



THE CITY OF WINNIPEG

TENDER NO. 152-2023

NEWPCC UV TRANSFORMER ENCLOSURE REPAIR

APPENDIX C

Transformer Inspection Report



Service Report

Customer: **City of Winnipeg NEWPCC**
2230 Main Street
Winnipeg, Manitoba
R2V 4T8

Attention: Ryan Norrie

Subject: UV Transformer Testing and Inspections

Prepared by: Curtis Zary
Date: May 6 2021
IER Job #: 39021



May 6, 2021

City of Winnipeg NEWPCC
2230 Main Street
Winnipeg, Manitoba
R2V 4T8

Attention: Ryan Norrie
Subject: UV Transformer Testing and Inspections
IER Job #: 39021

Ryan,

Attached for your records is a brief summary of services performed, deficiencies and recommendations from the UV Transformer Testing and Inspections. Also included are the individual equipment test sheets where additional information can be found.

It was a pleasure working with you and your personnel. If you have any questions or if we can be of further assistance feel free to let us know.

Regards,

Curtis Zary.

I. SERVICES PERFORMED

- Isolate UV Transformers to perform inspections, cleaning and testing.

II. DEFICIENCIES/RECOMMENDATIONS

- All 4 outdoor 4160V dry type UV transformers have top entry cable and bus duct. That combined with 3 piece poorly designed enclosure roofs have caused water entry and corrosion of the roof tops. IER recommends continued monitoring of transformers.
- UVT-2 Severely corroded enclosure roof.



- UVT-2 4160V primary H1 cable heat shrink has split due to transformer heat. This has exposed the tape shield which was found to be broken in 2 places.



- UVT-3 Corroded Enclosure Roof.



- LST-4 Corroded Roof.



- LST-5 Minor Roof Corrosion.



- IER recommends continued electrical maintenance to ensure system function and reliability.



Dry Type Transformer Test Sheet

Customer: NEWPCC Job #: 39021 Date: May 5 2021

Equipment ID: _____ Tested By: CZ/MZ
 Substation: UV Feeder: UVT-2

Type: <u>ANN</u> Manufacturer: <u>GE</u> Serial #: <u>RPF-0002-170064</u> kVA: <u>4000</u> PRI: <u>4160</u> <u>V</u> SEC: <u>480/277</u> <u>V</u> Impedance: <u>7.64% @ 170C</u>	Phases: <u>3</u> Hz: <u>60</u> BIL-PRI: <u>60</u> <u>kV</u> BIL-SEC: <u>10</u> <u>kV</u> Winding Temp.: <u>n/a</u> <u>°C</u> Tap Setting - Found: <u>4 to 2</u> - <u>8 to 6</u> Tap Setting - Left: _____ - _____ Transformer Connection: <u>Delta / Wye</u>
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Turns Ratio Test (TTR)

Tap Position:	4&3	to	8&7	4&2	to	8&7	4&2	to	8&6	4&1	to	8&6	4&1	to	8&5	
Primary Voltage:	4368		4264		4160		4056		3952							
Calculated Ratio:					12.008											
H1-H /X -X :					n/a cannot isolate											
Exciting Current [mA]:					n/a											
H2-H /X -X :					n/a											
Exciting Current [mA]:					n/a											
H3-H /X -X :					n/a											
Exciting Current [mA]:					n/a											

Insulation resistance Test @ 1000VDC, Core to Ground @ 500VDC [M(Meg) G(Gig) T(Tera) Ohms]

	Hi to Lo and Ground	Lo to Hi and Ground	Hi and Lo to Ground	Core to Ground
Measured	n/a	n/a	n/a	n/a
Corrected to 20°C				

Inspection of Dry Type Transformer:

Exterior / Interior Condition: top rusting, inside cleaned

Clean and Inspect Insulators: cleaned, ok

Mounting and Supports: cleaned, ok

Iron and Coils: cleaned, ok

Check All Connections for Tightness: ok

Inspect for Signs of Overheating: ok

Inspect for Adequate Electrical Clearance: ok

Arrestors: n/a

Ventilation Filters: n/a

Fans: n/a

NGR / Grounding: n/a, OX tied to ground.

Comments:

Cleaning and inspection only cannot isolate secondary for testing due to ground current of 72A at XO.
 Insulation Resistance High to Low and Ground @ 5KVDC for 1 minute = 43.1G ohms. Test includes primary cables.
 H1 Primary cables heat shrink split exposing tape shield. Shield is broken in 2 places.
 Top of transformer enclosure severely corroded.



Dry Type Transformer Test Sheet

Customer: NEWPCC Job #: 39021 Date: May 5 2021

Equipment ID: _____ Tested By: CZ/MZ
 Substation: UV Feeder: UVT-3

Type: <u>ANN</u> Manufacturer: <u>GE</u> Serial #: <u>RPH-0002-171064</u> kVA: <u>4000</u> PRI: <u>4160</u> <u>V</u> SEC: <u>480/277</u> <u>V</u> Impedance: <u>7.48% @ 170C</u>	Phases: <u>3</u> Hz: <u>60</u> BIL-PRI: <u>60</u> <u>kV</u> BIL-SEC: <u>10</u> <u>kV</u> Winding Temp.: <u>n/a</u> <u>°C</u> Tap Setting - Found: <u>4 to 2</u> - <u>8 to 6</u> Tap Setting - Left: _____ - _____ Transformer Connection: <u>Delta / Wye</u>
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Turns Ratio Test (TTR)

Tap Position:	4&3	to	8&7	4&2	to	8&7	4&2	to	8&6	4&1	to	8&6	4&1	to	8&5
Primary Voltage:	4368		4264			4160			4056			3952			
Calculated Ratio:						12.008									
H1-H /X -X :						n/a cannot isolate									
Exciting Current [mA]:						n/a									
H2-H /X -X :						n/a									
Exciting Current [mA]:						n/a									
H3-H /X -X :						n/a									
Exciting Current [mA]:						n/a									

Insulation resistance Test @ 1000VDC, Core to Ground @ 500VDC [M(Meg) G(Gig) T(Tera) Ohms]

	Hi to Lo and Ground	Lo to Hi and Ground	Hi and Lo to Ground	Core to Ground
Measured	n/a	n/a	n/a	n/a
Corrected to 20°C				

Inspection of Dry Type Transformer:

Exterior / Interior Condition: top rusting, inside cleaned.

Clean and Inspect Insulators: cleaned, ok

Mounting and Supports: cleaned, ok

Iron and Coils: cleaned, ok

Check All Connections for Tightness: ok

Inspect for Signs of Overheating: ok

Inspect for Adequate Electrical Clearance: ok

Arrestors: n/a

Ventilation Filters: n/a

Fans: n/a

NGR / Grounding: n/a, OX tied to ground.

Comments:

Cleaning and inspection only cannot isolate secondary for testing due to ground current of 24A at XO.
 Insulation Resistance High to Low and Ground @ 5KVDC for 1 minute = 43.7G ohms. Test includes primary cables.
 Top of transformer enclosure corroded.



Dry Type Transformer Test Sheet

Customer: NEWPCC Job #: 39021 Date: May 5 2021

Equipment ID: _____	Tested By: <u>CZ/MZ</u>
Substation: <u>UV</u>	Feeder: <u>LST-4</u>
Type: <u>ANN</u>	Phases: <u>3</u>
Manufacturer: <u>GE</u>	Hz: <u>60</u>
Serial #: <u>RPF-0003-170063</u>	BIL-PRI: <u>60</u> kV
kVA: <u>1250</u>	BIL-SEC: <u>10</u> kV
PRI: <u>4160</u> V	Winding Temp.: <u>n/a</u> °C
SEC: <u>600/347</u> V	Tap Setting - Found: <u>4 to 2</u> - <u>8 to 6</u>
Impedance: <u>7.14% @ 170C</u>	Tap Setting - Left: _____ - _____
	Transformer Connection: <u>Delta / Wye</u>

Turns Ratio Test (TTR)

Tap Position:	4&3	to	8&7	4&2	to	8&7	4&2	to	8&6	4&1	to	8&6	4&1	to	8&5
Primary Voltage:	4368		4264			4160			4056			3952			
Calculated Ratio:						12.008									
H1-H /X -X :						12.005									
Exciting Current [mA]:						52.6									
H2-H /X -X :						12.008									
Exciting Current [mA]:						45.6									
H3-H /X -X :						12.008									
Exciting Current [mA]:						57									

Insulation resistance Test @ 1000VDC, Core to Ground @ 500VDC [M(Meg) G(Gig) T(Tera) Ohms]

	Hi to Lo and Ground	Lo to Hi and Ground	Hi and Lo to Ground	Core to Ground
Measured	102G	120G	73.2G	490G
Corrected to 20°C				

Inspection of Dry Type Transformer:

Exterior / Interior Condition: top rusting, inside dirty, cleaned

Clean and Inspect Insulators: cleaned, ok

Mounting and Supports: cleaned, ok

Iron and Coils: cleaned, ok

Check All Connections for Tightness: ok

Inspect for Signs of Overheating: ok

Inspect for Adequate Electrical Clearance: ok

Arrestors: n/a

Ventilation Filters: n/a

Fans: n/a

NGR / Grounding: n/a, OX tied to ground.

Comments:

Secondary disconnected for testing.
 Insulation Resistance High to Low and Ground @ 5KVDC for 1 minute = 40.4G ohms. Test includes primary cables.
 Top of transformer enclosure corroded.



Dry Type Transformer Test Sheet

Customer: NEWPCC Job #: 39021 Date: May 5 2021

Equipment ID: _____	Tested By: <u>CZ/MZ</u>
Substation: <u>UV</u>	Feeder: <u>LST-5</u>
Type: <u>ANN</u>	Phases: <u>3</u>
Manufacturer: <u>GE</u>	Hz: <u>60</u>
Serial #: <u>RPH-0001-171016</u>	BIL-PRI: <u>60</u> kV
kVA: <u>1250</u>	BIL-SEC: <u>10</u> kV
PRI: <u>4160</u> V	Winding Temp.: <u>72</u> °C
SEC: <u>600/347</u> V	Tap Setting - Found: <u>4 to 2</u> - <u>8 to 6</u>
Impedance: <u>7.0% @ 170C</u>	Tap Setting - Left: _____ - _____
	Transformer Connection: <u>Delta / Wye</u>

Turns Ratio Test (TTR)

Tap Position:	4&3	to	8&7	4&2	to	8&2	4&2	to	8&6	4&1	to	8&6	4&1	to	8&5
Primary Voltage:	4368		4264			4160			4056			3952			
Calculated Ratio:						12.008									
H1-H /X -X :						12.003									
Exciting Current [mA]:						38									
H2-H /X -X :						12.005									
Exciting Current [mA]:						31.5									
H3-H /X -X :						12.004									
Exciting Current [mA]:						38.1									

Insulation resistance Test @ 1000VDC, Core to Ground @ 500VDC [M(Meg) G(Gig) T(Tera) Ohms]

	Hi to Lo and Ground	Lo to Hi and Ground	Hi and Lo to Ground	Core to Ground
Measured	146G	219G	95.8G	12.7G
Corrected to 20°C				

Inspection of Dry Type Transformer:

Exterior / Interior Condition: cleaned, ok

Clean and Inspect Insulators: cleaned, ok

Mounting and Supports: cleaned, ok

Iron and Coils: cleaned, ok

Check All Connections for Tightness: ok

Inspect for Signs of Overheating: ok

Inspect for Adequate Electrical Clearance: ok

Arrestors: n/a

Ventilation Filters: n/a

Fans: n/a

NGR / Grounding: n/a, OX tied to ground.

Comments:

Secondary disconnected for testing.
 Insulation Resistance High to Low and Ground @ 5KVDC for 1 minute = 47.8G ohms. Test includes primary cables.
 Top of transformer enclosure minor corrosion.