.1376	1.16	8.43	23	3.3530	48.52	14.47
8	0.1552	1.32	8.51	24	4.1094	51.60	12.56
9	0.1988	1.80	9.05	25	5.0118	53.36	10.65
10	0.2472	2.32	9.39				
11	0.3026	2.96	9.78				
12	0.3564	3.60	10.10				
13	0.4362	4.64	10.64				
14	0.5668	6.36	11.22				
15	0.6592	7.64	11.59				
16	0.8094	9.80	12.11				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.70	12.12
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.00	0.00	15	2.0000	30.80	15.40
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.20	5.00	17	5.0000	53.30	10.66
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTX.test

DATE: 08/27/20 16:04:00

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTX

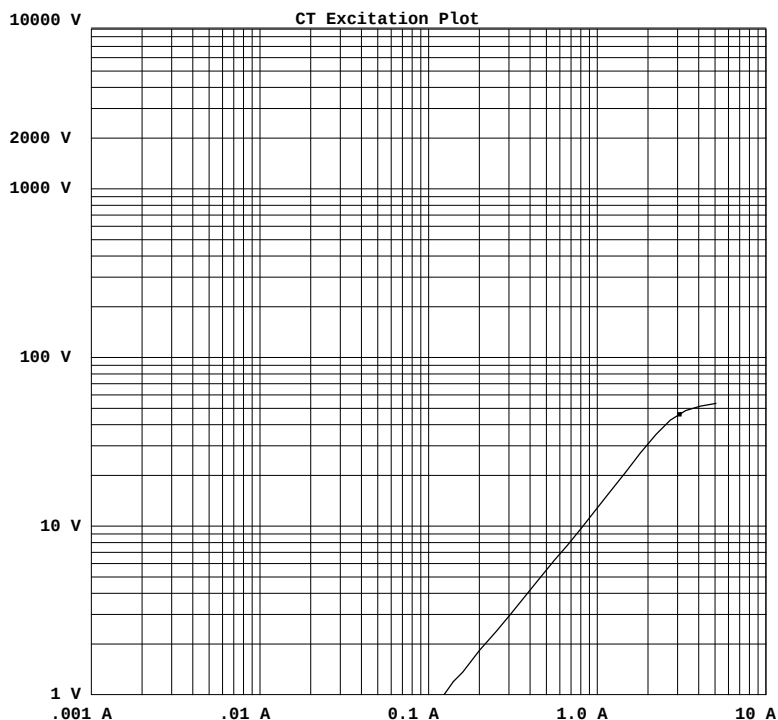
TEST # 8: X3-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.60°
Vkp[Volts]: 45.96	Vkp[Volts]: 38.56	Vkp[Volts]: 0.00	M-RATIO: 10.058	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0798	Ikp[Amps]: 2.2054	Ikp[Amps]: 0.0000	% ERROR: 0.5800	Winding Res: 95.88 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0372	0.20	5.38	17	1.1928	16.00	13.41
2	0.0568	0.36	6.34	18	1.4666	20.76	14.16
3	0.0746	0.56	7.51	19	1.8046	27.24	15.09
4	0.0976	0.76	7.79	20	2.2364	35.08	15.69
5	0.1054	0.80	7.59	21	2.7136	42.48	15.65
6	0.1404	1.20	8.55	22	3.3432	48.44	14.49
7	0.1592	1.36	8.54	23	4.0932	51.56	12.60
8	0.2008	1.84	9.16	24	5.0670	53.52	10.56
9	0.2504	2.36	9.42				
10	0.3060	3.00	9.80				
11	0.3576	3.64	10.18				
12	0.4386	4.68	10.67				
13	0.5572	6.28	11.27				
14	0.6674	7.72	11.57				
15	0.8160	9.88	12.11				
16	0.9788	12.48	12.75				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.60	12.00
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.00	0.00	15	2.0000	30.80	15.40
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.20	5.00	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTX.test

MFR: Siemens

TEST # 9: X4-X5

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

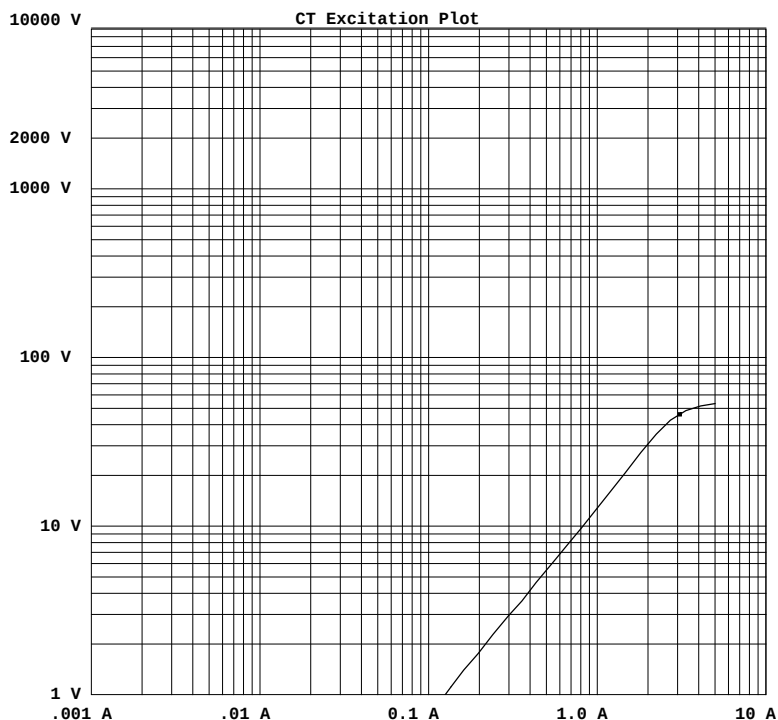
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.84°
Vkp[Volts]: 46.00	Vkp[Volts]: 39.00	Vkp[Volts]: 0.00	M-RATIO: 10.050	Ex I[Amps]: 0.775	In Phase
Ikp[Amps]: 3.0906	Ikp[Amps]: 2.2326	Ikp[Amps]: 0.0000	% ERROR: 0.4950	Winding Res: 86.40 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0368	0.20	5.43	17	1.1968	16.04	13.40
2	0.0464	0.32	6.90	18	1.4654	20.68	14.11
3	0.0590	0.36	6.10	19	1.8176	27.40	15.07
4	0.0894	0.72	8.05	20	2.2428	35.12	15.66
5	0.1104	0.84	7.61	21	2.7168	42.48	15.64
6	0.1362	1.12	8.22	22	3.3562	48.52	14.46
7	0.1614	1.40	8.67	23	4.1060	51.60	12.57
8	0.1970	1.76	8.93	24	5.0052	53.32	10.65
9	0.2410	2.28	9.46				
10	0.2990	2.96	9.90				
11	0.3576	3.60	10.07				
12	0.4344	4.64	10.68				
13	0.5688	6.40	11.25				
14	0.6616	7.68	11.61				
15	0.8042	9.72	12.09				
16	0.9766	12.44	12.74				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.70	12.12
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.00	0.00	15	2.0000	30.70	15.35
5	0.0200	0.10	5.00	16	4.0000	51.20	12.80
6	0.0400	0.20	5.00	17	5.0000	53.30	10.66
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 16:04:00

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

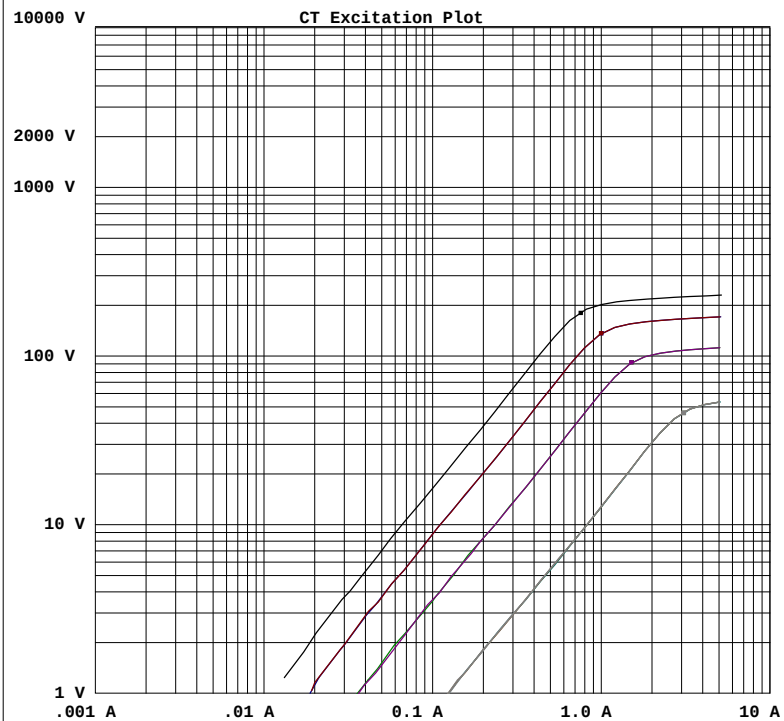
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	45.96/3.0946	37.92/2.1664	48.64/3.3898	50/5.0	10.051	0.508 %	-0.68° [In Ø]	92.55 m-ohms
2	X1-X3	91.92/1.5164	74.36/1.1938	94.64/1.6478	100/5.0	20.041	0.203 %	-0.02° [In Ø]	141.19 m-ohms
3	X1-X4	136.60/1.0022	110.40/0.7866	141.24/1.0974	150/5.0	30.017	0.058 %	-0.14° [In Ø]	162.66 m-ohms
4	X1-X5	180.00/0.7576	150.60/0.6060	190.08/0.8226	200/5.0	40.008	0.021 %	0.00° [In Ø]	191.60 m-ohms
5	X2-X3	46.00/3.0840	39.12/2.0440	0.00/0.0000	50/5.0	10.049	0.493 %	-0.82° [In Ø]	91.19 m-ohms
6	X2-X4	91.64/1.5086	74.72/1.1980	94.72/1.6540	100/5.0	20.035	0.176 %	0.34° [In Ø]	116.52 m-ohms
7	X2-X5	136.52/0.9982	110.60/0.7878	141.28/1.0978	150/5.0	30.023	0.078 %	0.08° [In Ø]	145.36 m-ohms
8	X3-X4	45.96/3.0798	38.56/2.2054	0.00/0.0000	50/5.0	10.058	0.580 %	-0.60° [In Ø]	95.88 m-ohms
10	X4-X5	46.00/3.0906	39.00/2.2326	0.00/0.0000	50/5.0	10.050	0.495 %	-0.84° [In Ø]	86.40 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: H3-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 16:04:00

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1916 Ohm Rct75: 0.2285 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.32	Vsec: 32.15
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.42	Vsec: 41.77
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.71	Vsec: 71.27
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.13	Vsec: 113.17
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.12	Vsec: 212.35
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.12	Vsec: 411.90
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.12	Vsec: 811.67



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

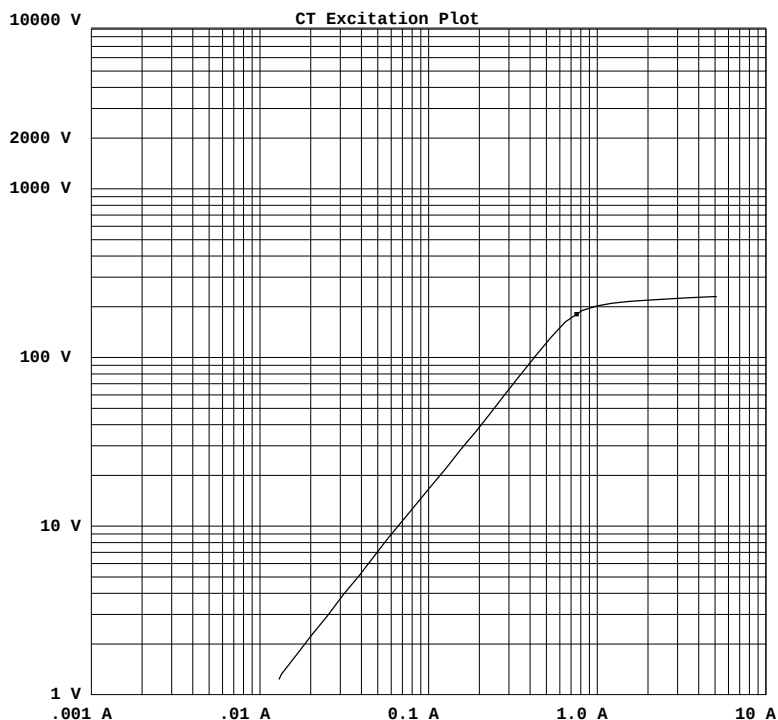
TEST # 1: X1-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/5.0	Ex V[Volts]: 98.400	Phase Angle:0.18°
Vkp[Volts]: 180.44	Vkp[Volts]: 150.68	Vkp[Volts]: 190.16	M-RATIO: 40.004	Ex I[Amps]: 0.415	In Phase
Ikp[Amps]: 0.7554	Ikp[Amps]: 0.6032	Ikp[Amps]: 0.8176	% ERROR: 0.0098	Winding Res: 181.17 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0130	1.24	95.38	17	0.2870	61.36	213.80
2	0.0134	1.32	98.51	18	0.3532	79.72	225.71
3	0.0176	1.88	106.82	19	0.4336	102.96	237.45
4	0.0204	2.28	111.76	20	0.5310	131.48	247.61
5	0.0250	2.92	116.80	21	0.6472	162.44	250.99
6	0.0312	3.92	125.64	22	0.8112	189.72	233.88
7	0.0390	5.12	131.28	23	0.9956	202.40	203.29
8	0.0480	6.72	140.00	24	1.2252	209.72	171.17
9	0.0578	8.56	148.10	25	1.5348	214.84	139.98
10	0.0710	10.96	154.37	26	1.8534	217.84	117.54
11	0.0854	13.68	160.19	27	2.2072	220.52	99.91
12	0.1092	18.44	168.86	28	2.7526	223.24	81.10
13	0.1252	21.64	172.84	29	3.4212	225.92	66.04
14	0.1568	28.80	183.67	30	4.1840	228.08	54.51
15	0.1914	36.56	191.01	31	5.0896	230.00	45.19
16	0.2336	46.96	201.03				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	38.70	193.50
2	0.0020	0.20	100.00	13	0.4000	93.20	233.00
3	0.0040	0.40	100.00	14	0.5000	122.40	244.80
4	0.0050	0.50	100.00	15	0.8000	187.90	234.88
5	0.0080	0.80	100.00	16	1.0000	202.50	202.50
6	0.0100	1.00	100.00	17	2.0000	219.00	109.50
7	0.0200	2.20	110.00	18	4.0000	227.60	56.90
8	0.0400	5.30	132.50	19	5.0000	229.80	45.96
9	0.0500	7.10	142.00				
10	0.0800	12.70	158.75				
11	0.1000	16.60	166.00				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

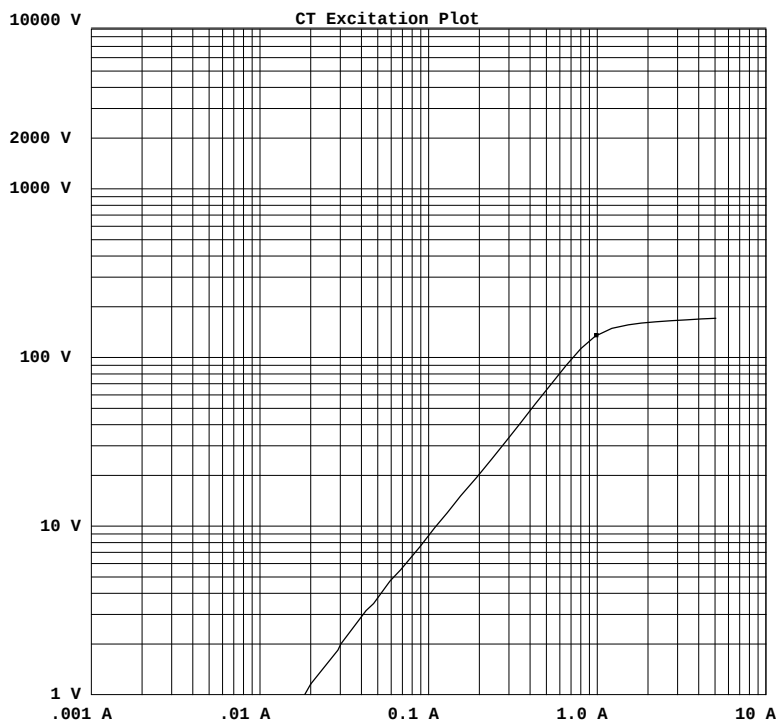
TEST # 2: X1-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 90.300	Phase Angle:0.10°
Vkp[Volts]: 135.64	Vkp[Volts]: 111.08	Vkp[Volts]: 141.12	M-RATIO: 30.015	Ex I[Amps]: 0.653	In Phase
Ikp[Amps]: 0.9880	Ikp[Amps]: 0.7886	Ikp[Amps]: 1.0926	% ERROR: 0.0487	Winding Res: 147.95 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0184	1.00	54.35	17	0.4288	53.04	123.69
2	0.0200	1.16	58.00	18	0.5260	68.32	129.89
3	0.0290	1.84	63.45	19	0.6546	90.00	137.49
4	0.0302	2.00	66.23	20	0.8012	113.08	141.14
5	0.0426	3.16	74.18	21	0.9738	133.92	137.52
6	0.0472	3.48	73.73	22	1.2214	148.92	121.93
7	0.0590	4.72	80.00	23	1.5278	156.20	102.24
8	0.0684	5.52	80.70	24	1.8274	160.00	87.56
9	0.0886	7.52	84.88	25	2.2266	162.96	73.19
10	0.1088	9.80	90.07	26	2.7654	165.40	59.81
11	0.1292	12.04	93.19	27	3.3758	167.28	49.55
12	0.1548	15.12	97.67	28	4.1548	169.44	40.78
13	0.1950	19.72	101.13	29	5.0572	171.08	33.83
14	0.2374	25.08	105.64				
15	0.2866	31.64	110.40				
16	0.3498	40.80	116.64				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.40	102.00
2	0.0020	0.10	50.00	13	0.4000	48.60	121.50
3	0.0040	0.20	50.00	14	0.5000	64.20	128.40
4	0.0050	0.30	60.00	15	0.8000	112.90	141.13
5	0.0080	0.40	50.00	16	1.0000	135.50	135.50
6	0.0100	0.60	60.00	17	2.0000	161.30	80.65
7	0.0200	1.20	60.00	18	4.0000	169.00	42.25
8	0.0400	2.90	72.50	19	5.0000	171.00	34.20
9	0.0500	3.80	76.00				
10	0.0800	6.70	83.75				
11	0.1000	8.80	88.00				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

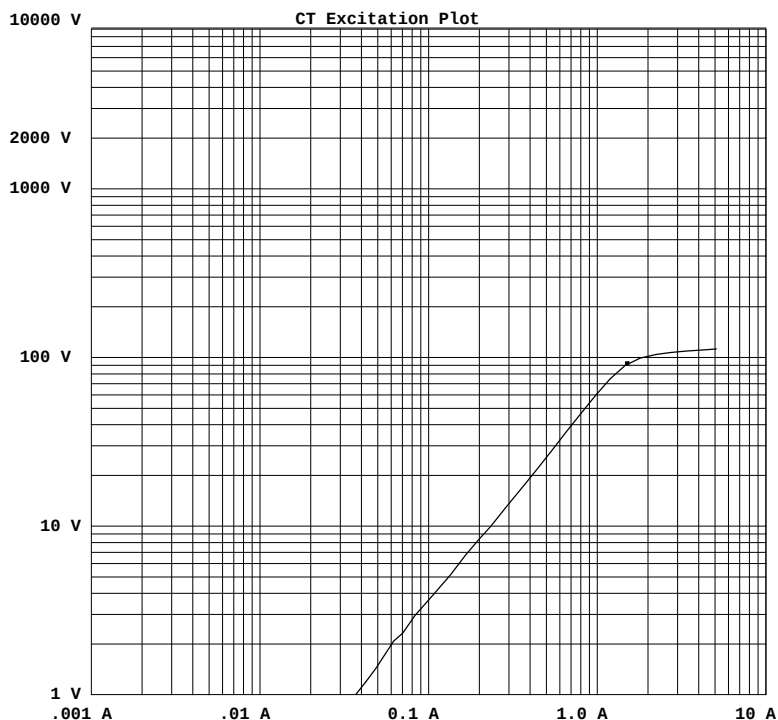
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.600	Phase Angle: -0.30°
Vkp[Volts]: 92.12	Vkp[Volts]: 74.56	Vkp[Volts]: 94.92	M-RATIO: 20.047	Ex I[Amps]: 0.781	In Phase
Ikp[Amps]: 1.5064	Ikp[Amps]: 1.1906	Ikp[Amps]: 1.6476	% ERROR: 0.2330	Winding Res: 239.53 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0274	0.72	26.28	17	0.6502	35.88	55.18
2	0.0298	0.76	25.50	18	0.7930	45.96	57.96
3	0.0426	1.20	28.17	19	0.9812	59.92	61.07
4	0.0488	1.44	29.51	20	1.1948	74.84	62.64
5	0.0620	2.08	33.55	21	1.4634	89.72	61.31
6	0.0702	2.32	33.05	22	1.7982	99.20	55.17
7	0.0832	2.96	35.58	23	2.2428	104.44	46.57
8	0.1066	3.92	36.77	24	2.7232	107.16	39.35
9	0.1354	5.16	38.11	25	3.3596	109.20	32.50
10	0.1654	6.72	40.63	26	4.1060	110.80	26.98
11	0.1992	8.36	41.97	27	5.0832	112.28	22.09
12	0.2324	9.92	42.69				
13	0.2886	13.00	45.05				
14	0.3506	16.48	47.01				
15	0.4320	21.28	49.26				
16	0.5404	28.24	52.26				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.60	51.20
4	0.0050	0.10	20.00	15	0.8000	46.50	58.13
5	0.0080	0.20	25.00	16	1.0000	61.20	61.20
6	0.0100	0.30	30.00	17	2.0000	101.60	50.80
7	0.0200	0.50	25.00	18	4.0000	110.60	27.65
8	0.0400	1.10	27.50	19	5.0000	112.20	22.44
9	0.0500	1.50	30.00				
10	0.0800	2.80	35.00				
11	0.1000	3.60	36.00				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

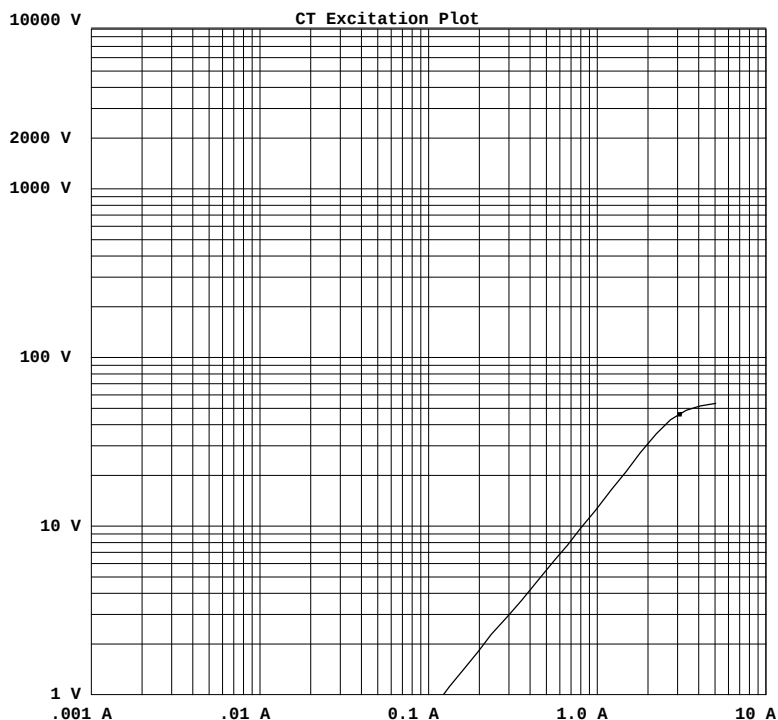
TEST # 4: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -1.04°
Vkp[Volts]: 46.04	Vkp[Volts]: 38.88	Vkp[Volts]: 48.44	M-RATIO: 10.039	Ex I[Amps]: 0.776	In Phase
Ikp[Amps]: 3.0808	Ikp[Amps]: 2.2162	Ikp[Amps]: 3.3428	% ERROR: 0.3900	Winding Res: 81.95 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0376	0.24	6.38	17	1.2174	16.56	13.60
2	0.0562	0.36	6.41	18	1.4794	21.00	14.19
3	0.0788	0.60	7.61	19	1.8014	27.28	15.14
4	0.0976	0.76	7.79	20	2.2428	35.32	15.75
5	0.1076	0.84	7.81	21	2.7232	42.76	15.70
6	0.1330	1.12	8.42	22	3.3692	48.72	14.46
7	0.1600	1.40	8.75	23	4.0802	51.60	12.65
8	0.1966	1.80	9.16	24	5.0410	53.44	10.60
9	0.2352	2.28	9.69				
10	0.2948	2.92	9.91				
11	0.3568	3.64	10.20				
12	0.4382	4.68	10.68				
13	0.5630	6.36	11.30				
14	0.6674	7.72	11.57				
15	0.7984	9.72	12.17				
16	0.9726	12.36	12.71				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.80	12.80
4	0.0100	0.10	10.00	15	2.0000	30.90	15.45
5	0.0200	0.10	5.00	16	4.0000	51.30	12.82
6	0.0400	0.20	5.00	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

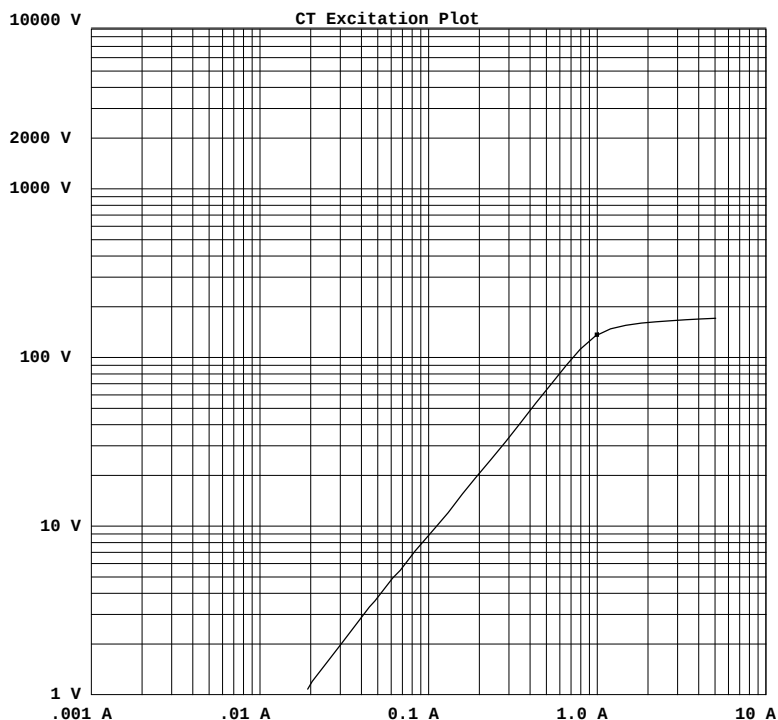
TEST # 5: X2-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 91.900	Phase Angle:0.12°
Vkp[Volts]: 136.48	Vkp[Volts]: 111.12	Vkp[Volts]: 141.56	M-RATIO: 30.016	Ex I[Amps]: 0.663	In Phase
Ikp[Amps]: 0.9958	Ikp[Amps]: 0.7872	Ikp[Amps]: 1.0956	% ERROR: 0.0530	Winding Res: 145.20 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0192	1.08	56.25	17	0.4324	53.76	124.33
2	0.0204	1.20	58.82	18	0.5260	68.32	129.89
3	0.0250	1.56	62.40	19	0.6576	90.40	137.47
4	0.0308	2.04	66.23	20	0.7938	112.16	141.30
5	0.0446	3.32	74.44	21	0.9778	134.32	137.37
6	0.0480	3.60	75.00	22	1.2006	148.08	123.34
7	0.0612	4.92	80.39	23	1.4774	155.40	105.18
8	0.0680	5.48	80.59	24	1.8306	160.00	87.40
9	0.0832	7.12	85.58	25	2.2332	162.96	72.97
10	0.1104	9.88	89.49	26	2.7688	165.40	59.74
11	0.1306	12.04	92.19	27	3.3758	167.56	49.64
12	0.1588	15.52	97.73	28	4.1482	169.44	40.85
13	0.1888	19.20	101.69	29	5.0410	171.08	33.94
14	0.2324	24.64	106.02				
15	0.2866	31.68	110.54				
16	0.3506	40.96	116.83				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	20.60	103.00
2	0.0020	0.10	50.00	13	0.4000	48.70	121.75
3	0.0040	0.20	50.00	14	0.5000	64.30	128.60
4	0.0050	0.30	60.00	15	0.8000	112.90	141.13
5	0.0080	0.40	50.00	16	1.0000	135.70	135.70
6	0.0100	0.60	60.00	17	2.0000	161.20	80.60
7	0.0200	1.20	60.00	18	4.0000	169.10	42.27
8	0.0400	2.90	72.50	19	5.0000	171.00	34.20
9	0.0500	3.80	76.00				
10	0.0800	6.80	85.00				
11	0.1000	8.80	88.00				



FILENAME: H3-CTY.test

MFR: Siemens

TEST # 6: X2-X4

DATE: 08/27/20 16:14:07

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

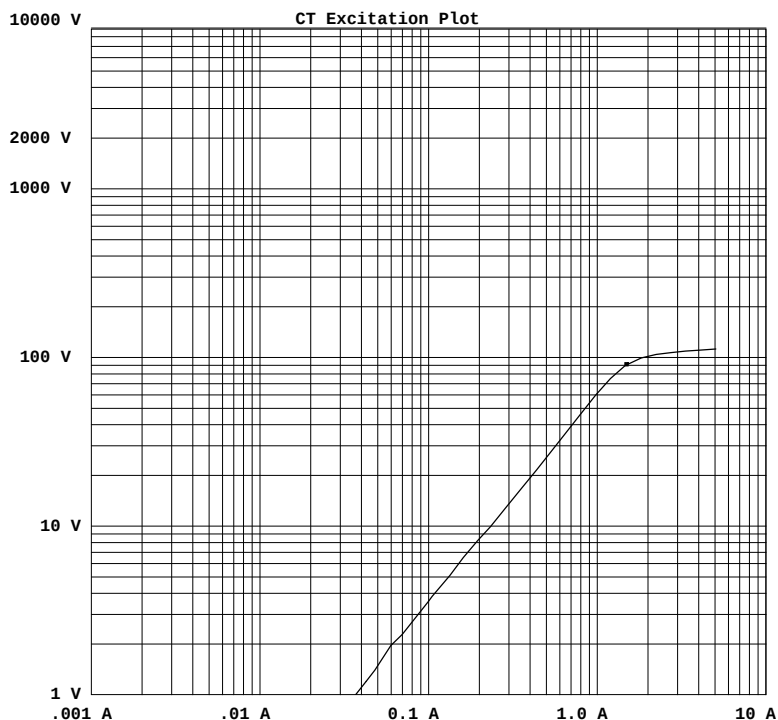
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTY

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 100/5.0	Ex V[Volts]: 45.500	Phase Angle: -0.18°
Vkp[Volts]: 91.20	Vkp[Volts]: 74.72	Vkp[Volts]: 95.04	M-RATIO: 20.036	Ex I[Amps]: 0.781	In Phase
Ikp[Amps]: 1.4922	Ikp[Amps]: 1.1928	Ikp[Amps]: 1.6616	% ERROR: 0.1790	Winding Res: 112.19 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0270	0.68	25.19	17	0.6452	35.32	54.74
2	0.0298	0.76	25.50	18	0.7938	45.96	57.90
3	0.0426	1.20	28.17	19	0.9804	59.88	61.08
4	0.0480	1.40	29.17	20	1.1968	75.00	62.67
5	0.0598	1.96	32.78	21	1.4670	89.84	61.24
6	0.0698	2.28	32.66	22	1.8242	99.44	54.51
7	0.0994	3.56	35.81	23	2.2364	104.32	46.65
8	0.1050	3.84	36.57	24	2.7200	107.00	39.34
9	0.1342	5.12	38.15	25	3.3432	109.20	32.66
10	0.1610	6.52	40.50	26	4.0802	110.80	27.16
11	0.1954	8.20	41.97	27	5.0506	112.44	22.26
12	0.2328	9.92	42.61				
13	0.2870	12.88	44.88				
14	0.3572	16.84	47.14				
15	0.4358	21.48	49.29				
16	0.5438	28.44	52.30				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.00	0.00	12	0.2000	8.40	42.00
2	0.0020	0.00	0.00	13	0.4000	19.40	48.50
3	0.0040	0.10	25.00	14	0.5000	25.60	51.20
4	0.0050	0.10	20.00	15	0.8000	46.40	58.00
5	0.0080	0.20	25.00	16	1.0000	61.20	61.20
6	0.0100	0.20	20.00	17	2.0000	101.50	50.75
7	0.0200	0.50	25.00	18	4.0000	110.60	27.65
8	0.0400	1.10	27.50	19	5.0000	112.40	22.48
9	0.0500	1.50	30.00				
10	0.0800	2.70	33.75				
11	0.1000	3.60	36.00				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

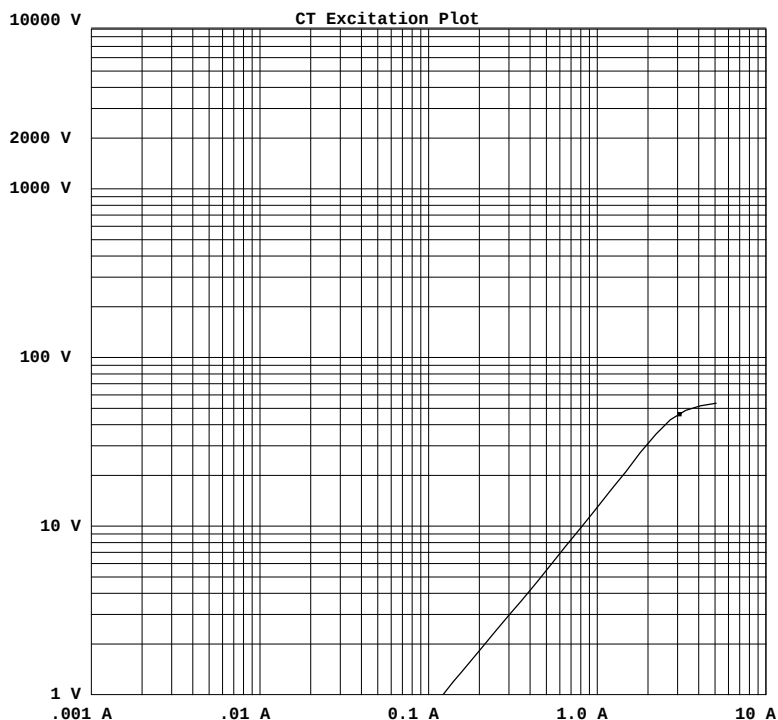
TEST # 7: X2-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -1.32°
Vkp[Volts]: 46.08	Vkp[Volts]: 39.16	Vkp[Volts]: 48.44	M-RATIO: 10.078	Ex I[Amps]: 0.774	In Phase
Ikp[Amps]: 3.0750	Ikp[Amps]: 2.0360	Ikp[Amps]: 3.3304	% ERROR: 0.7750	Winding Res: 112.44 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0372	0.24	6.45	17	0.9734	12.48	12.82
2	0.0508	0.32	6.30	18	1.2222	16.64	13.61
3	0.0598	0.40	6.69	19	1.4758	21.00	14.23
4	0.0698	0.52	7.45	20	1.7982	27.28	15.17
5	0.0932	0.76	8.15	21	2.2364	35.20	15.74
6	0.1022	0.80	7.83	22	2.7168	42.76	15.74
7	0.1404	1.20	8.55	23	3.3400	48.56	14.54
8	0.1564	1.36	8.70	24	4.0964	51.76	12.64
9	0.2016	1.84	9.13	25	5.0734	53.56	10.56
10	0.2504	2.40	9.58				
11	0.3060	3.04	9.93				
12	0.3576	3.64	10.18				
13	0.4468	4.76	10.65				
14	0.5660	6.40	11.31				
15	0.6498	7.60	11.70				
16	0.7956	9.72	12.22				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.80	12.25
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.10	10.00	15	2.0000	30.90	15.45
5	0.0200	0.10	5.00	16	4.0000	51.40	12.85
6	0.0400	0.20	5.00	17	5.0000	53.40	10.68
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

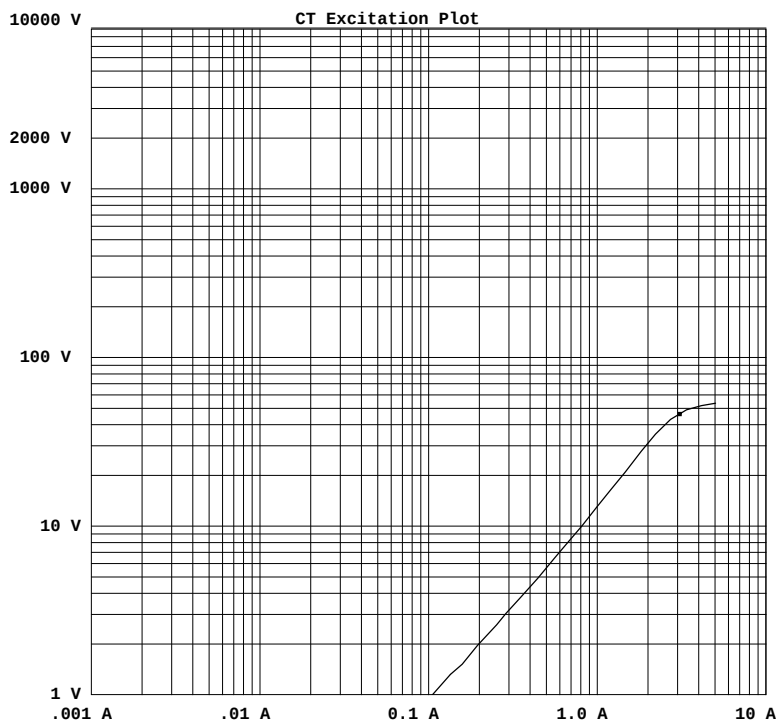
TEST # 8: X3-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.700	Phase Angle: -1.68°
Vkp[Volts]: 46.24	Vkp[Volts]: 38.04	Vkp[Volts]: 48.72	M-RATIO: 10.227	Ex I[Amps]: 0.779	In Phase
Ikp[Amps]: 3.0828	Ikp[Amps]: 2.1370	Ikp[Amps]: 3.3548	% ERROR: 2.2740	Winding Res: 130.17 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0362	0.28	7.73	17	0.9914	12.96	13.07
2	0.0484	0.36	7.44	18	1.2026	16.44	13.67
3	0.0570	0.48	8.42	19	1.4658	20.96	14.30
4	0.0828	0.80	9.66	20	1.8274	27.84	15.23
5	0.0980	0.92	9.39	21	2.2170	35.12	15.84
6	0.1054	1.00	9.49	22	2.7232	42.96	15.78
7	0.1346	1.32	9.81	23	3.3854	49.00	14.47
8	0.1584	1.52	9.60	24	4.1482	51.88	12.51
9	0.1950	1.96	10.05	25	5.0312	53.64	10.66
10	0.2534	2.60	10.26				
11	0.2878	3.04	10.56				
12	0.3528	3.80	10.77				
13	0.4452	4.92	11.05				
14	0.5622	6.52	11.60				
15	0.6510	7.76	11.92				
16	0.8120	10.04	12.36				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.70	11.40
2	0.0050	0.00	0.00	13	0.8000	9.90	12.38
3	0.0080	0.10	12.50	14	1.0000	13.10	13.10
4	0.0100	0.10	10.00	15	2.0000	31.10	15.55
5	0.0200	0.20	10.00	16	4.0000	51.30	12.82
6	0.0400	0.30	7.50	17	5.0000	53.60	10.72
7	0.0500	0.40	8.00				
8	0.0800	0.80	10.00				
9	0.1000	1.00	10.00				
10	0.2000	2.00	10.00				
11	0.4000	4.40	11.00				



FILENAME: H3-CTY.test

DATE: 08/27/20 16:14:07

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: H3-CTY

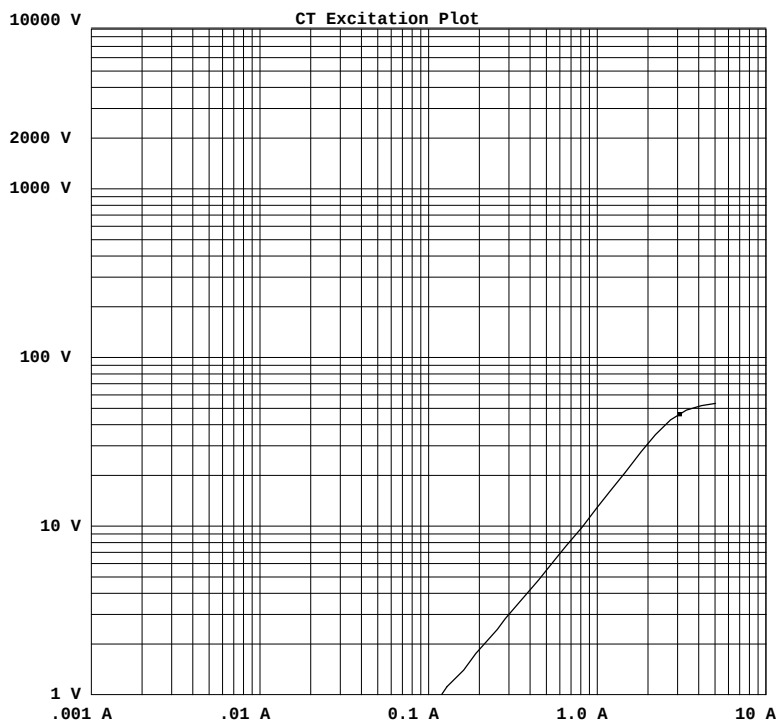
TEST # 9: X4-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 50/5.0	Ex V[Volts]: 9.400	Phase Angle: -0.80°
Vkp[Volts]: 46.08	Vkp[Volts]: 37.80	Vkp[Volts]: 48.72	M-RATIO: 10.049	Ex I[Amps]: 0.777	In Phase
Ikp[Amps]: 3.0890	Ikp[Amps]: 2.1382	Ikp[Amps]: 3.3744	% ERROR: 0.4900	Winding Res: 82.92 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0368	0.20	5.43	17	0.9964	12.88	12.93
2	0.0480	0.32	6.67	18	1.2092	16.40	13.56
3	0.0558	0.36	6.45	19	1.4684	20.84	14.19
4	0.0764	0.56	7.33	20	1.8242	27.68	15.17
5	0.0998	0.76	7.62	21	2.2170	34.92	15.75
6	0.1062	0.84	7.91	22	2.7200	42.68	15.69
7	0.1288	1.12	8.70	23	3.3822	48.80	14.43
8	0.1614	1.40	8.67	24	4.1548	51.88	12.49
9	0.1908	1.76	9.22	25	5.0312	53.52	10.64
10	0.2558	2.44	9.54				
11	0.2854	2.84	9.95				
12	0.3506	3.60	10.27				
13	0.4496	4.80	10.68				
14	0.5660	6.40	11.31				
15	0.6534	7.64	11.69				
16	0.8160	9.88	12.11				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0040	0.00	0.00	12	0.5000	5.50	11.00
2	0.0050	0.00	0.00	13	0.8000	9.70	12.12
3	0.0080	0.00	0.00	14	1.0000	12.90	12.90
4	0.0100	0.00	0.00	15	2.0000	30.90	15.45
5	0.0200	0.10	5.00	16	4.0000	51.30	12.82
6	0.0400	0.20	5.00	17	5.0000	53.50	10.70
7	0.0500	0.30	6.00				
8	0.0800	0.60	7.50				
9	0.1000	0.80	8.00				
10	0.2000	1.80	9.00				
11	0.4000	4.20	10.50				



FILENAME: H3-CTY.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 16:14:07

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

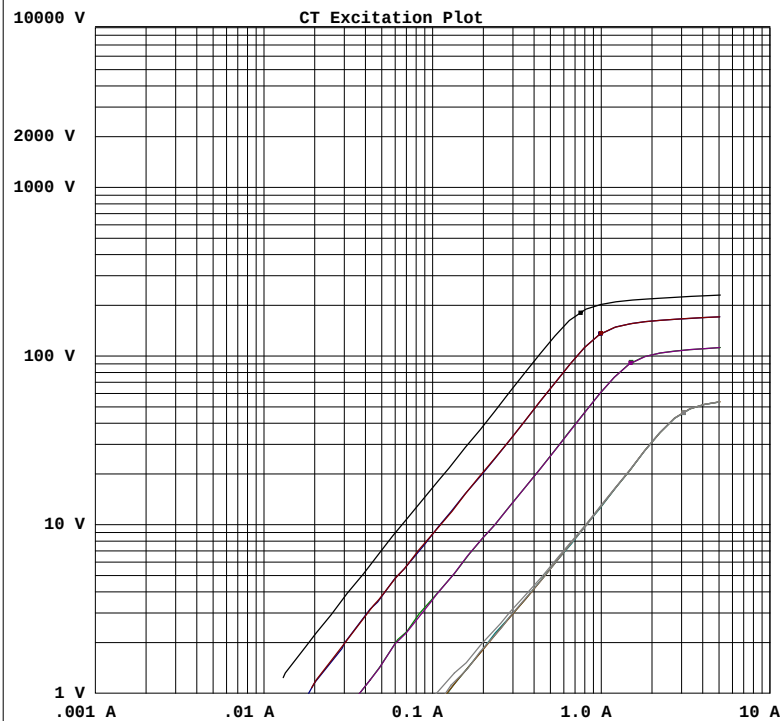
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTY

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	46.04/3.0808	38.88/2.2162	48.44/3.3428	50/5.0	10.039	0.390 %	-1.04° [In Ø]	81.95 m-ohms
2	X1-X3	92.12/1.5064	74.56/1.1906	94.92/1.6476	100/5.0	20.047	0.233 %	-0.30° [In Ø]	239.53 m-ohms
3	X1-X4	135.64/0.9880	111.08/0.7886	141.12/1.0926	150/5.0	30.015	0.049 %	0.10° [In Ø]	147.95 m-ohms
4	X1-X5	180.44/0.7554	150.68/0.6032	190.16/0.8176	200/5.0	40.004	0.010 %	0.18° [In Ø]	181.17 m-ohms
5	X2-X3	46.08/3.0750	39.16/2.0360	48.44/3.3304	50/5.0	10.078	0.775 %	-1.32° [In Ø]	112.44 m-ohms
6	X2-X4	91.20/1.4922	74.72/1.1928	95.04/1.6616	100/5.0	20.036	0.179 %	-0.18° [In Ø]	112.19 m-ohms
7	X2-X5	136.48/0.9958	111.12/0.7872	141.56/1.0956	150/5.0	30.016	0.053 %	0.12° [In Ø]	145.20 m-ohms
8	X3-X4	46.24/3.0828	38.04/2.1370	48.72/3.3548	50/5.0	10.227	2.274 %	-1.68° [In Ø]	130.17 m-ohms
10	X4-X5	46.08/3.0890	37.80/2.1382	48.72/3.3744	50/5.0	10.049	0.490 %	-0.80° [In Ø]	82.92 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: H3-CTY.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 16:14:07

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: H3-CTY

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	200/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	150/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	100/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	50/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	150/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	100/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	50/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	50/5.0	[X]	[X]	[X]	500.00	5.00	
X4-X5	50/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.1812 Ohm Rct75: 0.2161 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.31	Vsec: 30.92
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.41	Vsec: 40.56
Class: C50	Br: 0.45	Bi: 0.22	Btot: 0.70	Vsec: 70.08
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.12	Vsec: 112.37
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.12	Vsec: 211.63
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.11	Vsec: 411.23
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.11	Vsec: 811.02



FILENAME: X1-CTW.test

DATE: 08/27/20 16:51:57

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTW

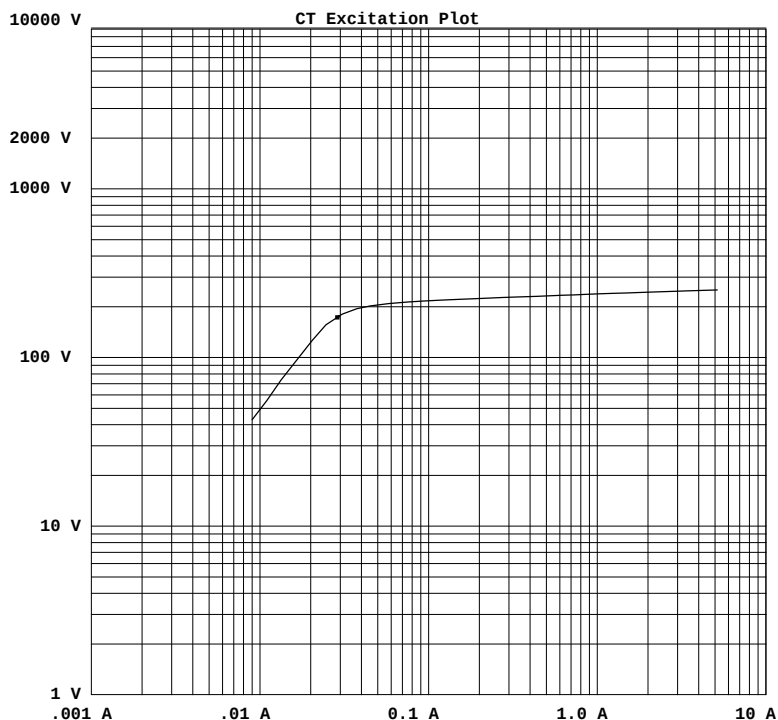
TEST # 1: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3480/5.0	Ex V[Volts]: 97.700	Phase Angle:0.02°
Vkp[Volts]: 172.80	Vkp[Volts]: 147.28	Vkp[Volts]: 185.08	M-RATIO: 696.166	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0288	Ikp[Amps]: 0.0234	Ikp[Amps]: 0.0326	% ERROR: 0.0238	Winding Res: 602.04 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	42.76	4751.11	17	0.3552	229.16	645.16
2	0.0110	55.68	5061.82	18	0.4370	230.80	528.15
3	0.0134	73.92	5516.42	19	0.6238	234.04	375.18
4	0.0164	95.68	5834.15	20	0.7282	235.40	323.26
5	0.0204	126.08	6180.39	21	0.8334	236.72	284.04
6	0.0246	156.48	6360.98	22	1.0304	238.64	231.60
7	0.0308	181.08	5879.22	23	1.2526	240.52	192.02
8	0.0376	195.12	5189.36	24	1.4758	241.60	163.71
9	0.0450	202.40	4497.78	25	1.8728	243.76	130.16
10	0.0582	208.92	3589.69	26	2.2656	245.40	108.32
11	0.0758	213.48	2816.36	27	2.7654	247.00	89.32
12	0.0906	215.92	2383.22	28	3.3432	248.36	74.29
13	0.1162	218.92	1883.99	29	4.1224	250.00	60.64
14	0.1490	221.32	1485.37	30	5.1480	251.60	48.87
15	0.2056	224.32	1091.05				
16	0.2752	227.00	824.85				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	4.80	4800.00	12	0.2000	224.00	1120.00
2	0.0020	9.50	4750.00	13	0.4000	230.00	575.00
3	0.0040	19.00	4750.00	14	0.5000	231.90	463.80
4	0.0050	23.80	4760.00	15	0.8000	236.30	295.38
5	0.0080	38.00	4750.00	16	1.0000	238.40	238.40
6	0.0100	49.20	4920.00	17	2.0000	244.30	122.15
7	0.0200	123.00	6150.00	18	4.0000	249.80	62.45
8	0.0400	197.50	4937.50	19	5.0000	251.40	50.28
9	0.0500	204.90	4098.00				
10	0.0800	214.20	2677.50				
11	0.1000	217.00	2170.00				



FILENAME: X1-CTW.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 16:51:57

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

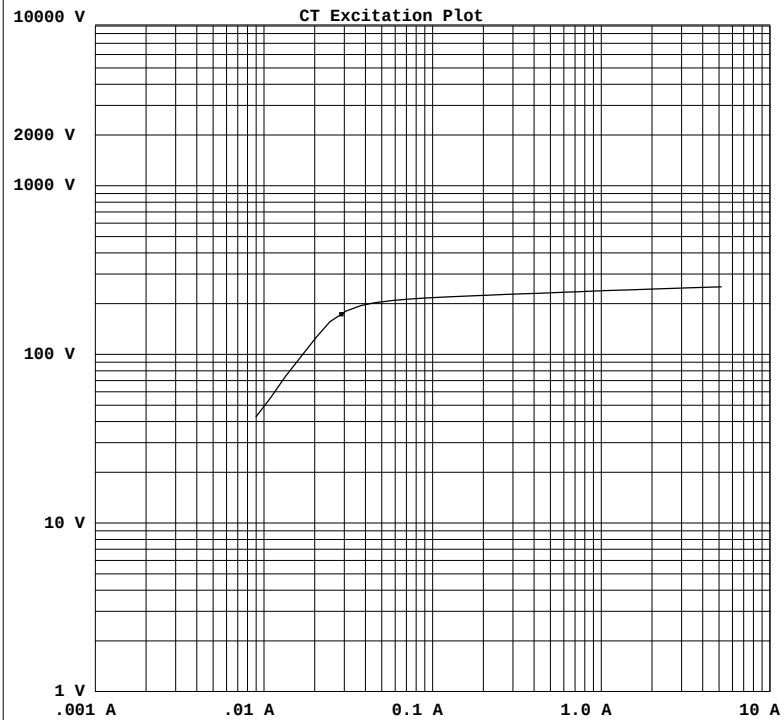
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X1-CTW

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	172.80/0.0288	147.28/0.0234	185.08/0.0326	3480/5.0	696.166	0.024 %	0.02° [In Ø]	602.04 m-ohms

Test Notepad





Vanguard Instruments Company, Inc.

www.vanguard-instruments.com

FILENAME: X1-CTW.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 16:51:57

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X1-CTW

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X2	3480/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C100 for Single Tap: X1-X2

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.6020 Ohm Rct75: 0.7180 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.81	Vsec: 80.92
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.90	Vsec: 90.23
Class: C50	Br: 0.45	Bi: 0.22	Btot: 1.19	Vsec: 118.82
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.49	Vsec: 149.45
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.44	Vsec: 243.96
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.40	Vsec: 440.31
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.38	Vsec: 838.21



FILENAME: X1-CTX.test

MFR: Siemens

TEST # 1: X1-X5

DATE: 08/27/20 16:45:36

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

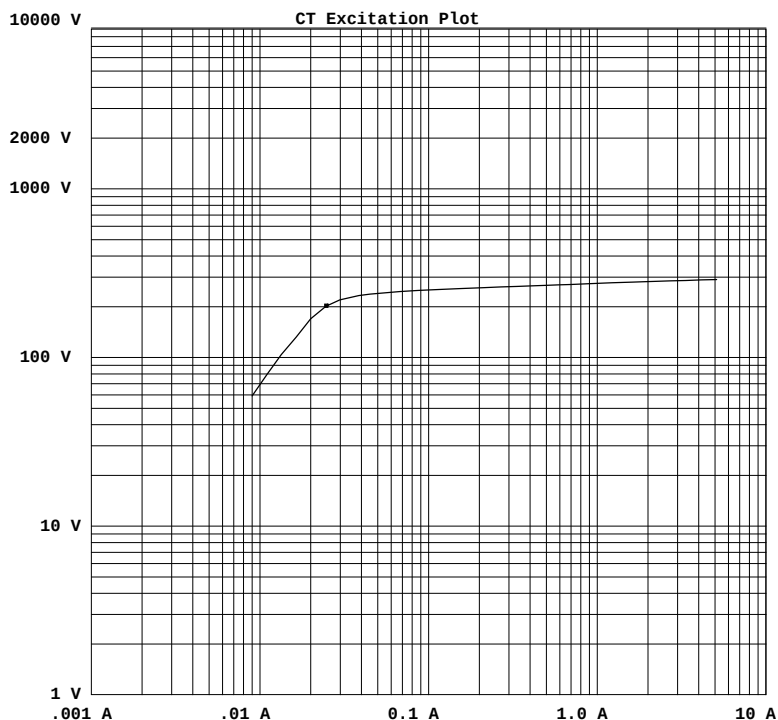
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X1-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 4000/5.0	Ex V[Volts]: 98.800	Phase Angle:0.08°
Vkp[Volts]: 202.76	Vkp[Volts]: 170.12	Vkp[Volts]: 211.04	M-RATIO: 800.120	Ex I[Amps]: 0.013	In Phase
Ikp[Amps]: 0.0248	Ikp[Amps]: 0.0200	Ikp[Amps]: 0.0272	% ERROR: 0.0151	Winding Res: 693.63 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	59.24	6582.22	17	0.4180	266.20	636.84
2	0.0110	79.20	7200.00	18	0.5034	268.08	532.54
3	0.0134	104.04	7764.18	19	0.5934	269.72	454.53
4	0.0164	132.16	8058.54	20	0.6916	271.32	392.31
5	0.0200	169.72	8486.00	21	0.8900	274.04	307.91
6	0.0246	201.60	8195.12	22	1.2214	277.80	227.44
7	0.0298	220.00	7382.55	23	1.6262	279.96	172.16
8	0.0386	233.24	6042.49	24	1.8338	281.08	153.28
9	0.0450	237.84	5285.33	25	2.2494	283.24	125.92
10	0.0676	246.48	3646.15	26	2.7362	284.84	104.10
11	0.0866	250.00	2886.84	27	3.3432	286.48	85.69
12	0.1158	253.48	2188.95	28	4.1482	288.64	69.58
13	0.1572	256.72	1633.08	29	5.1026	290.24	56.88
14	0.2090	259.72	1242.68				
15	0.2686	262.16	976.02				
16	0.3334	264.04	791.96				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	6.60	6600.00	12	0.2000	259.20	1296.00
2	0.0020	13.20	6600.00	13	0.4000	265.70	664.25
3	0.0040	26.30	6575.00	14	0.5000	268.00	536.00
4	0.0050	32.90	6580.00	15	0.8000	272.80	341.00
5	0.0080	52.70	6587.50	16	1.0000	275.30	275.30
6	0.0100	69.20	6920.00	17	2.0000	282.00	141.00
7	0.0200	169.70	8485.00	18	4.0000	288.20	72.05
8	0.0400	234.20	5855.00	19	5.0000	290.10	58.02
9	0.0500	239.80	4796.00				
10	0.0800	248.80	3110.00				
11	0.1000	251.60	2516.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

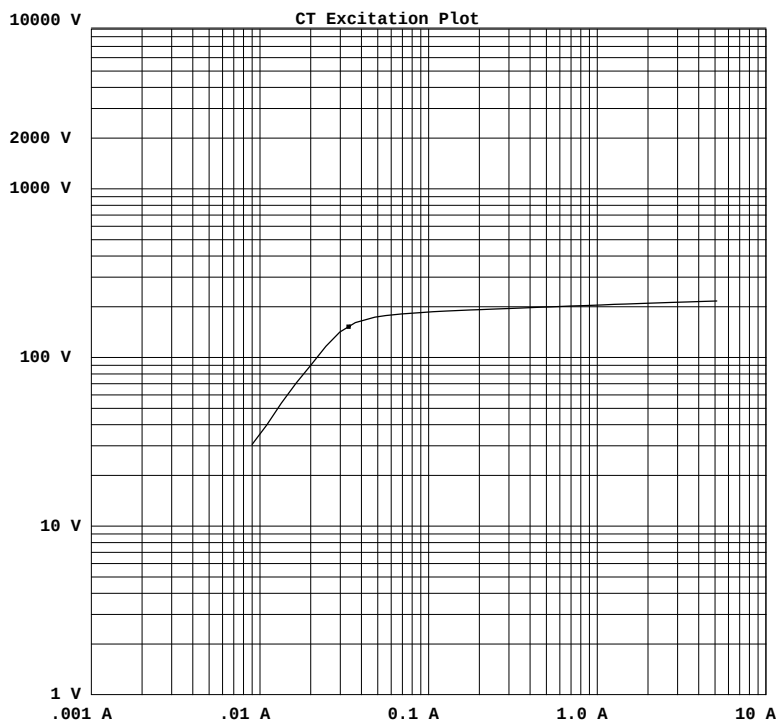
TEST # 2: X1-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3000/5.0	Ex V[Volts]: 98.600	Phase Angle:0.04°
Vkp[Volts]: 152.28	Vkp[Volts]: 129.44	Vkp[Volts]: 160.16	M-RATIO: 600.195	Ex I[Amps]: 0.022	In Phase
Ikp[Amps]: 0.0336	Ikp[Amps]: 0.0272	Ikp[Amps]: 0.0364	% ERROR: 0.0326	Winding Res: 517.44 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	30.56	3395.56	17	0.2364	193.76	819.63
2	0.0110	39.88	3625.45	18	0.3166	195.92	618.83
3	0.0134	53.64	4002.99	19	0.3532	196.76	557.08
4	0.0164	70.52	4300.00	20	0.4582	198.64	433.52
5	0.0200	90.00	4500.00	21	0.5256	199.72	379.98
6	0.0246	116.60	4739.84	22	0.7110	202.16	284.33
7	0.0298	141.60	4751.68	23	0.8272	203.24	245.70
8	0.0368	161.08	4377.17	24	1.0530	205.12	194.80
9	0.0480	173.52	3615.00	25	1.2600	206.76	164.10
10	0.0558	177.28	3177.06	26	1.4798	207.56	140.26
11	0.0690	181.32	2627.83	27	1.8728	209.44	111.83
12	0.0914	185.12	2025.38	28	2.2688	211.08	93.04
13	0.1062	187.00	1760.83	29	2.7396	212.40	77.53
14	0.1260	188.64	1497.14	30	3.4082	213.76	62.72
15	0.1774	191.60	1080.05	31	4.1386	215.12	51.98
16	0.2024	192.40	950.59	32	5.1220	216.48	42.26

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	3.40	3400.00	12	0.2000	192.30	961.50
2	0.0020	6.80	3400.00	13	0.4000	197.60	494.00
3	0.0040	13.60	3400.00	14	0.5000	199.30	398.60
4	0.0050	17.00	3400.00	15	0.8000	203.00	253.75
5	0.0080	27.20	3400.00	16	1.0000	204.70	204.70
6	0.0100	35.20	3520.00	17	2.0000	210.00	105.00
7	0.0200	90.00	4500.00	18	4.0000	214.90	53.73
8	0.0400	164.60	4115.00	19	5.0000	216.30	43.26
9	0.0500	174.50	3490.00				
10	0.0800	183.20	2290.00				
11	0.1000	186.20	1862.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

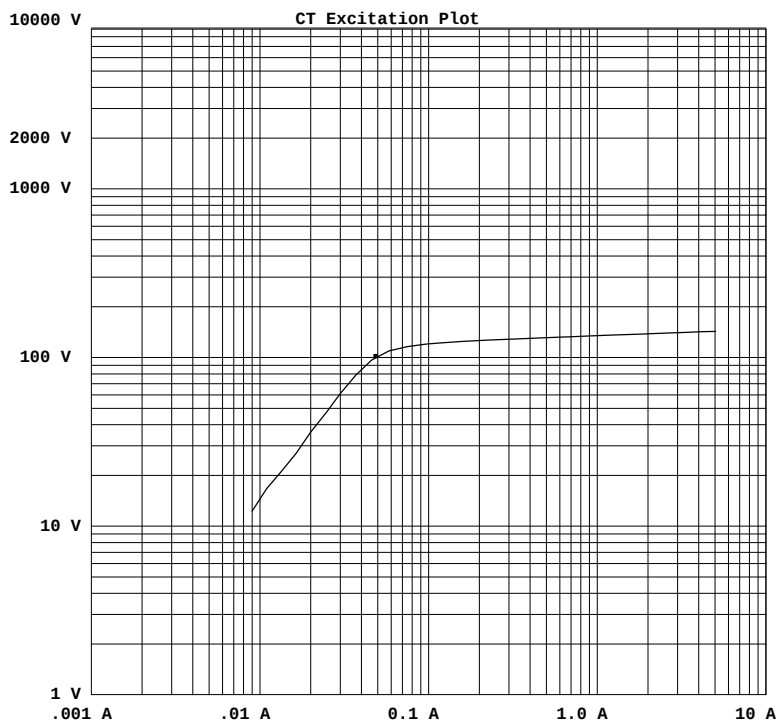
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2000/5.0	Ex V[Volts]: 66.800	Phase Angle:0.00°
Vkp[Volts]: 101.96	Vkp[Volts]: 83.08	Vkp[Volts]: 103.36	M-RATIO: 400.162	Ex I[Amps]: 0.032	In Phase
Ikp[Amps]: 0.0486	Ikp[Amps]: 0.0388	Ikp[Amps]: 0.0524	% ERROR: 0.0404	Winding Res: 355.44 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	12.28	1364.44	17	0.2554	127.56	499.45
2	0.0110	16.76	1523.64	18	0.3002	128.52	428.11
3	0.0134	21.08	1573.13	19	0.3548	129.32	364.49
4	0.0164	27.04	1648.78	20	0.4526	130.68	288.73
5	0.0200	36.20	1810.00	21	0.5668	131.76	232.46
6	0.0250	47.84	1913.60	22	0.6806	132.84	195.18
7	0.0298	60.72	2037.58	23	0.7922	133.52	168.54
8	0.0372	79.04	2124.73	24	0.9722	134.60	138.45
9	0.0460	96.60	2100.00	25	1.2080	135.80	112.42
10	0.0582	109.44	1880.41	26	1.4856	136.88	92.14
11	0.0750	116.20	1549.33	27	1.8080	137.84	76.24
12	0.0956	120.00	1255.23	28	2.2234	138.92	62.48
13	0.1084	121.20	1118.08	29	2.7980	140.24	50.12
14	0.1256	122.68	976.75	30	3.3984	141.08	41.51
15	0.1568	124.44	793.62	31	4.1028	142.16	34.65
16	0.2188	126.76	579.34	32	5.0376	142.96	28.38

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	1.40	1400.00	12	0.2000	126.00	630.00
2	0.0020	2.70	1350.00	13	0.4000	130.00	325.00
3	0.0040	5.40	1350.00	14	0.5000	131.10	262.20
4	0.0050	6.80	1360.00	15	0.8000	133.60	167.00
5	0.0080	10.90	1362.50	16	1.0000	134.80	134.80
6	0.0100	14.50	1450.00	17	2.0000	138.30	69.15
7	0.0200	36.20	1810.00	18	4.0000	142.00	35.50
8	0.0400	84.60	2115.00	19	5.0000	142.90	28.58
9	0.0500	100.80	2016.00				
10	0.0800	117.10	1463.75				
11	0.1000	120.40	1204.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

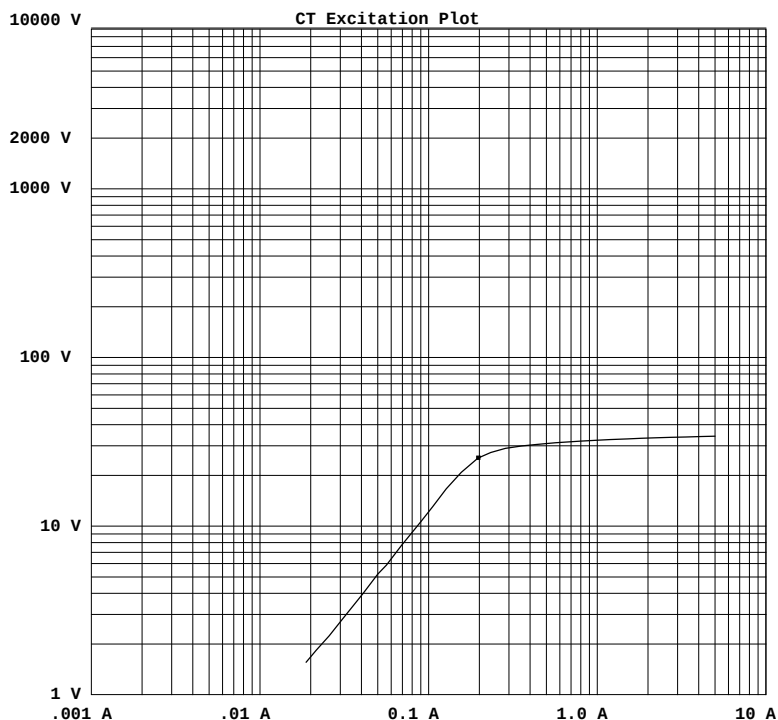
TEST # 4: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 500/5.0	Ex V[Volts]: 17.300	Phase Angle:0.00°
Vkp[Volts]: 25.44	Vkp[Volts]: 20.24	Vkp[Volts]: 26.84	M-RATIO: 100.108	Ex I[Amps]: 0.131	In Phase
Ikp[Amps]: 0.1974	Ikp[Amps]: 0.1518	Ikp[Amps]: 0.2242	% ERROR: 0.1075	Winding Res: 126.47 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0188	1.56	82.98	17	0.4336	30.52	70.39
2	0.0216	1.84	85.19	18	0.5642	31.24	55.37
3	0.0258	2.24	86.82	19	0.6686	31.60	47.26
4	0.0308	2.80	90.91	20	0.7914	31.92	40.33
5	0.0410	4.00	97.56	21	1.0082	32.36	32.10
6	0.0500	5.20	104.00	22	1.1980	32.64	27.25
7	0.0562	5.88	104.63	23	1.5102	32.96	21.82
8	0.0690	7.68	111.30	24	1.8274	33.20	18.17
9	0.0898	10.60	118.04	25	2.2234	33.44	15.04
10	0.1058	13.04	123.25	26	2.7460	33.64	12.25
11	0.1272	16.64	130.82	27	3.3596	33.80	10.06
12	0.1564	20.88	133.50	28	4.1548	34.00	8.18
13	0.1962	25.32	129.05	29	5.0020	34.16	6.83
14	0.2336	27.36	117.12				
15	0.2858	28.96	101.33				
16	0.3568	29.92	83.86				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	25.50	127.50
2	0.0020	0.20	100.00	13	0.4000	30.20	75.50
3	0.0040	0.30	75.00	14	0.5000	30.90	61.80
4	0.0050	0.40	80.00	15	0.8000	31.90	39.87
5	0.0080	0.70	87.50	16	1.0000	32.40	32.40
6	0.0100	0.80	80.00	17	2.0000	33.30	16.65
7	0.0200	1.70	85.00	18	4.0000	34.00	8.50
8	0.0400	3.90	97.50	19	5.0000	34.20	6.84
9	0.0500	5.20	104.00				
10	0.0800	9.20	115.00				
11	0.1000	12.20	122.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

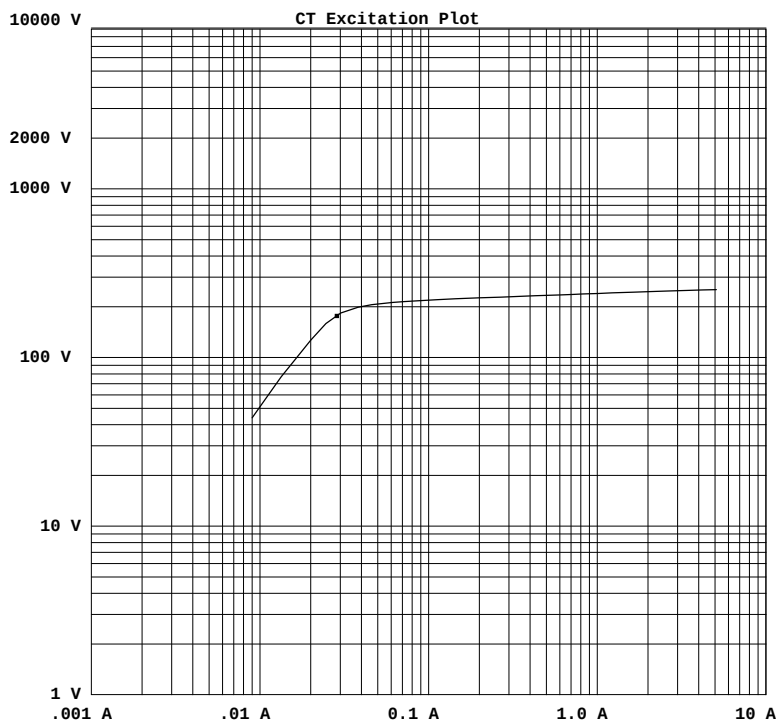
TEST # 5: X2-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3500/5.0	Ex V[Volts]: 97.800	Phase Angle:0.06°
Vkp[Volts]: 176.24	Vkp[Volts]: 148.12	Vkp[Volts]: 185.76	M-RATIO: 700.205	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0286	Ikp[Amps]: 0.0230	Ikp[Amps]: 0.0312	% ERROR: 0.0293	Winding Res: 622.14 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	43.92	4880.00	17	0.3474	230.52	663.56
2	0.0110	58.36	5305.45	18	0.4292	232.40	541.47
3	0.0134	77.04	5749.25	19	0.6066	235.40	388.06
4	0.0164	98.92	6031.71	20	0.7162	237.00	330.91
5	0.0200	126.76	6338.00	21	0.8206	238.08	290.13
6	0.0246	158.92	6460.16	22	1.0202	240.00	235.25
7	0.0302	183.76	6084.77	23	1.2256	241.88	197.36
8	0.0382	198.92	5207.33	24	1.6326	244.04	149.48
9	0.0460	205.68	4471.30	25	1.8436	245.40	133.11
10	0.0612	212.16	3466.67	26	2.2332	247.00	110.60
11	0.0710	214.56	3021.97	27	2.7266	248.36	91.09
12	0.0854	217.00	2540.98	28	3.3920	250.24	73.77
13	0.1116	220.24	1973.48	29	4.1904	251.60	60.04
14	0.1444	222.96	1544.04	30	5.0896	252.96	49.70
15	0.2008	225.92	1125.10				
16	0.2686	228.36	850.19				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	4.90	4900.00	12	0.2000	225.90	1129.50
2	0.0020	9.80	4900.00	13	0.4000	231.70	579.25
3	0.0040	19.50	4875.00	14	0.5000	233.60	467.20
4	0.0050	24.40	4880.00	15	0.8000	237.90	297.38
5	0.0080	39.00	4875.00	16	1.0000	239.80	239.80
6	0.0100	51.20	5120.00	17	2.0000	246.00	123.00
7	0.0200	126.80	6340.00	18	4.0000	251.30	62.83
8	0.0400	200.50	5012.50	19	5.0000	252.80	50.56
9	0.0500	207.40	4148.00				
10	0.0800	216.10	2701.25				
11	0.1000	218.80	2188.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

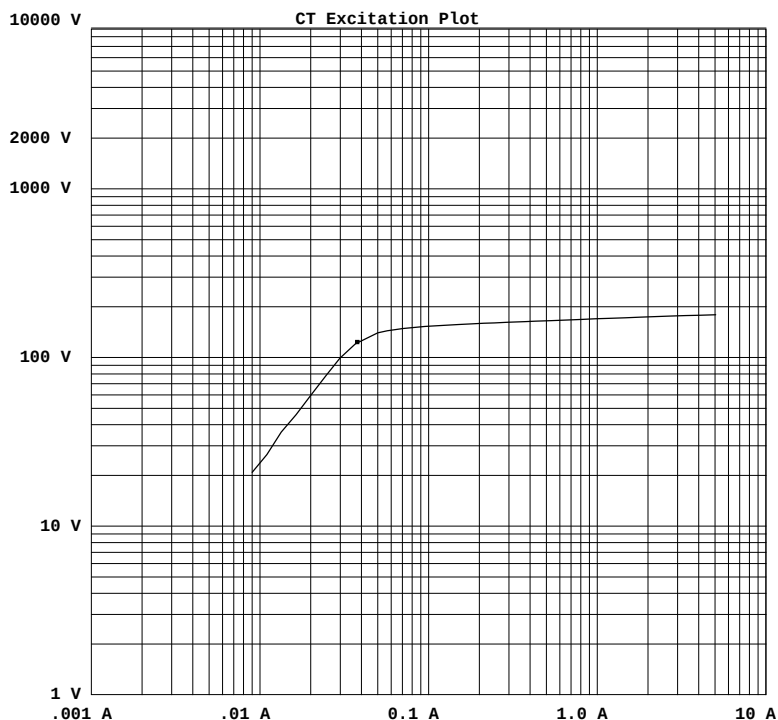
TEST # 6: X2-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2500/5.0	Ex V[Volts]: 79.900	Phase Angle:0.04°
Vkp[Volts]: 123.52	Vkp[Volts]: 103.72	Vkp[Volts]: 131.60	M-RATIO: 500.238	Ex I[Amps]: 0.025	In Phase
Ikp[Amps]: 0.0378	Ikp[Amps]: 0.0310	Ikp[Amps]: 0.0442	% ERROR: 0.0476	Winding Res: 445.71 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	20.88	2320.00	17	0.2460	160.52	652.52
2	0.0110	26.60	2418.18	18	0.2924	161.88	553.63
3	0.0134	36.16	2698.51	19	0.3732	163.24	437.41
4	0.0164	45.88	2797.56	20	0.4316	164.32	380.72
5	0.0200	59.64	2982.00	21	0.5274	165.40	313.61
6	0.0246	78.12	3175.61	22	0.6948	167.28	240.76
7	0.0298	99.04	3323.49	23	0.8148	168.36	206.63
8	0.0368	120.52	3275.00	24	0.9796	169.72	173.25
9	0.0500	140.00	2800.00	25	1.2100	171.08	141.39
10	0.0570	144.04	2527.02	26	1.4688	172.16	117.21
11	0.0706	148.64	2105.38	27	1.7982	173.52	96.50
12	0.0952	152.96	1606.72	28	2.2850	175.12	76.64
13	0.1066	154.04	1445.03	29	2.7428	176.20	64.24
14	0.1506	157.00	1042.50	30	3.3660	177.28	52.67
15	0.1798	158.36	880.76	31	4.0932	178.36	43.57
16	0.2126	159.72	751.27	32	5.0376	179.44	35.62

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	2.30	2300.00	12	0.2000	159.20	796.00
2	0.0020	4.60	2300.00	13	0.4000	163.70	409.25
3	0.0040	9.30	2325.00	14	0.5000	165.10	330.20
4	0.0050	11.60	2320.00	15	0.8000	168.20	210.25
5	0.0080	18.60	2325.00	16	1.0000	169.80	169.80
6	0.0100	23.80	2380.00	17	2.0000	174.20	87.10
7	0.0200	59.60	2980.00	18	4.0000	178.20	44.55
8	0.0400	125.20	3130.00	19	5.0000	179.40	35.88
9	0.0500	140.00	2800.00				
10	0.0800	150.30	1878.75				
11	0.1000	153.40	1534.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

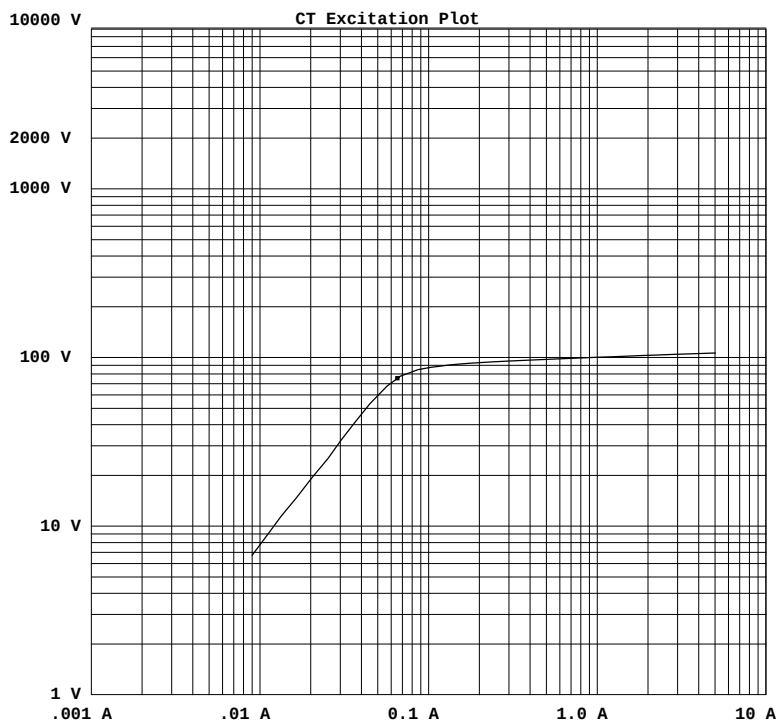
TEST # 7: X2-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1500/5.0	Ex V[Volts]: 51.000	Phase Angle:0.00°
Vkp[Volts]: 75.32	Vkp[Volts]: 61.52	Vkp[Volts]: 79.16	M-RATIO: 300.251	Ex I[Amps]: 0.044	In Phase
Ikp[Amps]: 0.0654	Ikp[Amps]: 0.0516	Ikp[Amps]: 0.0720	% ERROR: 0.0835	Winding Res: 283.96 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	6.72	746.67	17	0.2434	94.32	387.51
2	0.0110	8.80	800.00	18	0.2898	95.12	328.23
3	0.0134	11.48	856.72	19	0.3868	96.48	249.43
4	0.0164	14.68	895.12	20	0.4288	96.88	225.93
5	0.0204	19.44	952.94	21	0.5528	97.96	177.21
6	0.0254	25.28	995.28	22	0.6788	98.76	145.49
7	0.0302	32.20	1066.23	23	0.8468	99.72	117.76
8	0.0368	41.60	1130.43	24	0.9804	100.28	102.28
9	0.0450	53.32	1184.89	25	1.1988	101.08	84.32
10	0.0566	67.56	1193.64	26	1.4852	101.88	68.60
11	0.0680	77.56	1140.59	27	1.8242	102.68	56.29
12	0.0866	84.72	978.29	28	2.2364	103.52	46.29
13	0.1026	87.44	852.24	29	2.7688	104.32	37.68
14	0.1376	90.68	659.01	30	3.3888	105.00	30.98
15	0.1748	92.44	528.83	31	4.1354	105.68	25.55
16	0.1950	93.12	477.54	32	5.0248	106.36	21.17

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.80	800.00	12	0.2000	93.20	466.00
2	0.0020	1.50	750.00	13	0.4000	96.60	241.50
3	0.0040	3.00	750.00	14	0.5000	97.50	195.00
4	0.0050	3.70	740.00	15	0.8000	99.40	124.25
5	0.0080	6.00	750.00	16	1.0000	100.40	100.40
6	0.0100	7.80	780.00	17	2.0000	103.00	51.50
7	0.0200	19.00	950.00	18	4.0000	105.60	26.40
8	0.0400	46.20	1155.00	19	5.0000	106.40	21.28
9	0.0500	59.40	1188.00				
10	0.0800	82.20	1027.50				
11	0.1000	87.00	870.00				



FILENAME: X1-CTX.test

DATE: 08/27/20 16:45:36

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X1-CTX

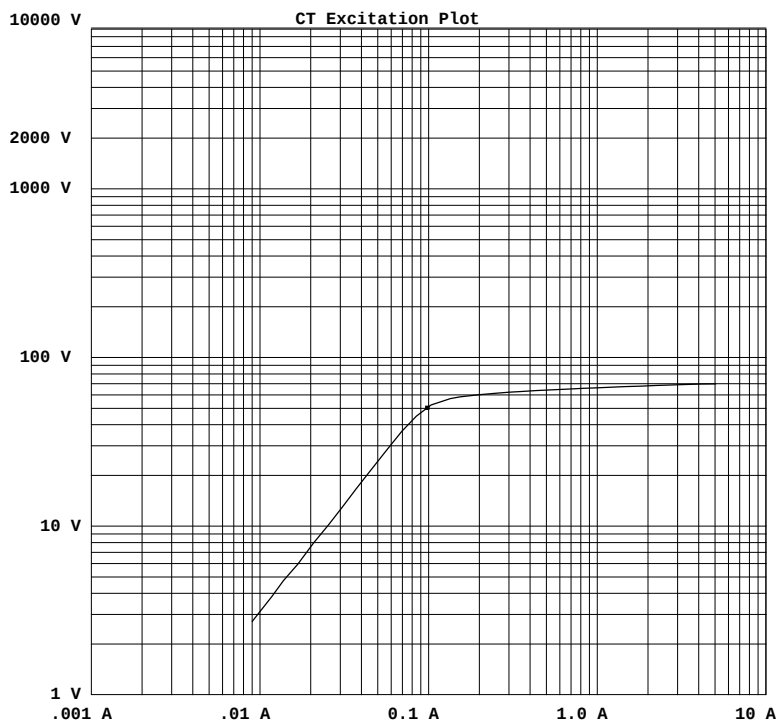
TEST # 8: X3-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1000/5.0	Ex V[Volts]: 34.200	Phase Angle:0.00°
Vkp[Volts]: 50.32	Vkp[Volts]: 41.76	Vkp[Volts]: 53.16	M-RATIO: 200.137	Ex I[Amps]: 0.066	In Phase
Ikp[Amps]: 0.0984	Ikp[Amps]: 0.0790	Ikp[Amps]: 0.1094	% ERROR: 0.0685	Winding Res: 221.02 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	2.72	302.22	17	0.2476	61.40	247.98
2	0.0118	3.84	325.42	18	0.3002	62.28	207.46
3	0.0138	4.76	344.93	19	0.3510	62.92	179.26
4	0.0168	5.96	354.76	20	0.4316	63.64	147.45
5	0.0208	7.96	382.69	21	0.5704	64.52	113.11
6	0.0254	10.12	398.43	22	0.6604	64.92	98.30
7	0.0308	12.96	420.78	23	0.8182	65.60	80.18
8	0.0372	16.64	447.31	24	0.9832	66.16	67.29
9	0.0454	21.44	472.25	25	1.2560	66.76	53.15
10	0.0562	28.16	501.07	26	1.4642	67.24	45.92
11	0.0694	36.48	525.65	27	1.8372	67.76	36.88
12	0.0846	44.92	530.97	28	2.2202	68.24	30.74
13	0.1034	52.28	505.61	29	2.7362	68.72	25.12
14	0.1346	57.04	423.77	30	3.3206	69.20	20.84
15	0.1540	58.44	379.48	31	4.1320	69.60	16.84
16	0.1982	60.20	303.73	32	5.0572	69.84	13.81

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.30	300.00	12	0.2000	60.20	301.00
2	0.0020	0.60	300.00	13	0.4000	63.40	158.50
3	0.0040	1.20	300.00	14	0.5000	64.10	128.20
4	0.0050	1.50	300.00	15	0.8000	65.50	81.88
5	0.0080	2.40	300.00	16	1.0000	66.20	66.20
6	0.0100	3.10	310.00	17	2.0000	68.00	34.00
7	0.0200	7.60	380.00	18	4.0000	69.50	17.38
8	0.0400	18.30	457.50	19	5.0000	69.80	13.96
9	0.0500	24.30	486.00				
10	0.0800	42.40	530.00				
11	0.1000	51.00	510.00				



FILENAME: X1-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 16:45:36

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

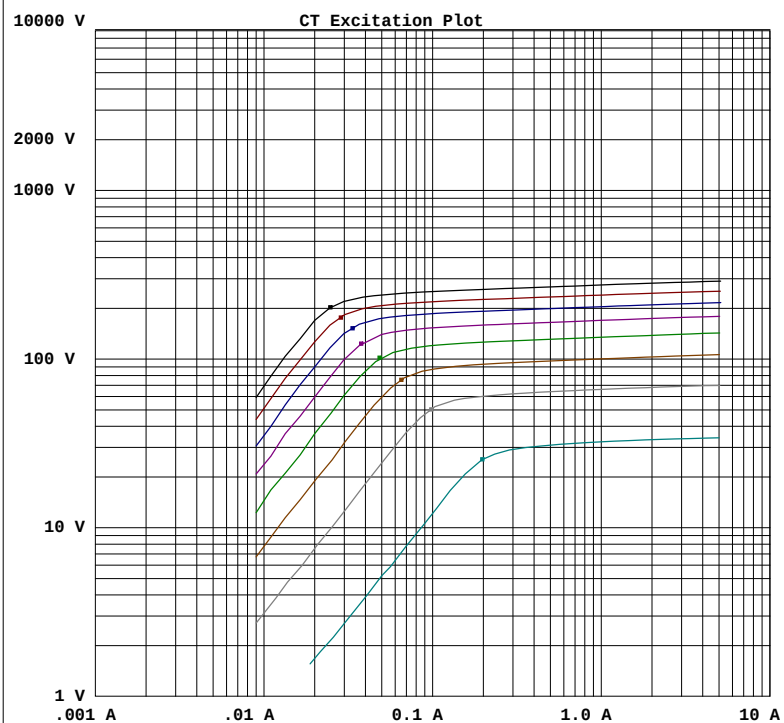
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X1-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	25.44/0.1974	20.24/0.1518	26.84/0.2242	500/5.0	100.108	0.108 %	0.00° [In Ø]	126.47 m-ohms
2	X1-X3	101.96/0.0486	83.08/0.0388	103.36/0.0524	2000/5.0	400.162	0.040 %	0.00° [In Ø]	355.44 m-ohms
3	X1-X4	152.28/0.0336	129.44/0.0272	160.16/0.0364	3000/5.0	600.195	0.033 %	0.04° [In Ø]	517.44 m-ohms
4	X1-X5	202.76/0.0248	170.12/0.0200	211.04/0.0272	4000/5.0	800.120	0.015 %	0.08° [In Ø]	693.63 m-ohms
5	X2-X3	75.32/0.0654	61.52/0.0516	79.16/0.0720	1500/5.0	300.251	0.084 %	0.00° [In Ø]	283.96 m-ohms
6	X2-X4	123.52/0.0378	103.72/0.0310	131.60/0.0442	2500/5.0	500.238	0.048 %	0.04° [In Ø]	445.71 m-ohms
7	X2-X5	176.24/0.0286	148.12/0.0230	185.76/0.0312	3500/5.0	700.205	0.029 %	0.06° [In Ø]	622.14 m-ohms
8	X3-X4	50.32/0.0984	41.76/0.0790	53.16/0.1094	1000/5.0	200.137	0.069 %	0.00° [In Ø]	221.02 m-ohms

Test Notepad





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FILENAME: X1-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 16:45:36

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X1-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	4000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	3000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	2000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	3500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	2500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	1500/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	1000/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.6936 Ohm Rct75: 0.8273 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.92	Vsec: 91.83
Class: C20	Br: 0.18	Bi: 0.09	Btot: 1.01	Vsec: 101.10
Class: C50	Br: 0.45	Bi: 0.22	Btot: 1.30	Vsec: 129.57
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.58	Vsec: 158.48
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.52	Vsec: 251.77
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.47	Vsec: 447.14
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.44	Vsec: 844.41



FILENAME: X2-CTS.test

DATE: 08/27/20 17:10:19

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTS

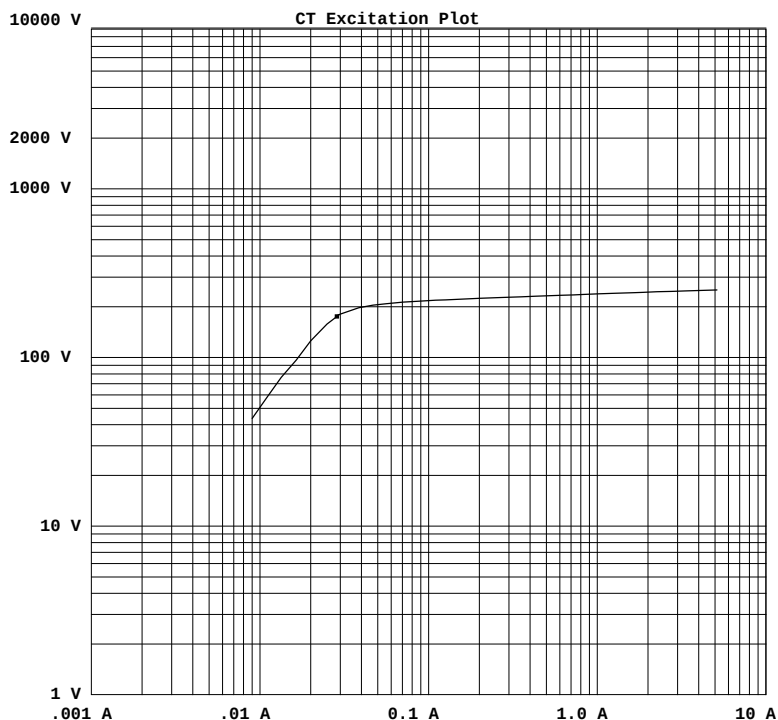
TEST # 1: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3480/5.0	Ex V[Volts]: 98.700	Phase Angle:0.08°
Vkp[Volts]: 175.08	Vkp[Volts]: 144.36	Vkp[Volts]: 183.52	M-RATIO: 695.895	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0286	Ikp[Amps]: 0.0228	Ikp[Amps]: 0.0312	% ERROR: 0.0150	Winding Res: 606.30 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	43.56	4840.00	17	0.3532	229.16	648.81
2	0.0110	57.96	5269.09	18	0.4336	231.08	532.93
3	0.0134	76.36	5698.51	19	0.6234	234.04	375.43
4	0.0164	96.48	5882.93	20	0.7248	235.40	324.78
5	0.0200	125.52	6276.00	21	0.8304	236.72	285.07
6	0.0250	158.08	6323.20	22	1.0276	238.64	232.23
7	0.0298	180.52	6057.72	23	1.2482	240.52	192.69
8	0.0386	197.56	5118.13	24	1.6586	242.68	146.32
9	0.0468	204.32	4365.81	25	1.8696	243.76	130.38
10	0.0562	208.64	3712.46	26	2.2656	245.64	108.42
11	0.0706	212.96	3016.43	27	2.7622	247.00	89.42
12	0.0920	216.48	2353.04	28	3.3368	248.64	74.51
13	0.1100	218.92	1990.18	29	4.1126	250.00	60.79
14	0.1268	220.00	1735.02	30	5.1286	251.60	49.06
15	0.2024	224.56	1109.49				
16	0.2722	227.00	833.95				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	4.80	4800.00	12	0.2000	224.40	1122.00
2	0.0020	9.70	4850.00	13	0.4000	230.30	575.75
3	0.0040	19.40	4850.00	14	0.5000	232.10	464.20
4	0.0050	24.20	4840.00	15	0.8000	236.30	295.38
5	0.0080	38.70	4837.50	16	1.0000	238.40	238.40
6	0.0100	50.80	5080.00	17	2.0000	244.40	122.20
7	0.0200	125.50	6275.00	18	4.0000	249.80	62.45
8	0.0400	198.70	4967.50	19	5.0000	251.40	50.28
9	0.0500	205.80	4116.00				
10	0.0800	214.50	2681.25				
11	0.1000	217.60	2176.00				



FILENAME: X2-CTS.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 17:10:19

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

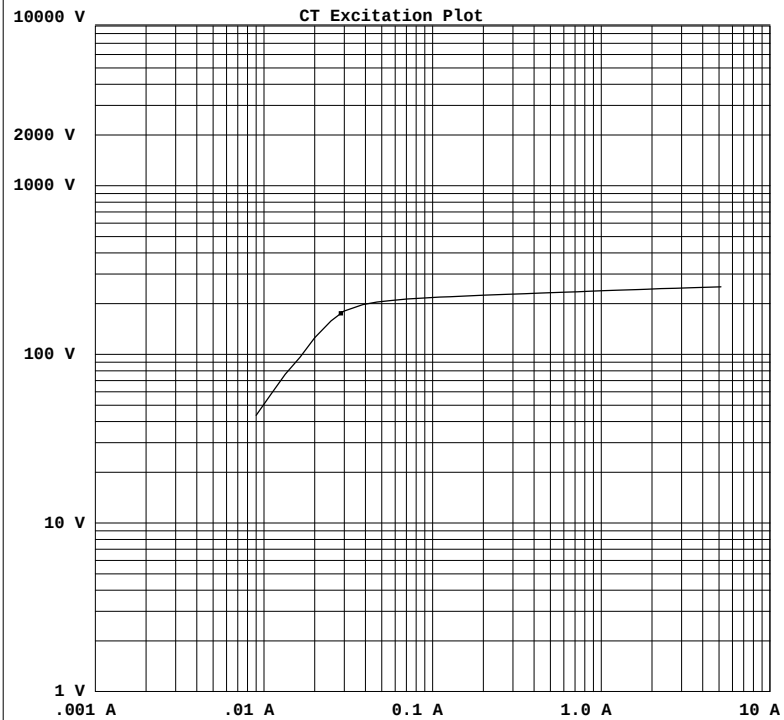
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X2-CTS

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	175.08/0.0286	144.36/0.0228	183.52/0.0312	3480/5.0	695.895	0.015 %	0.08° [In Ø]	606.30 m-ohms

Test Notepad





FILENAME: X2-CTS.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 17:10:19

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X2-CTS

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X2	3480/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C100 for Single Tap: X1-X2

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.6063 Ohm Rct75: 0.7231 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.81	Vsec: 81.43
Class: C20	Br: 0.18	Bi: 0.09	Btot: 0.91	Vsec: 90.73
Class: C50	Br: 0.45	Bi: 0.22	Btot: 1.19	Vsec: 119.32
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.50	Vsec: 149.87
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.44	Vsec: 244.32
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.41	Vsec: 440.63
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.38	Vsec: 838.50



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

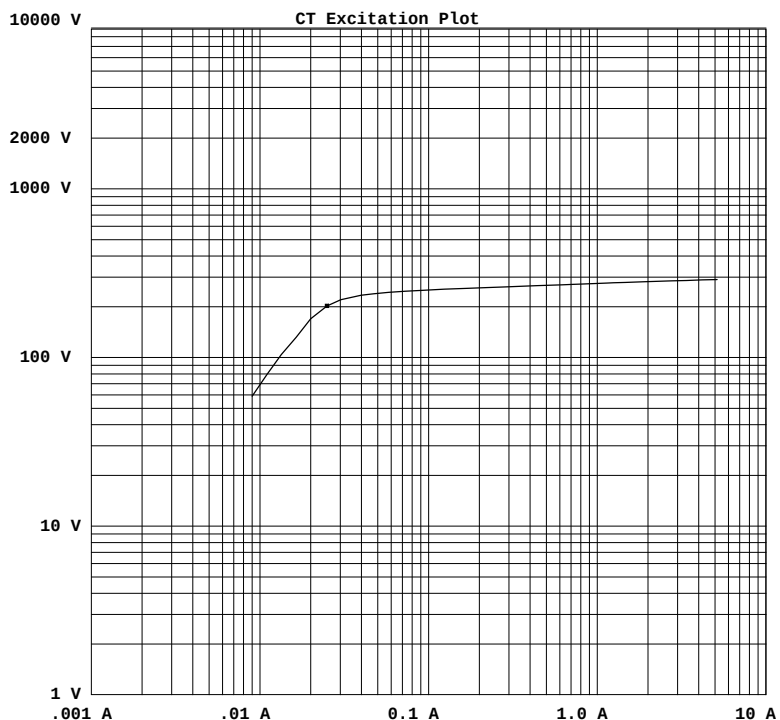
TEST # 1: X1-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 4000/5.0	Ex V[Volts]: 137.800	Phase Angle:0.02°
Vkp[Volts]: 202.40	Vkp[Volts]: 167.56	Vkp[Volts]: 209.72	M-RATIO: 800.411	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0250	Ikp[Amps]: 0.0198	Ikp[Amps]: 0.0270	% ERROR: 0.0514	Winding Res: 695.71 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	59.04	6560.00	17	0.3540	264.56	747.34
2	0.0110	79.32	7210.91	18	0.4406	266.72	605.36
3	0.0134	104.20	7776.12	19	0.6184	269.96	436.55
4	0.0164	131.88	8041.46	20	0.7196	271.60	377.43
5	0.0200	170.00	8500.00	21	0.8152	272.96	334.84
6	0.0250	202.40	8096.00	22	1.1394	276.72	242.86
7	0.0302	220.52	7301.99	23	1.2478	277.80	222.63
8	0.0398	234.04	5880.40	24	1.4712	278.88	189.56
9	0.0472	238.92	5061.86	25	1.8566	281.08	151.40
10	0.0578	243.48	4212.46	26	2.2786	283.24	124.30
11	0.0726	247.28	3406.06	27	2.7752	284.84	102.64
12	0.0936	250.80	2679.49	28	3.3790	286.48	84.78
13	0.1244	254.32	2044.37	29	4.1840	288.64	68.99
14	0.1688	257.28	1524.17	30	5.1416	290.24	56.45
15	0.2238	260.24	1162.82				
16	0.2850	262.40	920.70				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	6.60	6600.00	12	0.2000	259.00	1295.00
2	0.0020	13.10	6550.00	13	0.4000	265.70	664.25
3	0.0040	26.20	6550.00	14	0.5000	267.80	535.60
4	0.0050	32.80	6560.00	15	0.8000	272.80	341.00
5	0.0080	52.50	6562.50	16	1.0000	275.10	275.10
6	0.0100	69.20	6920.00	17	2.0000	281.80	140.90
7	0.0200	170.00	8500.00	18	4.0000	288.20	72.05
8	0.0400	234.20	5855.00	19	5.0000	290.00	58.00
9	0.0500	240.10	4802.00				
10	0.0800	248.50	3106.25				
11	0.1000	251.50	2515.00				



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FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

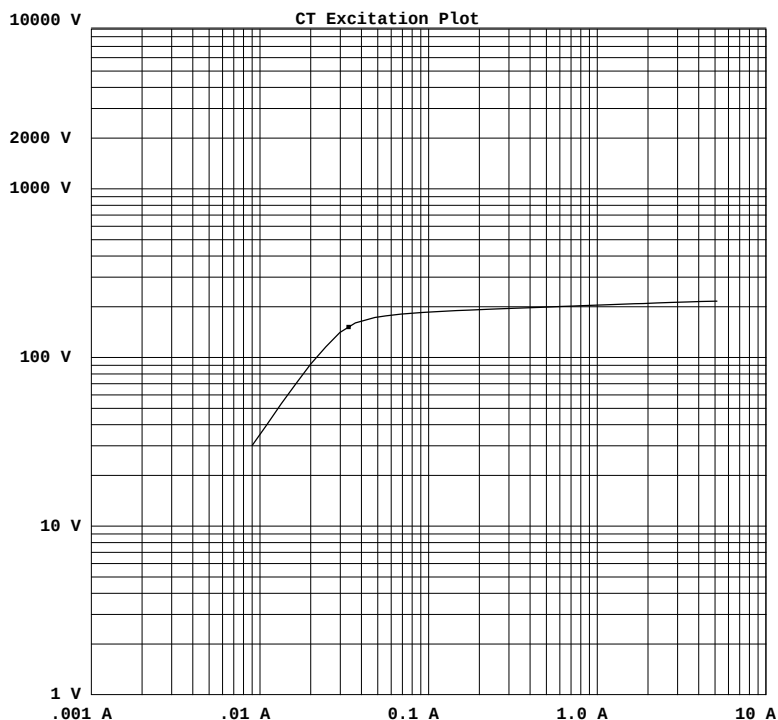
TEST # 2: X1-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3000/5.0	Ex V[Volts]: 97.600	Phase Angle:0.00°
Vkp[Volts]: 151.76	Vkp[Volts]: 129.00	Vkp[Volts]: 159.60	M-RATIO: 600.048	Ex I[Amps]: 0.022	In Phase
Ikp[Amps]: 0.0336	Ikp[Amps]: 0.0274	Ikp[Amps]: 0.0364	% ERROR: 0.0080	Winding Res: 518.76 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	30.08	3342.22	17	0.2340	193.48	826.84
2	0.0110	40.00	3636.36	18	0.3112	195.68	628.79
3	0.0134	53.24	3973.13	19	0.4000	197.56	493.90
4	0.0164	70.28	4285.37	20	0.4550	198.36	435.96
5	0.0200	91.48	4574.00	21	0.6148	200.80	326.61
6	0.0246	115.80	4707.32	22	0.7026	201.88	287.33
7	0.0298	140.80	4724.83	23	0.8198	202.96	247.57
8	0.0368	160.52	4361.96	24	1.0498	204.84	195.12
9	0.0480	172.68	3597.50	25	1.2536	206.20	164.49
10	0.0558	176.76	3167.74	26	1.6684	208.36	124.89
11	0.0684	180.80	2643.27	27	1.8728	209.16	111.68
12	0.0910	184.84	2031.21	28	2.2754	210.80	92.64
13	0.1058	186.48	1762.57	29	2.7460	212.40	77.35
14	0.1458	189.72	1301.23	30	3.4146	213.48	62.52
15	0.1740	191.08	1098.16	31	4.1418	215.12	51.94
16	0.2016	192.40	954.37	32	5.1318	216.20	42.13

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	3.30	3300.00	12	0.2000	192.30	961.50
2	0.0020	6.70	3350.00	13	0.4000	197.60	494.00
3	0.0040	13.40	3350.00	14	0.5000	199.00	398.00
4	0.0050	16.70	3340.00	15	0.8000	202.80	253.50
5	0.0080	26.80	3350.00	16	1.0000	204.40	204.40
6	0.0100	35.00	3500.00	17	2.0000	209.70	104.85
7	0.0200	91.50	4575.00	18	4.0000	214.80	53.70
8	0.0400	164.00	4100.00	19	5.0000	216.00	43.20
9	0.0500	173.70	3474.00				
10	0.0800	182.90	2286.25				
11	0.1000	185.80	1858.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

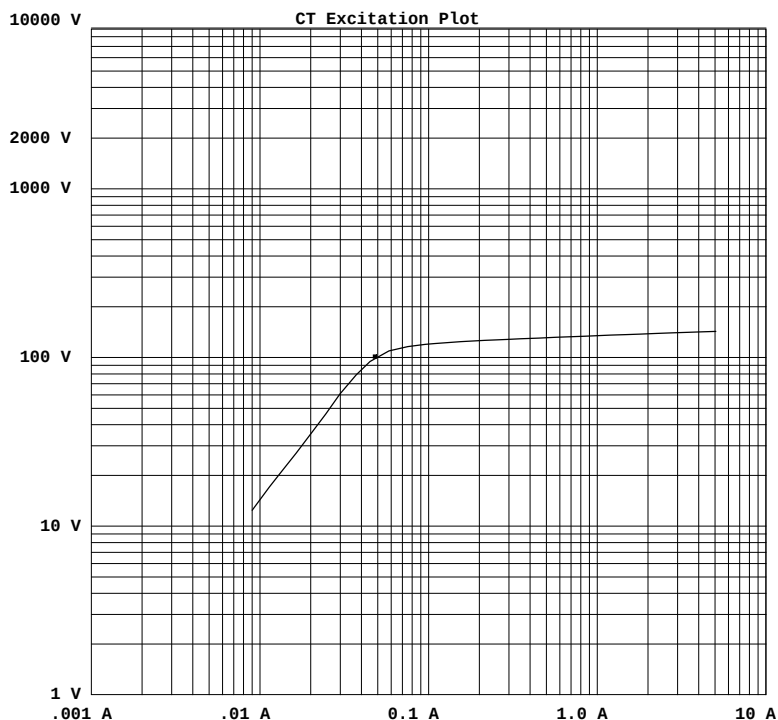
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2000/5.0	Ex V[Volts]: 65.600	Phase Angle: -0.04°
Vkp[Volts]: 101.12	Vkp[Volts]: 83.88	Vkp[Volts]: 102.40	M-RATIO: 400.167	Ex I[Amps]: 0.032	In Phase
Ikp[Amps]: 0.0482	Ikp[Amps]: 0.0392	Ikp[Amps]: 0.0518	% ERROR: 0.0418	Winding Res: 366.51 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	12.44	1382.22	17	0.2952	128.24	434.42
2	0.0114	17.08	1498.25	18	0.3520	129.16	366.93
3	0.0134	21.00	1567.16	19	0.4492	130.52	290.56
4	0.0164	27.12	1653.66	20	0.5606	131.76	235.03
5	0.0204	36.20	1774.51	21	0.6714	132.68	197.62
6	0.0246	46.40	1886.18	22	0.8526	133.92	157.07
7	0.0298	60.72	2037.58	23	1.0396	135.00	129.86
8	0.0372	78.92	2121.51	24	1.2076	135.80	112.45
9	0.0450	94.72	2104.89	25	1.4922	136.88	91.73
10	0.0582	109.44	1880.41	26	1.7982	137.68	76.57
11	0.0754	116.20	1541.11	27	2.2136	138.92	62.76
12	0.0956	119.72	1252.30	28	2.7914	140.24	50.24
13	0.1088	121.08	1112.87	29	3.4082	141.08	41.39
14	0.1556	124.32	798.97	30	4.1094	141.88	34.53
15	0.2152	126.48	587.73	31	5.0474	142.96	28.32
16	0.2534	127.44	502.92				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	1.40	1400.00	12	0.2000	125.90	629.50
2	0.0020	2.80	1400.00	13	0.4000	129.80	324.50
3	0.0040	5.50	1375.00	14	0.5000	131.10	262.20
4	0.0050	6.90	1380.00	15	0.8000	133.60	167.00
5	0.0080	11.00	1375.00	16	1.0000	134.80	134.80
6	0.0100	14.40	1440.00	17	2.0000	138.30	69.15
7	0.0200	35.30	1765.00	18	4.0000	141.80	35.45
8	0.0400	84.60	2115.00	19	5.0000	142.90	28.58
9	0.0500	100.30	2006.00				
10	0.0800	117.00	1462.50				
11	0.1000	120.20	1202.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

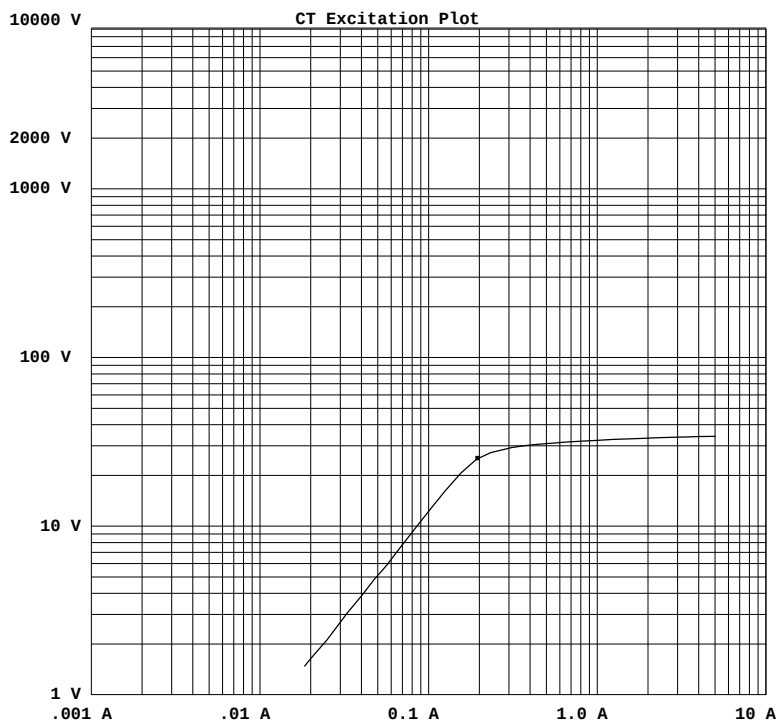
TEST # 4: X1-X2

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 500/5.0	Ex V[Volts]: 17.000	Phase Angle: -0.08°
Vkp[Volts]: 25.32	Vkp[Volts]: 20.44	Vkp[Volts]: 26.28	M-RATIO: 100.085	Ex I[Amps]: 0.130	In Phase
Ikp[Amps]: 0.1954	Ikp[Amps]: 0.1540	Ikp[Amps]: 0.2164	% ERROR: 0.0847	Winding Res: 128.30 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0184	1.48	80.43	17	0.4296	30.48	70.95
2	0.0200	1.64	82.00	18	0.5660	31.20	55.12
3	0.0250	2.12	84.80	19	0.6682	31.56	47.23
4	0.0328	3.04	92.68	20	0.8090	31.92	39.46
5	0.0402	3.88	96.52	21	1.0082	32.32	32.06
6	0.0476	4.84	101.68	22	1.2412	32.68	26.33
7	0.0562	5.84	103.91	23	1.5140	32.92	21.74
8	0.0680	7.48	110.00	24	1.8274	33.16	18.15
9	0.0882	10.44	118.37	25	2.2202	33.40	15.04
10	0.1042	12.88	123.61	26	2.7526	33.64	12.22
11	0.1256	16.24	129.30	27	3.3206	33.80	10.18
12	0.1556	20.68	132.90	28	4.0802	34.00	8.33
13	0.1918	24.88	129.72	29	5.0052	34.12	6.82
14	0.2332	27.28	116.98				
15	0.3108	29.24	94.08				
16	0.3740	30.04	80.32				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	25.40	127.00
2	0.0020	0.20	100.00	13	0.4000	30.20	75.50
3	0.0040	0.30	75.00	14	0.5000	30.80	61.60
4	0.0050	0.40	80.00	15	0.8000	31.90	39.87
5	0.0080	0.60	75.00	16	1.0000	32.30	32.30
6	0.0100	0.80	80.00	17	2.0000	33.30	16.65
7	0.0200	1.60	80.00	18	4.0000	34.00	8.50
8	0.0400	3.80	95.00	19	5.0000	34.10	6.82
9	0.0500	5.10	102.00				
10	0.0800	9.20	115.00				
11	0.1000	12.20	122.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

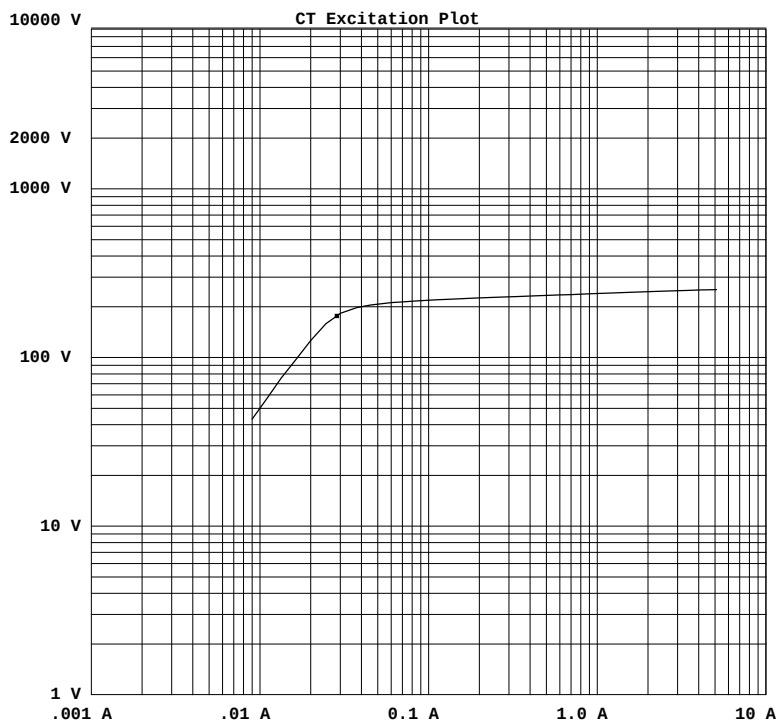
TEST # 5: X2-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3500/5.0	Ex V[Volts]: 98.800	Phase Angle:0.02°
Vkp[Volts]: 176.32	Vkp[Volts]: 148.56	Vkp[Volts]: 185.68	M-RATIO: 700.014	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0286	Ikp[Amps]: 0.0232	Ikp[Amps]: 0.0314	% ERROR: 0.0021	Winding Res: 621.38 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	43.16	4795.56	17	0.3408	230.24	675.59
2	0.0110	57.16	5196.36	18	0.4218	232.16	550.40
3	0.0134	75.68	5647.76	19	0.5034	233.76	464.36
4	0.0164	97.68	5956.10	20	0.5996	235.12	392.13
5	0.0200	126.20	6310.00	21	0.7072	236.48	334.39
6	0.0246	158.64	6448.78	22	0.8116	237.84	293.05
7	0.0302	183.24	6067.55	23	1.0100	240.00	237.62
8	0.0376	198.08	5268.09	24	1.2210	241.60	197.87
9	0.0454	205.12	4518.06	25	1.6358	244.04	149.19
10	0.0602	211.60	3514.95	26	1.8468	245.12	132.73
11	0.0694	213.76	3080.12	27	2.2364	246.72	110.32
12	0.0836	216.48	2589.47	28	2.7362	248.36	90.77
13	0.1088	219.72	2019.49	29	3.4018	250.24	73.56
14	0.1404	222.40	1584.05	30	4.0834	251.60	61.62
15	0.1954	225.40	1153.53	31	5.0962	252.96	49.64
16	0.2624	228.08	869.21				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	4.80	4800.00	12	0.2000	225.60	1128.00
2	0.0020	9.60	4800.00	13	0.4000	231.60	579.00
3	0.0040	19.20	4800.00	14	0.5000	233.70	467.40
4	0.0050	24.00	4800.00	15	0.8000	237.70	297.12
5	0.0080	38.40	4800.00	16	1.0000	239.90	239.90
6	0.0100	50.20	5020.00	17	2.0000	245.80	122.90
7	0.0200	126.20	6310.00	18	4.0000	251.40	62.85
8	0.0400	200.20	5005.00	19	5.0000	252.80	50.56
9	0.0500	207.10	4142.00				
10	0.0800	215.80	2697.50				
11	0.1000	218.60	2186.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

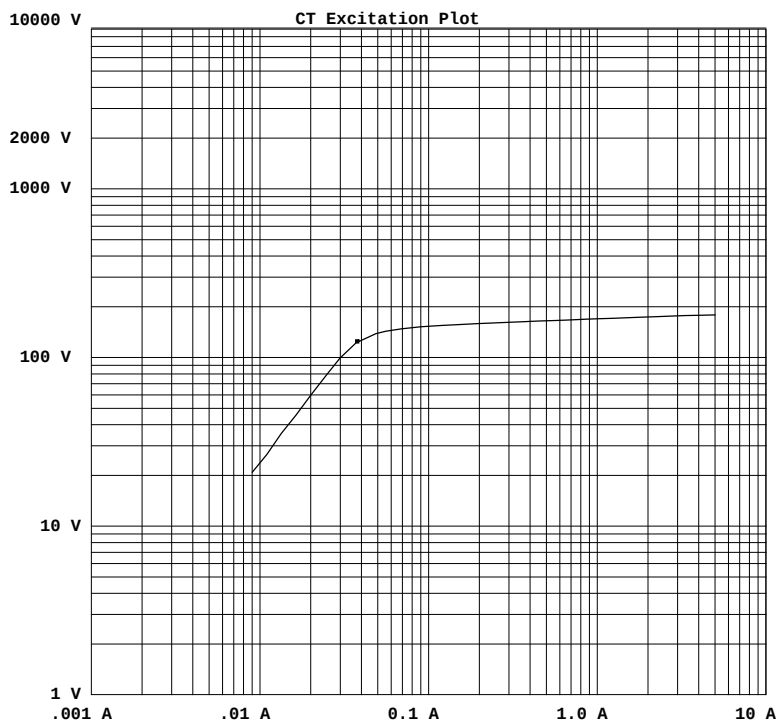
TEST # 6: X2-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2500/5.0	Ex V[Volts]: 79.800	Phase Angle:0.02°
Vkp[Volts]: 124.48	Vkp[Volts]: 105.32	Vkp[Volts]: 133.00	M-RATIO: 500.117	Ex I[Amps]: 0.025	In Phase
Ikp[Amps]: 0.0378	Ikp[Amps]: 0.0314	Ikp[Amps]: 0.0448	% ERROR: 0.0234	Winding Res: 444.76 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	20.88	2320.00	17	0.2328	160.24	688.32
2	0.0110	26.64	2421.82	18	0.3190	162.16	508.34
3	0.0134	35.48	2647.76	19	0.3544	162.96	459.82
4	0.0164	45.72	2787.80	20	0.4530	164.60	363.36
5	0.0200	59.72	2986.00	21	0.5626	165.92	294.92
6	0.0246	78.12	3175.61	22	0.6682	167.00	249.93
7	0.0298	98.92	3319.46	23	0.8464	168.64	199.24
8	0.0372	122.28	3287.10	24	1.0074	169.72	168.47
9	0.0488	138.64	2840.98	25	1.2526	171.08	136.58
10	0.0558	143.24	2567.03	26	1.6456	172.96	105.10
11	0.0690	148.08	2146.09	27	1.8436	173.52	94.12
12	0.0902	152.16	1686.92	28	2.2396	174.60	77.96
13	0.1186	154.84	1305.56	29	2.7948	176.20	63.05
14	0.1416	156.48	1105.08	30	3.3302	177.28	53.23
15	0.1678	157.84	940.64	31	4.1516	178.36	42.96
16	0.1982	159.16	803.03	32	5.0084	179.16	35.77

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	2.30	2300.00	12	0.2000	159.20	796.00
2	0.0020	4.60	2300.00	13	0.4000	163.70	409.25
3	0.0040	9.30	2325.00	14	0.5000	165.20	330.40
4	0.0050	11.60	2320.00	15	0.8000	168.20	210.25
5	0.0080	18.60	2325.00	16	1.0000	169.70	169.70
6	0.0100	23.80	2380.00	17	2.0000	174.00	87.00
7	0.0200	59.70	2985.00	18	4.0000	178.20	44.55
8	0.0400	126.20	3155.00	19	5.0000	179.20	35.84
9	0.0500	139.40	2788.00				
10	0.0800	150.20	1877.50				
11	0.1000	153.10	1531.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

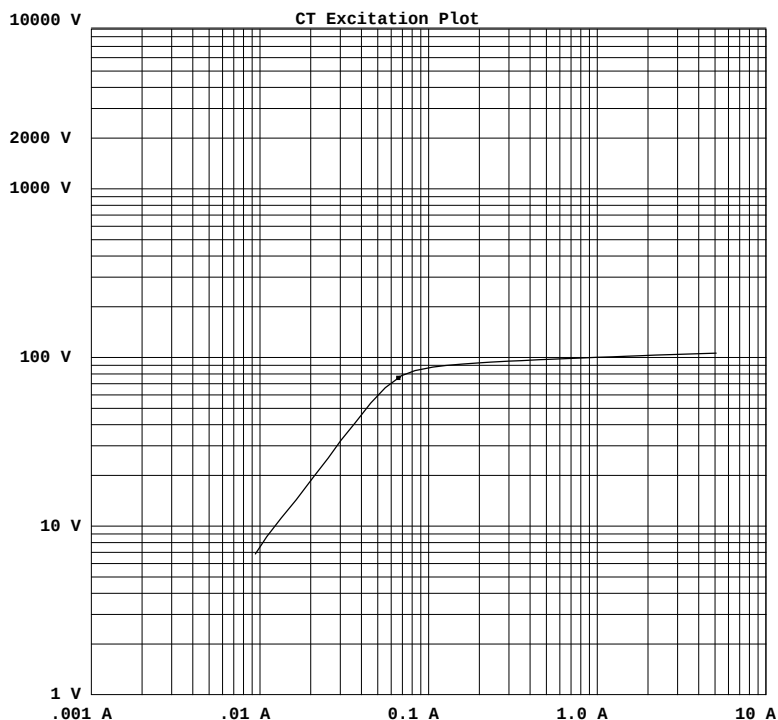
TEST # 7: X2-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1500/5.0	Ex V[Volts]: 51.600	Phase Angle: -0.04°
Vkp[Volts]: 75.68	Vkp[Volts]: 61.76	Vkp[Volts]: 79.32	M-RATIO: 300.082	Ex I[Amps]: 0.044	In Phase
Ikp[Amps]: 0.0662	Ikp[Amps]: 0.0518	Ikp[Amps]: 0.0720	% ERROR: 0.0274	Winding Res: 291.46 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0094	6.84	727.66	17	0.2336	93.92	402.05
2	0.0110	8.68	789.09	18	0.2976	95.12	319.62
3	0.0134	11.20	835.82	19	0.3528	95.92	271.88
4	0.0164	14.32	873.17	20	0.4510	97.00	215.08
5	0.0208	19.64	944.23	21	0.5650	97.96	173.38
6	0.0254	25.36	998.43	22	0.6932	98.76	142.47
7	0.0302	32.20	1066.23	23	0.8222	99.44	120.94
8	0.0368	41.16	1118.48	24	0.9930	100.28	100.99
9	0.0454	53.72	1183.26	25	1.2284	101.08	82.29
10	0.0554	66.28	1196.39	26	1.5126	101.88	67.35
11	0.0690	78.12	1132.17	27	1.8080	102.56	56.73
12	0.0832	83.76	1006.73	28	2.2170	103.36	46.62
13	0.1062	87.84	827.12	29	2.7460	104.20	37.95
14	0.1268	89.72	707.57	30	3.3530	104.84	31.27
15	0.1596	91.60	573.93	31	4.1094	105.52	25.68
16	0.2040	93.24	457.06	32	5.0766	106.20	20.92

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.70	700.00	12	0.2000	93.10	465.50
2	0.0020	1.40	700.00	13	0.4000	96.40	241.00
3	0.0040	2.90	725.00	14	0.5000	97.40	194.80
4	0.0050	3.60	720.00	15	0.8000	99.30	124.12
5	0.0080	5.80	725.00	16	1.0000	100.30	100.30
6	0.0100	7.50	750.00	17	2.0000	102.90	51.45
7	0.0200	18.70	935.00	18	4.0000	105.40	26.35
8	0.0400	45.80	1145.00	19	5.0000	106.20	21.24
9	0.0500	59.50	1190.00				
10	0.0800	82.50	1031.25				
11	0.1000	86.70	867.00				



FILENAME: X2-CTX.test

DATE: 08/27/20 17:05:22

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X2-CTX

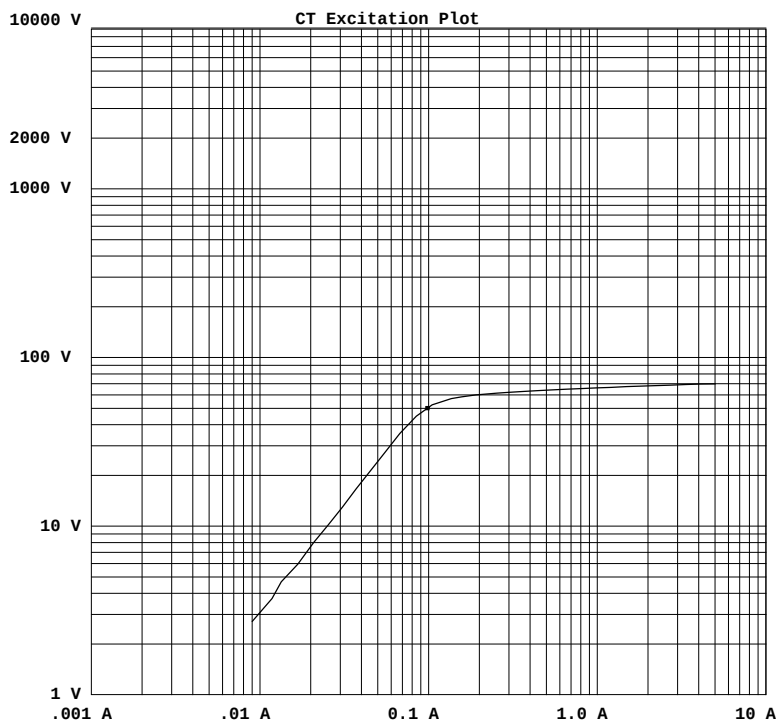
TEST # 8: X3-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1000/5.0	Ex V[Volts]: 34.100	Phase Angle: -0.04°
Vkp[Volts]: 50.12	Vkp[Volts]: 41.36	Vkp[Volts]: 53.40	M-RATIO: 200.040	Ex I[Amps]: 0.066	In Phase
Ikp[Amps]: 0.0986	Ikp[Amps]: 0.0782	Ikp[Amps]: 0.1114	% ERROR: 0.0201	Winding Res: 227.05 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	2.72	302.22	17	0.2538	61.48	242.24
2	0.0118	3.72	315.25	18	0.2882	62.08	215.41
3	0.0134	4.68	349.25	19	0.3560	62.92	176.74
4	0.0168	5.96	354.76	20	0.4312	63.52	147.31
5	0.0208	8.00	384.62	21	0.5298	64.24	121.25
6	0.0254	10.16	400.00	22	0.6636	64.92	97.83
7	0.0308	12.92	419.48	23	0.8226	65.52	79.65
8	0.0372	16.64	447.31	24	0.9930	66.08	66.55
9	0.0450	21.20	471.11	25	1.2088	66.60	55.10
10	0.0558	27.76	497.49	26	1.4910	67.24	45.10
11	0.0676	35.48	524.85	27	1.8210	67.64	37.14
12	0.0846	44.92	530.97	28	2.2072	68.16	30.88
13	0.1050	52.48	499.81	29	2.7200	68.64	25.24
14	0.1366	57.04	417.57	30	3.3562	69.20	20.62
15	0.1572	58.52	372.26	31	4.1028	69.60	16.96
16	0.1908	60.00	314.47	32	5.0214	69.84	13.91

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.30	300.00	12	0.2000	60.20	301.00
2	0.0020	0.60	300.00	13	0.4000	63.30	158.25
3	0.0040	1.20	300.00	14	0.5000	64.00	128.00
4	0.0050	1.50	300.00	15	0.8000	65.40	81.75
5	0.0080	2.40	300.00	16	1.0000	66.10	66.10
6	0.0100	3.10	310.00	17	2.0000	67.90	33.95
7	0.0200	7.60	380.00	18	4.0000	69.60	17.40
8	0.0400	18.30	457.50	19	5.0000	69.80	13.96
9	0.0500	24.20	484.00				
10	0.0800	42.40	530.00				
11	0.1000	50.60	506.00				



FILENAME: X2-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 17:05:22

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

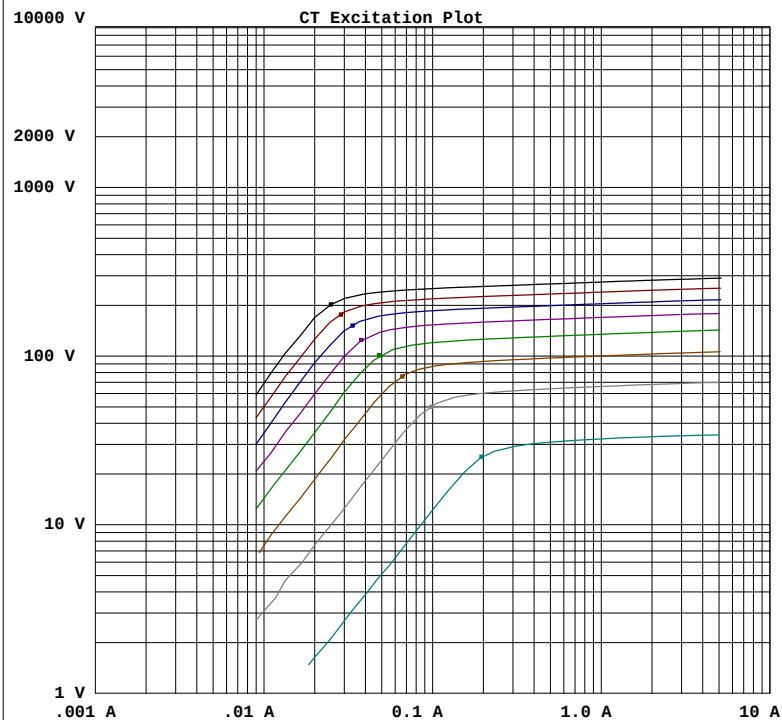
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X2-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	25.32/0.1954	20.44/0.1540	26.28/0.2164	500/5.0	100.085	0.085 %	-0.08° [In Ø]	128.30 m-ohms
2	X1-X3	101.12/0.0482	83.88/0.0392	102.40/0.0518	2000/5.0	400.167	0.042 %	-0.04° [In Ø]	366.51 m-ohms
3	X1-X4	151.76/0.0336	129.00/0.0274	159.60/0.0364	3000/5.0	600.048	0.008 %	0.00° [In Ø]	518.76 m-ohms
4	X1-X5	202.40/0.0250	167.56/0.0198	209.72/0.0270	4000/5.0	800.411	0.051 %	0.02° [In Ø]	695.71 m-ohms
5	X2-X3	75.68/0.0662	61.76/0.0518	79.32/0.0720	1500/5.0	300.082	0.027 %	-0.04° [In Ø]	291.46 m-ohms
6	X2-X4	124.48/0.0378	105.32/0.0314	133.00/0.0448	2500/5.0	500.117	0.023 %	0.02° [In Ø]	444.76 m-ohms
7	X2-X5	176.32/0.0286	148.56/0.0232	185.68/0.0314	3500/5.0	700.014	0.002 %	0.02° [In Ø]	621.38 m-ohms
8	X3-X4	50.12/0.0986	41.36/0.0782	53.40/0.1114	1000/5.0	200.040	0.020 %	-0.04° [In Ø]	227.05 m-ohms

Test Notepad





FILENAME: X2-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 17:05:22

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X2-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	4000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	3000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	2000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	3500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	2500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	1500/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	1000/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.6957 Ohm Rct75: 0.8298 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.92	Vsec: 92.08
Class: C20	Br: 0.18	Bi: 0.09	Btot: 1.01	Vsec: 101.35
Class: C50	Br: 0.45	Bi: 0.22	Btot: 1.30	Vsec: 129.82
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.59	Vsec: 158.69
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.52	Vsec: 251.95
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.47	Vsec: 447.30
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.45	Vsec: 844.55



FILENAME: X3-CTX.test

DATE: 08/27/20 17:23:23

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X3-CTX

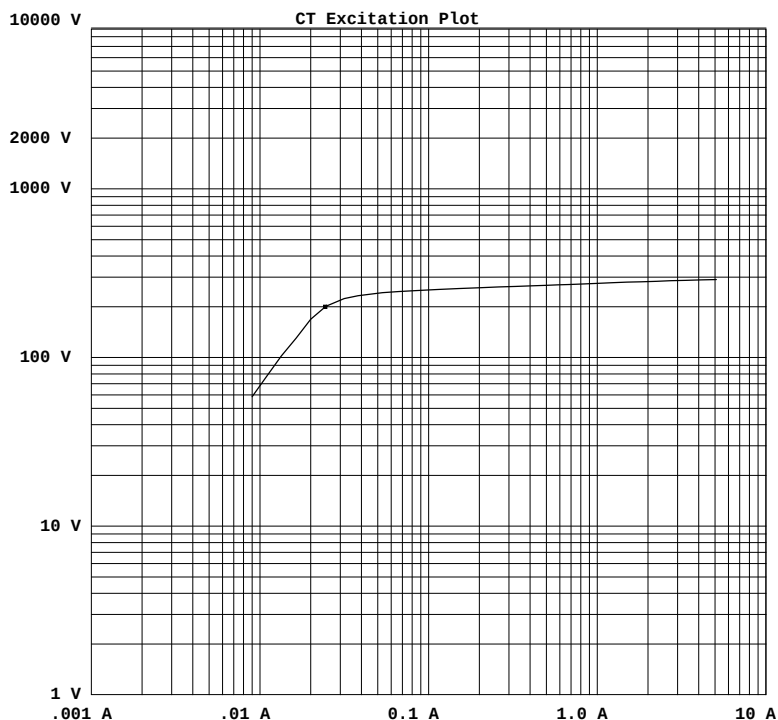
TEST # 1: X1-X5

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 4000/5.0	Ex V[Volts]: 98.000	Phase Angle:0.04°
Vkp[Volts]: 199.68	Vkp[Volts]: 171.24	Vkp[Volts]: 208.28	M-RATIO: 799.971	Ex I[Amps]: 0.013	In Phase
Ikp[Amps]: 0.0244	Ikp[Amps]: 0.0202	Ikp[Amps]: 0.0266	% ERROR: 0.0036	Winding Res: 701.75 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	58.64	6515.56	17	0.4132	266.48	644.92
2	0.0110	77.68	7061.82	18	0.5018	268.36	534.79
3	0.0134	102.00	7611.94	19	0.5864	269.96	460.37
4	0.0164	130.40	7951.22	20	0.6814	271.32	398.18
5	0.0200	168.64	8432.00	21	0.8522	273.76	321.24
6	0.0246	201.32	8183.74	22	1.0990	276.72	251.79
7	0.0316	223.76	7081.01	23	1.2080	277.80	229.97
8	0.0382	232.68	6091.10	24	1.5044	279.96	186.09
9	0.0532	242.40	4556.39	25	1.8242	281.08	154.08
10	0.0664	246.48	3712.05	26	2.2494	283.24	125.92
11	0.0842	249.72	2965.80	27	2.7428	285.40	104.05
12	0.1136	253.48	2231.34	28	3.3432	287.00	85.85
13	0.1522	256.72	1686.73	29	4.1418	288.64	69.69
14	0.2028	259.72	1280.67	30	5.0896	290.24	57.03
15	0.2620	262.16	1000.61				
16	0.3276	264.32	806.84				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	6.50	6500.00	12	0.2000	259.60	1298.00
2	0.0020	13.00	6500.00	13	0.4000	266.20	665.50
3	0.0040	26.00	6500.00	14	0.5000	268.30	536.60
4	0.0050	32.60	6520.00	15	0.8000	273.00	341.25
5	0.0080	52.10	6512.50	16	1.0000	275.50	275.50
6	0.0100	68.20	6820.00	17	2.0000	282.00	141.00
7	0.0200	168.60	8430.00	18	4.0000	288.40	72.10
8	0.0400	233.80	5845.00	19	5.0000	290.10	58.02
9	0.0500	240.30	4806.00				
10	0.0800	249.00	3112.50				
11	0.1000	251.70	2517.00				



FILENAME: X3-CTX.test

MFR: Siemens

TEST # 2: X1-X4

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

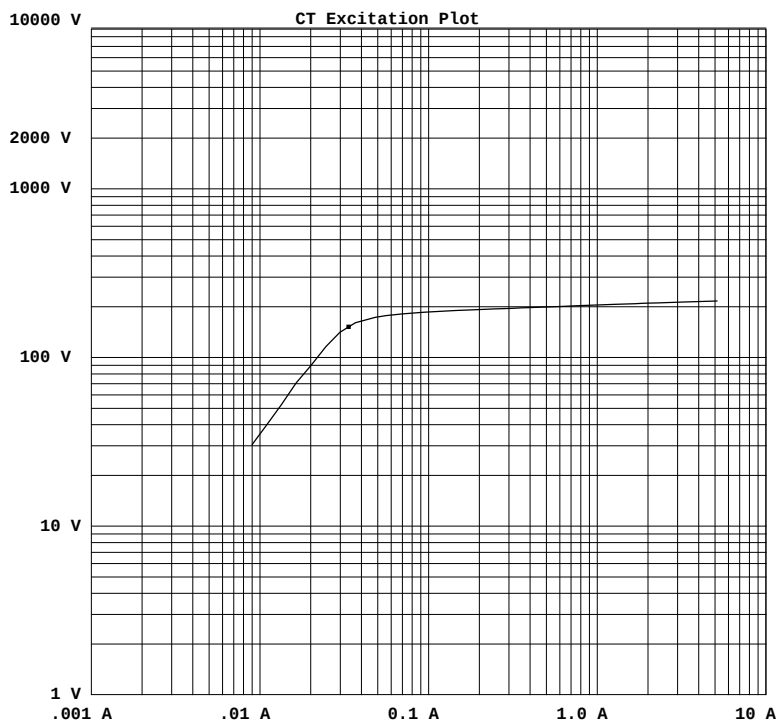
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3000/5.0	Ex V[Volts]: 97.800	Phase Angle:-0.02°
Vkp[Volts]: 152.00	Vkp[Volts]: 129.28	Vkp[Volts]: 159.40	M-RATIO: 600.139	Ex I[Amps]: 0.022	In Phase
Ikp[Amps]: 0.0336	Ikp[Amps]: 0.0274	Ikp[Amps]: 0.0362	% ERROR: 0.0232	Winding Res: 523.22 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	30.48	3386.67	17	0.2378	194.04	815.98
2	0.0110	40.00	3636.36	18	0.3128	195.92	626.34
3	0.0134	52.44	3913.43	19	0.3506	197.00	561.89
4	0.0164	70.68	4309.76	20	0.4566	198.92	435.65
5	0.0200	89.32	4466.00	21	0.6176	201.08	325.58
6	0.0246	116.08	4718.70	22	0.7064	202.16	286.18
7	0.0298	141.08	4734.23	23	0.8288	203.48	245.51
8	0.0368	160.80	4369.57	24	1.0576	205.40	194.21
9	0.0484	173.24	3579.34	25	1.2604	206.76	164.04
10	0.0562	177.28	3154.45	26	1.6814	208.64	124.09
11	0.0694	181.32	2612.68	27	1.8858	209.72	111.21
12	0.0914	185.40	2028.45	28	2.2818	211.08	92.51
13	0.1066	187.00	1754.22	29	2.7526	212.40	77.16
14	0.1474	190.24	1290.64	30	3.3270	213.76	64.25
15	0.1758	191.60	1089.87	31	4.1482	215.12	51.86
16	0.2048	192.96	942.19	32	5.1448	216.48	42.08

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	3.40	3400.00	12	0.2000	192.70	963.50
2	0.0020	6.80	3400.00	13	0.4000	197.90	494.75
3	0.0040	13.50	3375.00	14	0.5000	199.50	399.00
4	0.0050	17.00	3400.00	15	0.8000	203.20	254.00
5	0.0080	27.10	3387.50	16	1.0000	204.90	204.90
6	0.0100	35.20	3520.00	17	2.0000	210.10	105.05
7	0.0200	89.30	4465.00	18	4.0000	214.90	53.73
8	0.0400	164.20	4105.00	19	5.0000	216.30	43.26
9	0.0500	174.10	3482.00				
10	0.0800	183.30	2291.25				
11	0.1000	186.30	1863.00				



FILENAME: X3-CTX.test

DATE: 08/27/20 17:23:23

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X3-CTX

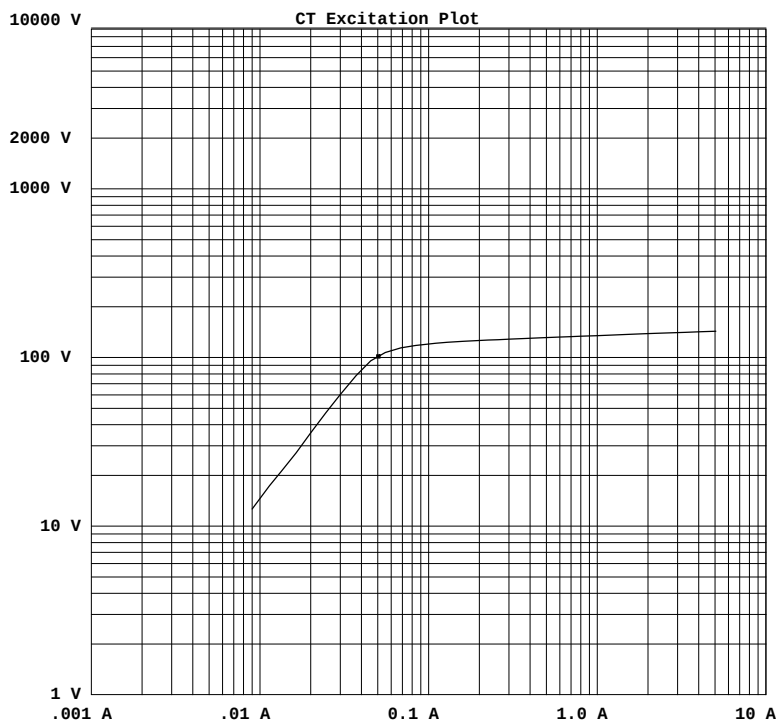
TEST # 3: X1-X3

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2000/5.0	Ex V[Volts]: 68.400	Phase Angle: -0.04°
Vkp[Volts]: 101.40	Vkp[Volts]: 87.40	Vkp[Volts]: 106.96	M-RATIO: 400.117	Ex I[Amps]: 0.033	In Phase
Ikp[Amps]: 0.0504	Ikp[Amps]: 0.0408	Ikp[Amps]: 0.0552	% ERROR: 0.0293	Winding Res: 373.55 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	12.64	1404.44	17	0.2590	127.68	492.97
2	0.0114	17.36	1522.81	18	0.3080	128.76	418.05
3	0.0134	21.12	1576.12	19	0.3606	129.60	359.40
4	0.0164	27.20	1658.54	20	0.4632	130.92	282.64
5	0.0200	35.80	1790.00	21	0.5774	132.00	228.61
6	0.0246	47.16	1917.07	22	0.6904	132.96	192.58
7	0.0298	59.92	2010.74	23	0.8016	133.76	166.87
8	0.0372	78.24	2103.23	24	0.9852	134.84	136.87
9	0.0454	95.52	2103.96	25	1.2186	135.92	111.54
10	0.0554	107.16	1934.30	26	1.4988	137.16	91.51
11	0.0684	114.20	1669.59	27	1.8566	138.36	74.52
12	0.0836	117.96	1411.00	28	2.2266	139.16	62.50
13	0.1104	121.48	1100.36	29	2.7136	140.24	51.68
14	0.1292	123.08	952.63	30	3.3206	141.08	42.49
15	0.1600	124.72	779.50	31	4.1224	142.16	34.48
16	0.2254	127.00	563.44	32	5.0572	143.24	28.32

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	1.40	1400.00	12	0.2000	126.10	630.50
2	0.0020	2.80	1400.00	13	0.4000	130.10	325.25
3	0.0040	5.60	1400.00	14	0.5000	131.30	262.60
4	0.0050	7.00	1400.00	15	0.8000	133.80	167.25
5	0.0080	11.20	1400.00	16	1.0000	134.90	134.90
6	0.0100	14.60	1460.00	17	2.0000	138.70	69.35
7	0.0200	35.80	1790.00	18	4.0000	142.00	35.50
8	0.0400	84.10	2102.50	19	5.0000	143.20	28.64
9	0.0500	100.90	2018.00				
10	0.0800	117.10	1463.75				
11	0.1000	120.10	1201.00				



FILENAME: X3-CTX.test

MFR: Siemens

TEST # 4: X1-X2

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

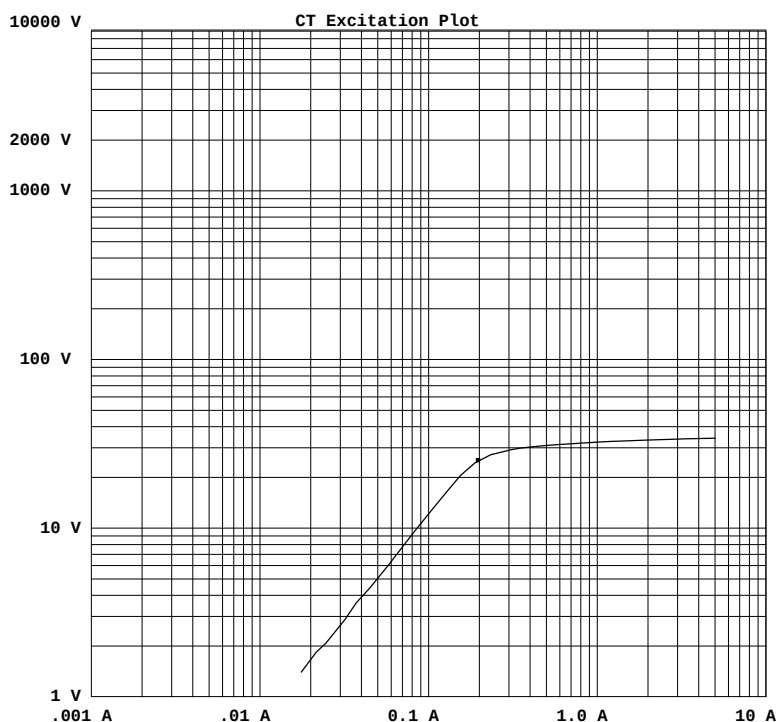
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 500/5.0	Ex V[Volts]: 17.000	Phase Angle: -0.06°
Vkp[Volts]: 25.28	Vkp[Volts]: 20.48	Vkp[Volts]: 26.88	M-RATIO: 100.096	Ex I[Amps]: 0.130	In Phase
Ikp[Amps]: 0.1968	Ikp[Amps]: 0.1540	Ikp[Amps]: 0.2278	% ERROR: 0.0955	Winding Res: 129.05 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0176	1.40	79.55	17	0.4284	30.52	71.24
2	0.0216	1.84	85.19	18	0.5326	31.12	58.43
3	0.0246	2.08	84.55	19	0.6476	31.52	48.67
4	0.0320	2.88	90.00	20	0.8000	31.96	39.95
5	0.0372	3.60	96.77	21	1.0182	32.40	31.82
6	0.0450	4.44	98.67	22	1.2132	32.68	26.94
7	0.0578	6.04	104.50	23	1.4798	32.96	22.27
8	0.0726	8.12	111.85	24	1.8306	33.24	18.16
9	0.0862	10.12	117.40	25	2.2234	33.44	15.04
10	0.1030	12.60	122.33	26	2.7492	33.68	12.25
11	0.1268	16.24	128.08	27	3.3302	33.84	10.16
12	0.1548	20.60	133.07	28	4.0768	34.00	8.34
13	0.1888	24.40	129.24	29	5.0084	34.16	6.82
14	0.2340	27.28	116.58				
15	0.3124	29.28	93.73				
16	0.3498	29.84	85.31				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	25.10	125.50
2	0.0020	0.20	100.00	13	0.4000	30.30	75.75
3	0.0040	0.30	75.00	14	0.5000	30.90	61.80
4	0.0050	0.40	80.00	15	0.8000	32.00	40.00
5	0.0080	0.60	75.00	16	1.0000	32.40	32.40
6	0.0100	0.80	80.00	17	2.0000	33.30	16.65
7	0.0200	1.70	85.00	18	4.0000	34.00	8.50
8	0.0400	3.90	97.50	19	5.0000	34.20	6.84
9	0.0500	5.10	102.00				
10	0.0800	9.20	115.00				
11	0.1000	12.20	122.00				



FILENAME: X3-CTX.test

MFR: Siemens

TEST # 5: X2-X5

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

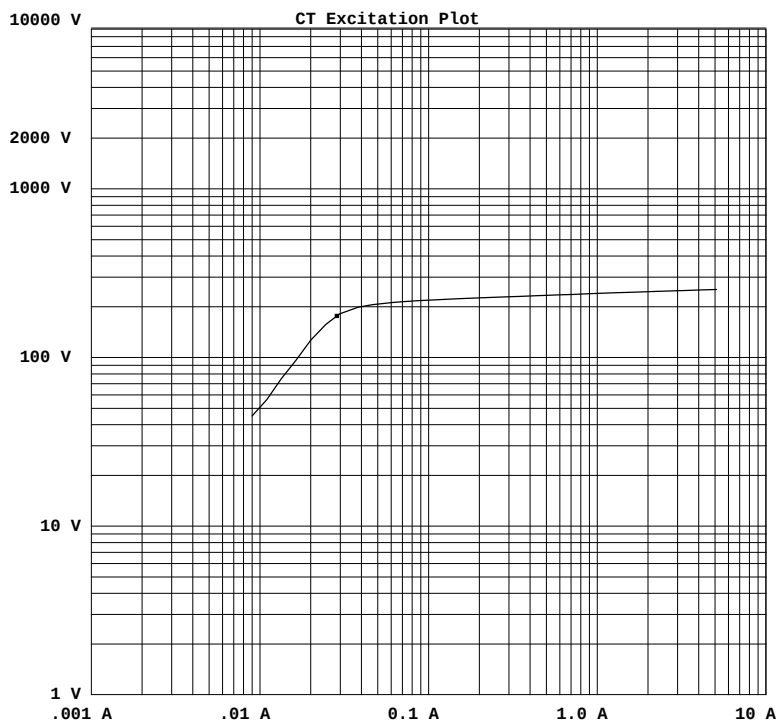
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 3500/5.0	Ex V[Volts]: 97.800	Phase Angle:0.02°
Vkp[Volts]: 176.16	Vkp[Volts]: 145.20	Vkp[Volts]: 184.52	M-RATIO: 700.142	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0286	Ikp[Amps]: 0.0228	Ikp[Amps]: 0.0310	% ERROR: 0.0203	Winding Res: 625.50 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	45.12	5013.33	17	0.3528	230.80	654.20
2	0.0110	56.36	5123.64	18	0.4344	232.40	534.99
3	0.0134	74.84	5585.07	19	0.6160	235.64	382.53
4	0.0164	96.76	5900.00	20	0.7232	237.00	327.71
5	0.0200	126.88	6344.00	21	0.8284	238.36	287.74
6	0.0246	157.28	6393.50	22	1.0300	240.24	233.24
7	0.0298	181.88	6103.36	23	1.2310	241.88	196.49
8	0.0382	198.64	5200.00	24	1.6522	244.32	147.88
9	0.0464	205.68	4432.76	25	1.8566	245.40	132.18
10	0.0616	212.16	3444.16	26	2.2494	246.72	109.68
11	0.0710	214.56	3021.97	27	2.7492	248.64	90.44
12	0.0866	217.28	2509.01	28	3.4114	250.24	73.35
13	0.1136	220.52	1941.20	29	4.0996	251.60	61.37
14	0.1478	223.24	1510.42	30	5.1058	253.24	49.60
15	0.2048	226.20	1104.49				
16	0.2726	228.64	838.74				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	5.00	5000.00	12	0.2000	226.00	1130.00
2	0.0020	10.00	5000.00	13	0.4000	231.70	579.25
3	0.0040	20.00	5000.00	14	0.5000	233.60	467.20
4	0.0050	25.10	5020.00	15	0.8000	238.00	297.50
5	0.0080	40.10	5012.50	16	1.0000	240.00	240.00
6	0.0100	50.80	5080.00	17	2.0000	245.90	122.95
7	0.0200	126.90	6345.00	18	4.0000	251.40	62.85
8	0.0400	200.20	5005.00	19	5.0000	253.10	50.62
9	0.0500	207.20	4144.00				
10	0.0800	216.10	2701.25				
11	0.1000	218.90	2189.00				



FILENAME: X3-CTX.test

DATE: 08/27/20 17:23:23

COMPANY: TC Energy

STATION: Fox Valley

CIRCUIT: 126-FXVLY-A0-T-01

MFR: Siemens

MODEL: N/A

SN: T.040N.001092.01

OPERATOR: BM

COMMENTS: X3-CTX

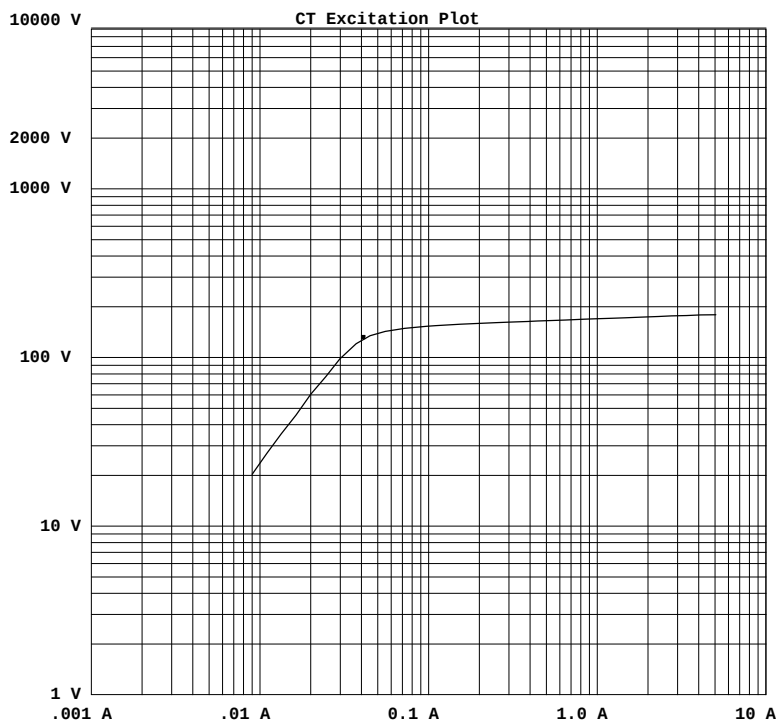
TEST # 6: X2-X4

TEST NOTES:

KNEE TYPE: IEEE 30 Deg

FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 2500/5.0	Ex V[Volts]: 88.600	Phase Angle:0.00°
Vkp[Volts]: 132.08	Vkp[Volts]: 103.36	Vkp[Volts]: 131.20	M-RATIO: 500.083	Ex I[Amps]: 0.027	In Phase
Ikp[Amps]: 0.0410	Ikp[Amps]: 0.0310	Ikp[Amps]: 0.0428	% ERROR: 0.0166	Winding Res: 446.67 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	20.32	2257.78	17	0.2554	161.08	630.70
2	0.0110	27.04	2458.18	18	0.3022	162.16	536.60
3	0.0134	35.32	2635.82	19	0.3876	163.76	422.50
4	0.0164	45.68	2785.37	20	0.4418	164.60	372.57
5	0.0200	60.52	3026.00	21	0.5368	165.92	309.09
6	0.0246	77.16	3136.59	22	0.6476	167.00	257.88
7	0.0298	98.24	3296.64	23	0.8238	168.64	204.71
8	0.0372	120.80	3247.31	24	0.9874	169.72	171.89
9	0.0450	134.84	2996.44	25	1.2194	171.08	140.30
10	0.0554	142.96	2580.51	26	1.4676	172.16	117.31
11	0.0722	148.92	2062.60	27	1.8046	173.52	96.15
12	0.0976	153.24	1570.08	28	2.2948	175.12	76.31
13	0.1104	154.60	1400.36	29	2.7590	176.48	63.97
14	0.1284	155.92	1214.33	30	3.3822	177.56	52.50
15	0.1548	157.56	1017.83	31	4.1094	178.92	43.54
16	0.2196	160.00	728.60	32	5.0540	179.44	35.50

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	2.20	2200.00	12	0.2000	159.30	796.50
2	0.0020	4.50	2250.00	13	0.4000	164.00	410.00
3	0.0040	9.00	2250.00	14	0.5000	165.40	330.80
4	0.0050	11.30	2260.00	15	0.8000	168.40	210.50
5	0.0080	18.10	2262.50	16	1.0000	169.80	169.80
6	0.0100	23.70	2370.00	17	2.0000	174.20	87.10
7	0.0200	60.50	3025.00	18	4.0000	178.70	44.67
8	0.0400	125.80	3145.00	19	5.0000	179.40	35.88
9	0.0500	138.80	2776.00				
10	0.0800	150.20	1877.50				
11	0.1000	153.50	1535.00				



FILENAME: X3-CTX.test

MFR: Siemens

TEST # 7: X2-X3

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

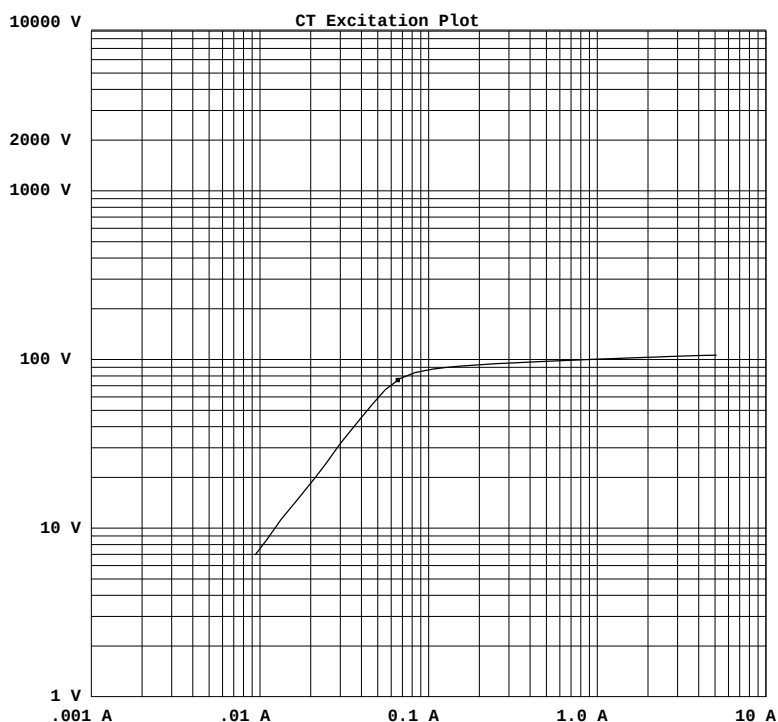
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1500/5.0	Ex V[Volts]: 50.000	Phase Angle: -0.08°
Vkp[Volts]: 75.48	Vkp[Volts]: 63.20	Vkp[Volts]: 79.04	M-RATIO: 300.204	Ex I[Amps]: 0.043	In Phase
Ikp[Amps]: 0.0658	Ikp[Amps]: 0.0532	Ikp[Amps]: 0.0722	% ERROR: 0.0681	Winding Res: 295.42 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0094	6.96	740.43	17	0.2526	94.60	374.51
2	0.0110	8.56	778.18	18	0.2944	95.28	323.64
3	0.0134	11.32	844.78	19	0.4054	96.76	238.68
4	0.0164	14.44	880.49	20	0.4444	97.16	218.63
5	0.0212	19.84	935.85	21	0.5642	98.12	173.91
6	0.0246	24.16	982.11	22	0.6954	99.04	142.42
7	0.0298	31.52	1057.72	23	0.8168	99.60	121.94
8	0.0372	41.48	1115.05	24	0.9948	100.52	101.05
9	0.0460	53.72	1167.83	25	1.2268	101.20	82.49
10	0.0554	66.20	1194.95	26	1.5106	102.00	67.52
11	0.0676	77.04	1139.64	27	1.8144	102.68	56.59
12	0.0832	83.76	1006.73	28	2.2170	103.52	46.69
13	0.1062	87.84	827.12	29	2.7460	104.32	37.99
14	0.1264	89.84	710.76	30	3.3498	105.00	31.35
15	0.1564	91.60	585.68	31	4.1028	105.68	25.76
16	0.2012	93.24	463.42	32	5.0702	106.20	20.95

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.70	700.00	12	0.2000	93.20	466.00
2	0.0020	1.50	750.00	13	0.4000	96.70	241.75
3	0.0040	3.00	750.00	14	0.5000	97.60	195.20
4	0.0050	3.70	740.00	15	0.8000	99.50	124.38
5	0.0080	5.90	737.50	16	1.0000	100.50	100.50
6	0.0100	7.60	760.00	17	2.0000	103.10	51.55
7	0.0200	18.50	925.00	18	4.0000	105.60	26.40
8	0.0400	45.40	1135.00	19	5.0000	106.20	21.24
9	0.0500	59.00	1180.00				
10	0.0800	82.40	1030.00				
11	0.1000	86.70	867.00				



FILENAME: X3-CTX.test

MFR: Siemens

TEST # 8: X3-X4

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

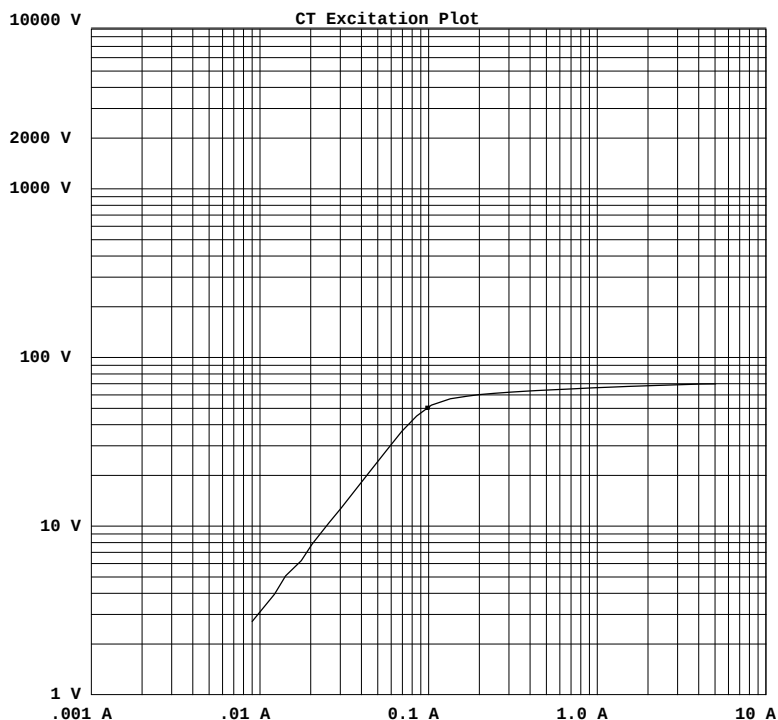
OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1000/5.0	Ex V[Volts]: 34.100	Phase Angle: -0.06°
Vkp[Volts]: 50.28	Vkp[Volts]: 41.56	Vkp[Volts]: 52.44	M-RATIO: 200.007	Ex I[Amps]: 0.066	In Phase
Ikp[Amps]: 0.0986	Ikp[Amps]: 0.0788	Ikp[Amps]: 0.1050	% ERROR: 0.0035	Winding Res: 230.78 milliohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0090	2.72	302.22	17	0.2456	61.40	250.00
2	0.0122	3.96	324.59	18	0.3030	62.36	205.81
3	0.0142	5.08	357.75	19	0.3728	63.16	169.42
4	0.0176	6.24	354.55	20	0.4332	63.64	146.91
5	0.0204	7.84	384.31	21	0.5684	64.60	113.65
6	0.0258	10.52	407.75	22	0.6584	65.00	98.72
7	0.0302	12.72	421.19	23	0.8178	65.68	80.31
8	0.0368	16.40	445.65	24	0.9804	66.20	67.52
9	0.0450	21.20	471.11	25	1.2314	66.80	54.25
10	0.0558	27.76	497.49	26	1.5176	67.36	44.39
11	0.0694	36.48	525.65	27	1.8404	67.84	36.86
12	0.0850	45.00	529.41	28	2.2170	68.24	30.78
13	0.1038	52.24	503.28	29	2.7362	68.72	25.12
14	0.1346	56.96	423.18	30	3.3628	69.20	20.58
15	0.1692	59.04	348.94	31	4.1158	69.72	16.94
16	0.2000	60.28	301.40	32	5.0376	69.84	13.86

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.30	300.00	12	0.2000	60.30	301.50
2	0.0020	0.60	300.00	13	0.4000	63.40	158.50
3	0.0040	1.20	300.00	14	0.5000	64.10	128.20
4	0.0050	1.50	300.00	15	0.8000	65.60	82.00
5	0.0080	2.40	300.00	16	1.0000	66.20	66.20
6	0.0100	3.10	310.00	17	2.0000	68.00	34.00
7	0.0200	7.60	380.00	18	4.0000	69.60	17.40
8	0.0400	18.30	457.50	19	5.0000	69.80	13.96
9	0.0500	24.20	484.00				
10	0.0800	42.30	528.75				
11	0.1000	50.80	508.00				



FILENAME: X3-CTX.test

MFR: Siemens

SUMMARY REPORT

DATE: 08/27/20 17:23:23

MODEL: N/A

KNEE TYPE: IEEE 30 Deg

COMPANY: TC Energy

SN: T.040N.001092.01

FREQUENCY: 60 Hz

STATION: Fox Valley

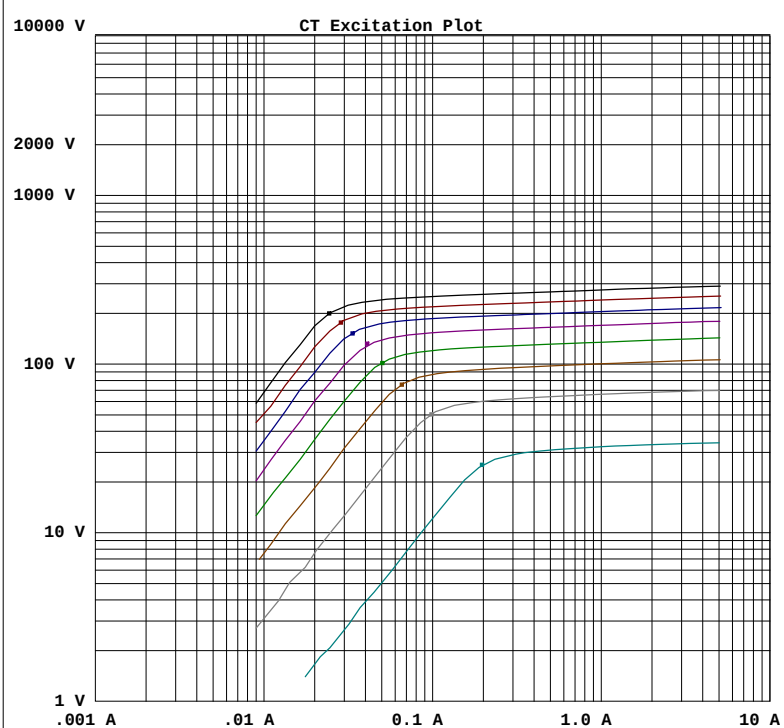
OPERATOR: BM

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	25.28/0.1968	20.48/0.1540	26.88/0.2278	500/5.0	100.096	0.096 %	-0.06° [In Ø]	129.05 m-ohms
2	X1-X3	101.40/0.0504	87.40/0.0408	106.96/0.0552	2000/5.0	400.117	0.029 %	-0.04° [In Ø]	373.55 m-ohms
3	X1-X4	152.00/0.0336	129.28/0.0274	159.40/0.0362	3000/5.0	600.139	0.023 %	-0.02° [In Ø]	523.22 m-ohms
4	X1-X5	199.68/0.0244	171.24/0.0202	208.28/0.0266	4000/5.0	799.971	0.004 %	0.04° [In Ø]	701.75 m-ohms
5	X2-X3	75.48/0.0658	63.20/0.0532	79.04/0.0722	1500/5.0	300.204	0.068 %	-0.08° [In Ø]	295.42 m-ohms
6	X2-X4	132.08/0.0410	103.36/0.0310	131.20/0.0428	2500/5.0	500.083	0.017 %	0.00° [In Ø]	446.67 m-ohms
7	X2-X5	176.16/0.0286	145.20/0.0228	184.52/0.0310	3500/5.0	700.142	0.020 %	0.02° [In Ø]	625.50 m-ohms
8	X3-X4	50.28/0.0986	41.56/0.0788	52.44/0.1050	1000/5.0	200.007	0.003 %	-0.06° [In Ø]	230.78 m-ohms

Test Notepad





FILENAME: X3-CTX.test

MFR: Siemens

TEST PLAN

DATE: 08/27/20 17:23:23

MODEL: N/A

TEST NOTES:

COMPANY: TC Energy

SN: T.040N.001092.01

KNEE TYPE: IEEE 30 Deg

STATION: Fox Valley

OPERATOR: BM

FREQUENCY: 60 Hz

CIRCUIT: 126-FXVLY-A0-T-01

COMMENTS: X3-CTX

	Nameplate Ratio	Ratio Test	Excitation Test	Winding Res Test	Excitation Voltage (V)	Excitation Current (A)	Note
X1-X5	4000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X4	3000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X3	2000/5.0	[X]	[X]	[X]	500.00	5.00	
X1-X2	500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X5	3500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X4	2500/5.0	[X]	[X]	[X]	500.00	5.00	
X2-X3	1500/5.0	[X]	[X]	[X]	500.00	5.00	
X3-X4	1000/5.0	[X]	[X]	[X]	500.00	5.00	

Burden Test []

Insulation Test []

Classification: C200 for Multi Tap: X1-X5

IRated: 5.00 Tmeas: 25.00 C Rmeas: 0.7017 Ohm Rct75: 0.8370 Ohm

Class: C10	Br: 0.09	Bi: 0.04	Btot: 0.93	Vsec: 92.80
Class: C20	Br: 0.18	Bi: 0.09	Btot: 1.02	Vsec: 102.07
Class: C50	Br: 0.45	Bi: 0.22	Btot: 1.31	Vsec: 130.53
Class: C100	Br: 0.50	Bi: 0.87	Btot: 1.59	Vsec: 159.29
Class: C200	Br: 1.00	Bi: 1.73	Btot: 2.52	Vsec: 252.48
Class: C400	Br: 2.00	Bi: 3.46	Btot: 4.48	Vsec: 447.75
Class: C800	Br: 4.00	Bi: 6.93	Btot: 8.45	Vsec: 844.96



Shermco Industries®

One Line. One Company.®

Appendix H: Parts List

SIEMENS

Siemens S.A. de C.V.

MANEJO DE ACTA
NOMBRE DEL REGISTRO: PACKING LISTA DE EMBARQUE

AG 75-18

SIEMENS S.A. DE C.V.
KM. 8 CARRETERA GUANAJUATO-SAL
GUANAJUATO, GTO.

NUMBER
FECHA: 4 de Julio de 2012

REVISION DE LISTA DE EMBARQUE: 0

P.O.
O. FABRICACION: TP-1092.01

SHIPPED TO:
EMBARCADO A:

TransCanada Pipeline

CITY: Burlington
STATE: Ontario
CANADA

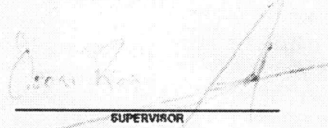
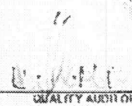
ZIP:

CONTRACT N°:
No. CONTRATO: 9000017832

BOX CAJA	OUTLINE PARTIDA	MEASURE UNIDAD	QUANTITY CANTIDAD	DESCRIPTION DESCRIPCION	LENGTH LARGO	WIDTH ANCHO	HEIGHT ALTO	WEIGHT PESO LBS - KG
2	1	PC	1	H V BUSHING ABB 230 KV CLASS, 1050 KV BIL, 600 A, COLOR GRAY, STYLE 230W0800OUT, WITH STUD 1.5" DIA 12UNF-2A x 51 USABLE THD. SILVER PLATED, TOP TERMINAL SERIAL H1: 1000027404	192"	30"	46"	1300 LBS
5	1	PC	1	H V BUSHING ABB 230 KV CLASS, 1050 KV BIL, 600 A, COLOR GRAY, STYLE 230W0800OUT, WITH STUD 1.5" DIA 12UNF-2A x 51 USABLE THD. SILVER PLATED, TOP TERMINAL SERIAL H2: 1000027410	192"	30"	46"	1300 LBS
4	1	PC	1	H V BUSHING ABB 230 KV CLASS, 1050 KV BIL, 600 A, COLOR GRAY, STYLE 230W0800OUT, WITH STUD 1.5" DIA 12UNF-2A x 51 USABLE THD. SILVER PLATED, TOP TERMINAL SERIAL H2: 1000027405	192"	30"	46"	1300 LBS
5	2	PC	3	L V BUSHING ABB 15 KV CLASS, 110 KV BIL, 4000 A, COLOR GRAY, STYLE COTA 016J0400AN, WITH STUD 3.0" DIA 12UN-2A x 76 USABLE THD, SILVER PLATED, TOP TERMINAL SERIAL X1: 1000028070, SERIAL X2: 1000028071, AXT, SERIAL X3: 1000028043.	46"	35"	55"	270 LBS
	3	PC	1	X0 BUSHING ABB 15 KV CLASS, 110 KV BIL, 4000 A, COLOR GRAY, STYLE COTA 016J0400AN, WITH STUD 3.0" DIA 12UN-2A x 76 USABLE THD, SILVER PLATED, TOP TERMINAL SERIAL X0: 1000028000				
8	53	PC	3	HV LIGHTNING ARRESTER 192 KV DUTY CYCLE RATING 78 KV MCOV OHIO BRASS SERIAL: S-00057, S-00058, S-00059, S-00060, S-00061, S-00062 WITH RINGS	56"	41"	56"	1322 LBS
7	1	PC	3	EXTERNAL CONNECTOR DELTA PM60C12-1-412E FOR BUSHING H V	53"	31"	26"	275 LBS
	2	PC	3	EXTERNAL CONNECTOR DELTA PM60C12-1-M18-E FOR BUSHING L V				
	3	PC	1	EXTERNAL CONNECTOR DELTA PM60C12-1-M18-E FOR BUSHING X0				
	17	PC	12	SEISMIC BRACES FOR RADIATOR (TOP AND BOTTOM)				
	17	PC	6	F0 ANGLE FOR SUPPORT BETWEEN RADIATORS WITH F0 ANGLE				
	54	PC	3	FOR SEISMIC BRACES FOR RADIATOR				
	56	PC	1	DISCHARGER COUNTER OHIO BRASS				
	56	PC	4	COPPER BAR FOR CONNECTION DISCHARGER COUNTER OHIO BRASS				
		PC	4	40 AWG BARE COPPER CABLE FOR H V LIGHTNING GROUNDING CONNECTION				
		PC	4	POST INSULATORS .16 KV CLASS 110 KV WITH LV JUNCTION BOX				
		PC	9	COPPER BAR FOR CONNECTION LV BUSHING				
		PC	3	COPPER BAR FOR CONNECTION X0 BUSHING				
		PC	9	INSULATOR BASES (3 PER ARRESTER)				
		PC	3	CONNECTOR FOR CABLE ON LIGHTNING ARRESTERS				
	23	PC	1	CABLE FOR LV BOX GROUNDING				
	23	SET	46	BOLT 1/2" X 2" WITH DOUBLE WASHER FLAT, LOCK WASHER AND BRONZE NUT FOR LV BOX ASSEMBLY				
				GASKET SET				
1		PC	3	O-RING NITRILE BUNA-N BLACK COLOR 2.055" Ø X 0.275" THK FOR H V BUSHING				
1		PC	3	O-RING NITRILE BUNA-N BLACK COLOR 1.655" Ø X 0.275" THK FOR H V BUSHING				
2		PC	3	O-RING VITON ORANGE COLOR 0.725" Ø X 0.275" THK FOR L V BUSHING				
3		PC	1	O-RING VITON ORANGE COLOR 0.725" Ø X 0.275" THK FOR X0 BUSHING				
9		PC	3	RECTANGULAR GASKET NITRILE (SIZE C) FOR ACCESS TO BUSHING CONNECTION IN COVER (527" x 553 mm)				
10		PC	1	RECTANGULAR GASKET NITRILE (SIZE C) FOR ACCESS TO BUSHING CONNECTION IN SEG 4 (527" x 553 mm)				
11		PC	1	RECTANGULAR GASKET NITRILE (SIZE C) FOR ACCESS TO BUSHING CONNECTION IN SEG 3 (527" x 553 mm)				
14		PC	2	O-RING NITRILE BUNA-N BLACK COLOR 7.475" Ø X 0.187" THK FOR VSPM IN MAIN TANK				
16		PC	28	RECTANGULAR BUNA-N BLACK COLOR 5.225" Ø X 0.275" THK FOR RADIATOR VALVE				
22		PZA	3	O-RING, GASKET NITRILE BUNA N, Ø INT 4.75" x 0.75" ESP NOM FOR TC'S BLOCKS				
33		PZA	1	O-RING, GASKET NITRILE BUNA N, COLOR NEGRO, Ø INT. 4.250" x 0.210" ESP NOM FOR THERMAL PLATE				
34		PZA	1	O-RING, GASKET NITRILE BUNA N, Ø INT 2.315" x 0.210" ESP NOM FOR GAUGE				
36		PZA	1	O-RING, GASKET NITRILE BUNA N, COLOR NEGRO, Ø INT 2.725" x 0.210" ESP NOM FOR RELAY				
40		PZA	1	RECTANGULAR GASKET 3/8" Ø x 1.25 MM FOR INDEX				
48 A		PC	1	O-RING NITRILE BUNA-N BLACK COLOR 7.475" Ø X 0.187" THK FOR VSPM IN MAIN TANK				

INSTALLED

4

BOX CAJA	OUTLINE PARTIDA	MEASURE UNIDAD	QUANTITY CANTIDAD	DESCRIPTION DESCRIPCION	LENGTH LARGO	WIDTH ANCHO	HEIGHT ALTO	WEIGHT PESO
				EXTRA STAINLESS STEEL HARDWARE				LBS 50°C
4		SET	1	BOLT 1" X 2 1/4" WITH FLAT AND LOCK WASHER FOR H.V. BUSHING				
4		SET	8	BOLT 1/2" X 3" WITH DOUBLE FLAT LOCK WASHER AND BRONZE NUT FOR H.V. BUSHING TURRET				
4	2	SET	2	BOLT 1/2" X 1 1/4" WITH FLAT AND LOCK WASHER FOR L.V. BUSHING				
4	3	SET	1	BOLT 1/2" X 1 1/4" WITH FLAT AND LOCK WASHER FOR X.B. BUSHING				
4	6	SET	1	BOLT 1/8" X 2 1/2" WITH DOUBLE FLAT LOCK WASHER AND BRONZE NUT FOR CONTROL CABINET				
4	10, 10, 10	SET	10	BOLT 1/2" X 3 1/4" WITH FLAT AND LOCK WASHER FOR ACCESS TO TRANSFORMERS MANHOLE IN COVER				
4	114	SET	1	BOLT 1/2" X 1 1/4" WITH FLAT AND LOCK WASHER FOR VSP IN MAIN TANK				
4	16	SET	8	BOLT 3/4" X 2" WITH FLAT AND LOCK WASHER FOR RADIATOR VALVE				
4	20	SET	2	BOLT 3/4" X 3" WITH DOUBLE FLAT WASHER, LOCK WASHER AND BRONZE NUT FOR H.V. LIGHTNING ARRESTER SUPPORT TANK				
4	20	SET	2	BOLT 3/4" X 2 1/2" WITH DOUBLE FLAT WASHER, LOCK WASHER AND BRONZE NUT FOR H.V. LIGHTNING ARRESTER TOWER				
4	23	SET	8	BOLT 1/2" X 2" WITH DOUBLE FLAT WASHER, LOCK WASHER AND BRONZE NUT FOR LV BOX ASSEMBLY				
4	23	SET	16	1/2" WITH FLAT WASHER, LOCK WASHER AND BRONZE NUT FOR LV BOX ASSEMBLY				
8	15	PC	2	RADIATORS DETACHABLES (HOT DIPPED GALVANIZED) WITH CENTRE BRING IN BRIDLES OF 1850 mm	95"	73"	72"	2540 LBS
		PC	2	1" DIA. GLOBE VALVE FOR RADIATOR VENT				
		PC	2	1" DIA. GLOBE VALVE FOR RADIATOR DRAIN				
	30	PC	4	COOLING FAN KRENZ VENT. 3 PH. 60 HZ. 1/2 HP. 1750 RPM				
		SET	8	BOLT 3/4" Ø UNC X 2" WITH WASHER AND LOCK WASHER FOR ANGLE SEISMIC				
		PC	4	FE ANGLE FOR SEISMIC BRACES FOR RADIATOR				
9	15	PC	2	RADIATORS DETACHABLES (HOT DIPPED GALVANIZED) WITH CENTRE BRING IN BRIDLES OF 1850 mm	95"	73"	72"	2540 LBS
		PC	2	1" DIA. GLOBE VALVE FOR RADIATOR VENT				
		PC	2	1" DIA. GLOBE VALVE FOR RADIATOR DRAIN				
	30	PC	4	COOLING FAN KRENZ VENT. 3 PH. 60 HZ. 1/2 HP. 1750 RPM				
		SET	8	BOLT 3/4" Ø UNC X 2" WITH WASHER AND LOCK WASHER FOR ANGLE SEISMIC				
		PC	4	FE ANGLE FOR SEISMIC BRACES FOR RADIATOR				
10	15	PC	3	RADIATORS DETACHABLES (HOT DIPPED GALVANIZED) WITH CENTRE BRING IN BRIDLES OF 1850 mm	95"	73"	98"	3510 LBS
		PC	3	1" DIA. GLOBE VALVE FOR RADIATOR VENT				
		PC	3	1" DIA. GLOBE VALVE FOR RADIATOR DRAIN				
	30	PC	4	COOLING FAN KRENZ VENT. 3 PH. 60 HZ. 1/2 HP. 1750 RPM				
		SET	10	BOLT 3/4" Ø UNC X 2" WITH WASHER AND LOCK WASHER FOR ANGLE SEISMIC				
		PC	4	FE ANGLE FOR SEISMIC BRACES FOR RADIATOR				
11	20	PC	1	H.V. LIGHTNING SUPPORT BRACKET DETACHABLE	228"	12"	14"	3300 LBS
		PC	4	STAINLESS STEEL CLAMPS FOR GROUNDING CABLE				
12	20	PC	3	BRACES FOR HV ARRESTERS SUPPORT	104"	43"	20"	700 LBS
	20	SET	12	BOLT 3/4" Ø UNC X 2 1/2" WITH WASHER, LOCK WASHER AND BRONZE NUT FOR H.V. LIGHTNING ARRESTER SUPPORT				
	20	SET	4	BOLT 3/4" Ø UNC X 2 1/2" WITH WASHER, LOCK WASHER AND BRONZE NUT FOR H.V. LIGHTNING ARRESTER SUPPORT SEISMIC				
		PC	1	CLAMP FOR GROUNDING CABLE				
	20	PC	2	FE ANGLE FOR H.V. LIGHTNING ARRESTER SUPPORT SEISMIC				
	23	PC	2	LV BOX SUPPORT				
13	23	PC	1	LV BOX	55"	45"	54"	2900 LBS
		PC	1	AL ANGLE FOR LV BOX				
	23	SET	4	BOLT 5/8" X 1 1/2" WITH WASHER FLAT, LOCK WASHER FOR LV BOX ASSEMBLY				
				 SUPERVISOR  QUALITY AUDITOR				



Shermco Industries®

One Line. One Company.®

Appendix I: Test Equipment – Calibration Certificates



Certificate of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca



For Instrument : Vanguard WRM-10

Description : Transformer Resistance Meter

Serial Number : 97236

Asset Number : RF 13

Customer: Shermco - Regina

1033 Kearns Cres.

Regina, SK

S4P 3B2

The CAT Rental Store certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques.

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Quality Management system registered to ISO 9001: 2015

CALIBRATION INFORMATION

Cal Date: 4 Mar 2020

Temperature 20.0°C

Condition as Received/Returned: IN TOLERANCE
(Pass)

Next Cal Due: 4 Mar 2021

Humidity 40 %

Remarks:

Cal Procedure Vanguard WRM-10

Revision 1.0

STANDARDS USED FOR CALIBRATION

Asset Number	Description	Cal Date	Due Date
101294	Burster 1282-0.001 1 mOhm Standard Resistor	03 May 2019	03 May 2020
101295	Burster 1282-0.01 10 mOhm Standard Resistor	03 May 2019	03 May 2020
101296	Burster 1282-0.1 100 mOhm Standard Resistor	03 May 2019	03 May 2020
SR2	YEW 2792 1 ohm Resistor	19 Feb 2020	19 Feb 2021
SR3	YEW 2792 1000 ohm Resistor	19 Feb 2020	19 Feb 2021
SR4	YEW 2892 100 ohm Resistor	19 Feb 2020	19 Feb 2021



Signed:

Edwin Zhang - Technician

SERIAL NUMBER: 97236

ASSET NUMBER: RF 13

Report of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca

UNIT UNDER TEST: Vanguard WRM-10 Transformer Resistance Meter
SERIAL NUMBER: 97236
ASSET NUMBER: RF 13
PROCEDURE NAME: Vanguard WRM-10
PROCEDURE REV.: 1.0
CALIBRATED BY: Edwin Zhang
P.O. NUMBER:
CUSTOMER: Shermco - Regina
1033 Kearns Cres.
Regina, SK S4P 3B2

TEST RESULT: PASS
PERFORMED ON: 04 March 2020
DATA TYPE: FOUND-LEFT
TEMPERATURE: 20.00 °C
HUMIDITY: 40 %

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REMARKS:

Standards Used

<u>Asset #</u>	<u>Description</u>	<u>Cal Date</u>	<u>Due Date</u>
101294	Burster 1282-0.001 1 mOhm Standard Resistor	5/3/2019	5/3/2020
101295	Burster 1282-0.01 10 mOhm Standard Resistor	5/3/2019	5/3/2020
101296	Burster 1282-0.1 100 mOhm Standard Resistor	5/3/2019	5/3/2020
SR2	YEW 2792 1 ohm Resistor	2/19/2020	2/19/2021
SR3	YEW 2792 1000 ohm Resistor	2/19/2020	2/19/2021
SR4	YEW 2892 100 ohm Resistor	2/19/2020	2/19/2021

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
Display Test		Y				Pass
V1	1.000	1.004	0.994	1.006	mΩ	Pass
	10.00	10.03	9.94	10.06	mΩ	Pass
	100.0	100.3	98.9	101.1	mΩ	Pass
	1.000	1.010	0.984	1.016	Ω	Pass
	100.00	100.30	98.40	101.60	Ω	Pass
	1000.00	1003.00	984.00	1016.00	Ω	Pass
V2	1.000	1.004	0.994	1.006	mΩ	Pass

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
	10.00	10.03	9.94	10.06	mΩ	Pass
	100.0	100.4	98.9	101.1	mΩ	Pass
	1.000	1.010	0.984	1.016	Ω	Pass
	100.00	100.20	98.40	101.60	Ω	Pass
	1000.00	998.50	984.00	1016.00	Ω	Pass
Current Output	10	8.741	8.0	12.0	ADC	Pass

***** End of Certificate *****

Technician


Edwin Zhang - Technician



Certificate of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca



For Instrument : Raytech TR-Spy Mark II
Description : Transformer Ratio Tester
Serial Number : 03544
Asset Number : RF 23

Customer: Shermco - Regina
1033 Kearns Cres.
Regina, SK
S4P 3B2

The CAT Rental Store certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques.

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Quality Management system registered to ISO 9001: 2015

CALIBRATION INFORMATION

Cal Date: 9 Mar 2020

Temperature 20.0°C

Condition as Received/Returned: IN TOLERANCE
(Pass)

Next Cal Due: 9 Mar 2021

Humidity 40 %

Remarks:

Cal Procedure Raytech TR-SPY Mark II Transformer Turns Ratiometer

Revision 1.0

STANDARDS USED FOR CALIBRATION

Asset Number	Description	Cal Date	Due Date
49001	Megger 550555 TTR Calibration Standard	17 Sep 2019	17 Sep 2020
IW5447	Fluke 89IV Multimeter	11 Oct 2019	11 Oct 2020
SR4	YEW 2892 100 ohm Resistor	19 Feb 2020	19 Feb 2021



Signed: _____

Edwin Zhang - Technician

SERIAL NUMBER: 03544

ASSET NUMBER: RF 23

Report of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca

UNIT UNDER TEST:	Raytech TR-Spy Mark II Transformer Ratio Tester	TEST RESULT:	PASS
SERIAL NUMBER:	03544	PERFORMED ON:	09 March 2020
ASSET NUMBER:	RF 23	DATA TYPE:	FOUND-LEFT
PROCEDURE NAME:	Raytech TR-SPY Mark II Transformer Turns Ratiometer	TEMPERATURE:	20.00 °C
PROCEDURE REV.:	1.0	HUMIDITY:	40 %
CALIBRATED BY:	Edwin Zhang		
P.O. NUMBER:			
CUSTOMER:	Shermco - Regina 1033 Kearns Cres. Regina, SK S4P 3B2		

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REMARKS:

Standards Used

Asset #	Description	Cal Date	Due Date
49001	Megger 550555 TTR Calibration Standard	9/17/2019	9/17/2020
IW5447	Fluke 89IV Multimeter	10/11/2019	10/11/2020
SR4	YEW 2892 100 ohm Resistor	2/19/2020	2/19/2021

Test Results

Test Description	True Value	Test Result	Lower limit	Upper limit	Units	TUR
10V	1.0000	1.0000	0.8500	1.1500	Ratio	Pass
	2.0000	1.9984	1.7000	2.3000	Ratio	Pass
	5.0000	5.0011	4.2500	5.7500	Ratio	Pass
	10.000	9.998	8.500	11.500	Ratio	Pass
	20.000	20.001	17.000	23.000	Ratio	Pass
	50.000	50.020	42.500	57.500	Ratio	Pass
	100.00	100.04	85.00	115.00	Ratio	Pass
	200.00	200.10	170.00	230.00	Ratio	Pass
	500.00	500.22	425.00	575.00	Ratio	Pass
	1000.0	1000.6	850.0	1150.0	Ratio	Pass
40V	2000.0	2002.7	1700.0	2300.0	Ratio	Pass

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
	1.0000	1.0001	0.9992	1.0008	Ratio	Pass
	2.0000	1.9984	1.9984	2.0016	Ratio	Pass
	5.0000	5.0001	4.9960	5.0040	Ratio	Pass
	10.000	9.997	9.992	10.008	Ratio	Pass
	20.000	20.003	19.984	20.016	Ratio	Pass
	50.000	50.007	49.960	50.040	Ratio	Pass
	100.00	100.02	99.92	100.08	Ratio	Pass
	200.00	200.08	199.84	200.16	Ratio	Pass
	500.00	500.16	499.60	500.40	Ratio	Pass
	1000.0	1000.5	999.2	1000.8	Ratio	Pass
	2000.0	2001.4	1998.4	2001.6	Ratio	Pass
Phase						
1.5		1.5				
-1.5		-1.7				
AC Amps						
100V, 100 Ohm		243				
40V, 100 Ohm		88				

***** End of Certificate *****

Technician



Edwin Zhang - Technician



Certificate of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca



For Instrument : Megger BM5200
Description : 5kV Insulation Tester
Serial Number : 101485610
Asset Number : RF 66

Customer: Shermco - Regina
1033 Kearns Cres.
Regina, SK
S4P 3B2

The CAT Rental Store certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques.

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Quality Management system registered to ISO 9001: 2015

CALIBRATION INFORMATION

Cal Date: 3 Jun 2020 Temperature 20.2°C Condition as Received/Returned: IN TOLERANCE
Next Cal Due: 3 Jun 2021 Humidity 35 % (Pass)
Remarks:
Cal Procedure Megger BM5200 5kV Insulation Tester Revision 1.0

STANDARDS USED FOR CALIBRATION

Asset Number	Description	Cal Date	Due Date
31922	Fluke 5520A Calibrator	21 May 2020	21 May 2021
IW5210	Fluke 80K-40 HV Probe	05 Dec 2019	05 Dec 2020
IW5702	WECO 1M-100G Resistance Box	30 Aug 2019	30 Aug 2020
TCRS AA00009827	Fluke 89IV RMS Multimeter	08 Nov 2019	08 Nov 2020



Signed: _____

Justin Smith - Technician

SERIAL NUMBER: 101485610

ASSET NUMBER: RF 66

Report of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca

UNIT UNDER TEST: Megger BM5200 5kV Insulation Tester
SERIAL NUMBER: 101485610
ASSET NUMBER: RF 66
PROCEDURE NAME: Megger BM5200 5kV Insulation Tester
PROCEDURE REV.: 1.0
CALIBRATED BY: Justin Smith
P.O. NUMBER:
CUSTOMER: Shermco - Regina
1033 Kearns Cres.
Regina, SK S4P 3B2

TEST RESULT: PASS
PERFORMED ON: 03 June 2020
DATA TYPE: FOUND-LEFT
TEMPERATURE: 20.20 °C
HUMIDITY: 35 %

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REMARKS:

Standards Used

<u>Asset #</u>	<u>Description</u>	<u>Cal Date</u>	<u>Due Date</u>
31922	Fluke 5520A Calibrator	5/21/2020	5/21/2021
IW5210	Fluke 80K-40 HV Probe	12/5/2019	12/5/2020
IW5702	WECO 1M-100G Resistance Box	8/30/2019	8/30/2020
TCSR AA00009827	Fluke 89IV RMS Multimeter	11/8/2019	11/8/2020

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
VDC IN	120.0	120.0	113.4	126.6	V	Pass
	360.0	361.0	346.2	373.8	V	Pass
	590.0	591.0	569.3	610.7	V	Pass
VAC IN (60Hz)	120.0	120.0	113.4	126.6	V	Pass
	360.0	360.0	346.2	373.8	V	Pass
	590.0	592.0	569.3	610.7	V	Pass
VDC OUT	264.0	265.1	264.0	276.5	V	Pass
	523.0	526.0	523.0	548.0	V	Pass
	1036.0	1040.1	1036.0	1086.0	V	Pass

Test Results

Test Description	True Value	Test Result	Lower limit	Upper limit	Units	TUR
250V	2570.0	2577.2	2570.0	2695.0	V	Pass
	5160.0	5168.5	5160.0	5410.0	V	Pass
250V	1.0	1.0	0.7	1.3	MΩ	Pass
	9.9	10.0	9.2	10.6	MΩ	Pass
	50.2	50.3	47.5	52.9	MΩ	Pass
	100.2	100.3	95.0	105.4	MΩ	Pass
	1.0	1.0	0.7	1.3	GΩ	Pass
	10.0	11.1	8.7	11.3	GΩ	Pass
500V	1.0	1.0	0.7	1.3	MΩ	Pass
	9.9	9.9	9.2	10.6	MΩ	Pass
	50.2	50.2	47.5	52.9	MΩ	Pass
	100.2	100.3	95.0	105.4	MΩ	Pass
	1.0	1.0	0.9	1.1	GΩ	Pass
	10.0	10.4	9.1	10.9	GΩ	Pass
1000V	1.0	1.0	0.7	1.3	MΩ	Pass
	9.9	10.0	9.2	10.6	MΩ	Pass
	50.2	50.2	47.5	52.9	MΩ	Pass
	100.2	100.5	95.0	105.4	MΩ	Pass
	1.0	1.0	0.9	1.1	GΩ	Pass
	10.0	10.2	9.3	10.7	GΩ	Pass
2500V	99.8	107.0	75.0	124.6	GΩ	Pass
	1.0	1.0	0.7	1.3	MΩ	Pass
	9.9	10.0	9.2	10.6	MΩ	Pass
	50.2	50.4	47.5	52.9	MΩ	Pass
	100.2	100.5	95.0	105.4	MΩ	Pass
	1.0	1.0	0.9	1.1	GΩ	Pass
5000V	10.0	10.5	9.4	10.6	GΩ	Pass
	99.8	112.0	86.9	112.7	GΩ	Pass
	1.0	0.9	0.7	1.3	MΩ	Pass
	9.9	10.0	9.2	10.6	MΩ	Pass
	50.2	50.6	47.5	52.9	MΩ	Pass
	100.2	100.9	95.0	105.4	MΩ	Pass
5000V	1.0	1.0	0.9	1.1	GΩ	Pass
	10.0	10.1	9.5	10.5	GΩ	Pass
	99.8	101.0	90.9	108.7	GΩ	Pass

***** End of Certificate *****

Technician

Justin Smith - Technician



CALIBRATION CERTIFICATE

This certificate warrants that the product referenced herein meets or exceeds all published specifications as determined by definitive test procedures which form a part of its historical record, and is Certified Traceable to the National Institute of Standards and Technology (N.I.S.T.).

Model Number: M4100 Instrument

Procedure Used: 72A-0900 or 72A-1792-01

Serial Number: 019700911

Certification Date: October 19, 2015

All equipment used in the test and calibration processes and secondary reference standards are calibrated to the highest order of accuracy and are traceable to the National Institute of Standards and Technology, or other international standards coordinated with N.I.S.T.

CERTIFICATION AS 4:1 CALIBRATION ACCURACY MAINTAINED.

Calibration Approval Person

Test Technician

Signature:

Title:

Signature:

Lenny Strike

Calibration Laboratory Location

Doble Engineering Company

85 Walnut Street

Watertown, MA 02472 USA

Telephone: (617) 926-4900 Fax (617) 926-0528



Responsibility For Quality Assurance Program

Doble Engineering Company

85 Walnut Street

Watertown, MA 02472 USA

Telephone: (617) 926-4900 Fax (617) 926-0528

Model Number: M4100 Instrument

Serial Number: 019700911

Doble Quality Revision: E Date: 7/15/2014

Recommended Calibration Due Date: 10/19/2020

Customer Name: Lee Saretsky

Customer PO#:

Shermco Canada

1033 Kearns Cres.

P.O. Box 995

Regina, Saskatchewan S4P 3E1 CANADA

Doble Engineering Company

Model: M4100				Tested By: L. Strike			
Serial #: 019700911				Date: 10/19/15			
Procedure Used: 72A-0900-01							
Calibration Standards Bench #: 513 STD Calibration Due Date: 02/18/16 Specification: Cap. Tolerance '+/- 0.25% %PF Tolerance '+/- 0.02% up to 39000 pfd '+/- 0.04% above							
KV	Standard Values		Measured Values		% Dev. from STD.		Cap. %pf
	Cap pfd	%pf	Cap pfd	%pf	Cap pfd	%pf	Pass/Fail Pass/Fail
2.5	163.08	0.2325	163.04	0.233	-0.02	0.001	Pass Pass
10.0	163.09	0.1975	163.04	0.203	-0.03	0.006	Pass Pass
2.5	261.58	0.232	261.55	0.232	-0.01	0.000	Pass Pass
10.0	261.61	0.1824	261.51	0.193	-0.04	0.011	Pass Pass
2.5	1088.78	0.1433	1088.37	0.156	-0.04	0.013	Pass Pass
10.0	1088.71	0.0944	1088.91	0.093	0.02	-0.001	Pass Pass
2.5	2625.12	0.1715	2625.82	0.171	0.03	-0.001	Pass Pass
10.0	2624.93	0.0991	2624.93	0.100	0.00	0.001	Pass Pass
2.5	5670.58	0.1778	5671.46	0.179	0.02	0.001	Pass Pass
10.0	5670.17	0.1016	5669.96	0.102	0.00	0.000	Pass Pass
2.5	15885.62	0.1219	15884.54	0.123	-0.01	0.001	Pass Pass
10.0	15884.72	0.0977	15888.31	0.104	0.02	0.006	Pass Pass
2.5	37515.02	0.1379	37523.61	0.142	0.02	0.004	Pass Pass
10.0	37513.07	0.1054	37523.16	0.114	0.03	0.009	Pass Pass
2.5	216085.05	0.1355	216120.00	0.140	0.02	0.005	Pass Pass
10.0	216085.05	0.1066	215930.00	0.105	-0.07	-0.002	Pass Pass
2.5	483920.44	0.1671	483550.00	0.161	-0.08	-0.006	Pass Pass
10.0	483728.96	0.0941	483400.00	0.097	-0.07	0.003	Pass Pass
2.5	964239.71	0.1797	963500.00	0.170	-0.08	-0.010	Pass Pass
10.0	963988.23	0.1088	963600.00	0.107	-0.04	-0.002	Pass Pass





Certificate of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca



For Instrument : Vanguard EZCT-2000

Customer: Shermco - Regina

Description : Current Transformer Tester

1033 Kearns Cres.

Serial Number : 93467

Regina, SK

Asset Number : RF 6

S4P 3B2

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Quality Management system registered to ISO 9001: 2015

CALIBRATION INFORMATION

Cal Date: 8 Jun 2020

Temperature 19.3°C

Condition as Received/Returned: IN TOLERANCE

Next Cal Due: 8 Jun 2021

Humidity 38 %

(Pass)

Remarks:

Cal Procedure EZCT-2000

Revision 1.0

STANDARDS USED FOR CALIBRATION

Asset Number	Description	Cal Date	Due Date
IW5210	Fluke 80K-40 HV Probe	05 Dec 2019	05 Dec 2020
IW5447	Fluke 89IV Multimeter	11 Oct 2019	11 Oct 2020
SR2	YEW 2792 1 ohm Resistor	19 Feb 2020	19 Feb 2021
TCRS 753075	H.W.SULLIVAN 46211 Current Transformer	08 Jun 2020	08 Jun 2021



Signed:

Justin Smith - Technician

Report of Calibration

The CAT Rental Store
Wirtanen Division
10235 - 180 Street Edmonton, AB T5L 3B2
PHONE: (780) 434-8421
www.catrents.ca

UNIT UNDER TEST:	Vanguard EZCT-2000 Current Transformer Tester	TEST RESULT:	PASS
SERIAL NUMBER:	93467	PERFORMED ON:	08 June 2020
ASSET NUMBER:	RF 6	DATA TYPE:	FOUND-LEFT
PROCEDURE NAME:	EZCT-2000	TEMPERATURE:	19.34 °C
PROCEDURE REV.:	1.0	HUMIDITY:	38 %
CALIBRATED BY:	Justin Smith		
P.O. NUMBER:			
CUSTOMER:	Shermco - Regina 1033 Kearns Cres. Regina, SK S4P 3B2		

The CAT Rental Store certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure unless otherwise noted. It has been calibrated using measurement standards traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques.

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Note: Any Test Uncertainty Ratio (TUR) that is less than four to one will appear under the "TUR" heading on the data record. If the TUR meets or exceeds four to one, the field is left blank.

REMARKS:

Standards Used

<u>Asset #</u>	<u>Description</u>	<u>Cal Date</u>	<u>Due Date</u>
IW5210	Fluke 80K-40 HV Probe	12/5/2019	12/5/2020
IW5447	Fluke 89IV Multimeter	10/11/2019	10/11/2020
SR2	YEW 2792 1 ohm Resistor	2/19/2020	2/19/2021
TCRS 753075	H.W.SULLIVAN 46211 Current Transformer	6/8/2020	6/8/2021

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
Test Channel						
X1-X2		Checked				
X1-X3		Checked				
X1-X4		Checked				
X1-X5		Checked				
X2-X3		Checked				
X2-X4		Checked				
X2-X5		Checked				
X3-X4		Checked				
X3-X5		Checked				
X4-X5		Checked				
Voltage						

Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Test Result</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>TUR</u>
Current	49.7	49.8	48.2	51.2	VAC	Pass
	300.5	300.6	296.5	304.5	VAC	Pass
	499.4	499.5	493.4	505.4	VAC	Pass
	1004.2	1004.8	993.2	1015.2	VAC	Pass
		Checked				
Ratio	10.000	10.026	9.880	10.120	A	Pass
	5.748	5.734	5.678	5.818	A	Pass
	2.597	2.558	2.557	2.637	A	Pass
	1.280	1.293	1.248	1.312	A	Pass
Resistance	10.000	10.006	9.990	10.010	Ratio	Pass
	20.000	20.016	19.980	20.020	Ratio	Pass
	50.000	49.978	49.950	50.050	Ratio	Pass
	100.000	100.100	99.900	100.100	Ratio	Pass
Resistance	1.000	1.020	0.970	1.030	Ω	Pass
	10.000	10.130	9.790	10.210	Ω	Pass

***** End of Certificate *****

Technician


Justin Smith - Technician