

THE CITY OF WINNIPEG

TENDER NO. 896-2021

NEWPCC UV TRANSFORMER 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.

| IER Industrial Electrical Repair Ir | пс. | Dry | Type Transfor | mer Test Sh | eet | | | | | | |
|---|--|--|--|----------------|--------------|--|--|--|--|--|--|
| Customer: | NEWPCC | | Job #: 39 | 021 Date | : May 5 2021 | | | | | | |
| Equipment ID: | | | Tested Bv | C | 7/\\/7 | | | | | | |
| Substation: | | UV | Feeder | : <u> </u> | VT-2 | | | | | | |
| Turner | | | | Dhasas | 2 | | | | | | |
| Type: Manufacturer: | <i>H</i> | GE | | Hz: | <u> </u> | | | | | | |
| Serial # | | 02-170064 | BIL-PRI: 60 kV | | | | | | | | |
| kVA: | 4 | 000 | | BIL-SEC: 10 | kV | | | | | | |
| PRI: | 4160 | V | Winding Temp.: n/a °C | | | | | | | | |
| SEC: | 480/277 | v | Tap Setting - Found: 4 to 2 - 8 to 6 | | | | | | | | |
| Impedance: | 7.64% | @ 170C | Tap Setti | ing - Left: | | | | | | | |
| | | | Transformer Co | nnection: | Delta / Wye | | | | | | |
| 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 | | | | | | | | |
| HZ-H/X -X : | | | n/a | | | | | | | | |
| | | | n/a | | | | | | | | |
| Exciting Current [mA]: | | | n/a | | | | | | | | |
| Insulation resistance Test | @ 1000VDC. Core to G | round @ 500VDC [M(Meg) | G(Gig) T(Tera) Ohms] | | | | | | | | |
| | | | | | | | | | | | |
| Manageral | Hi to Lo and Ground | Lo to Hi and Ground | Hi and Lo to Ground | Core to Ground | 7 | | | | | | |
| Measured | n/a | n/a | n/a | n/a | - | | | | | | |
| Confected to 20 C | | | | | | | | | | | |
| Inspection of Dry Type Tra | ansformer: | | | | | | | | | | |
| Exte | rior / Interior Condition: | top rusting, i | nside cleaned | _ | | | | | | | |
| Clean | and Inspect Insulators: | clean | d, ok | | | | | | | | |
| n | Mounting and Supports: | clean | cleaned, ok | | | | | | | | |
| | Iron and Coils: | clean | ed, ok | _ | | | | | | | |
| Check All Con | nections for Tightness: | 0 | ok | - | | | | | | | |
| Inspect fo | or Signs of Overheating: | (| ok | - | | | | | | | |
| Inspect for Adequa | te Electrical Clearance: | | <u></u> | | | | | | | | |
| | Arrestors: | n | /a | - | | | | | | | |
| | Ventilation Filters: | ń | /a | - | | | | | | | |
| | NGR / Grounding: | n/a OX tie | d to around | _ | | | | | | | |
| Commonts: | Nont, ereanang. | | | _ | | | | | | | |
| Cleaning and inspection on Insulation Resistance High H1 Primary cables heat shr **Top of transformer enclos | ly cannot isolate seconda to Low and Ground @ 5K ink split exposing tape shi ure severely corroded.** | ry for testing due to ground o VDC for 1 minute = 43.1G o eld. Shield is broken in 2 pla | current of 72A at XO. hms. Test includes primary aces. | cables. | | | | | | | |

| IER Industrial Electrical Repair In | nc. | | | | Dry | Туре | Tra | nsfor | mer | Test She | et | | | | | |
|---|-------------------------------------|-------------------------------|------------------|----------------|-------------|----------------------|-----------|-----------|-----------|--|------|----|------|--|--|--|
| Customer: | | Job #: 39021 Date: May 5 2021 | | | | | | | | | | | | | | |
| Equipment ID: | | | | | Те | ested By: | | CZ | /MZ | | | | | | | |
| Substation: | JV | | | | | Feeder: | | UV | T-3 | | | | | | | |
| Type: | | | | | | | Phases: | | 3 | | | | | | | |
| Manufacturer: | | | | | | | Hz: | | 60 | | | | | | | |
| Serial #: | | 4 | | BIL-PRI:60kV | | | | | | | | | | | | |
| kVA: | | | | BIL-SEC: 10 kV | | | | | | | | | | | | |
| PRI: | 4160 | | v | | | Winding Temp.:n/a °C | | | | | | | | | | |
| SEC: | 480/277 | 7 400/ | V | | | | Та | p Setting | - Found: | 4 to 2 | | 8 | to 6 | | | |
| Impedance: | | 7.48% | @ 170C | | | Tap Setting - Left: | | | | | | | | | | |
| | | | | | | | Transfo | ormer Co | nnection: | Date: May 5 2021 CZ/MZ UVT-3 vases: 3 Hz: 60 L-PRI: 60 KV -SEC: 10 remp: n/a °C cound: 4 to 2 4&1 to 4&1 to 4056 3952 | | | | | | |
| 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 is | olate | | | | | | | | |
| Exciting Current [mA]: | | | | | | n/a | | | | | | | | | | |
| H2-H /X -X : | | | | | | | | | | | | | | | | |
| Exciting Current [mA]: | | | | | | n/a | | | | | | | | | | |
| H3-H /X -X : | | | | | | | n/a | | | | | | | | | |
| Exciting Current [mA]: | | | | | | | n/a | | | | | | | | | |
| Insulation resistance Test | t @ 1000VDC, Co | ore to Gr | ound @ { | 500VDC | C [M(Meg) | G(Gig) T(| Tera) O | hms] | | | | | | | | |
| Hi to Lo and Ground | | | Lo to l | Hi and (| Ground | Hi and | I Lo to C | Ground | Core | e to Ground | _ | | | | | |
| Measured | n/a | | n/a | | | n/a | | | | n/a | - | | | | | |
| Corrected to 20°C | | | | | | | | | | | | | | | | |
| Inspection of Dry Type Tra | ansformer: | | | | | | | | | | | | | | | |
| Exte | rior / Interior Cor | ndition: | | tor | rustina ir | side clea | hed | | | | | | | | | |
| Clean | and Inspect Insu | ulators: | | 104 | clean | ed, ok | | | | | | | | | | |
| Ν | Mounting and Su | pports: | | | clean | aned ok | | | | | | | | | | |
| | Iron and | d Coils: | | | clean | ed, ok | | | _ | | | | | | | |
| Check All Con | nections for Tig | htness: | ok | | | | | | | | | | | | | |
| Inspect fo | or Signs of Overh | eating: | | ok | | | | | | | | | | | | |
| Inspect for Adequa | te Electrical Clea | arance: | | | C | ok | | | | | | | | | | |
| | Arr | estors: | n/a | | | | | | - | | | | | | | |
| | | | n | /a | | | - | | | | | | | | | |
| | | n n/a. OX tior | /a d to group | d | | - | | | | | | | | | | |
| Comments: | | anuny. | | 1 | | a to groun | u. | | _ | | | | | | | |
| Cleaning and inspection on | lv cannot isolate s | econdar | v for testi | na due t | to ground a | current of | 24A at X | 0. | | | | | | | | |
| Insulation Resistance High **Top of transformer enclos | to Low and Groun ure corroded.** | id @ 5K | VDC for 1 | minute | = 43.7G o | hms. Test | include | s primary | cables. | | | | | | | |

| IER Industrial Electrical Repair I | nc. | | Dry | Type Transformer Test Sheet | | | | | | | | | | |
|---|---|----------------|---------------|---|---------|-----------|-----------|---|-----|-----------|------|--|--|--|
| Customer: | NEWPCC | | | Job #: | _ | 390 | 021 | Date: | N | lay 5 20: | 21 | | | |
| Equipment ID: | | | C7 | C7/M7 | | | | | | | | | | |
| Substation: | | UV | | | | Feeder: | | LS | T-4 | | | | | |
| Type: | А | NN | | | | | Phases | | 3 | | | | | |
| Manufacturer: | | GE | | Hz: 60 | | | | | | | | | | |
| Serial #: | RPF-00 | 03-170063 | | | | | BIL-PRI | : 60 | | kV | | | | |
| kVA: | 1 | 250 | | _ | | | BIL-SEC | : 10 | | kV | | | | |
| PRI: | 4160 | v | | Winding Temp.:n/a°C | | | | | | | | | | |
| SEC: | 600/347 | V @ 1700 | | Tap Setting - Found: 4 to 2 - 8 to 6 | | | | | | | to 6 | | | |
| Impedance: | 7.14% | @ 170C | | - | 1 | Fap Setti | ng - Left | Ler Test Sheet | | | | | | |
| | | | | T | ransfo | rmer Co | nnection | er Test Sheet Date: May 5 2021 CZ/MZ LST-4 ases: 3 Hz: 60 -PRI: 60 NV NV sec: 10 NV NV emp: n/a order °C pund: 4 to 2 4 to 2 - 886 48.1 4056 3952 481 to 4056 3952 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 10 0 10 0 10 0 10 0 10< | | | | | | |
| 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 | 426 | 4 | | 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 | | | | | | | | | |
| Exciting Current [mA]: | | | | | | 57 | | | | | | | | |
| Insulation resistance Tes | t @ 1000VDC. Core to Gr | ound @ 500V[| DC [M(Mea) | G(Gia) T(T | era) Oh | msl | | | | | | | | |
| | Hi to Lo and Ground | Lo to Hi and | d Ground | Hiand | | round | Cor | e to Ground | | | | | | |
| Measured | 102G | G | | 73.2G | lound | | 490G | | | | | | | |
| Corrected to 20°C | | - | | | | | | | | | | | | |
| Inspection of Dry Type T | ransformer: | | | | | | | | _ | | | | | |
| Exte | erior / Interior Condition: | top | rusting, insi | de dirty, cle | aned | | | | | | | | | |
| Clear | and Inspect Insulators: | | clean | ied, ok | | | _ | | | | | | | |
| | Mounting and Supports: | | cleaned, ok | | | | | | | | | | | |
| | Iron and Coils: clean | | | | | | | | | | | | | |
| Check All Co | Check All Connections for Tightness: | | | | | | _ | | | | | | | |
| Inspect for | ok | | | | | | | | | | | | | |
| Inspect for Adequa | ok | | | _ | | | | | | | | | | |
| | i/a | | | _ | | | | | | | | | | |
| | /a | | | _ | | | | | | | | | | |
| | Fans: | | | | | | _ | | | | | | | |
| Comments: | Non y Grounding. | | | a to ground | | | - | | | | | | | |
| Secondary disconnected for | or testing. | | | | | | | | | | | | | |
| Insulation Resistance High **Top of transformer enclor | to Low and Ground @ 5K' sure corroded.** | VDC for 1 minu | te = 40.4G o | hms. Test i | ncludes | primary | cables. | | | | | | | |

| IER Industrial Electrical Repair In | Type Transformer Test Sheet | | | | | | | | | | | | | | |
|--|--------------------------------------|----------------------|---------------------|-------------|-------------|----------------------|----------------|----------------------------|-----------|----------|-------------|-------|------------|---------|------|
| Customer: | | N | EWPCC | | | | Job #: | : | 390 |)21 | _ | Date: | M | ay 5 20 | 21 |
| Equipment ID: | | | | | | T | | Τe | ested By: | | | CZ/ | /MZ | | |
| Substation: | | | | UV | | | | | Feeder: | | | LS | T-5 | | |
| Туре: | | | | | | | ├ | | | Phases | | | 3 | | |
| Manufacturer: | | | / | GE | | | | | | Hz | | | 60 | | |
| Serial #: | | | RPH-00 | 01-171016 | 6 | ! | | | | BIL-PRI | : | 60 | | kV | |
| kVA: | | | 1 | 250 | | | 1 | | I | BIL-SEC | : | 10 | | _kV | ļ |
| PRI: | | 4160 | | <u>v</u> | | ľ | | _ | Windin | ig Temp. | : | 72 | | _°C | ļ |
| SEC: | | 600/347 | , 7 0% | V @ 170C | | ľ | | Та | ρ Setting | - Found | : 4 | to 2 | | 8 | to 6 |
| impedance. | | | 1.070 | @ 1700 | | | - | Timefo | Tap Setti | ng - Len | : | r | | | |
| | | | | | | ! | | Transio | rmer Coi | INECTION | : <u> </u> | ں | elta / vv) | /e | |
| Turns Ratio Test (1115) | | <u> </u> | <u> </u> | <u> </u> | | | <u> </u> | | | <u> </u> | | | | | |
| 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 | I | | 4264 | ! | | 4160 | | | 4056 | | | 3952 | |
| Calculated Ratio: | L | | I | | | | <u> </u> | 12.008 | | <u> </u> | | | ļ | | |
| H1-H /X -X : | ļ | | ! | | | | | 12.003 | | <u> </u> | | ! | ļ | | |
| Exciting Current [mA]: | ┝─── | | ! | ── | | | | 38 | | <u> </u> | | ! | | | |
| H2-H /X -X : | | |] | ── | | ! | <u> </u> | 12.005 | | | | | | | |
| Exciting Current [mA]: | | | | ├─── | | | + | 31.5 | | | | | | | |
| Fyeiting Current [mA]: | | | | <u> </u> | | | | 12.00 4 38.1 | | + | | | | | |
| Exclusion resistance Test | <u>-</u> | | intro to G | | 500VDC | · M/Mea) | C(Gia) T(| | | | | | | | |
| | 1000 | VD0, 0. | | Ouna e e | | [INI(INIC 3) | G(Gig) . (. | eraj C. | ופווו | | | | | | |
| | Hi to L | _o and C | Ground | Lo to F | Hi and (| Ground | Hi and | Lo to G | Found | Cor | e to Gro | ound | 1 | | |
| Measured | ┝─── | 146G | ! | ── | 219G | ! | ── | 95.8G | | | 12.7G | ! | | | |
| Corrected to 20°C | <u> </u> | | | <u> </u> | | | <u> </u> | | | | | |] | | |
| Inspection of Dry Type Tra | ansforme | er: | | | | | | | | | | | | | |
| Exte | erior / Inte | erior Co | ondition: | | | clean | ied, <u>ok</u> | | | | | | | | |
| Clean | and Ins | pect Ins | sulators: | | | clean | ed, ok | | | - | | | | | |
| P | Mounting | ງ and Sເ | upports: | | | clean | ed, ok | | | _ | | | | | |
| | | Iron an | ıd Coils: | | | clean | ed, ok | | | - | | | | | |
| Check All Con | inections | s for Tig | jhtness: | | | 0 | <u>ok</u> | | | - | | | | | |
| Inspect to | Inspect for Signs of Overheating:0 | | | | | | | | | - | | | | | |
| Inspect for Adequa | ite Electr | rical Cie | arance: | | | 0 | <u>, k</u> | | | - | | | | | |
| Arrestors: | | | | | | | <u>/a</u> | | | - | | | | | |
| | ••• | Milane. | Fans: | | | n | /a | | | - | | | | | |
| | NC | GR / Grc | ounding: | | r | n/a, OX <u>tie</u> r | d to ground | d | | - | | | | | |
| Comments: | | | | | | | | | | - | | | | | |
| Secondary disconnected fo Insulation Resistance High **Top of transformer enclos | r testing. to Low ar sure minc | nd Grou or corros | nd @ 5K' sion.** | VDC for 1 | minute | = 47.8G of | hms. Test | includes | sprimary | cables. | | | | | |