



CITY MANAGER'S OFFICE
CITY OF NEWARK

220 South Main Street · Newark, Delaware 19711
302.366.7000 · Fax 302.366.7035 · www.newarkde.gov

BIDDER _____

BID SECURITY _____

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

NOTICE

Do not disassemble. Return intact with
properly completed forms or bid may be rejected.

CITY OF NEWARK
Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

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CITY OF NEWARK
Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE
DOUBLE CIRCUIT UNIT SUBSTATION

NOTICE OF LETTING

Sealed bids for Contract No. 23-04, The Rewind and Overhaul Of a 10000/12500/14000 kVA Outdoor Type Double Circuit Unit Substation, will be received by the City of Newark Purchasing Division (220 South Main Street; Newark, Delaware 19711) until 2:00 p.m., prevailing time, on Tuesday, April 25, 2023, and will be publicly opened and read aloud in the Council Chamber shortly thereafter.

Bids may also be emailed in PDF form to the City Purchasing Division at contracts@newark.de.us by the deadline noted above and will be opened immediately after the closing date and time and will be publicly recorded in the Council Chamber shortly thereafter.

Please contact contracts@newark.de.us for additional information or with questions regarding the submission or technical aspects of the contract. The deadline for questions is 5:00 p.m. on Tuesday, April 18, 2023.

Copies of the contract documents may be obtained by each prospective bidder on the City's website at <http://www.newarkde.gov/>.

CITY OF NEWARK
Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

GENERAL CONTRACTUAL PROVISIONS

1. BIDS

Each bid shall be submitted on the proposal form included herein. The proposal and all other required documents must be submitted in a sealed envelope clearly identified with the bidder's name and marked, "City of Newark - Contract No. 23-04, THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE DOUBLE CIRCUIT UNIT SUBSTATION," and will be received by the Purchasing Division (220 South Main Street; Newark, Delaware 19711) until 2:00 p.m., prevailing time, **Tuesday, April 25, 2023**. Each bid so submitted shall constitute an irrevocable offer for a period of sixty (60) days following the bid opening date. **Please note that the City of Newark will jointly be vetting bids on both price and delivery timelines.**

2. BID SECURITY

Each bid must be accompanied by a certified check, cashier's check or bid bond in the amount of ten percent (10%) of the proposed bid price, payable to the City of Newark. Failure to provide the required bid security may be grounds for rejection of the bid. If a bid bond is submitted, the attached "Bond to Accompany Proposal" form must be completed and issued by a surety licensed to operate in the State of Delaware.

If the successful bidder fails or refuses to execute and deliver the contract within fourteen (14) calendar days after receiving notice of the award of the contract, the successful bidder shall forfeit to the City for such failure or refusal the security deposited with the bid. Any certified check or cashier's check submitted as security shall be returned to all unsuccessful bidders thirty (30) calendar days after the bid opening date.

3. CONTRACT SURETY BOND

A contract surety bond satisfactory to the City of Newark and in the full amount of the contract shall be required by the successful bidder within fourteen (14) calendar days of the contract award date. Such bonds shall be provided to the City with the executed contract. Upon receipt of the contract surety bond, the City will return any certified check or cashier's check submitted as bid security by the successful bidder. Upon receipt of this surety bond, the City will return any certified or cashier's check submitted as bid security.

4. TAXES

The price(s) quoted shall not include federal or state taxes. If applicable, the successful bidder shall provide the City with three (3) copies of the required tax exemption forms to accompany the bidder's invoice.

5. AWARDS

The City Manager will review each of the bids submitted and make a recommendation to the City Council on the disposition of the bids. The City Council reserves the right to accept or reject any or all bids or parts of bids as they may determine and to waive any irregularities or defects where the best interest of the City would be served.

6. UNIT PRICES

In the event of a conflict or error in extension from unit price to total amount, the unit prices shall prevail and shall be considered the correct bid figures. Bidders are cautioned to thoroughly review their bid figures for errors prior to submitting their proposal.

7. INQUIRIES/REQUESTS FOR INFORMATION

All inquiries/requests for information regarding this RFP must be submitted via email to contracts@newark.de.us by 5:00 p.m. on **Tuesday, April 18, 2023**. These inquiries will be passed along to relevant staff for their review. Please submit all questions/requests for information in bulk (e.g., in a Word document attachment to an email) to limit the total number of emails received. Any answers deemed necessary will be provided via addendum prior to the bid opening date.

8. TIME OF COMPLETION AND LIQUIDATED DAMAGES

Contractor shall commence work on a date to be specified by the City in a written "Notice to Proceed" and to fully complete all work under this contract on or before the noted completion date. Liquidated damages of five hundred dollars (\$500) per day may be assessed to the Contractor by the City for each day the contract is extended beyond the completion date. Such damages shall be payable to the City immediately upon notice of a breach of contract completion timelines. Liquidated damages shall not be considered a penalty, but rather a reasonable estimate of the damages that would be suffered by the City in the event of a breach. The City and the contractor shall acknowledge that the actual damages resulting from a breach may be difficult to ascertain and that this provision represents a reasonable estimation of such damages. This provision shall not limit the City's right to pursue any other remedies available under law or equity.

9. COMPENSATION AND LIABILITY INSURANCE

- a. The Contractor shall at all times maintain and keep in force such insurance as will protect him from claims under Worker's Compensation Acts, and also such insurance as will protect him and the owner from any such claims for damages for personal injuries, including death, which may arise from operations under this contract, whether such operations be by the Contractor or by any Subcontractor or anyone directly or indirectly employed by any of them.
- b. The Contractor shall be required to provide Workers' Compensation (WC)/Employer's Liability (EL) coverage with limits of insurance not less than:

\$1,000,000 Per Accident
\$1,000,000 Per Illness, Employee
\$1,000,000 Per Illness, Aggregate

The Contractor shall be required to provide Contractors Professional Liability coverage with limits of insurance not less than (requests for waivers of Contractors Professional Liability coverage will be considered by the City on a case-by-case basis):

\$1,000,000 Per Claim
\$1,000,000 Per Aggregate

The Contractor shall be required to provide Umbrella/Excess Liability coverage with limits of insurance not less than:

\$3,000,000 Each Occurrence
\$3,000,000 Aggregate

The Contractor shall be required to provide Commercial General Liability (CGL) coverage with limits of insurance not less than:

\$1,000,000 Each Occurrence Limit
\$1,000,000 Personal & Advertising Injury Limit
\$2,000,000 Annual Aggregate Limit
\$2,000,000 Products-Completed Operations Limit
\$1,000,000 Business Auto Liability Limit (Owned, Hired, & Non-Owned Autos)

The Contractor, The City of Newark (Owner) and all other parties required of the Contractor shall be included as insured on the CGL, using Additional Insured Endorsements providing coverage as broad as the coverage provided for the named insured Subcontractor.

Subcontractors approved in association with the hiring of a Contractor shall be required to provide Commercial General Liability (CGL) coverage with limits of insurance in equal amount to those required of the Contractor.

All Contractors shall provide Contractors Pollution Liability with limits not less than:

Each Claim or Occurrence	\$1,000,000
Annual Aggregate	\$1,000,000

The Contractors Pollution Liability policy shall include coverage for Emergency Response Costs, Contingent Transportation, Non-Owned Disposal Sites, and Natural Resource Damage. If coverage is written on a claims-made basis, an Extended Reporting Period, or tail coverage, shall be provided for two (2) years following completion of the insured's services. In the alternative, the Contractors Pollution Liability policy shall be renewed for not less than two years following completion. The policy retroactive date shall be no later than the effective date of the Agreement.

- c. A copy of the Certificate of Insurance must accompany each bid. The Contractor shall ensure that all insurances required remain valid for the entire term of the contract, inclusive of any term extension(s) and retroactive if claim is made afterward. The Prime Contractor's attention should be directed to other sections of the contract documents in the event additional insurance is required based on the scope of work.

10. APPROVAL

The contractor shall receive approval in writing from the engineer before ordering any material for work to be done under this contract. Unless otherwise specified, the delivery address shall be:

F.O.B. City of Newark Central Stores
406 Phillips Avenue
Newark, Delaware 19711

The successful bidder shall include the type and serial number of all equipment on invoices and packing slips.

11. STANDARDS AND WARRANTY OF TITLE

No material, supplies, or equipment to be installed as part of the work shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which any interest therein or in any part thereof is retained by the seller or supplier. The contractor shall warrant good title to all material, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together by him to the City free from any claims, liens or charges. Neither the contractor nor any person, firm or corporation furnishing any material or labor covered by this contract shall have any right to a lien upon any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the contractor for their protection or any right under any law permitting such persons to look to funds due the contractor in the hands of the City. The provisions of this paragraph shall be inserted in all the subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

All equipment will be unused in all component parts and will be the latest current production including all accessories. The specifications will be construed as the minimum required. When the manufacturer's standards exceed these, the standard units will be furnished. All material will be free of defects. Manufacturer's standard warranties shall apply.

12. GUARANTEE

The contractor hereby guarantees all the work for a period of one (1) year after the date of completion and final acceptance thereof by the City as follows:

- (1) Against all faulty or imperfect materials and against all imperfect, careless, and/or unskilled workmanship.
- (2) The contractor agrees to replace with proper workmanship and materials, and to re-execute, correct or repair without cost to the City, any work which may be found to be improper or imperfect and/or which fails to perform as specified.
- (3) The guarantee obligations assumed by the contractor under these contract documents shall not be held or taken to be in any way impaired because of the specifications, indication or approval by or on behalf of the City of any articles, materials, means, combination of things used or to be used in the construction, performance and completion of the work or any part thereof.
- (4) No use or acceptance by the City of the work or any part thereof, nor any failure to use the same nor any repairs, adjustments, replacements, or corrections made by the City due to the contractor's failure to comply with any of his obligations under the contract documents, shall impair in any way the guarantee obligations assumed by the contractor under these contract documents.

13. EEO AND LICENSING

The bidder shall possess all business and other licenses required by the State of Delaware and the City of Newark. The bidder must also be a fair and equal opportunity employer.

14. PREFERENCE FOR DELAWARE LABOR

According to State law, any person, company or corporation who violates the requirements of Title 29 Section 6962, of the Delaware Code regarding preference for Delaware Labor shall pay penalty to the State Secretary of Finance equal to the amount of compensation paid to any person in violation of this Section. This regulation is waived if it is in conflict with Federal requirements.

15. NONCOLLUSION

The bidder shall not, either directly or indirectly, enter into any agreement, participate in any collusion, or otherwise take any action in restraint of free competitive bidding in connection with this contract.

16. ADDENDA

Any changes to the contract documents shall be made only by written addenda. Bidders shall bear the entire responsibility for being sure they have received any and all addenda. All addenda will be posted on the City website at www.newarkde.gov/bids. After the bids have been received, no claim that the bidder did not have complete information will be considered. No verbal agreement or conversation with any officer, agent or employee of the City, either before or after the execution of this contract, shall affect or modify any of the terms or conditions outlined herein.

17. EXCEPTIONS & OMISSIONS

Any and all exceptions which are taken to the specifications and terms and conditions outlined herein shall be noted in the space provided on the proposal form. The listing of any exception may be grounds for rejection of a bid.

Further, the bidder recognizes that the City of Newark is not in the business of preparing specifications, and any omissions in this ITB/RFP must be strictly addressed by the firm with the submittal of its proposal.

18. INCREASE AND/OR REDUCTION OF ESTIMATED QUANTITIES

- a. The contractor's attention is directed to the fact that the quantities indicated in this contract are approximate and may be increased or decreased by the engineer. Should there be an increase or a reduction in these quantities, these changes will in no way alter the unit prices bid by or paid to the contractor.
- b. The City shall have the right to delete any portion of the work included in this contract. Regardless of any changes, deletions or additions authorized by the City, all work done under this contract shall be based on the unit prices stipulated by the contractor in his proposal.

19. BASIS OF PAYMENT

Payment for these items shall be included in the unit prices for each item as described in the Proposal. All other items, methods, and materials necessary to complete the work as described above shall be incidental to the bid item the is being completed under. Application

and Certification for Payment shall be made on proper AIA Documents.

20. ADVERTISEMENT

It is further agreed that any bidder/contractor submitting bids will not use the name of the City in any advertisement without first obtaining the written consent of the City Manager or their designee. All such requests should be submitted in writing to contracts@newark.de.us.

21. CONTRACTOR'S UNDERSTANDING

No verbal agreement or conversation with any officer, agent or employee of the City of Newark either before or after the execution of this contract, except as otherwise provided herein, shall affect or modify any of the terms or obligations contained herein.

22. LIST OF SUBCONTRACTORS' CERTIFICATION

- a. Each bidder shall execute and submit with his bid, on the form provided herein, a list of subcontractors, including complete names and addresses, whose services the bidder intends to use in performing all work under the contract. Bids submitted without such a list, or with a list not completely or properly executed, are subject to rejection.
- b. Each bidder is required to notify all subcontractors that they are obligated to comply with the provisions of Federal and State law as they pertain to this project, and that they must submit evidence of such compliance upon notice or request. The bidder shall certify his compliance with this requirement on the list of subcontractors.
- c. After the contract has been awarded, the successful bidder shall not substitute another subcontractor for any subcontractor whose name was set forth on the list of subcontractors which accompanied his bid, without the written consent of the City.

23. INDEMNIFICATION

The contractor shall solely be responsible and liable for the accuracy and completeness of all work performed and shall agree to indemnify, defend and hold harmless the City of Newark, its officers, agents and employees, from and against any and all claims, actions, suits and proceedings arising out of, based upon or caused by negligent acts, omissions or errors

of or the infringement of any copyright of patent, by the contractor, its officers, agents, employees or subcontractors, in the performance of the contracted agreement.

24. OWNERSHIP OF MATERIAL

All documents prepared and submitted pursuant to this RFP or contract shall be property of the City upon submittal and will be subject to staff and public review and discussion in association with our public bidding and formal proposal process. Any information or documents deemed proprietary shall be so marked at time of submittal and limited to detail where the disclosure of contents could be prejudicial to competing offerors during the process of negotiation, and any commercial or financial information of a privileged or confidential nature.

25. TERMINATION OF AGREEMENT

This agreement may be terminated by the City upon thirty (30) days written notice if the contractor fails to perform satisfactorily in accordance with the terms and conditions of the contract. In the event this agreement is terminated, the contractor shall be paid for services satisfactorily rendered up to the termination date.

26. FORCE MAJEURE OCCURRENCE

Upon the occurrence of a force majeure event, the City of Newark shall immediately notify the awarded vendor. In this instance, the City shall be excused from any further financial or contractual obligations for as long as such circumstances prevail. As used in this document, a "force majeure occurrence" means acts of God; acts of the public enemy; acts of the State and any other governmental entity in its sovereign or contractual capacity; fires; floods; epidemics or pandemics; quarantine restrictions; strikes or other labor disputes; freight embargoes; unusually severe weather; or other unusual event outside of the reasonable control of a party hereto that prevents a party to this Agreement from performing its contractual obligations.

26. REGULATIONS AND EXCEPTIONS

Any and all exceptions which are taken to the specifications shall be noted on the Proposal form. The listing of an exception may be grounds for rejection. All equipment must meet all applicable federal or state regulations.

The application of lead paint as defined in Title 16, Chapter 30M of State Code and Chapter

7 of City Code as part of this contract is prohibited. The contractor will be subject to fines as outlined in State and City Code if it is determined that lead paint was applied in violation of State and City code.

Safety Data Sheet information for all paints applied to internal or external structures shall be provided to the City for review and approval prior to application. The contractor will be required to remove and remediate any lead paint to the satisfaction of the City, at no cost to the City. Prior to commencing removal and remediation efforts, the contractor shall provide a written remedial action plan which includes health safety protection requirements for both employees and the public for review and approval by the City and/or DNREC/DHSS. Any and all sample results that are generated as a result of improper application of lead paint shall be provided to the City within 5 working days of being received by the contractor. The contractor will also be required to replace all paint removed with non-lead paint to the satisfaction of the City, and at no cost to the City.

Failure to adequately remove, remediate, and replace lead paint applied in violation of State and City Code as outlined herein will be considered a breach of contract.

27. WORKMANSHIP

Workmanship shall conform to the best current manufacturing practice followed for equipment of the type. Component parts and units will be manufactured to definite standard dimensions, with proper fits and clearances.

28. DAMAGES FOR LATE DELIVERY

The dates for delivery of the equipment are important and may influence the award of the contract. Submitted delivery dates shall be calculated from the date of notification of award. Liquidated damages of \$25.00 per calendar day may be assessed by the City, at its discretion, for every day that delivery is extended beyond the submitted delivery date.

29. PAYMENT

Payment shall be made within thirty (30) days from receipt of the equipment, subject to final inspection and acceptance of the items by the City.

30. INSPECTIONS

All equipment shall be subject to final inspection. If, in any way, an item fails to meet the terms of the contract, it may be rejected or liquidated damages charges made. The decision of the City will be final and any rejected items or material will have to be replaced

at the expense of the bidder.

31. INTENT OF SPECIFICATIONS

It shall be the bidder's responsibility to furnish the equipment specifically indicated in these specifications and such other as may be required.

32. BIDDER'S QUALIFICATIONS

No contract will be awarded to any bidder who in the judgment of the City is not a responsible or fit bidder, or is not prepared with all the necessary experience, capital, organization, and equipment to conduct and complete the work for which the bidder proposes on the proposal form.

33. SHIPPING & FREIGHT QUOTED

The prices quoted are those for which the material will be furnished F.O.B. Destination and include all charges that may be imposed during the period of the contract.

Unless otherwise specified and agreed upon by both parties in writing, all material shall be designated F.O.B. Destination and have freight included in quotations.

CITY OF NEWARK

Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

TECHNICAL SPECIFICATIONS

1. SCOPE

This specification covers the rewind and overhaul of a double circuit, outdoor type, integral primary unit substation.

2. APPLICATION

The unit substation is connected to an incoming utility company transmission line, nominally operated at 34,500 volts, 3 phase, 3 wire, 60 hertz and to an outgoing City of Newark distribution circuit nominally operated at 12,470 volts, 3 phase, 4 wire wye, grounded neutral.

3. STANDARDS

The unit substation shall be rewound, overhauled and tested in accordance with the latest applicable provisions of the USAS, NEMA and I.E.E.E. Standards, hereinafter referred to as "Standards" except as may be modified by the requirements of this specification.

4. EQUAL PRODUCTS

Where a specific product is specified by catalog or model number, the acceptability of any other or equal product shall be subject to the sole judgement of the City of Newark.

5. BID CONDITIONS

- a. It shall be the bidder/vendor's responsibility to furnish the repairs specifically indicated in this specification and such other equipment as may be required to meet the intent of the specifications or as may be necessary to provide the operation intended and implied by the City of Newark. All such equipment shall be included in the bid.
- b. Any exceptions which the bidder/vendor may take to the specification of intent thereof shall be clearly indicated in the bid. Any such exceptions, not clearly stated in the bid, will not be considered for additions to the bid price.

6. EQUIPMENT AND SERVICES TO BE FURNISHED WITH THE UNIT SUBSTATION

- a. Failure analysis complete with pictures of failed equipment.
- b. Two (2) completed sets of drawings and parts catalogs specifically relating to this unit.
- c. Two (2) complete sets of post repair test results and operational checkout.

7. TRANSFORMING SECTION

The transforming section shall be **fully rewound** in accordance with the following:

a. TYPE OF TRANSFORMER

The transformer is an oil-immersed, self-cooled, forced-air cooled type.

b. INSULATION CLASS

- 1. High voltage - 34.5 kV, BIL - 200 kV
- 2. Low voltage and neutral 15 kV, BIL – 110 kV

c. RATINGS

- 1. The ratings of the transforming section shall be:

Self-cooled	10,000 KVA @ 55 degrees C rise
Forced air cooled	12,500 KVA @ 55 degrees C rise
Forced air cooled	14,000 KVA @ 65 degrees C rise

Frequency	60 hertz
Number of phases	Three
High voltage (delta connected)	34,400 volts
Low voltage (wye connected-grounded neutral)	13090/7560 volts
Percent impedance	6.2

d. MANUAL NO-LOAD TAP CHANGER

The transformer high voltage winding shall have four EEI-NEMA rated taps having voltage ratings of 36,200; 35,300; 34,500; 33,500 and 32,600 volts, with an externally operated manual tap changer handle with provisions for padlocking on any tap position. The high voltage tap changer shall be designed for changing taps only when the transformer is de-energized.

e. AUTOMATIC LOAD TAP CHANGING EQUIPMENT

The low voltage winding of the transformer shall include automatic tap changing equipment which will operate under load to provide 10% raise and 10% lower in voltage terminals in 32-5/8% steps.

With the load tap changing equipment on a position at or above rated secondary voltage, the transformer shall be capable of supplying its rated kVA. With the load tap changing equipment on a position below rated secondary voltage, the transformer shall be capable of supplying current equal to the current at rated kVA and rated low voltage.

f. TRANSFORMER WINDINGS

- a) The high voltage and low voltage windings shall be rewound using **copper**.
- b) The H1, H2 and H3 Bushings shall be replaced.
- c) The high voltage and low voltage lightning arrestors shall be replaced.

8. TRANSFORMER PERFORMANCE

Transformer performance shall equal or exceed those shown on the attached General Electric Company Substation Transformer Performance Specifications.

9. TRANSFORMER DIMENSIONS AND WEIGHTS

Transformer dimensions and weights are as shown on the attached drawing.

10. TRANSFORMER NAME PLATE DATA

Transformer name plate data is as shown on attached drawing.

11. LOAD TAP CHANGER

An inspection shall be performed according to the manufacturer's recommendations on the load tap changer, including all contacts, safety switch interlocks and hand crank mechanism. This includes a visual inspection and electrical testing. Replacement parts and/or contacts if needed shall be installed **after a cost estimate has been supplied and approved by the City of Newark.** A pressure test shall be performed to verify integrity of the compartment.

12. OIL

The main tank and tap changer tank will be shipped with oil. After servicing, the tap changer and transformer tanks shall be filled with new **inhibited** oil. This oil shall be free of explosive gases and must conform to the following minimum specifications for use in high voltage equipment:

Dielectric	30 kV minimum
IFT, 25°C	35 dynes minimum
Acid	0.04 maximum mg. KOH/g maximum
Power Factor, 25°C	0.10 maximum
Water	25 PPM maximum

Oil test results must be submitted which would be expected to exceed the above specifications and be free of all polychlorinated biphenyls (PCB). **The bid price shall include disposal of existing oil in both the transformer and tap changer tank.** Existing oil PCB test results are attached.

13. SHIPMENT

Labor for disconnection from the distribution system and reattachment to the distribution

system shall be provided by the City of Newark. Transformer will be prepared for shipment by the City of Newark personnel and a crane will be provided for loading and unloading the transformer at the City of Newark West Main Street Substation. **It will be the successful bidder's responsibility to supply a truck and driver to collect and deliver the transformer to the West Main Street Substation, 7 Thompson Lane, Newark, Delaware.** The successful bidder will assume all responsibility and liability once the unit is loaded onto the shipping vehicle until the unit is removed from the shipping vehicle after repair.

The repaired unit substation shall be shipped as complete as possible consistent with shipping limitation and protection to the equipment. The transformer and low voltage tap changer compartments shall be filled with insulating oil prior to shipment.

The unit will be shipped with H.V. bushings, and H.V. arrestors. Per attached drawing shipping height with bushings removed is 142.5".

14. TESTS

The repaired unit substation shall be tested in accordance with the latest revision of the ANSI Standards. Two (2) copies of the report of these tests shall be submitted to the City of Newark. Testing shall include the following:

- a. Leak test
- b. DOBLE excitation current
- c. DOBLE power factor
- d. Bushing power factor
- e. Megger
- f. TTR
- g. Polarity
- h. Resistance
- i. Hi Pot
- j. Load loss

- k. No load loss
- l. Induced potential
- m. Applied potential

15. GUARANTEES

The manufacturer shall guarantee the equipment repaired by him to give successful service for a minimum period of one (1) year after the due date of final payment or equipment is placed in service, whichever is first. He shall guarantee that the equipment be free from defects as to material, design and workmanship and that the performance of the equipment shall be in accordance with the specifications and the best accepted practice for industrial-utility use.

16. PAINT

Transformer tank and radiator cooling fins shall be painted with a finish coat of ANSI Gray #70.

17. REFERENCES

Bidders shall provide a customer list with contact names and phone numbers for references.

18. SPARE PARTS

New gaskets shall be supplied for installation at the cooling fin flapper valves.

CITY OF NEWARK
Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

PROPOSAL

TO: The Mayor and City Council

FROM: _____

The undersigned as a lawfully authorized agent for the below named Bidder has carefully examined the General Provision, Specifications, and Proposal to be known as Contract No. 23-04 and binds himself upon award to him by the Mayor and City Council of Newark, Delaware to execute in accordance with such award, a contract of which contract this Proposal and said General Provisions and any Addenda shall be a part, and to furnish the equipment as specified F.O.B. Newark, Delaware in a manner that is in complete accordance with said General Provisions and Specifications, at the following named prices for the items:

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
1	1	The rewind and overhaul of a 10000/12500/14000 KVA outdoor type double circuit unit substation

Manufacturer: _____

Delivery date: _____

Price: _____

COMPLY

- a. Quote is for a full rewind YES
- b. Copper used for high voltage and low voltage windings YES
- c. New oil inhibited YES

We acknowledge that we **are/are not (circle one)** registered on www.sam.gov. We also acknowledge that there are no exceptions noted against us as outlined on www.sam.gov.

Our unique entity identifier (UEI), as outlined on www.sam.gov is (write N/A if none): _____

We acknowledge receipt of addendum(a) numbers: _____

Exceptions: _____

Contact Information for Notice of Award/Rejection (If different from below): _____

DATE: _____ BIDDER/CONTRACTOR: _____

BY: _____
Its legally authorized representative

Print Name _____

TITLE: _____

STREET ADDRESS: _____

CITY, STATE, ZIP: _____

TELEPHONE: _____

CITY OF NEWARK

Delaware

CONTRACT NO. 23-04

THE REWIND AND OVERHAUL OF A 10000/12500/14000 KVA OUTDOOR TYPE

DOUBLE CIRCUIT UNIT SUBSTATION

BOND TO ACCOMPANY PROPOSAL

(not necessary if certified or cashier's check is used)

KNOW ALL MEN BY THESE PRESENTS THAT _____ of
_____ of the County of _____
and State of _____, principal, and _____ of
as surety, legally authorized to do business in the State of Delaware, are held and firmly bound
unto the City of Newark in the sum of _____ Dollars, to be paid to said City of
Newark for use and benefit of the Mayor and Council of Newark, for which payment well and
truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators
and successors, jointly and severally, for and in the whole, firmly by these presents. Sealed
with our seal dated the _____ day of _____ in the year of our Lord, two thousand and
twenty-three (2023).

NOW THE CONDITIONS OF THIS OBLIGATIONS IS SUCH, that if the above bounded
principal who has submitted to said City of Newark, a certain proposal to enter into a certain
Contract No. 23-04, The Rewind and Overhaul of a 10000/12500/14000 kVA Outdoor Type
Double Circuit Unit Substation, and if said shall well and truly enter into and executes said
contract and furnish therewith such Surety Bond or Bonds as may be required by the terms of

said contract and approved by said City of Newark, said Contract, and said Bond to be entered into within ten (10) days after the date of official notice of award thereof in accordance with the terms of said proposal, then this obligation to be void, otherwise shall remain in full force and virtue.

SIGNED AND SEALED IN THE
PRESENCE OF WITNESS:

(SEAL)

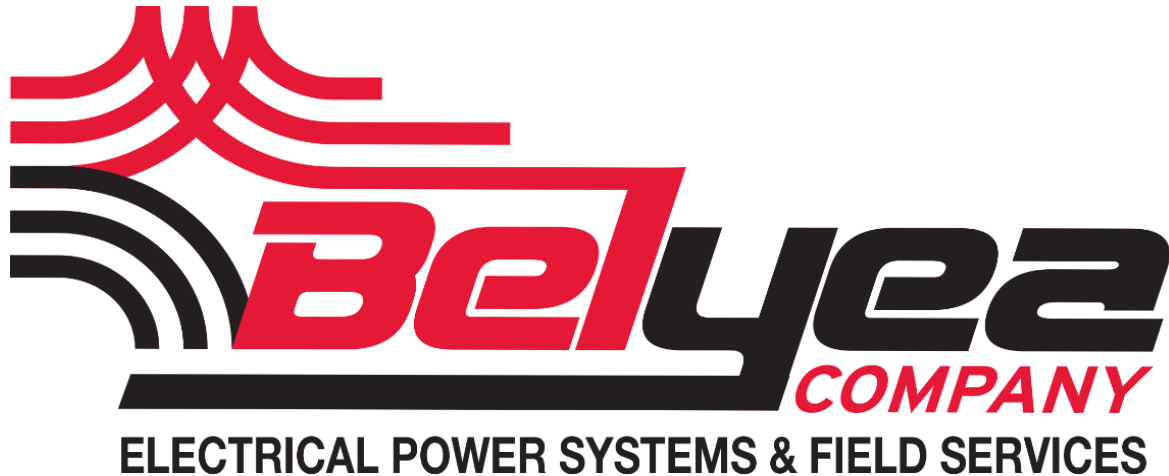
SIGNED _____(SEAL)

BY _____(SEAL)

SIGNED _____

BY _____(SEAL)

Belyea Company
2200 Northwood Avenue
Easton, PA 18045
P: (610) 515-8775
F: (610) 258-1230



Belyea Company

Test Report

Date: 7/20/2022

Prepared For: City of Newark Delaware

Project Name: Unit 76 Trip Investigation

Job #: 22-065M

FOR ACCEPTANCE AND MAINTENANCE SERVICES CONTACT

Belyea Company ~2200 Northwood Avenue, Easton PA 18045
www.belyeapower.com

Belyea Company
2200 Northwood Avenue
Easton, PA 18045
P: (610) 515-8775
F: (610) 258-1230
Dear City of Newark Delaware,



Belyea Company is providing our report of findings for the contract services recently completed. Please review this information carefully, and please contact our office for any questions or concerns that are not addressed in the report.

This report includes test results along with comments, deficiencies and suggested corrective actions as they apply to your contract. We at Belyea Company are happy to be of service and look forward to meeting your future requirements.

Job Number 22-065M

Scope of Work:

Belyea Company was asked to support the post fault investigation of the Unit 76 transformer for the City of Newark Delaware. Belyea Company provided transformer turns ratio testing, winding resistance testing, and insulation resistance testing. Belyea Company also procured and oil sample of the main tank.

Job Specific Information:

The transformer was de-energized by a differential relay trip approximately two weeks prior the testing. Upon visual inspection signs of flashover was noted on all three phases between the primary breaker and the primary bushings. This could have caused the differential trip if the zone of protection included the load side bus of the primary breaker. Belyea is uncertain of the boundaries of the transformer differential zone of protection. Belyea Company reviewed previous test results and noted that the excitation results and the B- phase ratio results were un-obtainable. Belyea Company tested the turns ratio with our Raytech meter and found an overload condition on B- phase on all taps. Belyea Company then used a variac and three meters to measure the turns ratio manually. Belyea Company applied 100VAC to the primary and the calculated that the secondary voltage would be 21.915. The A and C phase results were almost dead on with extremely low current required to apply the 1000VAC. The B-phase results were 7.8VAC on the secondary and 2.4AAC were required to achieve that voltage. This seems to indicate a turn-to-turn issue on the secondary winding of the transformer.

Indicated Corrective Actions:

Belyea Company would recommend opening the LTC and performing visual inspections of the LTC and main tank. If no deficiencies are noted, then Belyea Company would recommend disconnecting the LTC from the main tank and performing tests to isolate the problem. The primary compartment of the transformer should be cleaned and tested to ensure that no damage was caused the insulation system. The heaters should be verified.

Thank you for your business. If you have any questions, please give us a call.

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2200 Northwood Avenue
Easton, PA 18045
P: (610) 515-8775
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Deficiency Summary Job #22-065M

Page _____

Customer City of Newark Delaware

Location: 7 Thompson Lane Substation
Substation: Unit 76
Position: T-76
Equipment: 56000 – MWA – 3Ø WINDINGS RES & TURNS RATIO

Page: _____
Date: 7/19/2022

DIFICIENCIES: |

45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,7,9,11,15,17,18,19,23,25,27,29,30,31,32,33,34,35,36,37 Failed
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Belyea Company
2200 Northwood Avenue
Easton, PA 18045
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Table of Contents

Job #22-065M

Page _____

Customer City of Newark Delaware

Location	Substation	Position	PAGE NO.
Asset			
7 Thompson Lane Substation 56000 – MWA - 3Ø WINDINGS RES & TURNS RATION	Unit 76	T-76	
7 Thompson Lane Substation 56005 – TRANSFORMER INFO HISTORY	Unit 76	T-76	
7 Thompson Lane Substation 56905 – TWO-WINDING TRANSFORMER TEST	Unit 76	T-76	



3Ø Winding Resistance and Turns Ratio



CUSTOMER Belyea PAGE _____
ADDRESS 2200 Northwood Ave; Easton PA USA 18045 DATE 7/19/2022
OWNER City of Newark Delaware JOB # 22-065M
REPRESENTATIVE Mike Kish LOCATION 7 Thompson Lane Substation
SUBSTATION Unit 76 TEST STATUS _____
POSITION T-76 AMBIENT TEMPERATURE 89 °F HUMIDITY 47 %

Nameplate

MFR General Electric WEIGHT 63,300 lb OIL VOLUME 1,860 GAL
SER NO R270079A CLASS OA/FA COOLANT OIL
YEAR 1996 BIL _____ kV IMPEDANCE 6.2 %
TYPE SEALED

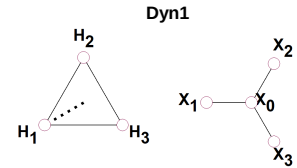


Diagram # 5 (ANSI)

	Voltage (V)		kVA	Rated I	# Taps	Nominal	Tap Changer	Tap Setting	First Tap Voltage	Last Tap Voltage	© Material
	L-L	L-G									
Primary	34,500		10,000	167.35	5	3	DETC	3	36,200	32,600	Cu
Secondary	13,090	7,558	10,000	441.06	33	17	OLTC		14,399	11,781	Cu

Transformer Test Conditions

AMBIENT TEMP. 89 °F OIL TEMP 25 °C REASON Fault Oper.
HUMIDITY 47 % WINDING TEMP 25 °C TEST STATUS _____
WEATHER Sunny

Turns Ratio - Primary Nominal to Secondary Taps

#	Tap Pri/Sec		Voltage Pri/Sec		Test V	Calc TTR	H ₁ - H ₃ / X ₁ - X ₀				H ₂ - H ₁ / X ₂ - X ₀				H ₃ - H ₂ / X ₃ - X ₀			
							Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)
6	Nominal	16R	34,500	14,399	0	4.150	4.151	0.02			0.000				4.152			
7	Nominal	15R	34,500	14,317		4.174	4.199	0.60		0.000	0.000			0.000	4.2			
8	Nominal	14R	34,500	14,235		4.198	4.199	0.03			0.000				4.2			
9	Nominal	13R	34,500	14,154		4.222	4.248	0.62			0.000				4.249			
10	Nominal	12R	34,500	14,072		4.246	4.248	0.04			0.000				4.249			
11	Nominal	11R	34,500	13,990		4.271	4.299	0.65		0.000	0.000			0.000	4.299			
12	Nominal	10R	34,500	13,908		4.297	4.299	0.06		0.000	0.000			0.000	4.299			
13	Nominal	9R	34,500	13,826		4.322	4.327	0.12		0.000	0.000			0.000	4.350			

TEST EQUIPMENT USED: TTR, Winding Ohm Meter, Megger

TESTED BY: Doug Williams

#	Tap Pri/Sec		Voltage Pri/Sec		Test V	Calc TTR	H ₁ - H ₃ / X ₁ - X ₀				H ₂ - H ₁ / X ₂ - X ₀				H ₃ - H ₂ / X ₃ - X ₀			
							Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)
14	Nominal	8R	34,500	13,745		4.347	4.350	0.06		0.000	0.000			0.000	4.350			
15	Nominal	7R	34,500	13,663		4.374	4.413	0.90		0.000	0.000			0.000	4.403			
16	Nominal	6R	34,500	13,581		4.400	4.403	0.07		0.000	0.000			0.000	4.403			
17	Nominal	5R	34,500	13,499		4.427	4.507	1.81		0.000	0.000			0.000	4.457			
18	Nominal	4R	34,500	13,417		4.454	4.502	1.08		0.000	0.000			0.000	4.457			
19	Nominal	3R	34,500	13,335		4.481	4.507	0.58		0.000	0.000			0.000	4.512			
20	Nominal	2R	34,500	13,254		4.509	4.512	0.08		0.000	0.000			0.000	4.512			
21	Nominal	1R	34,500	13,172		4.537	4.521	-0.34		0.000	0.000			0.000	4.569			
22	Nominal	Nominal	34,500	13,090		4.565	4.563	-0.04		0.000	0.000			0.000	4.569			
23	Nominal	1L	34,500	13,008		4.594	4.637	0.94		0.000	0.000			0.000	4.627			
24	Nominal	2L	34,500	12,926		4.623	4.627	0.09		0.000	0.000			0.000	4.627			
25	Nominal	3L	34,500	12,845		4.652	4.607	-0.97		0.000	0.000			0.000	4.687			
26	Nominal	4L	34,500	12,763		4.682	4.687	0.11		0.000	0.000			0.000	4.687			
27	Nominal	5L	34,500	12,681		4.712	4.748	0.76		0.000	0.000			0.000	4.748			
28	Nominal	6L	34,500	12,599		4.743	4.748	0.11		0.000	0.000			0.000	4.748			
29	Nominal	7L	34,500	12,517		4.774	4.811	0.78		0.000	0.000			0.000	4.811			
30	Nominal	8L	34,500	12,436		4.805	4.876	1.48		0.000	0.000			0.000	4.811			
31	Nominal	9L	34,500	12,354		4.837	4.876	0.81		0.000	0.000			0.000	4.876			
32	Nominal	10L	34,500	12,272		4.869	4.942	1.49		0.000	0.000			0.000	4.876			
33	Nominal	11L	34,500	12,190		4.902	4.942	0.82		0.000	0.000			0.000	4.942			
34	Nominal	12L	34,500	12,108		4.935	5.010	1.52		0.000	0.000			0.000	4.942			
35	Nominal	13L	34,500	12,026		4.969	5.010	0.83		0.000	0.000			0.000	5.01			
36	Nominal	14L	34,500	11,945		5.003	5.080	1.55		0.000	0.000			0.000	5.01			
37	Nominal	15L	34,500	11,863		5.037	5.080	0.85		0.000	0.000			0.000	5.08			
38	Nominal	16L	34,500	11,781		5.072	5.080	0.15		0.000	0.000			0.000	5.08			

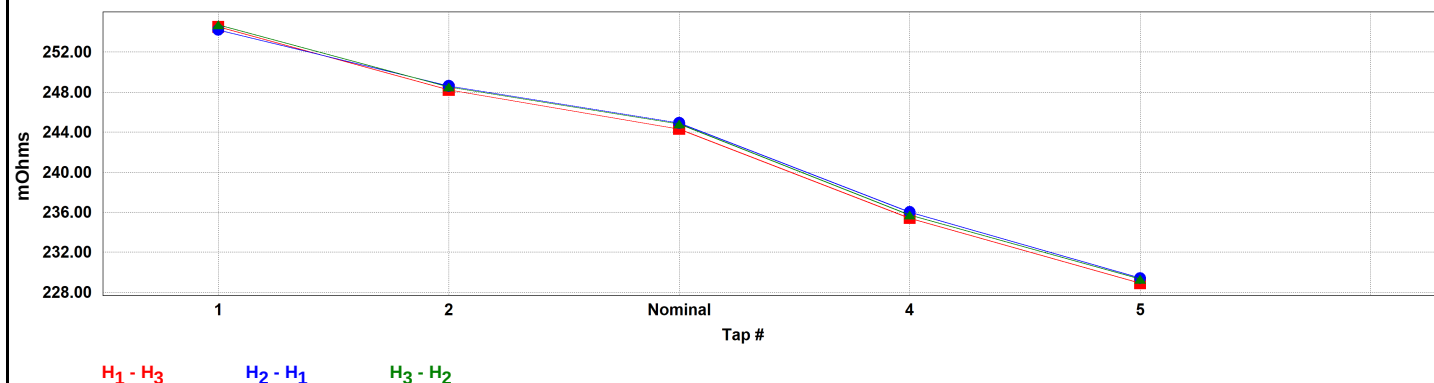
Turns Ratio - Manual Turns Ratio Tests

#	Tap Pri/Sec	Voltage Pri/Sec	Test V	Calc TTR	H ₁ - H ₃ / X ₁ - X ₀				H ₂ - H ₁ / X ₂ - X ₀				H ₃ - H ₂ / X ₃ - X ₀			
					Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)	Actual TTR	% Error	I exc mA	Phase (Deg)
39																

Resistance - Primary

#	Tap	Test Current (A) Stability (%/Digit)		Measured Resistance			Units: mΩ	Winding Diff Max: 2 %	
				H ₁ - H ₃	H ₂ - H ₁	H ₃ - H ₂			
40	1			254.5	254.2	254.7		0.196	
41	2			248.2	248.6	248.5		0.161	
42	Nominal			244.3	244.9	244.8		0.245	
43	4			235.4	236.0	235.7		0.255	
44	5			228.9	229.4	229.3		0.218	

Resistance - Primary



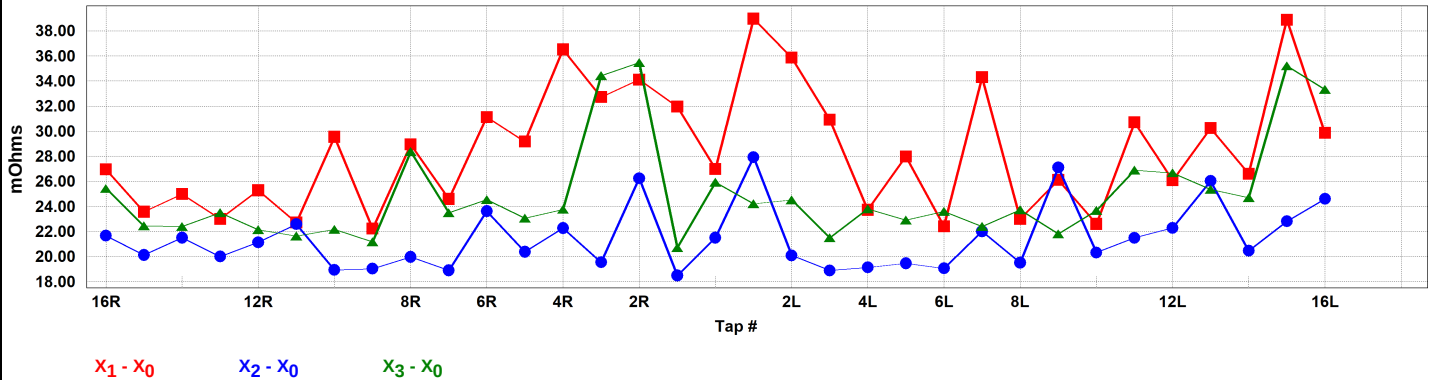
Resistance - Secondary

#	Tap	Test Current (A) Stability (%/Digit)		Measured Resistance			Units: mΩ	Winding Diff Max: 2 %	Make/Break			
				X ₁ - X ₀	X ₂ - X ₀	X ₃ - X ₀						
45	16R			26.95	21.66	25.42		21.437				
46	15R			23.57	20.12	22.45		15.649				
47	14R			24.98	21.50	22.39		15.159				
48	13R			23.00	20.00	23.50		15.789				
49	12R			25.28	21.14	22.14		18.116				
50	11R			22.71	22.58	21.64		4.796				

		Test Current (A)		Measured Resistance				Units: mΩ				
		Stability (%/Digit)										
#	Tap	X ₁ - X ₀		X ₂ - X ₀		X ₃ - X ₀		Winding Diff Max: 2 %		Make/Break		
51	10R		29.54		18.93		22.16	45.066				
52	9R		22.22		19.03		21.17	15.332				
53	8R		28.94		19.97		28.37	34.821				
54	7R		24.59		18.90		23.49	25.485				
55	6R		31.12		23.62		24.53	28.384				
56	5R		29.17		20.38		23.06	36.317				
57	4R		36.51		22.27		23.76	51.757				
58	3R		32.72		19.54		34.43	51.528				
59	2R		34.10		26.24		35.46	28.873				
60	1R		31.95		18.49		20.71	56.753				
61	Nominal		26.98		21.50		25.92	22.097				
62	1L		38.96		27.93		24.21	48.573				
63	2L		35.86		20.09		24.51	58.799				
64	3L		30.90		18.89		21.49	50.547				
65	4L		23.72		19.13		23.80	21.020				
66	5L		27.98		19.46		22.91	36.333				
67	6L		22.41		19.06		23.60	20.931				
68	7L		34.30		22.01		22.40	46.843				
69	8L		23.00		19.51		23.73	19.112				
70	9L		26.10		27.10		21.80	21.200				
71	10L		22.60		20.32		23.68	15.135				
72	11L		30.70		21.49		26.89	34.939				
73	12L		26.08		22.28		26.67	17.553				
74	13L		30.24		26.03		25.35	17.974				
75	14L		26.60		20.46		24.70	25.669				
76	15L		38.88		22.81		35.20	49.757				

		Test Current (A)	Measured Resistance			Units: mΩ		
		Stability (%/Digit)						
#	Tap		$X_1 - X_0$	$X_2 - X_0$	$X_3 - X_0$		Winding Diff Max: 2 %	Make/Break
77	16L		29.86	24.60	33.33		29.833	

Resistance - Secondary



Resistance - Manual Winding Resistance

First Winding Units: Ω								
---------------------------	--	--	--	--	--	--	--	--

COMMENTS:
DEFICIENCIES:

45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,7,9,11,15,17,18,19,23,25,27,29,30,31,32,33,34,35,36,37
Failed



TRANSFORMER INFORMATION & HISTORY



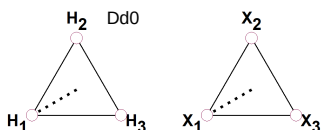
CUSTOMER Belyea PAGE _____
 ADDRESS 2200 Northwood Ave; Easton PA USA 18045 DATE 7/20/2022
 OWNER City of Newark Delaware JOB # 22-065M
 REPRESENTATIVE Mike Kish LOCATION 7 Thompson Lane Substation
 SUBSTATION Unit 76 TEST STATUS _____
 POSITION T-76 AMBIENT TEMPERATURE _____ °F HUMIDITY _____ %

NAMEPLATE DATA

HAS TERTIARY ☐

ALLOWED ERROR _____

MFR General Electric CLASS OA/FA PHASES 3
 SER NO R270079A COOLANT OIL REASON Fault Oper.
 YEAR 1996 TANK TYPE SEALED WEIGHT 63300 lb
 WINDING MATERIAL Cu
 OIL VOLUME 1,860 GAL
 OIL TEMP 25 °C
 IMPEDANCE 602 %
 WEATHER Sunny
 BIL _____ kV



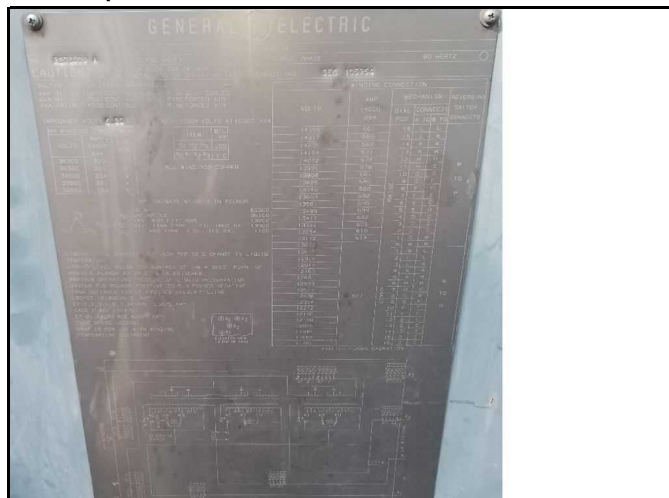
VOLTAGE (kV)		kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
L-L	L-G						
PRIMARY:				5	3	DETC	
SECOND:				1			

COMMENTS:

Asset Photo



Nameplate Photo



ASSET HISTORY

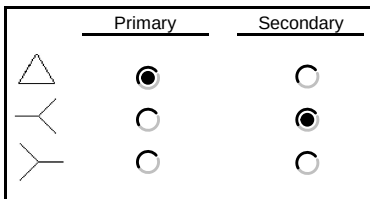
DATE	NOTES
2019	Through fault and Rapid Rise Relay Trip
2021	Squirrel caused a flash over and all primary bushing were replaced
7-22	Differential trip, visible flashover on all three phases between the primary breaker and the primary bushings.

CUSTOMER Belyea PAGE _____
 ADDRESS 2200 Northwood Ave; Easton PA USA 18045 DATE 7/20/2022
 OWNER City of Newark Delaware JOB # 22-065M
 REPRESENTATIVE Mike Kish LOCATION 7 Thompson Lane Substation
 SUBSTATION Unit 76 TEST STATUS _____
 POSITION T-76 AMBIENT TEMPERATURE _____ °F HUMIDITY _____ %

NAMEPLATE DATA

MANUFACTURER General Electric SERIAL NO. R270079A
 SPECIFICATION NO. _____ KVA 10,000 / 12,500 / 14,000 TYPE OA/FA CLASS AN
 PHASE 3 TEMPERATURE RISE 55 °C IMPEDANCE 6.2 % B.I.L. RATING _____ KV PRI. _____ KV SEC.
 COOLANT OIL CAPACITY 1860 GALLONS TOTAL WEIGHT 63300
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL COPPER K FACTOR N/A
 PRIMARY VOLTAGE 34,500 ☒ DELTA ☐ WYE RATED CURRENT 167 / 209 / 234 AMPERES
 SECONDARY VOLTAGE 13,090 7,558 ☐ DELTA ☒ WYE RATED CURRENT 441 / 551 / 618 AMPERES
 TAP VOLTAGES 36,200 35,300 34,500 33,500 32,600
 TAP CONNECTIONS 1 2 3 4 5
 TAP SETTING 3 34,500 VOLTS # FANS _____ TAP CHANGER: ☒ INTERNAL ☐ EXTERNAL DRY TYPE ☐

WINDING RESISTANCE TESTS



WINDING TESTED	TAP POSITION						
	1	2	3	4	5		
H1-H2							
H2-H3							
H3-H1							
X0-X1							
X0-X2							
X0-X3							

TRANSFORMER TURNS RATIO TESTS

TAP	NAMEPLATE VOLTAGE	CALCULATED RATIO	Measured H1-H2	% DEVIATION		Measured H2-H3	% DEVIATION		Measured H3-H1	% DEVIATION	
				TO CALCULATED	PASS/FAIL		TO CALCULATED	PASS/FAIL		TO CALCULATED	PASS/FAIL
1	36,200	4.790									
2	35,300	4.671									
3	34,500	4.565									
4	33,500	4.432									
5	32,600	4.313									

INSULATION RESISTANCE TEST

Windings TESTED	TEST VOLTAGE (VOLTS DC)	RESISTANCE (MEGOHMS)			RECOMMENDED MINIMUM (MEGOHMS)	POLARIZATION INDEX (PI)	DIELECTRIC ABSORP. RATIO (DAR)	ACCEPTABLE
		0.5 MINUTE	1.0 MINUTE	10 MINUTES				
PRIMARY TO SECONDARY AND GROUND	5,000	1,190	1,520	2,650	5,000	2.2	1.3	☒ YES ☐ NO
SECONDARY TO PRIMARY AND GROUND	5,000	816	1,025	1,740	5,000	2.1	1.3	☐ YES ☒ NO

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: 5KV Megger TESTED BY: Doug Williams



2200 Northwood Ave.
 Easton, PA 18045
 Tel : 610-515-8775
 Email : sales@belyeapower.com
 Web : www.belyeapower.com

Transformer Full Voltage, Insulation Resistance and Impedance test

KVA 10000
 HV 34.5 KV
 LV KV
 Impedance 6.2 %

Serial Number:
 Stock #
 Job #
 Date:

<u>100% Volts</u>	<u>Amps</u>	<u>Insulation Resistance</u>	
V1-V3	A	Test Temperature:	°C
V2-V1	B		
V3-V2	C	Hi - Low + Gnd =	MΩ @ 5 KV
<u>110%</u>		Low - Hi + Gnd =	MΩ @ 1 KV
V1-V3	A		Tested By
V2-V1	B	<u>Oil Dielectric</u>	
V3-V2	C	D-1816 1mm	KV
Tested By			Tested By

kVA	10000					
kV LL	34.5	Tested Impedance %		9.52		
%Z	6.2	% difference from Nameplate		53.53%		
	E12	I12	E23	I23	E31	I31
	Volts	Amps	Volts	Amps	Volts	Amps
Readings	110.200	5.000	119.600	5.000	110.100	5.000
Short Circuit Impedance Test per IEEE Std. 62-1995 6.1.4.5						

Tested By

Comments 2 phases are similar to each other but the other has a 8.5% lower impedance.
 Test was done with clamp on and multi meter



H₂b

ANALYTICAL SERVICES
INCORPORATED

Transformer Condition Assessment TCATM

Kyle Fleming
High Potential Testing

620 Ellis Road
Havertown, PA 19083

Location : City of Newark, Belyea
Bank & Phase : 3 Ph 10/12.5 KVA
Serial Number : R270079A
Manufacturer : GE
Date Mfgd : 1996
Size (kVA) :
Rating kV: 34.5-13090/7560

Date : 07-25-2022
Report Number : 4117452
Fluid volume : 1860
Fluid type : Mineral Oil
Preservation :
Cooling : OA/FA
Core & coil wt. :
Impedance :

Sample Date : 7/18/2022
Laboratory No. : 4117452
Container No. :
Temperature : 55C

H2	Hydrogen	(ppm) :	187
CH4	Methane	(ppm) :	233
C2H6	Ethane	(ppm) :	94
C2H4	Ethylene	(ppm) :	391
C2H2	Acetylene	(ppm) :	73
CO	Carbon monoxide	(ppm) :	698
CO2	Carbon dioxide	(ppm) :	10071
N2	Nitrogen	(ppm) :	92079
O2	Oxygen	(ppm) :	3224

Total (ppm) : 107050
TDCG (ppm) : 1676
SHL (%) : 6.44
ETCG (% in blanket) : 0.96

Particles	5 to 15 um :	537965
Particles	15 to 25 um :	2495
Particles	25 to 50 um :	830
Particles	50 to 100 um :	100
Particles	> 100 um :	15

D1533	Moisture	(ppm) :	4
D1816	Dielectric BV	(kV) :	30
D974	Acid Number	(mg KOH/g) :	0.06
D971	Interfacial Tension	(dynes/cm) :	34.5
D1500	Color Number	:	1.5
D924	Power Factor	:	0.032
D2668	Oxidation Inhibitor	(%) :	0.494

5 HMF	5 hydroxymethyl-2-furaldehyde	(ppm) :	<0.010
2 FAL	2 furaldehyde	(ppm) :	0.018
2 ACF	2 acetyl furan	(ppm) :	<0.010
5 MEF	5 methyl-2-furaldehyde	(ppm) :	<0.010
2 FOL	2 furfural	(ppm) :	<0.010

Estimated DP : 933

Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment : Potential 4

Sampling Interval : Retest immediately to establish condition.

Operating Procedure : Plan to remove from service for additional testing, investigation and analysis.

Comments : Heating at higher temperatures and arcing are indicated. Cellulose may be involved.

Field Comments : Fluid condition is within acceptable in-service parameters. Paper condition is as 'new.'



H₂b

ANALYTICAL SERVICES
INCORPORATED

Dissolved Gas Analysis

Jose Espinosa
Asplundh Engineering Services

100 Commerce Dr, Ste 102
Newark, DE 19713

Location : City of Newark/West Main
Bank & Phase : Unit 76 3 Ph 10/12.5 KVA
Serial Number : R270079A
Manufacturer : GE
Equipment Type : Transformer
Model :

Date : 07-11-2022
Report Number : 4117274
P.O. Number : 22CON03
Year of Mfg. : 1996
kV Rating : 34.5-13090/7560
Breathing :
Cooling : OA/FA
Fluid type : Mineral Oil
Fluid Volume : 1860

Sample Date :	7/5/2022	12/14/2021	11/5/2021	5/14/2018	10/4/2017	2/18/2015
Laboratory No. :	4117274	4114685	4114084	4095812	4093298	4078368
Container No. :						
Temperature :	20C	20C	NA	25C	20C	5C
Hydrogen (ppm) :	203	58	78	18	12	6
Methane (ppm) :	207	127	160	32	9	7
Ethane (ppm) :	53	62	66	45	12	9
Ethylene (ppm) :	249	227	242	13	25	29
Acetylene (ppm) :	51	7	7	0	2	1
Carbon monoxide (ppm) :	781	482	572	285	145	14
Carbon dioxide (ppm) :	7199	8126	9177	2715	3065	1243
Nitrogen (ppm) :	90671	90711	109107	85433	74887	68449
Oxygen (ppm) :	4854	9470	6653	1115	32219	33721
Total (ppm) :	104268	109270	126062	89656	110376	103479
TDCG (ppm) :	1544	963	1125	393	205	65
TDCG Rate (ppm/day) :	2.9	-4.2	0.6	0.8	0.1	0.1
TDCG (gallons) :						
TDHHG (ppm) :	509	415	468	90	46	45
ETCG (% in blanket) :	1.04	0.51	0.53	0.29	0.14	0.03
CH ₄ / H ₂ :	1.02	2.18	2.07	1.80	0.75	1.17
C ₂ H ₂ / C ₂ H ₄ :	0.20	0.03	0.03	0.00	0.07	0.02
C ₂ H ₂ / CH ₄ :	0.25	0.06	0.04	0.00	0.20	0.09
C ₂ H ₆ / C ₂ H ₂ :	1.04	8.30	9.21	9999.99	6.78	16.16
C ₂ H ₄ / C ₂ H ₆ :	4.69	3.67	3.67	0.29	2.06	3.10
CO ₂ / CO :	9.21	16.86	16.04	9.54	21.14	85.81
O ₂ / N ₂ :	0.05	0.10	0.06	0.01	0.43	0.49

Dissolved Gas Diagnostics

IEEE C57.104-2008 Code :
IEEE C57.104-2019 Status : 3E
Key Gas Method : Possible sparking, Overheating, Arcing,
Doernenburg Ratios : Thermal decomposition
Rodgers Ratios (3) : Not in table.
Rodgers Ratios (4) : Core and Tank Circulating Currents Overheated Joints.
CO₂ / CO :
Heat Index : 0.05
TDCG Level (ppm) : 1544
Sampling Interval : Quarterly
Operating Procedure :

Comments :



Dissolved Gas Analysis

Jose Espinosa
Asplundh Engineering Services

100 Commerce Dr, Ste 102
Newark, DE 19713

Location : City of Newark/West Main
Bank & Phase : Unit 76 3 Ph 10/12.5 KVA
Serial Number : R270079A
Manufacturer : GE
Equipment Type : Transformer
Model :

Date : 07-11-2022
Report Number : 4117274
P.O. Number : 22CON03
Year of Mfg. : 1996
kV Rating : 34.5-13090/7560
Breathing :
Cooling : OA/FA
Fluid type : Mineral Oil
Fluid Volume : 1860

Dissolved Gas Diagnostics

Extreme DGA : acetylene level (51 ppm) exceed table 2 by a factor of 25 and should be considered as an Extreme DGA according to clause 6.1.2.4 of IEEE c57.104-2019 guide

Belyea Company
2200 Northwood Avenue
Easton, PA 18045
P: (610) 515-8775
F: (610) 258-1230
fieldservice@belyeapower.com



Belyea Company

Test Report

Date: 8/25/2022
Prepared For: City of Newark

Project Name: Unit 76 Trip Investigation
Job #: 22-067M



2200 Northwood Avenue
Easton, PA 18045
P: (610) 515-8775
F: (610) 258-1230
fieldservice@belyeapower.com

Dear Mike ,

High Potential Testing LLC (HPT) is providing our report of findings for the contract services recently completed. Please review this information carefully, and please contact our office for any questions or concerns that are not addressed in the report.

This report includes test results along with comments, deficiencies and suggested corrective actions as they apply to your contract. We at HPT are happy to be of service and look forward to meeting your future requirements.

Job Number 22-067M

Scope of Work:

HPT was asked to provide services to support an internal inspection of the Load Tap Changer and further testing of the secondary of the transformer.

Job Specific Information:

HPT removed the oil from the LTC and performed an internal inspection that showed no issue that could be seen with out disassembling the LTC. The compartment was clean and free from contaminants. HPT then moved to testing of the secondary winding from the LTC. This showed major winding resistance disparities mainly on B-phase in the main tank of the transformer. HPT would recommend that an internal inspection of the main tank be performed and/or the transformer be sent for reconditioning.

Indicated Corrective Actions:

A main tank internal inspection should be performed. Preparations for reconditioning should be made.

Thank you for your business. If you have any questions please give us a call.



Table of Contents

Job #22-067M



PAGE

Customer City of Newark Delaware

Owner City of Newark Delaware

Location	Substation	Position	PAGE NO.
Asset			
F i e l d	S e r v i c e	R e p o r t	4
7 Thompson Lane Substation	Unit 76	T-76	5
56005 - TRANSFORMER INFO HISTORY			



Field Service Report



CUSTOMER	City of Newark Delaware	PAGE	4
ADDRESS	220 South Main Street, Newark DE 19711	DATE	8/25/2022
OWNER	City of Newark Delaware	JOB #	22-067M

DATE	8/25/2022	Description
------	-----------	-------------

T-76 Visual Inspection and Winding Resistance on-site 8-25-22

Inspection:

The internal inspection of the tap changer revealed no issues. The compartment was clean and free of any damage that could be seen without disassembling the device. The oil was filtered back into the compartment and the transformer was left in as found condition.

Winding Resistance Testing in Milliohms @ 10 amps:

The testing was performed entirely on the secondary winding. The first tests were performed from the M-Tap inside the tap changer.

M-TAP	X1	X2	X3	X0
A-Phase	17.337	85.695	24.02	3.9886
B-Phase	24.686	79.535	24.188	3.4444
C-Phase	25.692	86.555	16.236	5.2015

Secondary Bushing to Bushing:

X1-X3: 41.524	X2-X1: 37.026	X3-X2: 36.902
X1-X0: 21.324	X2-X0: 16.696	X3-X0: 21.132



TRANSFORMER INFORMATION & HISTORY

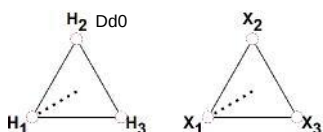


CUSTOMER City of Newark Delaware PAGE 5
 ADDRESS 220 South Main Street, Newark DE 19711 DATE 7/20/2022
 OWNER City of Newark Delaware JOB # 22-067M
 REPRESENTATIVE Mike Kish LOCATION 7 Thompson Lane Substation
 SUBSTATION Unit 76 TEST STATUS _____
 POSITION T-76 AMBIENT TEMPERATURE _____ °F HUMIDITY _____ %

NAMEPLATE DATA

HAS TERTIARY ☐

ALLOWED ERROR _____

MFR General Electric CLASS OA/FA PHASES 3SER NO R270079A COOLANT OIL _____ REASON Fault Oper.YEAR 1996 TANK TYPE SEALED WEIGHT 63300 lbWINDING MATERIAL CuOIL VOLUME 1,860 GALOIL TEMP 25 °C%IMPEDANCE 602 %WEATHER Sunny

BIL _____ kV

	VOLTAGE (kV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:					5	3	DETC	
SECOND:					1			

COMMENTS _____

Asset Photo

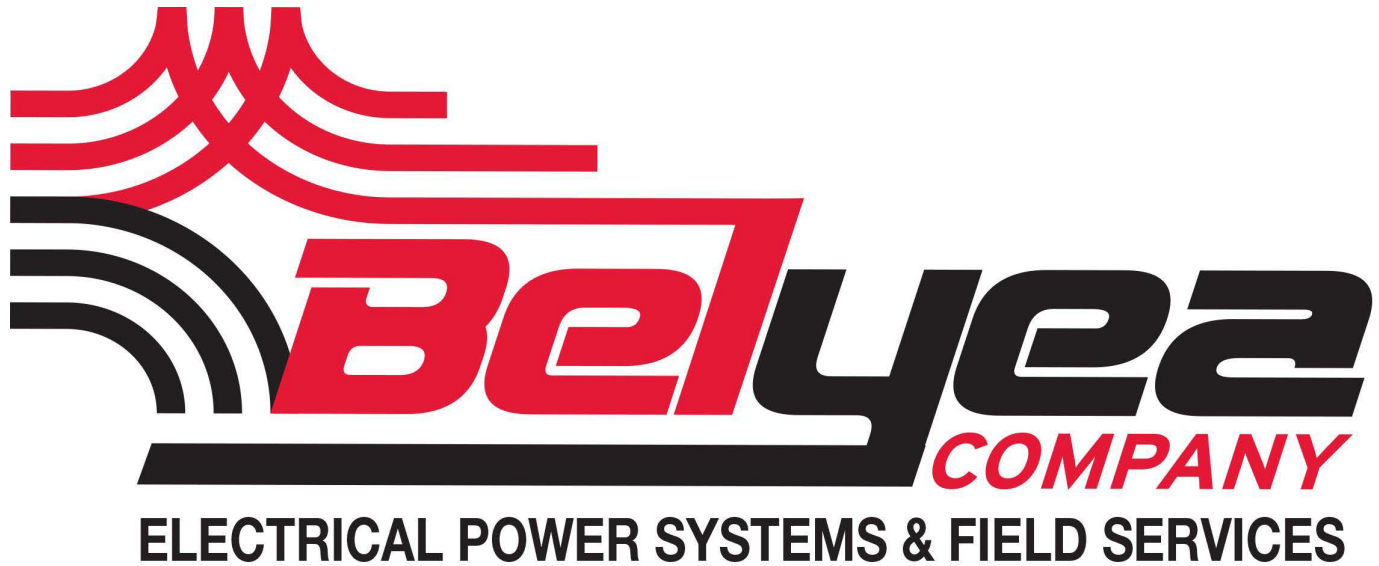


Nameplate Photo



ASSET HISTORY

DATE	NOTES
2019	Through fault and Rapid Rise Relay Trip
2021	Squirrel caused a flash over and all primary bushing were replaced
7-22	Differential trip, visible flashover on all three phases between the primary breaker and the primary bushings.
8-25-22	Internal Load Tap Changer inspection and secondary winding resistance testing



Test& Inspection Report

Date: 12/6/2022

Project: U nit 76 Internal Inspection

Scope of Work:

Belyea was asked to perform an internal inspection of the main tank of Unit 76 Transformer. To perform this task technicians removed approximately 1100 gallons of mineral oil to expose as much of the windings as possible. Once the oil was removed the technician entered the tank. Inside we found several layers of barrier board used to route and fault brace the leads above the windings. This made the visibility of the windings almost zero. The only visuals we could look at were from cameras that were lowered down below the barriers to capture images of the windings. From reviewing the images, it seems like there is some slight winding deformation in the center phase as compared to the others. The paper at the top also looks darker and frayed as compared to the outer windings. No issues were noted at the DETC or with any leads at the top of the tank. The auto transformer showed no signs of damage that the technician could see. Once the images were taken and some 360-degree video the inspection was complete. No obvious damage was noted during the inspection only signs of internal damage that may have bulged the center winding. This would correspond with the issues of excitation found with the center winding. Technician exited the tank and installed all covers as they were found. The tank was refilled to the proper level and a fresh nitrogen blanket was left in the airspace at 1.5lbs positive. If there are any questions or comments, please let us know and we will help the best we can.

Indicated Corrective Actions:

Belyea recommends untanking the unit to make repairs.

Thank you for your business. If you have any questions please give us a call.

Table of Contents
Job #22-067M-1

Customer City of Newark Delaware
Owner City of Newark Delaware

Location	Substation	Position	PAGE NO.
Asset			
7 Thompson Lane Substation	Unit 76	T-76	4
56005 - TRANSFORMER INFO HISTORY (2)			

TRANSFORMER INFORMATION & HISTORY

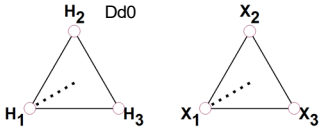
CUSTOMER City of Newark Delaware PAGE 4
 ADDRESS 2200 Northwood Ave; Easton PA USA 18045 DATE 12/5/2022
 OWNER City of Newark Delaware JOB # 22-067M-1
 REPRESENTATIVE _____ LOCATION 7 Thompson Lane Substation
 SUBSTATION Unit 76 TEST STATUS _____
 POSITION T-76 AMBIENT TEMPERATURE 50 °F HUMIDITY 45 %

NAMEPLATE DATA

HAS TERTIARY ☐

ALLOWED ERROR _____

MFR General Electric CLASS _____ PHASES 3
 SER NO R270079A COOLANT OIL _____ REASON Fault Oper.
 YEAR _____ TANK TYPE SEALED WEIGHT 63300 lb



WINDING MATERIAL Cu

OIL VOLUME 1,860 GAL

OIL TEMP 15 °C

IMPEDANCE 6.2 %

WEATHER Cloudy

BIL _____ kV

	VOLTAGE (kV)		kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	34,500		223	0.00	5	3	DETC	3
SECOND:	13,090		223	0.01	33	17	OLTC	

COMMENTS:

Asset Photo



Nameplate Photo



ASSET HISTORY

DATE	NOTES
11-23-22	Unit was drained and technician entered the main tank to investigate the ratio issues found during testing.









DESIGNED FOR NOMINAL IMPEDANCE VOLTS OF 6.45%

(6).125 HOLES

1.31 12 11.38 6 1.44 .188R

GENERAL ELECTRIC

TRANSFORMER

60 HERTZ

NO. R270079A

CLASS OA/FA

THREE PHASE

LOCATION SHOWING
+ + +
+ + +

CAUTION! INSTRUCTION BOOK INSIDE BOX
BEFORE INSTALLING OR OPERATING READ INSTRUCTIONS

GEK105964

SKETCH SHOWING
LOCATION OF HOLES

VOLTAGE RATING 34500-13090V/7560

KVA RATING 10000 CONTINUOUS 55 C RISE SELF COOLED
KVA RATING 12500 CONTINUOUS 55 C RISE FORCED AIR
KVA RATING 14000 CONTINUOUS 65 C RISE FORCED AIR

IMPEDANCE VOLTS 6.2%

34500-13090V VOLTS AT 10000 KVA

HV WINDING CONNECTION		DIAL POS	
VOLTS	AMP KVA		
36200	223	1	
35300	229	2	
34500	234	3	
33500	241	4	
32600	248	5	

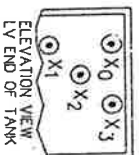
ITEM	BIL -KV
H ₁ H ₂ H ₃	200
X ₀ X ₁ X ₂ X ₃	110

ALL WINDINGS COPPER

APPROXIMATE WEIGHTS IN POUNDS

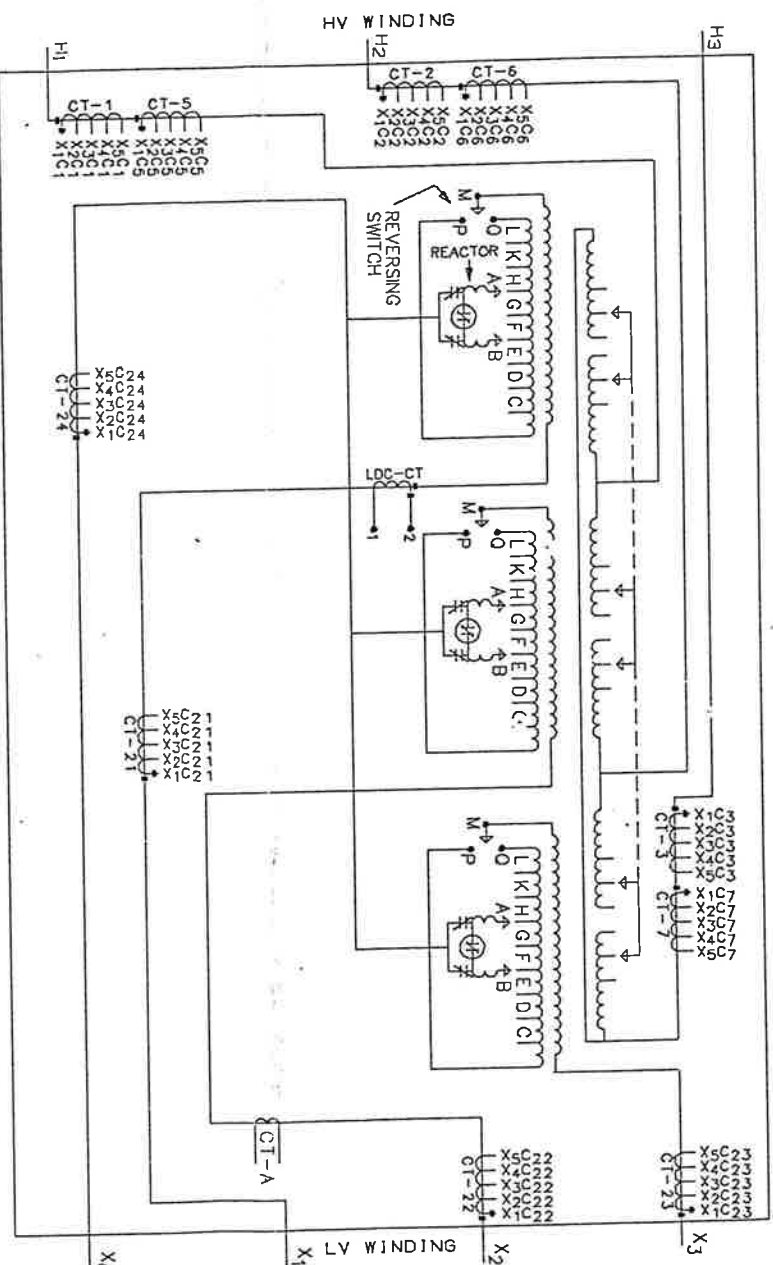
TOTAL 63300
TANK AND FITTINGS 35100
MAIN TANK TYPE 1 OIL 1960 GAL 13200
LTC HSG TYPE 1 OIL 150 GAL 13900
H₁ H₂ H₃ X₀ X₁ X₂ X₃ 1100

LIQUID LEVEL CHANGES .60 INCH PER 10 C CHANGE IN LIQUID TEMPERATURE.
LIQUID LEVEL BELOW TOP SURFACE OF THE HIGHEST POINT OF MANHOLE FLANGE AT 25 C IS 10.80 INCHES.
MAXIMUM OPERATING FREQUENCY OF LIQUID PRESERVATION SYSTEM 7.5 POUNDS POSITIVE TO 5.0 POUNDS NEGATIVE.
TANK SUITABLE FOR 14.7 POUNDS VACUUM FILLING.
LDC-CT IS 800/0.2 AMP
CT-1,2,3,5,6,7,24 ARE 1200/5 AMP.
CACC CLASS 10C4003.
CT-21,22,23 ARE 600/5 AMP.
CACC CLASS 10C2003.
CT-A IS FOR USE WITH WINDING TEMPERATURE EQUIPMENT.



FOR STEP DOWN OPERATION

LV WINDING CONNECTION						
VOLTS	AMP 14000 KVA	MECHANISM			REVERSING	
		DIAL POS	CONNECTS	SWITCH CONNECTS		
		A TO B TO				
14399	561	16 L	L			
14317	565	15 L	K			
14235	568	14 K	K			
14154	571	13 K	H			
14072	574	12 H	H		M	
13990	578	11 H	G			
13908	581	10 G	G		TO	
13826	585	9 G	F			
13745	588	8 F	F			
13663	592	7 F	E		P	
13581	595	6 E	E			
13499	599	5 E	D			
13417	602	4 D	D			
13335	606	3 D	C			
13254	610	2 C	C			
13172	614	1 C	M			
13090		N	M			
13008		1 M	L			
12926		2 L	L			
12845		3 L	K			
12763		4 K	K			
12681		5 K	H		M	
12599		6 H	H			
12517		7 H	G		TO	
12435	317	8 G	G			
12354		9 G	F		Q	
12272		10 F	F			
12190		11 F	E			
12108		12 E	E			
12026		13 E	D			
11945		14 D	D			
11863		15 D	C			
11781		16 C	C			



NR 226C4878 ROME, GEORGIA 1996 + CONTAINS NO DETECTABLE PCB AT TIME OF MANUFACTURE. +

DATE PREPARED 08/19/96 APPROVALS M T D ROME, GA. 226C4878

REVISIONS PRINTS TO

D/B

TITLE NAMEPLATE FIRST MADE FOR 226C4878 GENERAL ELECTRIC

CONT ON SH SH NO. 1

JN 64Q270079



GENERAL ELECTRIC COMPANY
MEDIUM TRANSFORMER OPERATION

ROME, GEORGIA 30165

TRANSFORMER TEST REPORT

For User CITY OF NEWARK
Date of Test 12/23/96 Purchaser's Order No. _____ GE Req'n. No. EG5-B-356489 IT.1
Type OA/FA Phase 3 Hertz 60 Insulating Fluid TYPE I OIL Polarity _____

10000/12500/14000 KVA 10000/12500/14000 KVA
H-WINDING 34500 Volts X-WINDING 13090Y/7560 Volts Y-WINDING _____ Volts

ALL LOSSES, RESISTANCE AND REGULATION BASED ON A TEMPERATURE OF 75 C

RESISTANCE, EXCITING CURRENT, LOSSES AND IMPEDANCE - Based on normal rating, unless otherwise stated. Losses and regulation are based on wattmeter measurements. For three-phase transformers the resistance is the sum of the three phases in series.

SERIAL NO.	RESISTANCE IN OHMS		% Exc. Current at 100% Rated Voltage	No Load Loss Watts at 100% Rated Voltage	34.500 kV to 13.090 kV 10000 kVA		_____ kV to _____ kV _____ kVA		_____ kV to _____ kV _____ kVA	
	WINDINGS				Load Loss Watts	% Imp	Load Loss Watts	% Imp	Load Loss Watts	% Imp
	H	X								
R270079A	1.291	.0594	0.09	6718	31710	6.20				
					Total Loss	% Imp	Total Loss	% Imp	Total Loss	% Imp
AVERAGE				0.09	6718	38428	6.20			
GUARANTEE				0.70	6900	41200	6.45			
REGULATION						100% PF	% PF	80% PF	% PF	
				AVERAGE		0.51		4.08		
				GUARANTEE		0.50		4.30		

TEMPERATURE RISES - Average rise in degrees C., corrected to instant of shutdown of transformer.

Serial No. * _____ with windings connected and loaded as follows:
Winding _____ kV _____ Amp., Winding _____ kV _____ Amp.
Winding _____ kV _____ Amp. until constant temperature rise was reached.

kVA	RISE OF WINDINGS BY RESISTANCE			Top Fluid Rise	AMBIENT TEMP.	
	H	X	Guarantee		Idle or Room	
10000	49.4	49.3	55	49.0	30.0	
14000	48.1	48.2	65	44.4	30.0	

INSULATION TESTS	Winding	Volt Rating	Test Voltage Applied in kV	Duration
APPLIED POTENTIAL TEST	H	34500	70	60 Seconds for All Tests
(Voltage applied between each winding and all other windings connected to core and ground)	X	13090	34	

INDUCED POTENTIAL TEST 2.00 times rated voltage across full winding at 300 hertz for 24 seconds.

REMARKS

* TEMPERATURE RISE DETERMINED FROM DESIGN DATA WHICH HAS BEEN VERIFIED BY TEST RESULTS ON SIMILAR TRANSFORMERS.

EACH TRANSFORMER CONTAINS A DIELECTRIC LIQUID WITH NO DETECTABLE PCB'S AT TIME OF MANUFACTURE - CERTIFICATION AVAILABLE.

I HEREBY CERTIFY THAT THIS IS A TRUE REPORT BASED ON FACTORY TESTS MADE IN ACCORDANCE WITH THE LATEST APPLICABLE STANDARDS OF THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) OR THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA), AND THAT EACH TRANSFORMER SUCCESSFULLY COMPLETED THE TESTS LISTED ABOVE.

Signed E. FELD Date 01/01/97 Approved E.L. MATHIS
E.F.

ADDITIONAL TEST DATA

SERIAL NO: R270079A

PURCHASER: CITY OF NEWARK
PURCHASER'S ORDER NO:
GE REQUISITION NO: EG5-B-356489 IT.1

DATE 1/08/97

INSULATION POWER FACTOR AT 20 C

<u>WINDING ENERGIZED</u>	<u>WINDING GROUNDED</u>	<u>WINDING GUARDED</u>	<u>%PF</u>
HV	LV	----	0.351
HV	----	LV	0.339
LV	HV	----	0.513
LV	----	HV	0.720

NO-LOAD LOSS AND % EXCITING CURRENT

<u>PERCENT EXCITATION</u>	<u>NO-LOAD</u>	<u>% EXCITING CURRENT</u>
110	8947	0.80

INSULATION POWER FACTOR

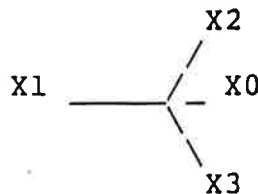
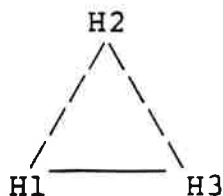
HV TO GROUND	2400 MEGOHMS
LV TO GROUND	1900 MEGOHMS
HV-LV	300 MEGOHMS

AN RIV VALUE OF LESS THAN 500 MICROVOLTS AT FULL INDUCE VOLTAGE WAS RECORDED.

THIS TRANSFORMER HAS BEEN DESIGNED TO MEET IMPULSE TEST LEVELS, NOT INCLUDING FRONT OF WAVE, IN ACCORDANCE WITH TABLE 4 OF ANSI C57.12.00-1993. BASIC DESIGN INFORMATION WAS OBTAINED FROM TESTS MADE ON UNITS OF SIMILAR DESIGNS.

WITH THE TRANSFORMER FULLY ASSEMBLED AND FILLED WITH OIL, 9.5 PSI OIL PRESSURE WAS MAINTAINED FOR 4 HOURS. AT THE END OF THIS PERIOD, THERE WAS NO LOSS OF PRESSURE OR VISIBLE LEAKAGE.

POLARITY AND PHASE DISPLACEMENT



G E N E R A L E - L E C T R I C
TRANSFORMER TEST REPORT
MEDIUM TRANSFORMER OPERATION - ROME GA. 30161

G.E. REQ'N EG5-B-356489 .IT.

SN R270079A

RATIO TEST REPORT

CONNECTION	PHASE A	PHASE B	PHASE C
36200-13090	4.7980	4.8030	4.7980
35300-13090	4.6790	4.6790	4.6790
34500-13090	4.5710	4.5710	4.5720
33500-13090	4.4390	4.4400	4.4410
32600-13090	4.3180	4.3190	4.3200
34500-14399	4.1530	4.1530	4.1540
34500-14317	4.1800	4.1800	4.1800
34500-14235	4.2010	4.2010	4.2020
34500-14153	4.2280	4.2280	4.2290
34500-14071	4.2500	4.2510	4.2510
34500-13989	4.2780	4.2780	4.2780
34500-13908	4.3010	4.3010	4.3010
34500-13826	4.3290	4.3290	4.3290
34500-13744	4.3520	4.3520	4.3520
34500-13662	4.3810	4.3810	4.3810
34500-13580	4.4050	4.4050	4.4050
34500-13499	4.4380	4.4340	4.4350
34500-13417	4.4590	4.4590	4.4600
34500-13335	4.4890	4.4890	4.4900
34500-13253	4.5150	4.5150	4.5150
34500-13171	4.5450	4.5450	4.5460
34500-13008	4.6030	4.6030	4.6030
34500-12926	4.6300	4.6300	4.6300
34500-12844	4.6620	4.6620	4.6620
34500-12762	4.6890	4.6890	4.6900
34500-12680	4.7220	4.7220	4.7230
34500-12599	4.7500	4.7510	4.7510
34500-12517	4.7850	4.7850	4.7850
34500-12435	4.8140	4.8140	4.8140
34500-12353	4.8480	4.8480	4.8490
34500-12271	4.8780	4.8780	4.8780
34500-12190	4.9140	4.9140	4.9140
34500-12108	4.9440	4.9450	4.9450
34500-12026	4.9810	4.9810	4.9810
34500-11944	5.0130	5.0130	5.0130
34500-11862	5.0500	5.0510	5.0510
34500-11781	5.0830	5.0830	5.0830

GENERAL ELECTRIC

ROME, GEORGIA

TRANSFORMER TEST REPORT

ZERO PHASE SEQUENCE IMPEDANCE OF TRANSFORMER

Purchaser CITY OF NEWARK

Date 1/8/97

Purchaser's Order No. _____ G.E. Req'n No. EG5-B-356489 It .1

Rating OA/FA-T-60-10/12.5/14MVA(55/65 C)-34500-13090Y/7560

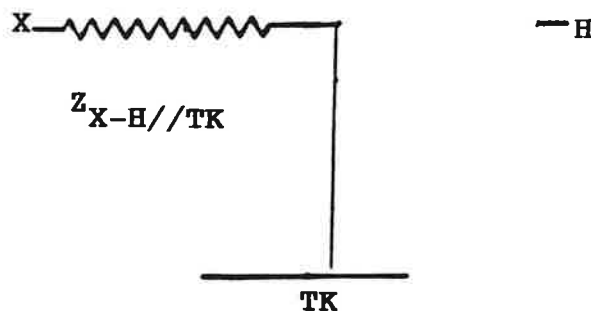
S/N R270079A

TESTED _____ values of percent Zero Phase Sequence Impedances and Zero Phase Sequence equivalent circuits determined from these values 34.5 Kv to 13.09 Kv Connection 10000 Kva base.

% IMPEDANCE VALUES

$$Z_{X-H//TK} = 6.11 = 0.351 + j 6.104$$

EQUIVALENT CIRCUIT





Alamo, Tennessee
CERTIFIED TEST REPORT

Apparatus: Condenser Bushing Customer: _____
Style: 034T0040HC
Rating: 34.5 kV 400 Amps
BIL: 200 kV
Max L-G Voltage: 22 kV
Serial: 6C00438601
Ambient Temperature: 21C Test Date: 12/12/96

1. Tap Test: This bushing passed a 60Hz, one minute applied test: 2kV tap to flange.

2. Power Factor and Capacitance:

The power factor/capacitance test is conducted per IEEE Std. C57.19.00-1991 & Std. C57.19.01-1991. Test equipment includes a dissipation factor/capacitance bridge #082, and a dielectric test set for measurements above 10kV.

Before 60Hz Withstand

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.21	95
Stud to Flange	N/A	N/A	N/A

3. Dry 60Hz Withstand and Partial Discharge:

The tests were conducted per IEEE Std. C57.19.00-1991, IEEE Std. C57.19.01-1991 specifications. The dielectric and partial discharge detection equipment is designed to meet or exceed IEEE 454-1973, C57.113-1988, and C83.2-1987 requirements which includes Hipotronics dividers, detectors, power sources to 1MV, and partial discharge detectors.

Test Voltage	Test Duration	Start	Finish
(kV)	(Min)	PC	PC
33	N/A	1	N/A
80	1	OK	OK
33	N/A	1	N/A

4. After 60Hz Withstand-Nameplate information

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.21	95
Stud to Flange	N/A	N/A	N/A

This bushing meets or exceeds all of the specified ANSI/IEEE test requirements. This includes an internal 22 psi oil pressure test for a minimum of one hour without resultant leakage. This unit was filled at the factory with PCB free (non-detectable) dielectric fluid in accordance with Federal polychlorinated biphenyl (PCB) regulation 40 CFR 81, dated May 31, 1978. The analysis is verified per ASTM-D4059 using a H.P. model 5710 Gas Chromatograph with a minimum detection level of 0.8 ppm (accuracy +/- 1.5%). The contents of this report are a true and correct record of data obtained from tests performed at the ABB Power T&D Plant, Components Division, Alamo, TN.

5. Test Results: Passed

Test Specialist: Robert Cottrell

Date: 12/12/96

Remarks:

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ABB

Alamo, Tennessee

CERTIFIED TEST REPORT

Apparatus: Condenser Bushing
Style: 034T0040HC
Rating: 34.5 kV 400 Amps
BL: 200 kV
Max L-G Voltage: 22 kV
Serial: 6C00436802
Ambient Temperature: 21C

Customer: _____

Test Date: 12/12/96

1. Tap Test: This bushing passed a 60Hz, one minute applied test: 2kV tap to flange.

2. Power Factor and Capacitance:

The power factor/capacitance test is conducted per IEEE Std. C57.19.00-1991 & Std. C57.19.01-1991. Test equipment includes a dissipation factor/capacitance bridge #082, and a dielectric test set for measurements above 10kV.

Before 60Hz Withstand

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.23	95
Stud to Flange	N/A	N/A	N/A

3. Dry 60Hz Withstand and Partial Discharge:

The tests were conducted per IEEE Std. C57.19.00-1991, IEEE Std. C57.19.01-1991 specifications. The dielectric and partial discharge detection equipment is designed to meet or exceed IEEE 454-1973, C57.113-1988, and C62.2-1987 requirements which includes Hipotronics dividers, detectors, power sources to 1MV, and partial discharge detectors.

Test Voltage	Test Duration	Start	Finish
(kV)	(Min)	PC	PC
33	N/A	1	N/A
80	1	OK	OK
33	N/A	1	N/A

4. After 60Hz Withstand—Nameplate information

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.23	95
Stud to Flange	N/A	N/A	N/A

This bushing meets or exceeds all of the specified ANSI/IEEE test requirements. This includes an internal 22 psig oil pressure test for a minimum of one hour without resultant leakage. This unit was filled at the factory with PCB free (non-detectable) dielectric fluid in accordance with Federal polychlorinated biphenyl (PCB) regulation 40 CFR 61, dated May 31, 1978. The analysis is verified per ASTM-D4068 using a H.P. model 5710 Gas Chromatograph with a minimum detection level of 0.3 ppm (accuracy +/- 5%). The contents of this report are a true and correct record of data obtained from tests performed at the ABB Power T&D Plant, Components Division, Alamo, TN.

5. Test Results: Passed

Test Specialist: Tony Ballard

Date: 12/12/96

Remarks:

ETIPS 92-2314 7 ABB

ABB

Alamo, Tennessee
CERTIFIED TEST REPORT

Apparatus: Condenser Bushing
Style: 034T0040HC
Rating: 34.5 kV 400 Amps
BIL: 200 kV
Max L-G Voltage: 22 kV
Serial: 6C00436503
Ambient Temperature: 21C

Customer: _____

Test Date: 12/12/96

1. Tap Test: This bushing passed a 60Hz, one minute applied test: 2kV tap to flange.

2. Power Factor and Capacitance:

The power factor/capacitance test is conducted per IEEE Std. C57.19.00-1991 & Std. C57.19.01-1991. Test equipment includes a dissipation factor/capacitance bridge #082, and a dielectric test set for measurements above 10kV.

Before 60Hz Withstand

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.21	95
Stud to Flange	N/A	N/A	N/A

3. Dry 60Hz Withstand and Partial Discharge:

The tests were conducted per IEEE Std. C57.19.00-1991, IEEE Std. C57.19.01-1991 specifications. The electric and partial discharge detection equipment is designed to meet or exceed IEEE 484-1973, C57.118-1988, and C59.2-1987 requirements which includes Hipotronics dividers, detectors, power sources to 1MV, and partial discharge detectors.

Test Voltage	Test Duration	Start	Finish
(kV)	(Min)	PC	PC
33	N/A	1	N/A
80	1	OK	OK
33	N/A	1	N/A

4. After 60Hz Withstand—Nameplate Information

Measurement	Applied kV	Power Factor (%)	Capacitance (Pfd)
(C1) Stud to Tap	10	0.22	95
Stud to Flange	N/A	N/A	N/A

This bushing meets or exceeds all of the specified ANSI/IEEE test requirements. This includes an internal 22 psig oil pressure test for a minimum of one hour without resultant leakage. This unit was filled at the factory with PCB free (non-detectable) dielectric fluid in accordance with Federal polychlorinated biphenyl (PCB) regulation 40 CFR 61, dated May 31, 1979. The analysis is verified per ASTM-D4059 using a H.P. model 5710 Gas Chromatograph with a minimum detection level of 0.8 ppm (accuracy +/- 10 %). The contents of this report are a true and correct record of data obtained from tests performed at the ABB Power T&D Plant, Camarillo, California, T&E.

5. Test Results: Passed

Test Specialist: Robert Cottrell

Date: 12/12/96

Remarks:

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