

Exhibit A

MONROE COUNTY CLERK'S OFFICE

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Receipt # 3454447

Book Page CIVIL

No. Pages: 3

Instrument: EFILING INDEX NUMBER

Control #: 202306060749

Index #: E2023005870

Date: 06/06/2023

Time: 12:29:40 PM

Return To:
County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee: CW

State of New York

MONROE COUNTY CLERK'S OFFICE
WARNING – THIS SHEET CONSTITUTES THE CLERKS
ENDORSEMENT, REQUIRED BY SECTION 317-a(5) &
SECTION 319 OF THE REAL PROPERTY LAW OF THE
STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

JAMIE ROMEO

MONROE COUNTY CLERK



SUPREME COURT
COUNTY OF MONROE STATE OF NEW YORK

COUNTY OF MONROE,

Plaintiff,

v.

SIEMENS INDUSTRY, INC.

Defendant.

SUMMONS

Index No.: _____

To the person or entity named as defendant above:

PLEASE TAKE NOTICE THAT YOU ARE HEREBY SUMMONED to answer the complaint of the plaintiff herein and to serve a copy of your answer on the plaintiff at the address indicated below within 20 days after the service of this Summons (not counting the day of service itself), or within 30 days after service is complete if the Summons is not delivered personally to you within the State of New York.

YOU ARE HEREBY NOTIFIED THAT should you fail to answer, a judgment will be entered against you by default for the relief demanded in the complaint

COUNTY OF MONROE

JOHN P. BRINGEWATT, ESQ.
COUNTY ATTORNEY
Attorney for Plaintiff County of Monroe

Dated: June 6, 2023

s/ Robert J. Shoemaker

Robert J. Shoemaker, Esq., of Counsel
Deputy County Attorney
307 County Office Building
39 West Main Street
Rochester, New York 14614
Telephone: 585.753.1472

To: Siemens Industry, Inc.
50 Methodist Hill Drive, Suite 1500
Rochester NY 14623

Venue: Plaintiff designates Monroe County as the place of trial. The basis of this designation is plaintiff's organization, residence, and location in Monroe County, and pursuant to contract.

MONROE COUNTY CLERK'S OFFICE

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Book Page CIVIL

No. Pages: 19

Instrument: COMPLAINT

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Return To:
County of Monroe Department of Law

County of Monroe

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**SUPREME COURT
COUNTY OF MONROE**

STATE OF NEW YORK

COUNTY OF MONROE,

Plaintiff,

v.

SIEMENS INDUSTRY, INC.

Defendant.

COMPLAINT

Index No.: _____

Plaintiff COUNTY OF MONROE by and through its attorney, County Attorney John P. Bringewatt, Deputy County Attorney Robert J. Shoemaker of counsel, as and for its complaint against defendant Siemens Industry, Inc., alleges:

BACKGROUND

1. Pursuant to contract, defendant Siemens was to operate, maintain, and inspect certain heat and power facilities. Siemens' failure perform its obligations under the contract resulted in a breakdown in the machinery, which required Monroe County to utilize expensive emergency diesel generators.

2. From approximately January 1, 2003 to December 31, 2022, Siemens was the exclusive operator of generators, boilers, and related equipment that provided electricity, heat, domestic hot water, and steam to two critical County facilities: Monroe Community Hospital, located at 435 East Henrietta Road, Rochester, New York ("MCH"), and the Monroe County Department of Human Services and Department of Public Health, located at 111 Westfall Road, Rochester, New York 14620 ("111 Westfall," and, together with MCH, the "County Facilities").

3. MCH is a New York State certified residential healthcare facility that provides long-term care for individuals with complex health conditions requiring higher levels of medical and nursing care.

4. 111 Westfall is a multi-story office building that houses a number of vital County departments, including the Department of Human Services and the Department of Public Health. In 2021, the County also used 111 Westfall as a cold-storage facility for the County’s COVID-19 vaccinations.

THE PARTIES

5. Plaintiff (the “County”) is a municipal corporation duly incorporated and existing under the laws of the State of New York.

6. Upon information and belief, defendant Siemens Industry, Inc., (“Siemens”) was at all relevant times a Delaware corporation.

VENUE AND JURISDICTION

7. At all relevant times, Siemens was doing business in Monroe County, State of New York.

8. As a result of Siemens’ negligence and numerous breaches of contract, the County sustained damages, costs, expenses, and losses arising out of and resulting from Siemens’ performance of the services, acts, omissions, negligence, and above-listed breaches under the 2019 Agreement in an amount that exceeds the jurisdictional limits of all lower courts which would otherwise have jurisdiction.

9. The damages in this matter exceed the Commercial Division threshold for the Seventh Judicial District.

10. The matter is properly venued in Monroe County pursuant to Section 14.7 of the 2019 Agreement (defined below).

THE CONTRACT AND NEWPOWER DISSOLUTION

11. Monroe Newpower Corporation was a not-for-profit local development corporation formed in 2002 to operate cogeneration facilities to produce steam, hot water, and electricity for MCH and 111 Westfall, as well as the County’s former Iola campus, which was located at the southeast corner of Westfall and East Henrietta Roads in the City of Rochester (the “Iola Facility”) and Monroe Community College’s Brighton campus.

12. Pursuant to a contract by and between Siemens and Monroe Newpower Corporation dated as of December 31, 2002 (the “2002 Agreement”), Siemens designed, procured, constructed, and installed the combined heat and power plant to serve MCH, 111 Westfall, and the former Iola Facility (the “Iola Cogeneration Facilities”).

13. Pursuant to the 2002 Agreement, Siemens was obligated to design, procure, construct, and install the Iola Cogeneration Facilities on or before July 1, 2004, and then maintain and operate the Iola Cogeneration Facilities until December 31, 2015.

14. Siemens and Monroe Newpower Corporation entered into an Operation and Maintenance Agreement dated as of December 31, 2015 (the “2015 Agreement”), which continued Siemens’ operation and maintenance of the Iola Cogeneration Facilities from January 1, 2016 until December 31, 2016, with three one-year options to renew (**Exhibit A**).

15. In February 2017, pursuant to an Order of Honorable Craig J. Doran, JSC, dated January 18, 2017 (**Exhibit B**) and Resolution 100 of 2017 of the Legislature of the County of Monroe (**Exhibit C**), Monroe Newpower Corporation was dissolved and the County was assigned and accepted the 2015 Agreement.

16. The 2015 Agreement was renewed for all three renewals and expired on December 31, 2019.

THE 2019 AGREEMENT WITH MONROE COUNTY

17. Siemens and Monroe County entered into an Operation and Maintenance Agreement dated December 13, 2019, attached as **Exhibit D** (the “2019 Agreement”).

18. Under the 2019 Agreement, Siemens continued to be responsible for the operation and maintenance of the Iola Cogeneration Facilities from January 1, 2020 until December 31, 2020, with two one-year options to renew.

19. At all relevant times, the County performed pursuant to the Agreements as legally obligated.

THE FACILITIES

20. The Iola Cogeneration Facilities included three Caterpillar generators (the “Generators”) and three Hurst boilers (the “Boilers”).

21. The Iola Cogeneration Facilities also included a 38 kV to 5 kV stepdown 4200 KVA transformer (the “ 4200 KVA Transformer”), which served as a critical link between the electric grid and the County Facilities in the event that the Generators failed or could not produce sufficient electricity to meet the County’s needs.

22. From at least September 1, 2015, to 2020, Monroe Newpower Corporation and the County continued to assess whether it was more effective to operate the Iola Cogeneration Facilities or to purchase retail gas and electricity to serve the County Facilities.

23. Upon information and belief, Siemens was aware that both Monroe Newpower Corporation and the County studied and continued to weigh the economic viability of continuing to operate the Iola Cogeneration Facilities. Indeed, in the County’s Request for Proposals for the

Operation and Maintenance of Monroe County Cogeneration Facilities dated August 2, 2019, which resulted in the 2019 Agreement, the County stated that “[t]he Respondent shall be aware that during the term of the agreement, the County and/or [Monroe Community College] may cause the electric and/or steam generation capacity of the cogen facility(ies) to cease operation.”

**THE COUNTY DETERMINES THAT IT WILL MOVE
TO THE ELECTRIC GRID, BUT THE FAILURE OF THE TRANSFORMER
PREVENTS IT FROM DOING SO**

24. In early 2020, the County determined that obtaining electricity from the grid was more economical than continuing the generation of electricity, and therefore explored ceasing Siemens’ operation of the Generators at the end of 2020.

25. In early 2020, Siemens determined that one of the three Generators was overdue for a major overhaul and another Generator was due for a top-end overhaul.

26. Because the County anticipated ceasing Siemens’ operation of the Generators at the end of 2020, the County determined that the cost of the major overhaul was not a prudent use of taxpayer funds. The County therefore authorized Siemens to perform the top-end overhaul, but did not proceed with the major overhaul.

27. On October 29, 2020, the County notified Siemens that it intended to renew the 2019 Agreement for calendar year 2021 for the Boilers, but that, pursuant to § 3.3 of the 2019 Agreement, the County was electing to cease Siemens’ operation of the Generators at the end of the 2020 calendar year.

28. At the County’s insistence and as part of Siemens’ vacation of the electric generation facilities under the 2019 Agreement, Siemens sampled the 4200 KVA Transformer oil on December 15, 2020.

29. The December 15, 2020 oil sampling resulted in the discovery of elevated combustible gas levels.

30. According to Siemens, the last time Siemens tested the 4200 KVA Transformer oil prior to December 15, 2020, was in 2011.

31. In early 2021, Siemens conducted additional testing to investigate the cause of the elevated combustible gas levels, including a de-energized inspection by O’Connell Electric Company, Inc. (“O’Connell”).

32. On or about March 11, 2021, O’Connell reported that they found evidence of arcing on the windings and that the 4200 KVA Transformer “was not acceptable to put back into service due to imminent failure of internal components.”

33. The County authorized an emergency procurement pursuant to New York General Municipal Law § 103(4) and ordered a replacement transformer on or about March 26, 2021. The earliest the replacement transformer would be available was mid-July 2021.

34. Without the transformer, not only were the County Facilities unable to permanently move to the grid, but they were also cut off from accessing the grid in the event of an emergency.

35. Smaller backup generators at MCH and 111 Westfall Road were capable of providing short-term emergency power for life and safety devices at these facilities. However, the County Facilities were now solely dependent on the Generators for the provision of long-term electricity at MCH and 111 Westfall.

36. Because the County had anticipated ceasing Siemens’ operation of the Generators at the end of 2020, the County had not authorized work in 2020 for the Generators to continue to operate through July 2021.

37. The Generators could not provide reliable electricity to power MCH and 111 Westfall until the anticipated delivery date for the new 4000 KVA transformer.

38. In order to protect the residents at MCH, the cold-storage of the County's COVID-19 vaccinations, and to ensure the uninterrupted operation of the County Departments of Human Services and Public Health, the County rented three large, portable diesel generators to serve as primary power until the new 4000 KVA transformer could be delivered and installed in July 2021.

39. Siemens participated in the County's decision to rent the three large, portable diesel generators during the weekly coordination calls chaired by Siemens.

40. On April 8, 2021, the County started to issue purchase orders for the rental, maintenance, and fueling of the three large, portable diesel generators and appurtenances. One of the portable generators was a 1,000 kW portable generator from Penn Power to power the chillers at MCH. The other two portable generators were 2,000 kW portable generators from Southworth-Milton (AKA Milton Cat) to provide primary power to MCH and 111 Westfall Road.

41. The new 4000 KVA transformer was delivered, installed, and tested on August 11, 2021.

42. The County Facilities were successfully connected to the grid the next day.

**SIEMENS' FAILURE TO MAINTAIN THE TRANSFORMER
RESULTS IN SUBSTANTIAL COSTS TO THE COUNTY**

43. From May 11, 2021, until the new 4000 KVA transformer was connected on August 12, 2021, the County ran the three large, portable diesel generators on a continuous basis (24 hours per day, 7 days per week).

44. To ensure reliable operation of the three large, portable diesel generators and supply of electricity to satisfy the critical needs of MCH and 111 Westfall Road, Monroe County had to purchase diesel fuel and continuously monitor the performance, fueling, and maintenance of the portable generators.

45. After the new 4000 KVA transformer was installed, Siemens and the County sent the original, dysfunctional 4200 KVA Transformer to Sunbelt-Solomon Solution's ("Sunbelt Solomon") Kansas facility for an inspection.

46. Sunbelt-Solomon Solutions inspected the 4200 KVA Transformer in September 2021 (at which representatives from Siemens and the County were present) and issued its inspection report on November 29, 2021 (the "Inspection Report").

47. In the Inspection Report, Sunbelt-Solomon found that "the cause for the [internal] arcing and faults was a result of an external event on the transformer."

48. The Inspection Report stated that the internal fault occurred sometime before Siemens sampled the 4200 KVA Transformer oil in December 2020.

49. The Inspection Report also noted that the center indicator pin was pushed up, which indicated that the pressure relief device had activated.

50. The pressure release device is designed to sense and relieve a dangerous pressure increase in the transformer tank that may be the result of a fault or short circuit condition (*see Exhibit E – Installation, Operation, and Maintenance manual for the 4200 KVA Transformer*).

51. The amount of corrosion beneath and around the indicator pin, which prevented it from being pushed back in, indicates that the pin had been pushed up for a lengthy period of time.

52. The County issued follow-up questions to Sunbelt-Solomon to determine if additional testing was necessary.

53. In its response dated May 25, 2022, Sunbelt-Solomon stated that: (1) no additional tests would be able to better identify what the external event was or when it occurred; (2) routine inspections of the 4200 KVA Transformer should have included the position of the center indicator pin; and (3) the damage to the 4200 KVA Transformer was not a function of the original manufacturing process.

54. It is evident from the Inspection Report and Sunbelt-Solomon’s answers to the follow-up questions that Siemens failed to perform their contractually obligated services related to the 4200 KVA Transformer under the 2019 Agreement.

55. Siemens failed to operate the 4200 KVA Transformer in a proper and workmanlike manner and in accordance with the practices, methods, and actions customarily engaged in or used by diligent and efficient operators of facilities of a nature similar to the 4200 KVA Transformer, in accordance with the 2015 Agreement, as assigned to the County, and the 2019 Agreement.

56. As noted in the Installation, Operation, and Maintenance manual for the 4200 KVA Transformer, Siemens should have “check[ed] all gauges and indicators regularly to ensure the transformer is operating properly within the limits of safe operations.” (**Exhibit B** - Manual § 6.1).

57. As observed by Sunbelt-Solomon, such inspection of the 4200 KVA Transformer should have included the position of the center indicator pin.

58. Moreover, Siemens should have sampled and tested the liquid in the 4200 KVA Transformer “at regular intervals, and the results recorded for future comparison.” (**Exhibit B** -

Manual § 6.3.1.8).

59. This requirement is echoed in O’Connell’s March 11, 2021 report: “Due to your critical dependence on the electrical distribution system, we recommend that similar maintenance and analysis [i.e., visual and mechanical inspection of all designated components in the electrical distribution system; compare nameplate capacity verses actual load conditions; provide recommendations for critical repairs; and test equipment] be performed on a regularly scheduled basis.”

60. Furthermore, Siemens failed to retest the 4200 KVA Transformer oil after one year as recommended by SD Myers in their November 21, 2011 report from a sampling event of November 5, 2011.

61. The Inspection Report stated that “the collar on the indicating plunger was broken and would not allow the indicating plunger to be reset” and that “[t]he HV lead assemblies had extensive carbon contamination and several of the zip ties used to support and stand off the HV leads had broken....The zip ties appear to have become brittle which caused them to break.”

62. Although Sunbelt-Solomon acknowledges that the broken zip ties “did not result in any arcing or failure points on the HV leads,” this nonetheless indicates at least three failures to operate, maintain, service, and repair the 4200 KVA Transformer: (1) the failure to maintain, service, and repair the broken collar; (2) the failure to support and stand off the HV lead with a more permanent and reliable repair than zip ties; and (3) to the extent the use of zip ties was even prudent to begin with, the failure to repair the broken zip ties.

63. Siemens failed to promptly make all necessary repairs, rebuilds, overhauls, replacements and renewals to the 4200 KVA Transformer, whether ordinary or extraordinary, structural or nonstructural, foreseen or unforeseen, in accordance with the 2019 Agreement.

64. Siemens failed to repair the damage to the 4200 KVA Transformer from the internal arcing and fault.

65. Siemens also failed to repair the collar on the indicating plunger and broken zip ties (or, alternatively, provide a more effective repair to support and stand off the HV leads).

66. Siemens failed to maintain the 4200 KVA Transformer in working order, in accordance with the 2019 Agreement.

67. The 4200 KVA Transformer was not in working order.

68. Siemens failed to protect the 4200 KVA Transformer against deterioration, including ordinary wear and tear, in accordance with the 2019 Agreement.

69. As demonstrated by the broken collar on the indicating plunger and zip ties, Siemens failed to protect the 4200 KVA Transformer against deterioration.

70. Siemens failed to cause the 4200 KVA Transformer to continue to have the capacity and functional ability to perform, on a continuing basis, in normal commercial operation, at design capacity, the functions for which it was specifically designed, in accordance with the 2019 Agreement.

71. The 4200 KVA Transformer did not have the capacity and functional ability to perform, on a continuing basis, in normal commercial operation, at design capacity, the functions for which it was specifically designed.

72. Siemens failed to comply with standards and periodic maintenance inspections required to enforce warranty and similar claims against contractors for the 4200 KVA

Transformer, and any standards imposed by any insurance policies in effect at any time, in accordance with the 2019 Agreement.

73. Siemens' failure to inspect the 4200 KVA Transformer at regular intervals throughout the term of the 2019 Agreement (and prior), including but not limited to failing to routinely sample the 4200 KVA Transformer oil since 2011 and/or inspecting the 4200 KVA Transformer to confirm that the center indicator pin had not tripped, was not in accordance with standards and periodic maintenance inspections required to enforce warranty and similar claims against contractors for the County Facilities nor any standards imposed by any insurance policies in effect at any time.

74. Siemens failed to provide all necessary labor, materials, and equipment for the proper operation and maintenance of the 4200 KVA Transformer, in accordance with the 2019 Agreement.

75. Siemens both failed to inspect the 4200 KVA Transformer as well as failed to repair broken and/or deteriorated portions of the 4200 KVA Transformer.

76. Siemens failed to investigate and submit reports to the County regarding the cause, response, and corrective action taken when the 4200 KVA Transformer failed, in accordance with the 2019 Agreement.

77. Siemens tested the 4200 KVA Transformer oil in December 2020 only because the County insisted upon it as part of Siemens' wind up of its operations.

78. The County, and not Siemens, then paid for the cost of the investigation of the failure.

79. Siemens failed to perform work in a manner consistent with the degree of care and skill ordinarily exercised by reputable firms performing the same or similar work in the

industry acting under similar circumstances and conditions in accordance with the 2019 Agreement.

80. Siemens' failure to inspect the 4200 KVA Transformer at regular intervals throughout the term of the 2019 Agreement (and prior), including but not limited to failing to sample the 4200 KVA Transformer oil since 2011 and/or inspecting the 4200 KVA Transformer to confirm that the center indicator pin had not tripped, was not consistent with the degree of care and skill ordinarily exercised by reputable firms performing the same or similar work in the industry acting under similar circumstances and conditions.

81. Siemens failed to give immediate verbal and written notice of any Service Failure or any material damage to the 4200 KVA Transformer.

82. Siemens did not notify the County when the 4200 KVA Transformer was damaged.

83. If Siemens had performed its obligations under the 2019 Agreement and made the County aware of the 4200 KVA Transformer's condition, the County would not have terminated services for the Generators in 2020.

84. If Siemens had made the County aware of the 4200 KVA Transformer's degraded condition when the County was assessing whether it was more effective to operate the Iola Cogeneration Facilities or to purchase retail gas and electricity and/or studying the continued economic viability of the Iola Cogeneration Facilities, the County would not have ceased Siemens' operation of the Generators when it did.

85. Alternatively, if Siemens had made the County aware of the 4200 KVA Transformer's degraded condition, the County would have replaced the 4200 KVA Transformer in 2020 (or earlier upon timely notification) while the Generators were fully operational.

86. This would have saved the County from having to rent and run the diesel generators, as well as: (1) permitted the County the opportunity to determine whether the 4200 KVA Transformer could have been repaired, and/or (2) avoided the increased cost of having to purchase a new 4000 KVA transformer through an emergency purchase order.

87. Sunbelt-Solomon’s inspection clearly demonstrated that Siemens acted in breach of the 2019 Agreement and was negligent in its operation and maintenance of the 4200 KVA Transformer.

88. Furthermore, it is evident from the fact that Siemens did not test the 4200 KVA Transformer oil since 2011 nor checked the 4200 KVA Transformer’s gauges and indicators regularly under the 2002 Agreement and 2015 Agreement that Siemens never intended to perform its obligations regarding the 4200 KVA Transformer under the 2019 Agreement.

89. The County was required, as a result of these breaches, inducement, and negligence, to pay for, among other things, a new 4000 KVA transformer, installation of the new 4000 KVA transformer, the leasing of generators and appurtenances, fuel, and associated maintenance, installation, and removal costs.

**AS AND FOR A FIRST CAUSE OF ACTION FOR
BREACH OF CONTRACT**

90. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if fully set forth herein.

91. Siemens’ failure to sample the transformer oil between 2011 and December 2020 and/or to inspect the Transformer to confirm that the center indicator pin had not tripped was in breach of § 2.1 of the 2019 Agreement.

92. Such breach caused damages that exceed the Commercial Division threshold for the Seventh Judicial District.

AS AND FOR A SECOND CAUSE OF ACTION FOR BREACH OF CONTRACT

93. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if fully set forth herein.

94. Siemens failed to keep the County Facilities, which included the 4200 KVA Transformer, in good and safe condition, repair, working order and condition, including ordinary wear and tear, as required under the 2019 Agreement.

95. As of at least December 2020, if not sooner, the 4200 KVA Transformer was not in good and safe condition, repair, working order, and condition, including ordinary wear and tear, and could not be used by the County. This failure was in breach of § 5.1 of the 2019 Agreement.

96. Such breach caused damages that exceed the Commercial Division threshold for the Seventh Judicial District.

AS AND FOR A THIRD CAUSE OF ACTION FOR BREACH OF CONTRACT

97. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if fully set forth herein.

98. Siemens failed to replace wear and tear items as necessary, such as the collar on the indicating plunger and the zip ties (or, alternatively, provide a more effective repair than zip ties to support and stand off the HV leads). This failure was in breach of § 5.11 of the 2019 Agreement.

99. Such breach caused damages that exceed the Commercial Division threshold for the Seventh Judicial District.

AS AND FOR A FOURTH CAUSE OF ACTION FOR BREACH OF CONTRACT

100. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if fully set forth herein.

101. Siemens failed to prepare and maintain a maintenance log for all maintenance and repairs.

102. The only documentation Siemens provided regarding maintenance and repair of the 4200 KVA Transformer were the oil sampling report from 2011 and a report from 2017 when there were two failed attempts to test the oil due to unsuitable weather conditions (that is, it was too cold out for the tester to properly test, and the tester never returned during warmer weather). This failure was in breach of § 5.12 of the 2019 Agreement.

103. Such breach caused damages that exceed the Commercial Division threshold for the Seventh Judicial District.

**AS AND FOR A FIFTH CAUSE OF ACTION FOR
BREACH OF CONTRACT**

104. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if fully set forth herein.

105. Siemens failed to promptly replace all Parts which may from time to time become worn out, lost, stolen, destroyed, seized, confiscated, damaged beyond repair, or permanently rendered unfit for any reason whatsoever, including but not limited to the collar on the indicating plunger. This failure was in breach of § 6.1 of the 2019 Agreement.

106. Such breach caused damages that exceed the Commercial Division threshold for the Seventh Judicial District.

**AS AND FOR A SIXTH CAUSE OF ACTION FOR
FRAUDULENT INDUCEMENT**

107. Plaintiff repeats and re-alleges paragraphs 1 through 89 of the complaint as if

fully set forth herein.

108. Siemens failed to give immediate verbal and written notice of any Service Failure or any material damage to the 4200 KVA Transformer, under the 2002, 2015, and 2019 Agreements.

109. Siemens did not give notice to the County that the 4200 KVA Transformer was damaged and could not be placed into service under the 2002, 2015, and 2019 Agreements.

110. Defendant's representations and/or material omissions of fact concerning its failure to perform as per the 2002 Agreement and 2015 Agreement caused the County to rely upon Siemens' supposed performance when the County agreed to the 2019 Agreement.

111. As a result of the County's reliance upon the contract and the representations and/or material omissions of Siemens, the County was forced to incur costs, expenses, damages, and losses exceeding what it would otherwise have been subjected to, and which exceed the Commercial Division threshold for the Seventh Judicial District.

112. The County demands a trial by jury.

WHEREFORE, the Plaintiff County of Monroe hereby claims and demands judgment against defendant for all causes of action in an amount that exceeds the Commercial Division threshold for the Seventh Judicial District, together with the costs and disbursements of this action and, pursuant to the Indemnification clause of Appendix B, reasonable attorneys' fees.

JOHN P. BRINGEWATT, ESQ.
COUNTY ATTORNEY
Attorney for Plaintiff County of Monroe

Dated: June 6, 2023

s/ Robert J. Shoemaker
Robert J. Shoemaker, Esq., of Counsel
Deputy County Attorney
307 County Office Building

39 West Main Street
Rochester, New York 14614
Telephone: 585.753.1472

To: Siemens Industry, Inc.
50 Methodist Hill Drive, Suite 1500
Rochester NY 14623

Attached: Exhibit A – The 2015 Agreement
Exhibit B – Order of Hon. Craig J. Doran dissolving Newpower
Exhibit C – Resolution 100 of 2017 of the Legislature of the County of Monroe
Exhibit D – The 2019 Agreement
Exhibit E – Installation, Operation, and Maintenance Manual

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MONROE COUNTY CLERK



SUPREME COURT
COUNTY OF MONROE STATE OF NEW YORK

<p>COUNTY OF MONROE,</p> <p style="text-align: right;"><i>Plaintiff,</i></p> <p style="text-align: center;">v.</p> <p>SIEMENS INDUSTRY, INC.</p> <p style="text-align: right;"><i>Defendant.</i></p>
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Index No.: _____

**AFFIRMATION IN SUPPORT OF CLAIM FOR EXEMPTION
PURSUANT TO CPLR §8017**

Robert J. Shoemaker, an attorney licensed to practice before the courts of the State of New York, hereby makes the following statements under penalty of perjury:

1. I am a Deputy County Attorney with the Monroe County Department of Law, with offices located at 307 COB, 39 West Main Street, Rochester, New York 14614.
2. There is presented for recording herewith certain documents by the County of Monroe who is a party to a litigation matter indexed with the Monroe County Clerk’s Office.
3. The County of Monroe is a tax exempt Municipal Corporation duly organized and existing under the laws and the Constitution of the State of New York and, therefore, pursuant to Civil Practice Law and Rules Section 8017, is exempt from the payment of any fees for filing, recording, or indexing any paper or document with the Monroe County Clerk.

Dated: June 6, 2023

s/ Robert J. Shoemaker
Robert J. Shoemaker, Esq.
Deputy County Attorney

MONROE COUNTY CLERK'S OFFICE

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Book Page CIVIL

No. Pages: 39

Instrument: EXHIBIT(S)

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Index #: E2023005870

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JAMIE ROMEO

MONROE COUNTY CLERK



OPERATION AND MAINTENANCE AGREEMENT

Dated as of December 31, 2015

between

SIEMENS INDUSTRY, INC. and
MONROE NEWPOWER CORPORATION

THIS OPERATION AND MAINTENANCE AGREEMENT, dated as of December 31, 2015, by and between SIEMENS INDUSTRY, INC., a Delaware State corporation having its office at 422 East Henrietta Road, Rochester, New York 14620 (the "Operator") and MONROE NEWPOWER CORPORATION, a not-for-profit local development corporation of the State of New York having its office at 39 West Main Street, Room 200, Rochester, New York 14614 (the "LDC").

WITNESSETH:

WHEREAS, the LDC owns and operates a certain facility located at 350 East Henrietta Road, Rochester, New York, which houses three (3) Caterpillar 3516, 1350 KW generators, three (3) boilers for steam production and associated piping, utilities and equipment; which facility provides electricity, heat and steam to the Monroe County Hospital, the County-owned facility at 111 Westfall Road and the Rochester Operations Center (the "Iola Facility") as well as the MCC co-generation plant located in the basement of Monroe Community College ("MCC"), 1000 East Henrietta Road, Rochester, New York, 14620, which houses four (4) Caterpillar 3516, 1350 KW generators, heat exchangers, chilled water loop systems and related piping, equipment and utilities that provide electricity and heating/cooling to the MCC campus (the "MCC Facility"); and

WHEREAS, the LDC additionally maintains certain equipment pursuant to certain easements of record in connection with the operation of the Iola Facility in the basement of the building located at and commonly referred to as the Iola Powerhouse at 444 East Henrietta Road, Rochester, New York, which shall be considered and is a component of the Iola Facility (and collectively with the Iola Facility and the MCC Facility, the "Facility"). All relevant equipment and utilities associated with the co-generation facilities are set forth in the Equipment Schedule annexed hereto and made hereof as Exhibit A; and

WHEREAS, the LDC has obligated itself under a certain energy supply with the County (the "Energy Supply Agreement") to provide certain energy to the County and MCC; and

WHEREAS, the LDC desires to contract with the Operator for the operation and maintenance of the Facility so as to enable the LDC to fulfill all of its obligations under the Energy Supply Agreement;

NOW THEREFORE, in consideration of the mutual promises and considerations herein set forth, it is agreed as follows:

ARTICLE I

DEFINITIONS

SECTION 1.1 - Definition. Unless the context shall otherwise require, capitalized terms herein have the meanings given to them in Appendix A attached hereto and incorporated herein.

ARTICLE II

APPOINTMENT OF OPERATOR AND ACCEPTANCE OF APPOINTMENT

SECTION 2.1 - Engagement and Appointment of Operator. Subject to all the terms and conditions of this Operation and Maintenance Agreement, the LDC hereby appoints the Operator, as of January 1, 2016, the operator of the Facility and the Operator hereby accepts, as of January 1, 2016, such appointment. Subject to all the terms and conditions of this Operation and Maintenance Agreement during the Operating Term, the Operator shall operate the Facility in compliance with this Operation and Maintenance Agreement, in a proper and workmanlike manner, in accordance with the practices, methods and actions customarily engaged in or used by diligent and efficient operators of facilities of a nature similar to the Facility and in a manner which will enable the LDC to comply with all its obligation to provide Energy Service and to fulfill its obligation under the Energy Supply Agreement. The Operator may, and at the request of the LDC shall, use facilities (whether temporary or permanent and whether owned by the Operator or any other Person) other than the Facility to provide Energy Service. The Operator acts as Operator hereunder as an independent contractor.

SECTION 2.2 - No Interest in Operator. This Operation and Maintenance Agreement is an operating agreement and does not convey to the Operator any right, title or interest in or to the Facility, except that the Operator shall have and is hereby granted a non-exclusive license to enter on, possess, operate, alter and maintain the Facility for the purpose of performing its obligations hereunder.

ARTICLE III

TERM AND OPERATING FEES

SECTION 3.1 - Term. This Operation and Maintenance Agreement shall be in effect from January 1, 2016 until December 31, 2016 with three one year options to renew pursuant to the terms and conditions hereof. Each one year option may be exercised in writing by the County or the LDC, as the case bay be, in its sole discretion pursuant to Section 14.1 at least ninety (90) days before the expiration date.

SECTION 3.2 - Basic Operation Fee. The LDC hereby agrees to pay, or cause to be paid, subject to Section 3.3 and 3.6 hereof, to the Operator an Operating Fee on each Operating Fee Payment Date in an amount equal to \$899,970 for 2016, and annually thereafter in an amount which shall be based on the previous year's Operating Fee plus the percentage annual increase, in the North East Urban Consumer Price Index.

SECTION 3.3 - Limited Liability of LDC to Pay Operating Fee. The Operating Fee that the LDC is required to pay pursuant to this Operation and Maintenance Agreement shall be made only to the extent that the LDC receives the County Service Charge (as defined in the Energy Supply Agreement) from the County pursuant to the Energy Supply Agreement, and the LDC shall not be personally liable for any such amounts. No recourse shall be had for any such payment or for any claim based thereon or upon any obligation, covenant or agreement contained in the Operation and Maintenance Agreement against any past, present or future officer, member or director of the LDC, or any incorporator, member, officer, director or trustee of any successor corporation, as such, either directly or through the LDC or any successor corporation, under any rule of law or equity, statute or constitution or by the enforcement of any assessment or penalty or otherwise, and all such liability of any such incorporator, member, officer, director or trustee as such is hereby expressly waived and released as a condition of and consideration for the execution of this Operation and Maintenance Agreement.

SECTION 3.4 - Payments on Business Days. If any date on which payment of an Operating Fee becomes due and payable is not a Business Day, then such payment need not be made on such scheduled date but may be made on the next succeeding Business Day with the same force and effect as if made on such scheduled date and (provided such payment is made on such next succeeding Business Day) no interest shall accrue on the amount of such payment from and after such scheduled date.

SECTION 3.5 - Place of Payment. All Operating Fees shall be paid by the LDC in immediately available funds before noon, local time at the place of payment, on the due dates therefore at any banking institution in the State with wire transfer facilities which the Operator may designate.

SECTION 3.6 - Late Payment. If any Operating Fee shall not be paid at the place and time provided in Section 3.5 hereof, the LDC shall pay, subject to Section 3.3 hereof, to the Operator interest (to the extent permitted by law) on such overdue amount from and including the due date thereof to but excluding the date of payment thereof (unless such payment shall be made after noon, local time, at the place of payment on such date of payment, in which case such date of payment shall be included) at the Stipulated Interest Rate. If any Operating Fee shall be paid on the date when due, but after noon, local time, at the place of payment, interest shall be payable as aforesaid for one day.

ARTICLE IV

DISCLAIMER OF WARRANTIES

SECTION 4.1 - Disclaimer of Warranties. The LDC makes no warranties or representations of any kind to the Operator with respect to the Facility.

ARTICLE V

MAINTENANCE AND OPERATION

SECTION 5.1 - Maintenance. (a) The Operator agrees that during the Operating Term it will operate, maintain, service and repair the Facility and every part and parcel thereof in accordance with good commercial practice and in any event will; (i) keep the Facility in good and safe condition, repair, working order and condition, ordinary wear and tear excepted; (ii) all routine maintenance on all equipment shall be done in accordance and in compliance with any and all applicable manufacturer's warranties and recommendations; (iii) promptly make all necessary repairs, replacements and renewals to the Facility (whether ordinary or extraordinary, structural or nonstructural, foreseen or unforeseen); (iv) maintain the Facility in working order and a neat and orderly condition, ordinary wear and tear excepted, and in a condition which permits compliance with, all applicable Governmental Requirements, including without limitation all Federal, state and local laws relating to labor, wages, nondiscrimination, environmental control, safety and other regulatory requirements; (v) operate the Facility in a sound and economic manner; (vi) protect the Facility against deterioration, other than that attributable to ordinary wear and tear; (vii) cause the Facility to continue to have the capacity and functional ability to perform, on a continuing basis, in normal commercial operation, at design capacity, the functions for which it was specifically designed; (viii) comply with such standards and periodic maintenance inspections as shall be required to enforce warranty and similar claims against contractors for the Facility and any standards imposed by any insurance policies in effect at any time with respect to the Facility or any part thereof; and (ix) provide all necessary labor, materials and equipment for the proper operation and maintenance of the Facility. Notwithstanding any of the foregoing, unless an Operating Event of Default shall have occurred and be continuing; the Operator may provide that; (A) the operation of the Facility may be subject to periodic, scheduled or unscheduled, partial shutdowns of portions of the Facility for maintenance or repair; (B) provided that compliance with any applicable Governmental Requirements is subject to the provisions of Section 6.2 hereof; and (C) no repair, replacement or maintenance shall be required hereunder or under the provisions of Section 5.20 or 6.1 hereof with respect to portions of the Facility which the Operator, with the consent of the County, determines are no longer necessary to the provision of Energy Service.

SECTION 5.2 - Hours of Operators, Operator Qualifications. Operator will provide plant operators to monitor both co-generation facilities located at the Facility site 24-hours per day. All operators must have experience in the operation and maintenance of natural gas fueled engines/generators, and must possess all required certifications from the generator manufacturer,

(Caterpillar). Operator and its operators must also possess and maintain all appropriate certifications and licenses to operate the Facility, as required by local, state and federal law.

SECTION 5.3 – Operation / Downtime. The successful Operator must operate all equipment in a safe and efficient manner in accordance with all applicable laws and regulations. The Operator shall be expected to minimize downtime by ensuring that no generator/engine is offline for routine maintenance and repairs for more than three (3) weeks in any calendar year, and that a minimum of three (3) out of four (4) generators at MCC are in service at all times, barring unforeseen or unanticipated failures beyond the Operator's control or changes in regulatory requirements. Failure to comply with this condition may result in a proportionate reduction of the service fee.

SECTION 5.4 – Chillers. The Operator must make all Chillers located at the MCC site available for service on or before March 1 of each year. A fee of two hundred dollars (\$200.00) per day shall be assessed against the Operator for any unexcused failure to have the Chillers online by the March 1 deadline. The Operator shall also be responsible for water treatment of MCC's co-generation heat loop system up to the plate heat exchangers. Chemical treatment shall comply with MCC's reasonably commercial standards.

SECTION 5.5 – Electricity Demands. The Operator shall monitor the Facility's electric demands and operate each plant in a manner that minimizes purchases of electricity from third-party utility companies, while minimizing heat rejected through the dry coolers.

SECTION 5.6 – System Failure Reporting. The Operator shall be required to promptly report any system failures to the designated representatives of Monroe County, MCC and RG&E as identified and set forth herein on Exhibit B and shall cooperate and coordinate its efforts with those respective entities to promptly restore operations. In the event of any system failure, the Operator shall investigate and submit reports to the LDC regarding the cause, response and corrective action taken. The respective designated representative, Monroe County, MCC and RG&E are designated on Exhibit B attached hereto and made a part hereof unless changed by written notice to the Operator.

SECTION 5.7 - Monthly Meetings. The Operator shall be required to meet with representatives of the LDC, Monroe County and MCC on a monthly basis to discuss operations, gas consumption and any ongoing maintenance or repair issues. The successful vendor shall further be required to provide detailed written responses within seven (7) working days to any complaints or inquiries regarding operations from the LDC, the Monroe County and/or MCC respectively.

SECTION 5.8 – Data Reporting. The Operator shall provide necessary data and information to representatives of the LDC, Monroe County and MCC respectively for purposes of preparing their annual budgets. The Operator shall also provide monthly usage data reports to the LDC representative for customer billing purposes. The Operator shall also furnish the LDC

with all data necessary to comply with reporting requirements from regulatory agencies regarding the output and operations of the co-generation Facility.

SECTION 5.9 – Cost of Natural Gas. The LDC shall be responsible for the cost to purchase and deliver natural gas for use in the co-generation Facilities. However, the Operator shall monitor natural gas consumption and provide monthly reports to the LDC with recommendations for the future acquisition of natural gas in accordance with market trends.

SECTION 5.10 – Engine Oil, Lubricants, Etc. Operator is responsible for the acquisition and cost of all engine oil, grease, spark plugs, filters, diagnostic fluids and lubricants necessary for the normal operation of the Facility.

SECTION 5.11 - Optional Additional Operation Obligations. The LDC shall have the option in its sole discretion to commission Operator to perform top-end overhauls on any of the engines for a lump sum payment of \$79,000 per engine. Top-end overhaul shall be defined as set forth in Exhibit C, incorporated herein by reference and made a part hereof, but shall require the purchase and utilization of the appropriate Cat Overhaul Kits and following use of the processes and procedures thereof.

SECTION 5.12 – Wholesale Replacement. The Operator will not be responsible for wholesale replacement of equipment that is damaged beyond repair due to a catastrophic failure unless such failure is a direct result of Operator's negligence or wrongdoing. Notwithstanding the foregoing, the Operator shall repair all leaks and replace small damage sections as necessary. The Operator shall not be responsible the comprehensive replacement of piping.

SECTION 5.13 – Maintenance Logs. Operator shall prepare and maintain onsite detailed maintenance logs for all maintenance and repairs performed on the engines and equipment for both co-generation facilities, which shall be readily available at all times for review by the LDC, Monroe County and MCC.

SECTION 5.14 – Operator Responsibility for Repair, Oversight and Coordination. It is anticipated and expected that from time-to-time the LDC may retain the services of third-party vendors to replace equipment, conduct comprehensive repairs (including those caused by catastrophic failure), overhaul equipment and furnish other services outside the scope of work of this Agreement. In such instances, the Operator shall be responsible for on-site supervision and management of all work performed by such third-parties and coordinate such work. These duties include assisting the LDC in drafting requests for proposals, acquiring quotes from qualified third-party vendors, the inspection and final approval of all work by any third-party vendor and recommendations to the LDC regarding approval of all third party payment applications or requests.

SECTION 5.15 – Emission Reports. The Operator shall coordinate and assist third-party vendors retained by the LDC for the preparation and submission of emission reports or other reporting required by federal, state or local agencies. These duties include providing the third-

party vendors access to the Facility as required, and furnishing Facility data and information as requested.

SECTION 5.16 – Governmental Requirements. The Operator shall promptly furnish to the LDC such information as may be required to enable the LDC to file any reports required by Governmental Requirements because of the LDC's interest in the Facility.

SECTION 5.17 – Maintenance Exclusions of Operator. Operator's operation and maintenance services do not include, directly or indirectly, performing or arranging for the detection, monitoring, handling, storage, removal, transportation, disposal or treatment of any pre-existing oils or Hazardous Materials existing onsite prior to December 1, 2002, except that certain asbestos containing interior pipe insulation within the Iola Powerhouse identified in Exhibit A, LDC represents that, to the best of its knowledge and belief, there is no other asbestos or any other hazardous or toxic materials, as defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, the regulations promulgated thereunder, and other applicable federal, state or local law ("Hazardous Materials"), present at the Facility. Operator will notify LDC within a reasonable time if Operator discovers or (d) suspects the presence of any Hazardous Material. All services have been priced and agreed to by Operator in reliance on LDC's representations as set forth herein. The presence of Hazardous Materials constitutes a change in the scope of services equivalent to a change order whose terms must be agreed to by the parties before Operator's obligations hereunder will continue. LDC shall be solely responsible for testing, abating, encapsulating, removing, remedying or neutralizing such Hazardous Materials, and for the costs thereof. Even if an appropriate change order has been entered into pursuant hereto, Operator will continue to have the right to stop providing services until the Facility is free from Hazardous Materials. In such event, Operator will receive an equitable extension of time to complete its services, and compensation for delays caused by Hazardous Materials remediation. In no event shall Operator be required or construed to take title, ownership or responsibility for any oil or Hazardous Materials. LDC shall sign any required waste manifests in conformance with all government regulations, listing LDC as the generator of the waste. Provided further that Operator may in its discretion assign to LDC the contract and payment obligation for that certain asbestos containing interior pipe insulation within the Iola Powerhouse identified in Exhibit A and reduce the Installation Fee by the amount of same, but said reduction in the Installation Fee is not to exceed \$50,000.

SECTION 5.18 - Grants, Aid, Etc. The Operator may, in the name of the County or LDC, apply for and obtain aid and grants from any governmental authority in connection with the Facility and/or provisions of Energy Service. The Operator shall be entitled to an administrative fee for obtaining such grants in an amount equal to twenty-five percent (25%) of the value of any grant awarded. The LDC and Operator agree to cooperate with the County in obtaining any such aid and grants.

SECTION 5.19 - Obligation to Rebuild. If the Facility shall be damaged or destroyed at any time or title to, or the use of, any part of the Facility shall be taken by Condemnation, in a manner not resulting in a Service Failure, the Operator shall, from the proceeds of any

Condemnation award or insurance received by the Operator or from moneys received by the Operator from any other person, promptly replace, repair, rebuild or restore the Facility to substantially the same condition and value as an operating entity as existed prior to such damage or destruction or Condemnation, with such changes, alterations and modifications as may be desired by the County, provided that such changes, alterations or modifications do not change the nature of the Facility.

SECTION 5.20 – Standard of Work by Operator. (a) The Work performed by Operator shall be conducted in a manner consistent with the degree of care and skill ordinarily exercised by reputable firms performing the same or similar Work in the same locale acting under similar circumstances and conditions.

(b) All Work shall be performed by Operator in conformity and a manner consistent with the LDC's obligation for same under the Energy Supply Agreement.

(c) Operator is not required to conduct safety or other tests, install new devices or equipment or make modifications to any Equipment beyond the Scope set forth in this Agreement. Any LDC request to change the Scope or the nature of the Work must be in the form of a mutually agreed change order, effective only when executed by all parties hereto.

(d) All reports and drawings specifically prepared for and deliverable to LDC pursuant to this Agreement ("Deliverables") shall become LDC's property upon full payment to Operator. Operator may retain file copies of such deliverables. All other reports, notes, calculations, data, drawings, estimates, specifications, manuals, other documents and all computer programs, codes and computerized materials prepared by or for Operator are instruments of Operator' work ("Instruments") and shall remain Operator' property. LDC, its employees and agents ("Permitted Users") shall have a right to make and retain copies of Instruments except uncompiled code, and to use all Instruments, provided however, the Instruments shall not be used or relied upon by any parties other than Permitted Users, and such use shall be limited to the particular project and location for which the Instruments were provided. All Deliverables and Instruments provided to LDC are for Permitted Users' use only for the purposes disclosed to Operator, and LDC shall not transfer them to others or use them or permit them to be used for any extension of the services or any other project or purpose, without Operator's express written consent. Any reuse of Deliverables or Instruments for other projects or locations without the written consent of Operator, or use by any party other than Permitted Users will be at Permitted Users' risk and without liability to Operator; and LDC shall indemnify, defend and hold Operator harmless from any claims, losses or damages arising therefrom.

SECTION 5.21 - Responsibilities of LDC. LDC, without cost to Operator, shall:

(a) Designate a contact person with authority to make decisions for LDC regarding the services performed by Operator and provide Operator with information sufficient to contact

such person in an emergency. If such representative cannot be reached Operator will, in its reasonable discretion, act accordingly and without penalty for such actions;

(b) Provide or arrange for reasonable access and make all provisions for Operator to enter any Facility to perform the services;

(c) Permit Operator to control and/or operate all Facility controls, systems, apparatus, equipment and machinery necessary to perform the services;

(d) Furnish Operator with all available information pertinent to the Facility and the services;

(e) Notify Operator promptly of any site conditions requiring special care, and provide Operator with any available documents describing the quantity, nature, location and extent of such conditions;

(f) Comply with all laws and provide any notices required to be given to any government authorities in connection with the services, except such notices Operator has expressly agreed in writing to give;

(g) Furnish to Operator any contingency plans related to the Facility and Property.

ARTICLE VI

REPLACEMENT OF PARTS; ALTERATIONS

SECTION 6.1 - Replacement of Parts. Except after a Service Failure, unless caused solely by or resulting solely from an act or omission of the Operator, the Operator will promptly replace all Parts which may from time to time become worn out, lost, stolen, destroyed, seized, confiscated, damage beyond repair or permanently rendered unfit for use for any reason whatsoever. The Operator may remove in the ordinary course of maintenance, service, repair, overhaul or testing, any Parts, whether or not worn out, lost, stolen, destroyed, seized, confiscated, damaged beyond repair or permanently rendered unfit for use, provided that the Operator will replace such Parts as promptly as possible. All replacement Parts shall be free and clear of all Liens and shall be in as good operating condition as, and shall have a value and utility at least equal to, the Parts replaced, assuming such replaced Parts were in the condition and repair required to be maintained by the terms hereof. Any cost incurred by the Operator in complying with this Section 6.1 shall constitute an Ordinary Operating Cost payable by Operator.

SECTION 6.2 - Alterations Required by Law. Except after a Service Failure, unless caused by or resulting solely from an act or omission of the Operator, the Operator shall during the operating Term make such Alterations to the Facility as may be required from time-to-time to meet Governmental Requirements as soon as practicable after any such Governmental

Requirements shall arise and, in any event, within the period specified by applicable law or by such Governmental Requirement, except to the extent Section 6.6 hereof shall apply. Any cost incurred by the Operator in complying with this Section 6.2 shall not constitute an Ordinary Operating Cost and shall be reimbursable from the LDC, but may, at the request of the LDC and County, be financed pursuant to Section 6.4 (b) hereof.

SECTION 6.3 - Optional Alterations. The Operator, at its own expense, may from time-to-time during the Operating Term make such other Alterations to the Facility as the Operator may deem necessary or appropriate for the purpose of providing Energy Service; provided, however, that neither the utility nor condition of the Facility will be diminished as a result of such Alteration.

SECTION 6.4 –LDC Financing of Alterations. The Operator agrees to give the County and the LDC at least 120 days' written notice or such maximum or lesser period necessary to comply with Governmental Requirement, of its intention to make any Alteration required pursuant to Section 6.2 hereof. The LDC shall pay for the cost of any Alteration required by law, and the LDC shall use its best efforts to raise money to make such payment if the Operator shall have provided the LDC with a written notice setting forth in reasonable detail the following:

- (a) a description of the nature of and reason for the Alteration desired to be made, which the Operator hereby agrees to furnish if the Alteration is described in Section 6.2 hereof; and
- (b) an estimate of the cost of such Alteration, which the Operator hereby agrees to furnish if the Alteration is described in Section 6.2 hereof.

SECTION 6.5- Title to Parts. Title to each Part (including any Alteration) incorporated in the Facility pursuant to this Article 6 shall without further act vest in the LDC and be deemed to constitute a part of the Facility in the following cases:

- (a) such Part shall be in replacement of or in substitution for, and not in addition to, any Part originally incorporated in the Facility during the construction thereof or any Part title to which shall have vested in the LDC pursuant to this Section;
- (b) such Part shall be required to be incorporated in the Facility pursuant to the terms of Section 6.1 or 6.2 hereof;
- (c) such Part cannot be readily removed from the Facility without adversely affecting or impairing the value, utility or condition that the Facility would have had at such time had such Part not been so incorporated; or
- (d) such Part shall be paid for by the LDC in accordance with Section 6.4 hereof or otherwise.

SECTION 6.6 - Permitted Contests. If, to the extent and for so long as (a) any contest with respect to any applicable Governmental Requirement relating to the operation or maintenance of the Facility shall be prosecuted in good faith by the Operator or (b) compliance with such Requirement shall have been excused or exempt by a valid nonconforming use permit, waiver, extension or forbearance believed in good faith by the Operator to exempt it from such requirement, the Operator shall not be required to comply with such requirement so long as such Contest is being prosecuted or so long as such waiver, extension or forbearance from compliance with such requirement shall be in effect but only if such contest shall not, in the reasonable opinion of the Operator, involve any reasonable likelihood of any (i) foreclosure, sale, forfeiture or loss of, any part of the Facility or of impairment of the operation of the Facility, (ii) the nonpayment of Service Fees, or (iii) a Service Failure.

SECTION 6.7 - Plans and Specifications. The Operator shall maintain throughout the Operating Term, and keep on file at its offices, a complete set of "as-built" Plans and Specifications of the Work (which shall reflect all Parts having a value in excess of \$100,000 incorporated in the Facility and all Alterations made pursuant to this Article 6, except that such Plans and Specifications shall as of any date not be required to reflect any such Parts so incorporated or Alterations so made within 90 days prior to such date.

ARTICLE VII

SERVICE FAILURE, LOSS, DESTRUCTION AND CONDEMNATION

SECTION 7.1 - Notice of Occurrence. If a Service Failure or any material damage to the Facility shall occur during the Operating Term, the Operator shall give the County, the Trustee and the LDC prompt written notice thereof.

SECTION 7.2 - Application of Certain Payments on a Service Failure. Any payments or proceeds received at any time by the Operator from any governmental authority, insurer or other Person as the result of the occurrence of a Service Failure shall be paid to the LDC.

SECTION 7.3 - Application of Insurance or Condemnation -- Proceeds For Other Than Service Failure. Any payments or proceeds received at any time as the result of any loss, condemnation, confiscation, theft or seizure of, or requisition of title to or use of, or damage to, the Facility or any part thereof not constituting a Service Failure shall after the Discharge Date be paid to the LDC and prior to the Discharge Date be paid to the Trustee; provided, payments or proceeds received by the Operator from an insurer in respect of any damage or loss shall be applied by the Operator toward repair or replacement of such loss or damage. Any moneys received by the Operator and not so used shall be paid by the Operator to the LDC.

ARTICLE VIII

INSURANCE

SECTION 8.1 - Insurance Required. Without limiting any of the other obligations or liabilities of the Operator under this Operation and Maintenance Agreement, at all time throughout the Operating Term (except as provided below), the Operator shall maintain or cause to be maintained at least the following minimum insurance coverage with respect to the Facility or such other insurance as is required in the Trust Indenture.

(a) comprehensive general public liability insurance applicable to the Facility, including, without limitation, blanket contractual, personal injury, property damage (including broad form property damage and explosion, collapse, underground property damage and sudden and accidental pollution, spillage or leakage of hazardous materials) and damage to property of others, including resultant loss of use therefrom, in such amount as are usually carried by person of established reputation operating similar properties; and

(b) such other insurance with respect to the Facility in such amounts and against such hazards as is usually carried by persons of established reputation operating similar properties.

All premiums with respect to the foregoing insurance shall be paid when due by the Operator and shall constitute an Ordinary Operating Cost.

SECTION 8.2 - Additional Provisions Respecting Insurance.

(a) All insurance required by Section 8.1 hereof shall be procured and maintained in financially sound and generally recognized responsible insurance companies selected by the Operator and approved by the LDC and authorized to write such insurance in the State. Such insurance may provide deductible amounts acceptable to the LDC upon the Operator's agreement to pay any such deductible amounts in the event of an insurance claim. All insurance policies carried in accordance with Section 8.1 hereof and all policies taken out in substitution or replacement for any such policies shall (a) name the LDC and the County as an additional insured, as their respective interests may appear (but without imposing upon any such parties any obligation imposed upon the insured, including, without limitation, the liability to pay the premium for such policies), (b) provide that payment for any loss shall be paid as provided in Section 7.2 or 7.3 hereof, as the case may be, (c) provide that in respect to the respective interests of the LDC and the County in such policies, the insurance shall not be invalidated by any action or inaction of the Operator or any other Person and shall insure the LDC, and the County as their interests may appear, regardless of any breach or violation by the Operator or any other Person of any warranties, declarations or conditions contained in such policies, (d) provide that as against the LDC and the County the insurers shall waive any rights of subrogation, any right of set-off and counterclaim and any other right of deduction whether by attachment or otherwise (except for claims arising out of the willful misconduct or gross negligence of such insured), (e) provide that if such insurance is cancelled for any reason whatever, or is changed in any material

respect in relation to the interest of the LDC and the County, of if such insurance is allowed to lapse for nonpayment of premium, such cancellation, change or lapse shall not be effective as to the LDC and the County for 30 days after receipt by the LDC and the County of written notice from such insurers of such cancellation, change or lapse (except that if it is not commercially practicable at the time of contracting for such insurance to obtain the waiver of notice requirements specified above, such policies shall provide for such waiver for as long a period of prior notice as shall then be commercially practicable to obtain) and (f) provide that, inasmuch as the policy is written to cover more than one insured, all terms, conditions, insurance agreements and endorsements, with the exception of limits of liability, shall operate in the same manner as if there were a separate policy covering each insured. Each insurance policy required under Section 8.1 hereof shall be primary without right of contribution from any other insurance which is carried by or on behalf of the LDC and the County with respect to its interest as such in the Facility.

SECTION 8.3 - Certificates, Etc. (a) Annually on or before each January 1, the Operator will furnish to the LDC and the County an ACORD form certificate of a firm of independent insurance brokers reasonably acceptable to the LDC and the County (i) certifying to the insurance then carried and maintained on the Facility (ii) identifying underwriters, type of insurance, insurance limits and policy term, and (iii) specifically listing the special provisions enumerated for such insurance required by Section 8.2. Upon request, the Operator will arrange to allow the LDC and the County view copies of all insurance policies, binders and cover notes or other evidence of such insurance relating to the Facility at Operator's insurance services facilities in Iselin, New Jersey. The Operator will cause such firm to advise the LDC and the County in writing promptly of any default in the payment of any premium and of any other act or omission on the part of the Operator or otherwise of which they have knowledge and which might invalidate or render unenforceable, in whole or in part, any insurance on the Facility.

(b) Concurrently with the furnishing of the certification referred to in Section 8.3 (a), the Operator will furnish the LDC and the County with a report stating that all premiums then due have been paid and that, in the opinion of the Operator the insurance then carried and maintained with respect to the Facility is in accordance with the terms of this Article 8. The Operator will advise the LDC and the County promptly in writing of any default in the payment of any premiums or any other act or omission on the part of the Operator which might invalidate or render unenforceable, in whole or in part, any insurance.

SECTION 8.4 - Insurance of County's Interest. Nothing contained herein shall prevent the County from carrying at its own expense additional insurance in excess of that required hereunder. Any such insurance maintained by the County shall not provide for or result in a reduction of the coverage or the amounts payable under any of the insurance maintained by the Operator in compliance with the provisions of this Article 8 (other than this Section 8.4).

ARTICLE IX

LIENS

SECTION 9.1 - Liens. The Operator will not directly or indirectly create, incur, assume or suffer to exist any Lien on or with respect to the Facility, title thereto or any interest therein or in this Operation and Maintenance Agreement except Permitted Liens. The Operator will promptly take such action as may be necessary duly to discharge any Lien not excepted above if the same shall arise at any time.

ARTICLE X INSPECTION

SECTION 10.1 - Inspection. The Operator shall furnish to the LDC and the county such information concerning the condition, use and operation of the Facility as the LDC and the County may reasonably request. Additionally, the Operator shall permit any authorized representative of the LDC and the County, at such Person's risk and expense, to visit and inspect the Facility, its condition, use and operation and the records maintained in connection therewith, provided that such visits and inspections do not interfere with the operations of the Operator and are scheduled at the reasonable request of the LDC and the County at times mutually convenient to such Person and the Operator, the Operator hereby agreeing to make all reasonable efforts to arrange for such visits and inspections at times convenient for such Person. Neither the LDC nor the County shall have any duty to make any such inspection nor shall any of them incur any liability or obligation by reason of not making any such inspection.

ARTICLE XI

VACATION OF FACILITY

SECTION 11.1 - Vacation of Facility. Except as otherwise provided herein, at the expiration of the Operating Term the Operator will vacate the Facility and deliver to the County the reports, records and documents referred to in Section 6.7 and 6.8 hereof

SECTION 11.2 - Condition. The Facility when vacated by the Operator shall (a) be in the condition required under Section 5.1 and Article 6 hereof and shall have been maintained throughout the Operating Term as if the Operator were the owner and operator thereof and as if the Operating Term were not then ending, and (b) be free and clear of any Liens (other than Permitted Liens).

ARTICLE XII

EVENTS OF DEFAULT

SECTION 12.1 - Operating Events of Default. The following events shall constitute Operating Events of Default (whether any such event shall be voluntary or involuntary or come about or be effected by operating of law or pursuant to or in compliance with any judgment, decree or order of any court or any order, rule or regulation of any administrative or governmental body).

(a) the Operator shall fail to perform or observe any covenant or agreement to be performed or observed by it hereunder and such failure shall continue unremedied for a period of 30 days after written notice thereof; provided, however, that unless a Service Failure has occurred and is continuing if such failure is in respect to Section 5.1(a), 5.2, 5.4, 5.6, 5.19, 6.1 or 6.2 and if the Operator shall be diligently pursuing curative action and shall have, within 60 days after occurrence of such failure, provided the LDC with a certificate of an engineer stating the nature of such curative action being done and to be done by the Operator (or, if testing or investigation shall be required, a preliminary evaluation of such curative action to be followed by a more accurate projection within 60 days following the completion of such tests and investigations) and the amount of time reasonably required to complete such curative action and the Operator is proceeding promptly and with due diligence to complete such curative action, such failure shall not become the Operating Event of Default until six months after its occurrence, if such failure materially reduces or adversely affects the ability of the Facility to perform, on a continuing basis, in normal commercial operation, the functions for which it was specifically designed, substantially in accordance with and as described in the as-built Plans and Specifications, or otherwise interferes with or impairs the operation of the Facility in any material respect (except to the extent that temporary reductions in the capacity of or interruptions of the operation of the Facility may be required during such curative action), or until 12 months after its occurrence, in all other cases;

(b) any representation or warranty made by the Operator herein proves to be false or misleading in any material respect, and such condition shall materially impair the ability of the Operator to perform any material obligation hereunder and shall continue unremedied for a period of 30 days after written notice thereof; or

(c) the Operator shall file any petition for dissolution or liquidation of the Operator, or the Operator shall commence a case under any applicable bankruptcy, insolvency or other similar law now or hereafter in effect, or the Operator shall have consented to the entry of an order for relief in a case under any such law, or the Operator generally shall fail to pay its debts as such debts become due, or the Operator shall fail promptly to satisfy or discharge any execution, garnishment or attachment of such consequence as may impair its ability to carry out its obligations under this Operation and Maintenance Agreement, or a receiver, Trustee or trustee (or other similar official) for the Operator or any substantial part of its property shall have been appointed or taken possession thereof, or the Operator shall make a general assignment for the

benefit of its creditors, or the Operator shall enter into an agreement or composition with its creditors, or the Operator shall take any action in furtherance of any of the foregoing; a petition in bankruptcy which results in an order for relief being entered or, notwithstanding that an order for relief has not been entered, the petition is not dismissed within 90 days of the date of the filing of the petition, or there shall be filed under any Federal or State law relating to bankruptcy, insolvency or relief of debtors of a petition against the Operator for reorganization, composition, extension or arrangement with creditors which either (i) results in a finding or adjudication of insolvency of the Operator or (ii) is not dismissed with 90 days of the date of the filing of such petition.

SECTION 12.2 - LDC Events of Default. The following events shall constitute LDC Events of Default (whether any such event shall be voluntary or involuntary or come about or be effected by operation of law or pursuant to or in compliance with any judgment, decree or order of any court or any order, rule or regulation of any administrative or governmental body).

(a) the LDC shall fail to perform or observe any covenant or agreement to be performed or observed by it hereunder and such failure shall continue unremedied for a period of 30 days after written notice thereof;

(b) any representation or warranty made by the LDC herein proves to be false or misleading in any material respect, and such condition shall materially impair the ability of the LDC to perform any material obligation hereunder and shall continue unremedied for a period of 30 days after written notice thereof; or

(c) the LDC shall file any petition for dissolution or liquidation of the LDC, or the LDC shall commence a case under any applicable bankruptcy, insolvency or other similar law now or hereafter in effect, or the LDC shall have consented to the entry of an order for relief in a case under any such law, or the LDC generally shall fail to pay its debts as such debts become due, or the LDC shall fail promptly to satisfy or discharge any execution, garnishment or attachment of such consequence as may impair its ability to carry out its obligations under this Operation and Maintenance Agreement, or a receiver, Trustee or trustee (or other similar official) for the LDC or any substantial part of its property shall have been appointed or taken possession thereof, or the LDC shall make a general assignment for the benefit of its creditors, or the LDC shall enter into an agreement or composition with its creditors, or the LDC shall take any action in furtherance of any of the foregoing; a petition in bankruptcy which results in an order for relief being entered or, notwithstanding that an order for relief has not been entered, the petition is not dismissed within 90 days of the date of the filing of the petition, or there shall be filed under any Federal or State law relating to bankruptcy, insolvency or relief of debtors of a petition against the LDC for reorganization, composition, extension or arrangement with creditors which either (i) results in a finding or adjudication of insolvency of the LDC or (ii) is not dismissed with 90 days of the date of the filing of such petition.

ARTICLE XIII
REMEDIES

SECTION 13.1 - In General Upon an Operating Event of Default. Upon the occurrence of any Operating Event of Default and at any time thereafter so long as the same shall be continuing, the LDC may, and at the request of the County if it is not then the Operator shall, in addition to any other remedies provided herein, exercise any one or more of the following remedies with respect to the Facility as the LDC in its sole discretion shall elect, to the extent permitted by, and subject to compliance with any mandatory requirements of applicable law then in effect:

- (a) cause the Operator, upon the written demand of the LDC and at the Operator's risk and expense, to surrender promptly, and the Operator shall surrender promptly, to the LDC the Facility in the condition required by and otherwise in accordance with this Operation and Maintenance Agreement; and
- (b) rescind or terminate this Operation and Maintenance Agreement, or, exercise any other right or remedy which may be available to it under applicable law or proceed by appropriate court action to enforce the terms hereof or to recover damages (after notification to the Operator in writing of the specific Operating Event of Default permitting exercise of such right).

All obligations of the Operator accrued or arising through the date of any rescission or termination shall survive such rescission or termination.

SECTION 13.2 - In General Upon an LDC Event of Default. Upon the occurrence of any LDC Event of Default and at any time thereafter so long as the same shall be continuing, the Operator may, in addition to any other remedies provided herein, exercise any one or more of the following remedies with respect to the Facility as the Operator in its sole discretion shall elect, to the extent permitted by, and subject to compliance with any mandatory requirements of applicable law then in effect:

- (a) suspend or terminate performance of all or a portion of the Work, services or Operator's other obligations under this Operation and Maintenance Agreement; and
- (b) rescind or terminate this Operation and Maintenance Agreement, or, exercise any other right or remedy which may be available to it under applicable law or proceed by appropriate court action to enforce the terms hereof or to recover damages (after notification to the LDC in writing of the specific LDC Event of Default permitting exercise of such right).

All obligations of the LDC accrued or arising through the date of any rescission or termination shall survive such rescission or termination.

SECTION 13.3 - Remedies Not Exclusive, Etc. No remedy referred to in the Article 13 is intended to be exclusive, but each shall be cumulative and in addition to any other remedy referred to above or otherwise available to each party at law or in equity; and the exercise or beginning of exercise by either party of any one or more of such remedies shall not preclude the simultaneous or later exercise by such party of any or all of such other remedies. No express or implied waiver by any party of any Operating Event of Default or LDC Event of Default shall in any way be, or construed to be, a waiver of any future or subsequent Operating Event of Default or LDC Event of Default.

ARTICLE XIV

MISCELLANEOUS

SECTION 14.1 - Notices. Unless otherwise specifically provided herein, all notices, consents, directions, approvals, instructions, requests and other communications required or permitted by the terms hereof to be given to any Person shall be given in writing and sent to the address specified set forth hereinabove and shall become effective three Business Days after being deposited in the mails, certified or registered with appropriate postage prepaid for first-class mail or, if delivered by hand or in the form of a telex or telegram, when received, and shall be directed to the address of such Person. From time-to-time, any such Person may designate a new address for purposes of communications hereunder by notice to the Operator, the County and the LDC.

SECTION 14.2 - Assignment. In order to secure the obligations of the LDC under the Trust Indenture, the LDC consents to the assignment to the Trustee of its interest in this Operation and Maintenance Agreement, subject to the reservations and conditions herein set forth. The Operator hereby consents to the assignment effected thereby and (i) agrees that all its obligations and liabilities under this Operation and Maintenance Agreement inure to the benefit of may be enforced by the Bond holders, to the extent assigned to the Trustee, and (ii) agrees to pay directly to the Trustee all amounts under such Sections of this Operation and Maintenance Agreement to the extent required to discharge the LDC's obligations to the Trustee as are then due and owing pursuant to the Trust Indenture.

SECTION 14.3 - Performance of Obligations to Trustee. The provisions of this Operation and Maintenance Agreement which require or permit action by, the consent, approval or authorization of, the furnishing of any notice, document, paper of information to, or the performance of any other obligation to, the Trustee, shall not be effective, and the Section hereof containing such provisions shall be read as though there were no such requirements or permissions, after all the Bonds shall have been paid in full (or after provision for payment thereof has been made in accordance with the Trust Indenture).

SECTION 14.4 - Binding Effect; Successors and Assigns. The terms and provisions of this Operation and Maintenance Agreement, and the respective rights and obligations hereunder

of the Operator and the LDC, shall be binding upon their respective successors and assigns and inure to the benefit of their respective permitted successors and assigns.

SECTION 14.5 - No Third Party Beneficiaries. Except as expressly stated herein, nothing contained in this Operation and Maintenance Agreement shall be construed to give any rights or benefits to anyone other than the LDC, the County, MCC and Operator without the express written consent of both parties. All obligations arising prior to this Agreement and all provisions of this Operation and Maintenance Agreement allocating responsibility or liability between the parties shall survive the completion of the Work and the termination of this Agreement.

SECTION 14.6 - Changed Conditions. As the Work and services are performed, conditions may change or circumstances outside Operator's reasonable control (including changes of law) may develop which would require Operator to expend additional costs, effort or time to complete the services, in which case Operator will notify LDC and an equitable adjustment shall be made to Operator's time for performance; provided further in the event that such changed condition or circumstance results from

- (a) a change in Governmental Requirements;
- (b) the action or failure to act of the LDC, County or MCC or their respective employees, agents or contractors other than the Operator; or
- (c) any force majeure event as defined in Section 14.7 that occurs after the completion of the Work.

then an equitable adjustment shall be made to Operator's compensation.

SECTION 14.7 - Force Majeure. Neither party shall not be responsible for loss, delay, injury, damage or failure of performance that may be caused by circumstances beyond its control, including but not restricted to acts or omissions by the other party or its employees, agents or contractors, Acts of God, war, civil commotion, acts or omissions of government authorities, fire, theft, corrosion, flood, water damage, lightning, freeze-ups, riots, explosions, quarantine restrictions, delays in transportation, or shortage of vehicles, fuel, labor or materials. In the event of such delay or failure, the time for performance shall be extended by a period equal to the time lost plus a reasonable recovery period.

SECTION 14.8 - Construction and Applicable Law. Any provision of this Operation and Maintenance Agreement that shall be prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof and any such prohibition or unenforceability in any jurisdiction shall not invalidate or render unenforceable the supplement, amendment or modification thereafter sought. The section headings in this Operation and Maintenance Agreement and the table of contents are for convenience of reference only and shall not control,

affect the meaning of or be taken as an interpretation of any provision hereof. This Operation and Maintenance Agreement has been negotiated and delivered in the State and shall in all respects be governed by and construed in accordance with the laws of the State, including matters of construction, validity and performance.

SECTION 14.9 – Jurisdiction / Venue. Any and all litigation concerning the subject matter of this Operation and Maintenance Agreement shall be subject to the Law of the State of New York and venued in Monroe County, New York.

SECTION 14.10 – Assignability / County Termination. The parties agree and understand that at some point the LDC may in its sole discretion assign this contract to the County. In the event the LDC does so assign the contract to the County, the County shall have the right, but not the obligation to terminate the contract at any time during the term thereof on ninety (90) days written notice to Siemens pursuant to Section 14.1.

Signature Page Follows

IN WITNESS WHEREOF, the LDC and the Operator have each caused this Operation and Maintenance Agreement to be duly executed as of the day and year first above written.

MONROE NEWPOWER CORPORATION

By: [Signature] as contract officer
Title: contract officer

ADDENDUM 1
ATTACHED HERETO IS INCORPORATED HEREIN AND MADE A PART HEREOF BY THIS REFERENCE

SIEMENS INDUSTRY, INC.

By: [Signature] 1/28/16
Title: **Gregory Aiken**
Branch Manager

STATE OF NEW YORK)
)ss.
COUNTY OF MONROE)

On this 4th day of February, 2016, before me personally came Rodney T. Bill Sr, to me known, who, being by me duly sworn, did depose and say that he resides at 4 Folkstone Lane Denfield NY 14526 that he is the contract officer of **MONROE NEWPOWER CORPORATION**, a Corporation of the State of Delaware described in and which executed the within Operation and Maintenance Agreement; and that he signed his name thereto by like order.

[Signature]
Notary Public

STATE OF NEW YORK)
)ss.
COUNTY OF MONROE)

STEPHANIE SCRIVENS
NOTARY PUBLIC, State of New York
Qualified in Monroe County
No. 01SC6182649
Commission Expires March 3, 2014

On this 28th day of JANUARY, 2016, before me personally came GREGORY AIKEN, to me known, who, being by me duly sworn, did depose and say that he ~~resides~~ works at 422 E HENRIETTA RD ROCHESTER NY, that he is the ROCHESTER BRANCH MANAGER of **SIEMENS INDUSTRY, INC.**, a Corporation of the State of Delaware described in and which executed the within Operation and Maintenance Agreement; and that he signed his name thereto by like order.

[Signature]
Notary Public

CORINNE M RATHBUN
NOTARY PUBLIC-STATE OF NEW YORK
No. 01RA6183335
Qualified In Monroe County
My Commission Expires March 17, 2016

Digitally signed by
Stephanie Greaney
DN cn=Stephanie
Greaney, o=Siemens
Corp, ou=Legal
Compliance,
email=stephanie.gre
aney@siemens.com,
c=US
Date: 2015.12.30
08:11:38 -0500

**Addendum 1 to Operation and Maintenance Agreement ("Agreement")
 between
 Monroe Newpower Corporation ("LCD")
 and
 Siemens Industry, Inc., Building Technologies Division ("Operator")
 Dated: January 26, 2016**

The LCD and Operator agree to modify the Terms and Conditions as follows, where the Terms and Conditions of the Agreement conflict with or differ from the Terms and Conditions of this Addendum, the provisions of this Addendum will control, and notwithstanding anything herein to the contrary, no reference to or incorporation of any contract, specification or document other than the Agreement and this Addendum shall grant rights to or impose any obligations upon either party relative to warranty, indemnity, insurance, delay, liquidated damages, payment or rights to drawings, computer code or other proprietary information:

SECTION 3.1 Term is hereby modified as follows: "This Operation...as the case may be..."

SECTION 3.2 Basic Operations Fee is hereby modified as follows: "The LDC...2016 within thirty (30) days of receipt of an invoice, and annually..."

SECTION 5.17 Maintenance Exclusions of Operation is hereby modified as follows: "Operator's operation...of any pre-existing oils or Hazardous Materials existing onsite prior to Operator beginning the operation and maintenance of the facility hereunder. Operator is responsible for the same only to the extent Operator introduces it as part of its work. December 1, 2002, except ~~Except~~ that certain...generator of the waste. ~~Provided further that Operator...not to exceed \$50,000.~~"

SECTION 8.1 Insurance Required is hereby modified as follows: "Without limiting...~~Facility or such other insurance as required in the Trust Indenture.~~" Paragraph (b) is hereby modified as follows: "such other...similar properties. Anything in the contract documents notwithstanding, Operator's sole obligation with respect to insurance shall be to provide Commercial General Liability on an occurrence basis with a limit of \$1,000,000 (\$10,000,000 general aggregate), Automobile Liability \$2,000,000 combined single limit, and Workers Compensation/Employer Liability \$1,000,000. The LDC (and other specific entities, if any, designated by the LDC) shall be included as additional insureds to the General Liability/Automobile Liability policies. A certificate of insurance shall be issued to the LDC that evidences the above insurance and which provides for thirty (30) days written notice to the certificate holder by U.S. mail should any of the policies be cancelled before the policy expiration date."

SECTION 8.2 Additional Provisions Respecting Insurance paragraph (a) is hereby modified as follows: "All insurance...an insurance claim. By signing this Agreement, the LDC acknowledges that Operators has declared and the LDC hereby approves Contractor's deductible in the amount of \$750,000 under Automobile Liability and \$30,000 under General Liability. Upon request, Contractor's broker will provide a letter certifying its deductibles. All insurance policies... cancellation, material change or laps... cancellation, material change or laps (except..."

SECTION 8.3 Certificates, Etc. paragraph (a) is hereby modified as follows: "Annually on or before...County, at their expense, to view copies..." Delete paragraph (b) in its entirety.

SECTION 9.1 Liens is modified by adding the following to the end: "Operator's obligations hereunder are contingent upon the LDC not violating its payment obligations under this Agreement."

Add new **SECTION 14.11** as follows: "Warranty of Equipment. Operator warrants to the LDC that all materials and equipment furnished shall be new unless otherwise specified, and that all work under this Agreement shall be of good quality, free from faults and defects and in conformance with the Agreement for a period of twelve (12) months after the earlier of substantial completion of the work or first beneficial operation or use. All auxiliary equipment not manufactured by Operator carries only such warranty as given by the manufacturer thereof and which is hereby assigned to the LDC. THE WARRANTIES FURNISHED BY OPERATOR AS EXPRESSLY INCLUDED HEREIN CONSTITUTE OPERATOR'S SOLE WARRANTY OBLIGATION HEREUNDER AND ARE IN LIEU OF ANY OTHER WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE."

Add new **SECTION 14.12** as follows: "Consequential Damage Waiver. Anything herein notwithstanding, in no event shall either the LDC or Operator be liable to the other party for special, indirect, incidental or consequential damages, including commercial loss, loss of use, or lost profits, even if either party has been advised of the possibility of such damages."

This Addendum may be executed in multiple counterparts, each of which shall be deemed original and all of which together shall constitute one and the same instrument.

The parties agree that this Addendum modifies the Operations and Maintenance Agreement between the parties dated December 31, 2015 and is incorporated therein by this reference.

LCD: **Monroe Newpower Corporation**
 By: [Signature], is authorized officer,
 Name: Rickard Bell Jr.

Operator: **Siemens Industry, Inc.**
 By: [Signature] 1/27/2016 GREG ALKEN
 Name: BRANCH GM - ROCHESTER
 By: [Signature] **Gregory Alken**
 Branch Manager
 Name: Corinne Rathbun
 Northeast Finance

APPENDIX A

DEFINITIONS

"Alterations" means reconstruction, construction of additions to or any other improvements to the Facility.

"Business Day" means any day (other than Saturday or Sunday) during which (i) commercial banks located in the State or in the City in which the principal office of the Trustee are located are not required or authorized by law to close; and (ii) The New York Stock Exchange, Inc. is not closed.

"Bonds" means bonds as defined in the Trust Indenture.

"Condemnation" means the lawful taking of the Facility or any part thereof by a governmental body.

"County" means the County of Monroe, New York or its successors or assigns.

"County Service Charge" means County Service Charge as such term is originally defined under that certain Energy Supply Agreement. Any modification to such definition after the date hereof shall not be effective for purposes of this Operation and Maintenance Agreement without the written consent of the parties hereto.

"Discharge Date" means the date on which the Bonds have been paid in full or provision therefore made in accordance with the terms of the Trust Indenture.

"Energy Service" means that certain steam and electricity required to be provided by the LDC to the County pursuant to Section 2.1 of the Energy Service Agreement. Any modification to such requirement after the date hereof shall not be effective for purposes of this Operation and Maintenance Agreement without the written consent of the parties hereto.

"Governmental Requirements" means Federal, State and local laws, rules, regulations and ordinances applicable at the time to the construction, operation and maintenance of the Facility.

"Operation and Maintenance Agreement" means the Operation and Maintenance Agreement dated as of December 31, 2015 by and between the LDC and the Operator, as the same may be amended from time to time.

"LDC" means The Monroe Newpower Corporation and its successors and assigns.

"LDC Event of Default" means an event of default provided in Section 12.2 of the Installation, Operation and Maintenance Agreement.

Appendix A-1

"Lien" means any sale, transfer, assignment, disposition, mortgage, pledge, security interest, lien, judgment lien, easement or other encumbrances on title, except Permitted Liens.

"Operating Events of Default" means an event of default provided in Section 12.1 of the Operation and Maintenance Agreement.

"Operating Fee" means the Operating Fee to be paid by the LDC to the Operator pursuant to Section 3.2 of the Operation and Maintenance Agreement.

"Operating Fee Payment Date" means the first day of each month during the Operating Term.

"Operating Term" means the term provided in Section 3.1 of the Operation and Maintenance Agreement.

"Operator" means the Operator of the Facility pursuant to the Operation and Maintenance Agreement, which is Siemens Industry, Inc.

"Ordinary Operating Cost" means the expenses reasonably incurred or to be incurred by the Operator in connection with the operation of the Facility, including, without limitation, all reasonable costs of operating, maintaining, or repairing the Facility pursuant to the Operation and Maintenance Agreement as may be necessary or proper to maintain Energy Service, fees and expenses reasonably incurred or to be incurred by the Operator and payable by the Operator to other Persons in connection with providing Energy Service, and all fees paid by the Operator to other parties in connection with the operation of the Facility; provided, however, Ordinary Operating Cost does not include any Energy Related Costs or Administrative Fees as such terms are originally defined under that certain Energy Supply Agreement. Any modification to such definitions after the date hereof shall not be effective for purposes of this Operation and Maintenance Agreement without the written consent of the parties hereto.

"Parts" means tangible and intangible chattels incorporated in the Facility.

"Permitted Liens" means Permitted Encumbrances as defined in the Trust Indenture.

"Person" means an individual, a corporation, a partnership, an association, a joint stock company, a trust, any unincorporated organization, a governmental body, political subdivision, municipality or authority or any other group or entity.

"Plan and Specifications" means the Plans and Specifications for the Facility.

"Service Failure" means an interruption in service as provided in Section 13.1 of the Energy Supply Agreement. Any modification to such section after the date hereof shall not be effective for purposes of this Operation and Maintenance Agreement without the written consent of the parties hereto.

Appendix A-2

"State" means the State of New York.

"Trustee" means the trustee as defined in the Trust Indenture.

"Trust Indenture" means the Trust Indenture dated as of December 31, 2002 by and between the LDC and Manufacturers and Traders Trust Company, as the same may be amended or supplemented from time to time.

"Trust Indenture Term" means the period commencing on the Closing Date and terminating on the earlier of (i) the date of maturity of the Bonds or (ii) the date on which the Bonds are paid or provision for the payment thereof has been made as provided in the Trust Indenture.

Appendix A-3

EXHIBIT A

Equipment Schedule

IOLA Powerhouse Site Plan

Exhibit A-1

**IOLAMCC Operations and Maintenance
Contract Scope of Work**

IOLA Building 11									
Mechanical Service Item Description	Tag	Location	Service	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:	
Condensate Recovery Module Schedule	Existing	Basement	Condensate Recovery	Included	Included	Included	Included		
Hot Water Recirculation Pumps	Existing	Basement	MCH Hot Water Supply	Included	Included	Included	Included		
Shell-In-Tube Heat Exchanger	DHX-1	Basement	MCH Hot Water Supply	Included	Included	Included	Included		
Domestic Hot Water Heating Station - 120 F	-	Basement	MCH Hot Water Supply	Included	Included	Included	Included		
Three 1500 Gallon HW Tanks	Existing	Basement	MCH Hot Water Supply	Included	Included	Included	Included		
Steam Pressure Reducing Valves	Existing	Basement	IOLA Campus LP Steam	Included	Included	Included	Included		
Steam / Hot Water Distribution Piping	Existing	Basement	IOLA Campus HW Dist	Not Included	N/A	Included	Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
600 kW Emergency Generator	Existing	Basement	ATS1 - Bldg 11	Not Included	Not Included	Not Included	Not Included	Generator taken out of service	
2,000 Gallon Fuel Oil Tank	Existing	Basement	ATS2 - Various Loads & MCC-E	Not Included	Not Included	Not Included	Not Included	Generator taken out of service	
Air Compressor - Control Air Piping	Existing	Basement	Emergency Generator Control Air	Included	Included	Included	Not Included	Maintenance and replacement of compressor only - repair of control air piping	
Sump Pumps (Qty - 2)	Existing	Basement	Tunnel Water Control	Included	Included	Included	Included	Repair only	
Electrical Service Item Description									
38 KV Utility Service Switchgear (NEMA 3R)	-	Outside	Utility Service	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
38 KV to 5 KV Step Down Transformer	-	Outside	IOLA Campus Power	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
5 KV Utility Service Switchgear (NEMA 1)	SG-1	Basement	IOLA-1 and SG-2	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Campus Distribution Switchgear (NEMA 1)	SG-2	Basement	IOLA-2 and S2T1	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Automatic Transfer Switch (ATS1, ATS2)	Existing	Basement	Emergency Generator	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Backwith Protective Relay	Existing	Basement	Utility Service	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
2 DC Power System Switch Gear Batteries	Existing	Basement	IOLA Campus Power	Included	Included	Included	Not Included		
Controls Service Item Description									
Steam / Hot Water Meters	-	Basement	Billing Meters	Included	Included	Included	Included		
Steam / Hot Water Valves	-	Basement	Control Valves	Included	Included	Included	Included		
Apogee Sensors & I/O from Various Meters	-	Basement	Data Collection	Included	Included	Included	Included		
Siemens 9500 Utility Meter	-	Basement	Billing Meter	Included	Included	Included	Included		

IOLA Distribution Between Buildings									
Service Item Description	Tag	Location	Service	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:	
Steam / Hot Water Distribution Piping	-	-	Steam / Hot Water Loops to Bldg 11	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Steam / Hot Water Meters	-	-	Utility Meters	Included	Included	Included	Included		
Steam / Hot Water Valves	-	-	Regulating Valves	Included	Included	Included	Included		
Hazardous Material	-	-		Not Included	N/A	N/A	N/A	Vendor is responsible for waste generated as part of the operation and maintenance such as used oil. Vendor is not responsible for any asbestos.	
Electrical Infrastructure	-	-	Existing Electrical	Not Included	N/A	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	

IOLA Building 12 (Fleet Building)									
Mechanical Service Item Description	Tag	Location	Service	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:	
Fan Schedule									
Plant Exhaust	EF-1, 2, 3	Roof	Exhaust Air from Cogen Equip Rm	Included	Included	Included	Included		
Cogen Rm Make-up Air	MAF-1, 2, 3, 4	Roof	Make-Up Air to Cogen Equip Rm	Included	Included	Included	Included		
Steam Boiler	B-1, 2, 3	Boiler Rm	Steam Production for MNP Cust	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Steam Boiler (Added to Plant by SBT)	B-4	Boiler Rm	Steam Production for MNP Cust	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Condensate Receiver	CR-1	Boiler Rm	Condensate Collection	Included	Included	Included	Included		
Plate and Frame Heat Exchanger									
Jacket Water Heat Recovery	HX-1, 2, 3	Cogen Equip Rm	Eng. HW Recovery	Included	Included	Included	Included		
Hot Water Loop	HX-4	Cogen Equip Rm	HX from Eng Recovery to Storage	Included	Included	Included	Included		
Boiler Feedwater Makeup	HX-5	Cogen Equip Rm	Pre-heat Boiler Make-up	Included	Included	Included	Included		
Expansion Tank	ET-1, 2, 3	Cogen Equip Rm	Thermal Expansion in HW Loops	Included	Included	Included	Included		
Cogeneration Unit	CG-1, 2, 3	Cogen Equip Rm	Electric Generation	Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	
Heat Recovery Steam Generator	HRS-1, 2	Cogen Equip Rm	Heat Recovery Boilers	Included	N/A	Included	Included	No Maintenance Required	
Engine Exhaust Silencer	EES-1, 2, 3	Cogen Equip Rm	Exhaust Noise Reduction	Included	N/A	Included	Included	No Maintenance Required	
Dry Cooler	DGR-1, 2	Outside Bldg	Eng HW Rejection if not required	Included	Included	Included	Included		
Cooling Tower	CT-1	Outside Bldg	Engine After Cooler Loop Cooling	Included	Included	Included	Included		
Pumps									
Jacket Water Heat Recovery	CGP-1, 2, 3	Cogen Equip Rm	Jacket Water Pumps	Included	Included	Included	Included		
After Cooler Loop	ACP-1A, 1B	Cogen Equip Rm	After cooler Pumps	Included	Included	Included	Included		
Hot Water Loop	HWP-1	Cogen Equip Rm	Hot Water Loop Pumps	Included	Included	Included	Included		
HP Condensate Return	CRP-1, 2	Boiler Rm	High Pressure Condensate Pump	Included	Included	Included	Included		
De-Aeration Pump	DAP-1, 2, 3	Boiler Rm	Fuel Oil Supply Pump	Included	Included	Included	Included		
Fuel Oil Pump	FOP-1, 2	Boiler Rm	Fuel Oil Supply Pump	Included	Included	Included	Included		
Boiler Feed Pumps	PMP-1, 2, 3	Boiler Rm	High Pressure Condensate	Included	Included	Included	Included		
Condensate Pumps	CP 1, 2	Boiler Rm	High Pressure Condensate	Included	Included	Included	Included		
Catalytic Converters	CC 1, 2, 3	Cogen Equip Rm	Emission Control	Included	Included	Included	Not Included	Repair/maintenance Only - catastrophic failure covered by Monroe Newpower	
Deaeration Tank	DT-1	Boiler Rm	Remove Air from condensate	Not Included	N/A	Included	Included	No Maintenance Required	
Fuel Oil Tank			Fuel Oil Storage	Not Included	N/A	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower	

**IOLAMCC Operations and Maintenance
Contract Scope of Work**

DA Tank and Fuel Oil Tank controls																			
New 150 KW backup generator				Level, leak and pressure controls	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Electrical Service Item Description				Emergency power for cogen ancillary's	Not Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Paralleling Switchgear (NEMA 1)	52T1, 52G1 52G2, 52G3		Cogen Equip Rm	Electric Generation Paralleling and delivery point	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Backwith & Schweitzer Protection Relays																			
Electrical Encorp Switchgear/Control System/Generator Breakers																			
5 KV to 480 V Step Down Transformer	T-1A		Cogen Equip Rm	MDP (600 Amp Distribution Panel)	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Main Distribution Panel	MDP		Cogen Equip Rm	HV-1, MCC-A, MCC-E, 480-120 V Transformers	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Motor Control Center																			
Motor Control Center - A	MCC-A		Cogen Equip Rm	Hot Water Pumps	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Motor Control Center - E	MCC-E		Cogen Equip Rm	Heat Recovery Pumps	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
Heating / Ventilation Panel	HV-1		Cogen Equip Rm	CGP-1, 2, 3, ACP-1A, 1B B1, 2, 3, 4, FOP-1, 2	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Breaker replacement only		
Low Voltage Panel	LV-1		Cogen Equip Rm	Make-up Air, Exhaust Fans and Engine Block Heaters	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Breaker replacement only		
Emergency Low Voltage Panel	MCC-E-LVP		Cogen Equip Rm	120 V Service in Building	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Breaker replacement only		
Automatic Transfer Switch	ATS		Cogen Equip Rm	Emergency Lights / UPS	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Breaker replacement only		
Motor Starters	25		Cogen Equip Rm	Battery Chargers	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Breaker replacement only		
Variable Frequency Drives	9		Cogen Equip Rm	Interface Diesel Gen with MCC-E	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
				Various Motor Control Centers	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
				Make-up Air, Exhaust Fans	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		
				Cooling Tower Fans	Included	Included	Included	Included	Included	Not Included	Included	Included	Included	Not Included	Included		Repair/maintenance only - catastrophic failure covered by Monroe Newpower		

IOLA Building 12 (Fleet Building)																			
Controls Service Item Description	Tag	Location	Service	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:											
Paralleling Switchgear Supervisory Control and Data Acquisition (SCADA)		Operations Room	Generator SCADA	Included	Included	Included	Included												
Fire Alarm / Security System		Operations Room	Building Security and Fire	Not Included	Included	Included	Not Included	Repair only											
Siemens Apogee Controls - Software / Computers		Operations Room	Cogen Controls and SCADA	Included	Included	Included	Included												
Apogee Sensors & I/O from Various Meters			Cogen Controls and SCADA	Included	Included	Included	Included												
Steam / Hot Water Meters			Utility Meters	Included	Included	Included	Included												
Steam / Hot Water Valves			Regulating Valves	Included	Included	Included	Included												
Miscellaneous Service Item Description																			
Water Treatment for Boilers and Cooling Tower			Chemical Treatment of Water Loops	Included	Included	Included	N/A												
Natural Gas Fuel for Generators and Boilers			Fuel for Generator	Not Included	Not Included	Not Included	Not Included												
Consumable Oil for Generators		Outside	Consumable Oil (Eqwv to NG)	Included	Included	Included	Included												
20000 Gallons of Diesel Fuel			Boiler Fuel in case of NG disruption	Not Included	Not Included	Not Included	Not Included												
Annual Diesel Fuel Testing / Filtering			Cleaning and Testing of Oil in Storage	Included	Included	N/A	N/A												
Ancillary Components for electrical and mechanical systems			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Heating, Ventilation and A/C (Non-Cogen Related)			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Building Water Consumption (Toilets, Sinks, Etc.)			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Electrical Infrastructure			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Lighting			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Building Structure			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Grounds Maintenance			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Garage Doors / Access Doors			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Routine Building Maintenance			Routine Building Maint.	Included	Included	Included	Not Included	Repair only											
Hazardous Material			Routine Building Maint.	Not Included	Not Included	Not Included	Not Included	Vendor is responsible for waste generated as part of its operations such as used oil. Vendor is not responsible for any asbestos.											
Refuse Collection			Routine Building Maint.	Included	N/A	N/A	N/A												

**IOLAMCC Operations and Maintenance
Contract Scope of Work**

Monroe Community College	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:
Mechanical Service Item Description	Tag	Location	Service		
Fan Schedule	VF-1, 2, 3, 4	Cogen Equip Rm	Make-Up Air to Cogen Equip Rm	Included	Included
Cogen Rm Make-up Air	B1, 2, 3	Bldg 7 Bsmt	HW Production for MNP Cust	Included	Not Included
Hot Water Boiler	B4	Bldg 21 Mech Rm 26	HW Production for MNP Cust	Not Included	Not Included
Hot Water Boiler					Repair/maintenance only - catastrophic failure covered by Monroe Newpower
Plate and Frame Heat Exchanger					MCC is to maintain
Jacket Water Heat Recovery	HX-1, 2, 3, 4, 10	Cogen Equip Room	Eng. HW Recovery to Secondary Loop	Included	Included
Hot Water Heating Loop	HX-5	Bldg 7 Bsmt	Secondary Loop to Boiler Loop	Included	Included
Hot Water Heating Loop	HX-6	Bldg 8 Bsmt	Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Loop	HX-7	Bldg 10 Mech Rm 18	Pool Heating	Not Included	Not Included
Pool Heat	HX-8	Bldg 10 Mech Rm 199	Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Loop	HX-9	Bldg 3 Mech Rm 199G	Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Loop	ET-1, 2, 3	Cogen Equip Room	Thermal Expansion in HW Loops	Included	Not Included
Expansion Tank	CG-1, 2, 3, 4	Cogen Equip Room	Electric Generation	Included	Included
Cogeneration Unit	HRS-1, 2, 3	Cogen Equip Room	Heat Recovery Boilers	Included	Not Included
Heat Recovery Steam Generator	EES-1, 2, 3, 4	Cogen Equip Room	Exhaust Noise Reduction	N/A	Included
Engine Exhaust Silencer	DGR-1, 2	Cogen Equip Room	Eng HW Rejection if not required	Included	Included
Dry Cooler	CT-1, CT-2	Bldg 7 Roof	Engine After Cooler Loop Cooling	Included	Included
Cooling Tower					
Pumps					
Boiler Feedwater Pump	BP-1, 2, 3	Bldg 7 Bsmt	Campus Hot Water Heating Loop	Included	Included
Cogen Heat Recovery Pump	CGP-1A, 1B	Cogen Equip Room	Cogen Secondary Heat Rec Loop	Included	Included
Aircooler Pump	CGP-2A, 2B	Cogen Equip Room	Engine After Cooler Loop Cooling	Included	Included
Absorber Generator Pump	CGP-3	Bldg 7 Bsmt	Absorber Generator Input Loop	Included	Included
Dry Cooler Pump	CGP-4A, CGP-4B	Cogen Equip Room	Secondary Heat Rejection Loop	Included	Included
Cogen Heat Recovery Pump	CGP-5A, CGP-5B	Cogen Equip Room	Domestic Hot Water Loop via HX-10	Included	Included
Chilled Water Loop	CWP-3, CWP-4	Bldg 7 Bsmt	Campus Cooling Water Heating Loop	Included	Included
Hot Water Heating Pump	HWP-1A, HWP-1B	Cogen Equip Room	Campus Hot Water Heating Loop	Included	Included
Hot Water Heating Pump	HWP-2A, HWP-2B	Bldg 21 Mech Rm	Building 21 Hot Water Heating Loop	Included	Included
(E) SVE-10 Pre-Heat	HWP-3	Bldg 7 Bsmt	Hot Water Preheat Coil	Not Included	Not Included
Domestic Hot Water Pump	DWP-1	Bldg 3 Mech Rm	Bldg 3 Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Pump	DWP-2	Bldg 8 Bsmt	Bldg 8 Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Pump	DWP-3	Bldg 21 Mech Rm	Bldg 21 Domestic Hot Water Loop	Not Included	Not Included
Domestic Hot Water Pump	CH-3	Bldg 7 Bsmt	Chilled Water Loop	Included	Included
350-Ton Hot Water Absorption Chiller	CH-3	Bldg 7 Bsmt	Chilled Water Loop	Included	Not Included
450-Ton Centrifugal Chiller	DWH-1	Bldg 6 Mech Rm 097D	Domestic Hot Water	Not Included	Not Included
Water Heater	DWH-2	Bldg 21 Mech Rm 099	Domestic Hot Water	Not Included	Not Included
Water Heater	CC-1, 2, 3, 4	Cogen Equip Rm	Emission Control	Included	Included
Catalytic Converters					Repair only - catastrophic failure covered by Monroe Newpower Insurance
Electrical Service Item Description					
38 KV Utility Service Entrance Switchgear (NEMA 3R)	SG-1	Outside	Utility Service	Included	Included
38 KV Campus Distribution Switchgear (NEMA 3R)	T1	Outside	Switchgear SG-2	Included	Not Included
38 KV to 5 KV Step Down Transformer	T1	Outside	Switchgear SG-2	Included	Not Included
38 KV to 5 KV Step Down Transformer	T2	Outside	Switchgear SG-4	Included	Not Included
38 KV to 5 KV Step Down Transformer	T2	Outside	Switchgear SG-4	Included	Not Included
Paralleling Switchgear (NEMA 1)	52G, 52G1, 52G2, 52G3, 52G4	Bldg 7 Switchgear Rm	Campus Utility Service	Included	Not Included
5 KV to 38 KV Step Up Transformer	T3	Bldg 7 Switchgear Rm	Raise Voltage to Utility Level	Included	Not Included
38 kV Load Break Switch	SG-5	Bldg 7 Switchgear Rm	Cable Protection between Cogen Plant and Service Entrance	Included	Not Included
Low Voltage Modifications to Cogen Room	SWBD-1	Bldg 7 Switchgear Rm	From Existing Unit Substation #1	Included	Not Included
480 V to 120 V Step Down Transformer		Bldg 7 Switchgear Rm		Included	Not Included
Encorp Switch Gear/Control System/Generator Breakers		Bldg 7 Switchgear Rm		Included	Not Included
2 DC Power System Batteries for Switch Gear				Included	Included
Motor Control Center					
Existing MCC	MCC-1	Bldg 7 Bsmt		Not Included	Not Included
Existing MCC	MCC-2	Bldg 7 Bsmt		Not Included	Not Included
New MCC	MCC-3	Bldg 7 Switchgear Rm	Various Pumps, Fans, Etc.	Included	Not Included
Motor Starters	25	Cogen Equip Rm	Various Motor Control Centers	Included	Included
Variable Frequency Drives	10	Bldg 7 Bsmt	Secondary Loop, Absorber Generator Loop, Misc. Pumps.	Included	Included

**IOLA/MCC Operations and Maintenance
Contract Scope of Work**

Monroe Community College

Controls Service Item Description	Tag	Location	Service	Item Covered under the RFP Scope of Work	Preventive Maintenance	Repair	Replacement	Notes:
Paralleling Switchgear Supervisory Control and Data Acquisition (SCADA)		Engineers Office		Included	Included	Included	Included	
Fire Alarm / Security System				Not Included	Included	Included	Not Included	New equipment in vault only - replacement of parts only
Siemens Apogee Controls - Software / Computers		Engineers Office		Included	Included	Included	Included	
Apogee Sensors & I/O from Various Meters		Bldg 7 Bsml		Included	Included	Included	Included	
Hot Water Meters		Bldg 7 Bsml		Included	Included	Included	Included	
Hot Water Valves		Bldg 7 Bsml		Included	Included	Included	Included	
Miscellaneous Service Item Description								
500 Gallon Fuel Oil		Bldg 7 Bsml		Included	Included	Included	Not Included	Vendor shall perform tank inspections daily.
Water Treatment for Boilers				Included	Included	Included	Included	
Water Treatment for Cooling Tower				Included	Included	Included	Included	
Natural Gas Fuel for Generators and Boilers				Not Included	Not Included	Not Included	Not Included	
Consumable Oil for Generators			Boilers	Included	Included	Included	Included	
Annual Diesel Fuel Testing / Filtering				Included	Included	N/A	N/A	
Ancillary Components for electrical and mechanical systems				Included	Included	Included	Included	Repair and replacement of equipment in vault only
Ventilation in Cogen Vault				Included	Included	Included	Included	
Existing Heating, Ventilation and A/C (Non Cogen Related)				Not Included	Not Included	Not Included	Not Included	MCC to provide PM, repair, replacement
Electrical Infrastructure				Included	Included	Included	Not Included	Repair/maintenance only - catastrophic failure covered by Monroe Newpower
Lighting				Included	Included	Included	Not Included	Repair and replacement of equipment in vault only
Hazardous Material				Not Included	Not Included	Not Included	Not Included	Vendor is responsible for waste generated as part of the operation and maintenance such as used oil, Vendor is not responsible for any asbestos.

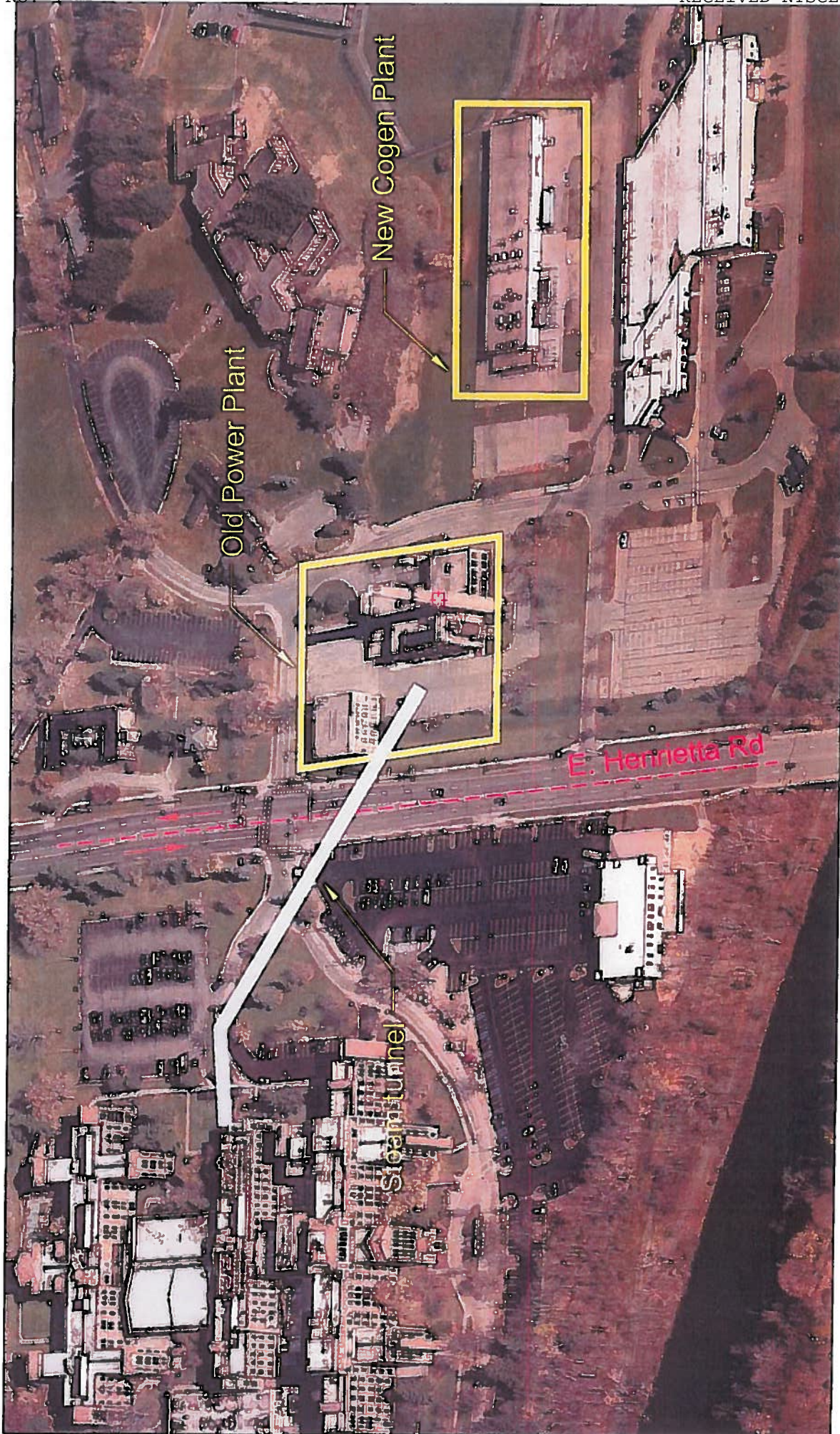


EXHIBIT B

Designated Representatives

**JAMES A. FUMIA, ESQ.
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39 W. MAIN STREET
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ROCHESTER, NEW YORK 14614**

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Exhibit B-1

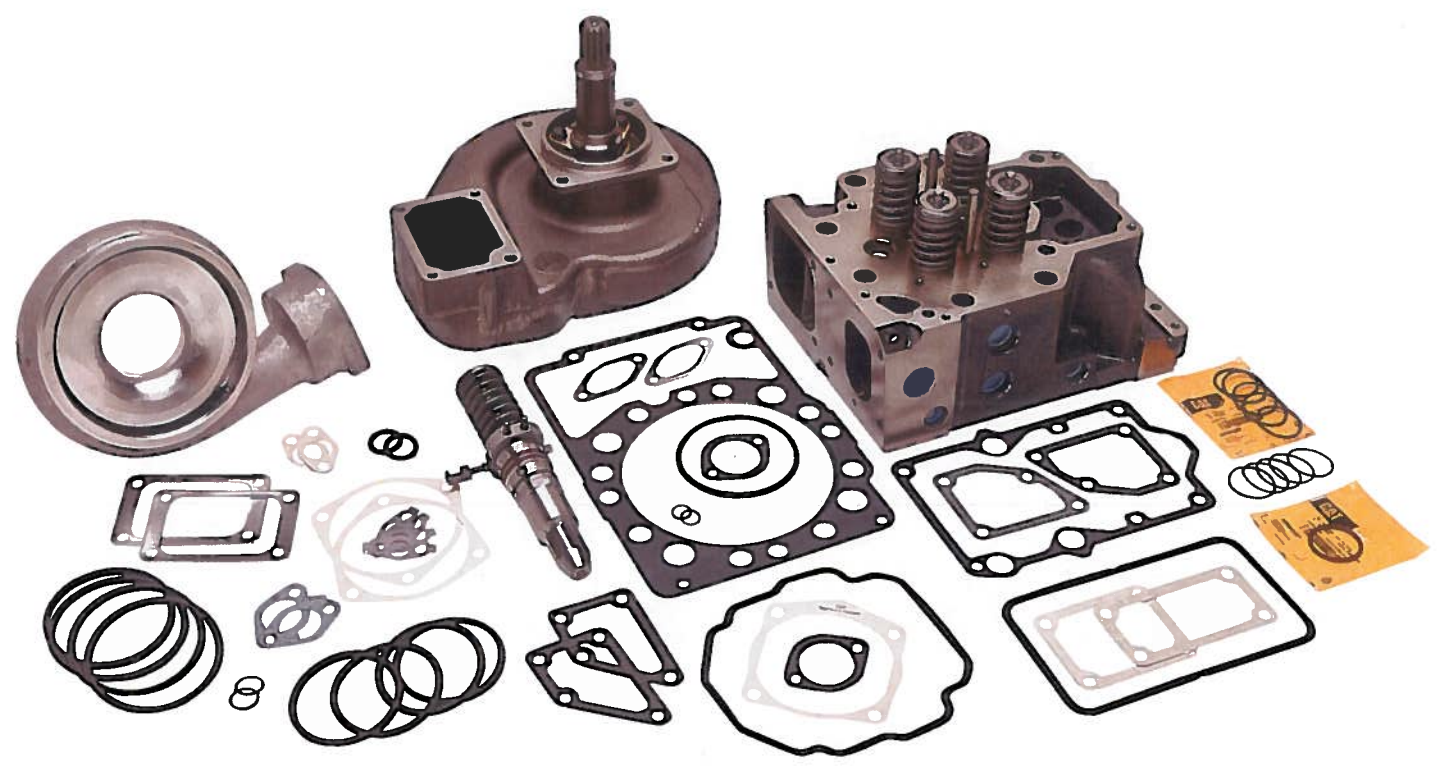
EXHIBIT C

Top-End Overhaul Kits

Exhibit C-1

Cat® Overhaul Kits (Top End)

For Commercial Gas and Diesel Engines (D3508, D3512, D3516, G3516)



Overhaul kits for D3500 and some G3500 engines offer a lower cost and convenient option to help meet your needs during an engine overhaul. Cat Engine Overhaul Kits offer exceptional life with the use of Genuine CAT® engine parts and are backed by the standard Caterpillar Engine Parts Warranty.

Cat Engine Overhaul Kits offer:

- Flexibility to build customer specific kits
- New and Reman parts availability
- Ease of ordering
- Competitive pricing
- Reduced repair time and downtime
- Reduced cost with an optimized base parts consist
- Consolidated parts packaging
- Exceptional life with Genuine CAT® parts



Cat® Overhaul Kits for D3500 and G3500 Commercial Gas Engines

Engine Overhaul Kits

When overhauling your engine, you have many factors to consider. Wouldn't it be easier if you had one simple solution?

Depending on your situation, Cat® Engine Overhaul Kits may be part of your solution. Trust the experts at your Caterpillar Authorized Service Locations for all of your parts and service needs. Come in and talk to us. We'll be glad to help you make an informed decision.

Advantage

Guaranteed for fit and function, Genuine Cat Parts offer you the highest in quality at an attractive price for your commercial engine. Cat Parts provide something that the other brands can never match...total support from your Caterpillar Authorized Service Locations.

See your Caterpillar Authorized Service location for specific part numbers.

Engine Overhaul Kit Selection Charts

D3508 & D3508B				
Engine Serial Prefix	Engine Serial Range	Engine Arrangement	New Kit Part Number	Reman Kit Part Number
23Z	1023-3488	2W-8406	359-9756	20R-0137
	3489-4789	2W-8406	359-9755	20R-0138
	4990-UP	2W-8406	359-9754	20R-0142
6PN	895-UP	173-6933	363-0407	20R-0151
	895-UP	112-2661	363-0407	20R-0151
1FZ	895-UP	159-8834	363-0407	20R-0151
	2501-UP	147-3166	363-0407	20R-0151
		197-9041	363-0407	20R-0151
		195-5876	363-0407	20R-0151

G3516				
Engine Serial Prefix	Engine Serial Range	Engine Arrangement	New Kit Part Number	Reman Kit Part Number
CSZ	1-UP	196-2057	359-9745	20R-0152
ZBA	1-UP	273-3076	359-9745	20R-0152
	1-UP	260-3665	359-9745	20R-0152
CTL	1-UP	260-3676	359-9743	20R-0158
	1-UP	196-2207	359-9743	20R-0158
	1-UP	196-2211	359-9767	20R-0154
4EK	2412-2499	165-5005	362-4992	20R0293
	2500-2931	165-5004	362-4990	20R0292
	2932-UP	165-5004	362-4989	20R0291
	3743-UP	101-1495	362-4723	20R0296
	3743-UP	101-1496	362-4723	20R0296
	125-4484	105-4176	362-4723	20R0296
	CTL 1st Prod	196-2213	362-4723	20R0296
	475-UP	117-6698	362-5066	20R0288
	500-2931	126-1779	362-5066	20R0288
	1328-UP	141-2927	362-5066	20R0288
	3743-UP	4P4444	362-4723	20R-0296

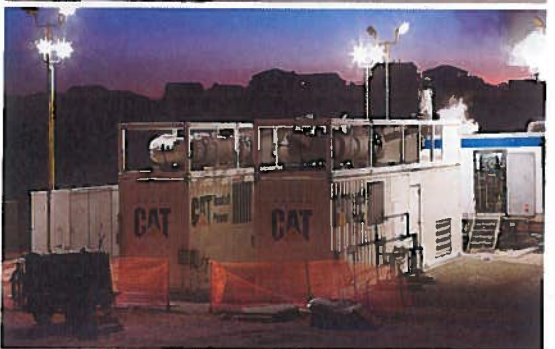
Cat® Overhaul Kits for D3500 and G3500 Commercial Gas Engines

Engine Overhaul Kit Selection Charts

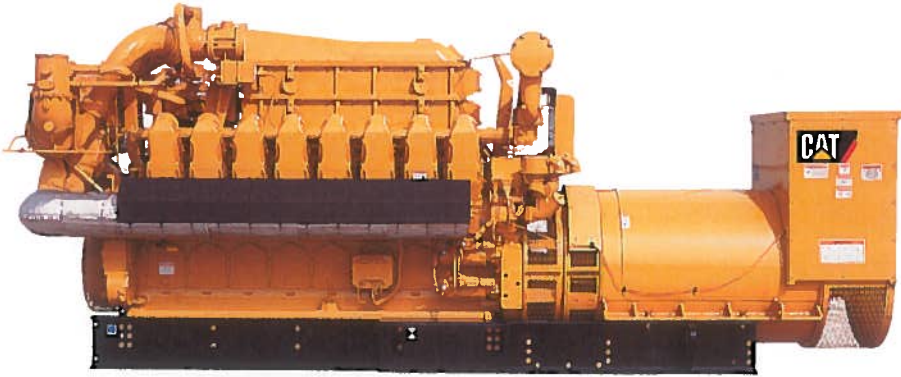
D3512 & D3512B				
Engine Serial Prefix	Engine Serial Range	Engine Arrangement	New Kit Part Number	Reman Kit Part Number
24Z	1634-UP	7C-1300	359-9765	20R-0144
	4366-UP	8N-5806	359-9765	20R-0144
	4366-7779	7C-5185	359-9764	20R-0143
	4366-7779	2W-8405	359-9764	20R-0143
1KZ	1-UP	197-9048	359-9764	20R-0143
	1-UP	274-2000	359-9764	20R-0143
8RM	762-UP	112-2662	359-9761	20R-0134
	762-UP	159-8835	359-9761	20R-0134
1GZ	1-UP	274-1995	359-9761	20R-0134
	2000-UP	147-3168	359-9761	20R-0134
	2000-UP	195-5875	359-9761	20R-0134



D3516 & D3516B				
Engine Serial Prefix	Engine Serial Range	Engine Arrangement	New Kit Part Number	Reman Kit Part Number
25Z	2744-UP	6I-2939	359-9748	20R-0147
	3315-UP	107-7350	359-9748	20R-0147
	684-2188	4P-4444	359-9748	20R-0147
	2189-UP	4P-4444	359-9749	20R-0146
	3453-7093	107-7346	359-9750	20R-0148
1LZ	1-UP	147-3163	359-9748	20R-0147
ZAP	1-UP	256-0757	359-9768	20R-0156
	1-UP	256-0758	359-9769	20R-0155
	1-UP	281-9204	359-9769	20R-0155
1HZ	1-UP	147-3169	359-9768	20R-0156
	1-UP	147-3170	359-9769	20R-0155
	1-UP	289-0524	359-9769	20R-0155
	1-UP	188-9442	359-9769	20R-0155
GZS	1-UP	260-3689	359-9769	20R-0155
	1-UP	260-3688	359-9769	20R-0155
	257684-2188	4P4444	359-9748	20R-0147
	2189 UP	4P4444	359-9749	20R-0146



Cat® Overhaul Kits for D3500 and G3500 Commercial Gas Engines



Engine Overhaul Consist

- Cylinder Heads
- Turbocharger Cartridge
- Injectors
- Waterpumps
- Cylinder Head Gaskets
- Turbocharger Gaskets
- Single Fuel Injector Gaskets
- Waterpump Gaskets

The Caterpillar Top End Overhaul Kits will provide a convenient, cost competitive repair option that will contain the parts, to the left, in the respective quantities per engine model.

Genuine CAT® engine parts packaged in your 3500 overhaul kit are specifically engineered to Caterpillar specifications assuring maximum performance, reliability, and durability.

Ordering

These kits are available for order through the Caterpillar® parts distribution system. Standard fees apply. Please allow up to 6 weeks for delivery.

Pricing

Please contact your service representative for special pricing and discounts that may be available.

CAT® DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

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MONROE COUNTY CLERK'S OFFICE

THIS IS NOT A BILL. THIS IS YOUR RECEIPT.

Receipt # 3454456

Book Page CIVIL

No. Pages: 3

Instrument: EXHIBIT(S)

Control #: 202306060758

Index #: E2023005870

Date: 06/06/2023

Time: 12:29:54 PM

Return To:
County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee:

State of New York

MONROE COUNTY CLERK'S OFFICE
WARNING – THIS SHEET CONSTITUTES THE CLERKS
ENDORSEMENT, REQUIRED BY SECTION 317-a(5) &
SECTION 319 OF THE REAL PROPERTY LAW OF THE
STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

JAMIE ROMEO

MONROE COUNTY CLERK



STATE OF NEW YORK, SUPREME COURT- MONROE COUNTY

In the Matter of the Application of
ERIC T. SCHNEIDERMAN,
Attorney General of the State of New York
For An Order Approving the Dissolution of

Index No. 2016-12906

**CORRECTED
ORDER OF DISSOLUTION**

MONROE NEWPOWER CORPORATION

Pursuant to Section 1101 of the Not-For-Profit
Corporation Law.

2017 JAN 26 PM 4:16
MONROE COUNTY CLERK

FILED

The Petitioner, **ERIC T. SCHNEIDERMAN**, Attorney General of the State of New York, pursuant to the authority vested in him by Section 1101 of the Not-For-Profit Corporation Law, having filed a petition verified on November 8, 2016 for an order to show cause why **MONROE NEWPOWER CORPORATION** should not be dissolved, and an order to show cause having issued on November 21, 2016, returnable before this Court on January 17, 2017, and due proofs of service in compliance with the order to show cause having been filed with this Court, and on the return date Petitioner **ERIC T. SCHNEIDERMAN**, Attorney General of the State of New York having appeared by Audrey Cooper, Assistant Attorney General; Respondent **MONROE NEWPOWER CORPORATION** having appeared by its attorney, Barclay Damon LLP, James S. Grossman, Esq. of counsel; Cheryl DiNolfo, Monroe County Executive having appeared by Michael E. Davis, County Attorney; and the New York State Budget Authority Office having filed a notice of appearance and affirmation in support of the relief requested, and the New York State Comptroller having acknowledged service without appearance in the action or opposition to the relief requested,

NOW, on motion of **ERIC T. SCHNEIDERMAN**, Attorney General of the State of New York, Audrey Cooper, Assistant Attorney General of counsel, it is hereby

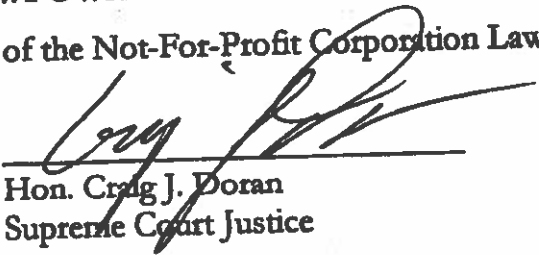
ORDERED that the physical, inchoate and cash assets of the corporation be transferred *in kind* to the County of Monroe in such a manner as to allow uninterrupted service to the County, and it is further

ORDERED that the County of Monroe shall operate and conduct the former business of **MONROE NEWPOWER CORPORATION** in a lawful manner, maintain its equipment, intellectual property and other assets and enter into contracts, where appropriate and without appearance of impropriety, to assure the continued delivery of services to the County, and it is further

ORDERED that **MONROE NEWPOWER CORPORATION** shall file with the Court and the NYS Authority Budget Office a final financial report accounting for its activities from January 1, 2016 to the date of the completion of the transfer of assets within ninety (90) days of entry of this order, and comply with any subsequent requirements of the NYS Budget Authority Office or the Court, and it is further

ORDERED that **MONROE NEWPOWER CORPORATION** be and is dissolved pursuant to Sections 1101 and 1109(c) of the Not-For-Profit Corporation Law.

Dated: January 18, 2017
Rochester, New York


Hon. Craig J. Doran
Supreme Court Justice

2017 JAN 26 PM 4:56

FILED

MONROE COUNTY CLERK'S OFFICE

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Book Page CIVIL

No. Pages: 2

Instrument: EXHIBIT(S)

Control #: 202306060759

Index #: E2023005870

Date: 06/06/2023

Time: 12:29:55 PM

Return To:
County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee:

State of New York

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JAMIE ROMEO

MONROE COUNTY CLERK



By Legislators Drawe and Hebert

Intro. No. 121

RESOLUTION NO. 100 OF 2017

ACCEPTING ASSETS AND LIABILITIES OF MONROE NEWPOWER CORPORATION PURSUANT TO ORDER OF DISSOLUTION

BE IT RESOLVED BY THE LEGISLATURE OF THE COUNTY OF MONROE, as follows:

Section 1. The County Executive, or her designee, is hereby authorized to accept the assets of Monroe Newpower Corporation pursuant to an order of dissolution, to include cash and capital equipment, with a book value of \$9,720,059 into internal services fund 9020, and with a book value of \$498,224 into capital fund 1812, as detailed in Attachment A.

Section 2. The County Executive, or her designee, is hereby authorized to accept the assignment of Monroe Newpower Corporation liabilities and commitments pursuant to an order of dissolution, to include accounts payable, purchase orders, and contracts for goods and services to be received, with a book value of \$47,613, into internal services fund 9020, as detailed in Attachment B.

Section 3. The 2017 operating budget of the Department of Environmental Services is hereby amended by appropriating the sum of \$487,613 into internal services fund 9020, funds center 8645020000, Iola Powerhouse for the payment of liabilities and commitments.

Section 4. Funding for these actions will be available in the 2017 operating budget of the Department of Environmental Services, internal services fund 9020, funds center 8645020000, Iola Powerhouse, once the MNP assets are accepted.

Section 5. This resolution shall take effect in accordance with Section C2-7 of the Monroe County Charter.

Matter of Urgency
File No. 17-0040

ADOPTION: Date: February 14, 2017 Vote: 29-0

ACTION BY THE COUNTY EXECUTIVE

APPROVED: ✓ VETOED: _____

SIGNATURE: *Cheryl D. Hebert* DATE: 2/16/17

EFFECTIVE DATE OF RESOLUTION: 2/16/17

MONROE COUNTY CLERK'S OFFICE

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No. Pages: 36

Instrument: EXHIBIT(S)

Control #: 202306060760

Index #: E2023005870

Date: 06/06/2023

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Return To:
County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee:

State of New York

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JAMIE ROMEO

MONROE COUNTY CLERK



OPERATION AND MAINTENANCE AGREEMENT

between

SIEMENS INDUSTRY, INC.

and

COUNTY OF MONROE

THIS AGREEMENT, dated as of the last date executed below ("Agreement"), by and between Siemens Industry, Inc., a Delaware corporation having its office at 50 Methodist Hill Drive, Suite 1500, Rochester, New York 14623 (the "Operator") and the COUNTY OF MONROE, a municipal corporation having its office at 39 West Main Street, Rochester, New York 14614 (the "COUNTY").

WITNESSETH:

WHEREAS, the COUNTY owns and operates a certain facility located at 430 East Henrietta Road, Rochester, New York, which houses three (3) Caterpillar 3516, 1350 KW generators, three (3) Hurst boilers for steam production and associated piping, utilities and equipment; which facility provides electricity, heat and steam to the Monroe County Hospital, and the County-owned facility at 111 Westfall Road (the "Iola Facility"); and

WHEREAS, the COUNTY additionally maintains certain equipment pursuant to certain easements of record in connection with the operation of the Iola Facility in the basement of the building located at and commonly referred to as the Iola Powerhouse at 422 East Henrietta Road, Rochester, New York, which shall be considered and is a component of the Iola Facility (and collectively with the Iola Facility shall be referred to as the "Facilities"). All relevant equipment and utilities associated with the co-generation facilities are set forth in the Equipment Schedule annexed hereto and made hereof as Exhibit A; and

NOW THEREFORE, in consideration of the mutual promises and considerations herein set forth, it is agreed as follows:

ARTICLE I

DEFINITIONS

SECTION 1.1 - Definitions. Unless the context shall otherwise require, capitalized terms herein have the meanings given to them in Appendix A attached hereto and incorporated herein.

ARTICLE II

APPOINTMENT OF OPERATOR AND ACCEPTANCE OF APPOINTMENT

SECTION 2.1 - Engagement and Appointment of Operator. Subject to all the terms and conditions of this Agreement, the COUNTY hereby appoints the Operator, as of January 1, 2020, the operator of the Facilities and the Operator hereby accepts, as of the date hereof, such appointment. Subject to all the terms and conditions of this Agreement during the Operating Term, the Operator shall operate the Facilities in compliance with this Agreement, in a proper and workmanlike manner, in accordance with the practices, methods and actions customarily engaged in or used by diligent and efficient operators of facilities of a nature similar to the Facilities and in a manner which will enable the COUNTY to comply with all its obligation to provide Energy Service. The Operator may, and at the request of the COUNTY shall, use facilities (whether temporary or permanent and whether owned by the Operator or any other Person) other than the Facilities to provide Energy Service. The Operator acts as an independent contractor.

SECTION 2.2 - No Interest in Operator. This Agreement is an operating agreement and does not convey to the Operator any right, title or interest in or to the Facilities, except that the Operator shall have and is hereby granted a non-exclusive license to enter on, possess, operate, alter and maintain the Facilities for the purpose of performing its obligations hereunder.

ARTICLE III

TERM AND FEES

SECTION 3.1 - Operating Term. This Agreement shall be in effect from January 1, 2020 until December 31, 2020 with two (2) calendar-year (January 1 through December 31) options to renew pursuant to the terms and conditions hereof. Each calendar-year option may be exercised in writing by the COUNTY, as the case may be, in its sole discretion pursuant to Section 14.1 at least sixty (60) days before the expiration date.

SECTION 3.2 - Annual Operating Fee. Subject to Section 3.3 and 3.4 hereof, the COUNTY hereby agrees to pay the Operator for 2020 an annual Operating Fee on each Fee Payment Date for the Facilities in an amount equal to:

- \$ 950,755 for Boiler Operations,
- \$ 76,356 for Boiler Maintenance,
- \$ 13,234 for Generator Operations, and
- \$ 210,813 for Generator Maintenance.

\$ 1,251,158 Total Annual Operating Fee, and annually thereafter in an amount which shall be based on the previous year's Operating Fee, plus no greater than the percentage annual increase of the Consumer Price Index (CPI) for the New York region, as published by the US Bureau of Labor Statistics.

SECTION 3.3 - Right to Cease Operation. The COUNTY reserves the right to cause the electric and/or boiler capacity of the Facilities to cease operation. Such termination shall be scheduled to the maximum extent practicable to coincide with the end of a calendar year.

SECTION 3.4 - Payments to Operator. The COUNTY will process requests from the Operator and make payments on a monthly basis. Payments will be made within thirty (30) days of receipt of the request contingent on:

- (a). Submission of properly executed vouchers by the Operator. (The COUNTY shall provide the forms and instructions for completion.)
- (b). Review and approval of the vouchers by the COUNTY or its designee.
- (c). Review and approval of payment by the Controller of Monroe County.

ARTICLE IV

DISCLAIMER OF WARRANTIES

SECTION 4.1 - Disclaimer of Warranties. The COUNTY makes no warranties or representations of any kind to the Operator with respect to the Facilities.

ARTICLE V

MAINTENANCE AND OPERATION

SECTION 5.1 - Maintenance. (a) The Operator agrees that during the Operating Term it will operate, maintain, service and repair the Facilities and every part and parcel thereof in accordance with good commercial practice and in any event will: (i) keep the Facilities in good and safe condition, repair, working order and condition, including ordinary wear and tear, Catastrophic Failure and force majeure excepted; (ii) all routine maintenance, rebuilds, overhauls on all equipment shall be done in accordance and in compliance with any and all applicable manufacturer's warranties and recommendations; (iii) promptly make all necessary repairs, rebuilds, overhauls, replacements and renewals to the Facilities (whether ordinary or extraordinary, structural or nonstructural, foreseen or unforeseen); (iv) maintain the Facilities in working order and a neat and orderly condition, ordinary wear and tear included, Catastrophic Failure and force majeure excepted, and in a condition which permits compliance with all applicable Governmental Requirements, including without limitation all Federal, state and local laws relating to labor, wages, nondiscrimination, environmental control, safety and other regulatory requirements; (v) perform or arrange for the detection, monitoring, handling, storage, removal, transportation, disposal or treatment of any pre-existing oils or Hazardous Materials existing onsite after December 1, 2002; (Operator will notify COUNTY within forty-eight hours if Operator discovers or suspects the presence of any Hazardous Material.) (vi) operate the Facilities in a sound and economic manner; (vii) protect the Facilities against deterioration, including ordinary wear and tear; (viii) cause the Facilities to continue to have the capacity and functional ability to perform, on a continuing basis, in normal commercial operation, at design capacity, the functions for which it was specifically designed; (ix) comply with such standards and periodic maintenance inspections as shall be required to enforce warranty and similar claims against contractors for the Facilities and any standards imposed by any insurance policies in effect at any time with respect to the Facilities or any part thereof; and (x) provide all necessary labor, materials and equipment for the proper operation and maintenance of the Facilities.

(b) Notwithstanding any of the foregoing, unless an Event of Default shall have occurred and be continuing; the Operator may provide that: (i) the operation of the Facilities may be subject to periodic, scheduled or unscheduled, partial shutdowns of portions of the Facilities for maintenance or repair; (ii) provided that compliance with any applicable Governmental Requirements is subject to the provisions of Section 6.2 hereof; and (iii) no repair, replacement or maintenance shall be required hereunder or under the provisions of Section 5.19 or 6.1 hereof with respect to portions of the Facilities which the Operator, with the consent of the County, determines are no longer necessary to the provision of Energy Service.

SECTION 5.2 - Hours of Operators, Operator Qualifications. Operator will provide plant operators to monitor the co-generation facilities located at the Facilities site 24-hours per day, 365-days per year. All operators must have experience in the operation and maintenance of natural gas fueled engines/generators and boilers, and must possess all required certifications from the generator and boiler manufacturer. Operator and its operators must also possess and maintain all appropriate certifications and licenses to operate the Facilities, as required by local, state and federal Law.

SECTION 5.3 - Operation/Downtime. The Operator must operate all equipment in a safe and efficient manner in accordance with all applicable laws and regulations. The Operator shall be

expected to minimize downtime by ensuring that no generator/engine or boiler is offline for routine maintenance and repairs for more than an aggregate of three (3) weeks in any calendar year barring Catastrophic Failure or force majeure beyond the Operator's control or changes in regulatory requirements. Failure to comply with this condition may result in a proportionate reduction of the Operating Fee.

SECTION 5.4 - Electricity Demands. The Operator shall monitor the Facilities' electric demands and operate each plant in a manner that minimizes purchases by the COUNTY of electricity from third party utility companies, while minimizing heat rejected through the dry coolers. The COUNTY shall be responsible for the cost to purchase and deliver electricity at the Facilities in the event that the site's electrical demand exceeds the capacity of the individual cogeneration facilities.

SECTION 5.5 - System Failure Reporting. The Operator shall be required to report immediately any system failures to the designated representatives of the COUNTY and RG&E and shall cooperate and coordinate its efforts with those respective entities to promptly restore operations. In the event of any system failure, the Operator shall investigate and submit reports to the COUNTY regarding the cause, response and corrective action taken. The respective designated representative of the COUNTY and RG&E are designated on Exhibit B attached hereto and made a part hereof unless changed by written notice to the Operator.

SECTION 5.6 - Monthly Meetings. The Operator shall be required to meet with representatives of the COUNTY at a mutually agreed upon location within Monroe County, on a monthly basis to discuss operations, gas consumption and any ongoing maintenance or repair issues. The Operator shall be required to provide detailed written responses within seven (7) working days to any complaints or inquiries regarding operations from the COUNTY .

SECTION 5.7 - Data Reports. The Operator shall provide necessary data and information to representatives of the COUNTY for purposes of preparing their annual budgets. The Operator shall also provide monthly usage data reports to the COUNTY representative for customer billing purposes.

SECTION 5.8 - Cost of Natural Gas. The COUNTY shall be responsible for the cost to purchase and deliver natural gas for use in the co-generation Facilities. However, the Operator shall monitor natural gas consumption and provide monthly reports to the COUNTY with recommendations for the future acquisition of natural gas in accordance with market trends.

SECTION 5.9 - Engine Oil, Lubricants, Etc. The Operator shall provide labor and material of all consumables and wear items (e.g., engine oil, lubricant, grease, spark-plugs, gaskets, belts, impellers, overhaul kits, coolant, filters, diagnostic fluids, etc.) required to operate the generators/engines, boilers, chillers, cooling towers, dry coolers, switchgear, heat exchangers, and appurtenant (parasitic) equipment for the proper operation and maintenance of the Facilities.

SECTION 5.10 - Optional Maintenance Obligations. The Operator shall notify the COUNTY a minimum of sixty (60) calendar days prior to the need to perform a partial or complete overhaul of an engine/generator set, based on actual run time and the manufacturer's recommended overhaul schedule. The COUNTY at its sole discretion may direct the Operator to defer any of these tasks if the equipment will be permanently removed from service within six (6) months of the scheduled overhaul. The Operating Fee for Maintenance at the specific Facilities shall be increased by a lump sum amount per engine of \$97,850 for a top-end overhaul, \$189,740 for a

bottom-end overhaul, or \$252,986 for complete equipment overhaul. Overhauls shall be defined as labor and materials per Caterpillar's OEM Overhaul Kits and following installation processes and procedures thereof. If the COUNTY elects to defer a manufacturer-recommended top-end, bottom-end or major overhaul, Siemens shall be released from the cost of repairs and operating expenses until such time that manufacturer-recommended top-end, bottom-end or major overhauls are completed on the specific generator set, or such time as the entire generator set is taken off-line.

SECTION 5.11 - Wholesale Replacement. The Operator will not be responsible for wholesale replacement of generators, boilers, or chillers (absorption or centrifugal) that are damaged beyond repair due to a Catastrophic Failure unless such failure is a direct result of Operator's negligence or wrongdoing. Notwithstanding the foregoing, the Operator shall repair all leaks, replace small damaged sections of pipe, repair or replace individual appurtenant (parasitic) components, and replace wear and tear items as necessary. The Operator shall not be responsible for the comprehensive replacement of piping.

SECTION 5.12 - Maintenance Logs. Operator shall prepare and maintain (store) on-site detailed maintenance logs for all maintenance and repairs performed on the engines, boilers and equipment for the co-generation facilities, which shall be readily available at all times for review by the COUNTY.

SECTION 5.13 - Operator Responsibility for Repair, Oversight and Coordination. It is anticipated and expected that from time-to-time the COUNTY may retain the services of third-party vendors to replace equipment, conduct comprehensive repairs (including those caused by Catastrophic Failure) and furnish other services outside the scope of work of this Agreement. In such instances, the Operator shall be responsible for on-site supervision and management of all work performed by such third-parties and coordinate such work. These duties include assisting the COUNTY in drafting requests for proposals, acquiring quotes from qualified third-party vendors, the inspection and final approval of all work by any third-party vendor and recommendations to the COUNTY regarding approval of all third party payment applications or requests.

SECTION 5.14 - Emission Reports. The Operator shall coordinate and prepare all reports, including emissions reports or other reporting required by federal, state or local agencies. Signature and submission of reports shall be by the party who is legally responsible to provide such reports. The Operator shall furnish the COUNTY with certified copies of all data necessary to comply with reporting requirements from regulatory agencies regarding the output and operations of the cogeneration facilities. These duties include providing the COUNTY or any third party access to the cogeneration facilities, as required, for auditing purposes.

SECTION 5.15 - Governmental Requirements. Notwithstanding the Operator's obligation to prepare reports per Section 5.14, the Operator shall promptly furnish to the COUNTY such information as may be required to enable the COUNTY to file any reports required by Governmental Requirements.

SECTION 5.16 - Maintenance Exclusions of Operator. The Operator's operation and maintenance services do not include, directly or indirectly, performing or arranging for the detection, monitoring, handling, storage, removal, transportation, disposal or treatment of any pre-existing oils or Hazardous Materials existing onsite prior to December 1, 2002, except that certain asbestos containing interior pipe insulation within the Iola Powerhouse identified in Exhibit C. The

COUNTY represents that, to the best of its knowledge and belief, there is no other asbestos or any other Hazardous Materials present at the Facilities. The Operator will notify COUNTY within forty-eight hours if Operator discovers or suspects the presence of any Hazardous Material. Any Hazardous Materials that existed onsite prior to December 1, 2002 shall constitute a change in the scope of services equivalent to a change order whose terms must be agreed to by the parties before Operator's obligations hereunder will continue. The COUNTY shall be solely responsible for testing, abating, encapsulating, removing, remedying or neutralizing such Hazardous Materials existing onsite prior to December 1, 2002, and for the costs thereof. Even if an appropriate change order has been entered into pursuant hereto, Operator will continue to have the right to stop providing services until the Facilities is free from Hazardous Materials existing onsite prior to December 1, 2002. In such event, Operator will receive an equitable extension of time to complete its services, and compensation for delays caused by Hazardous Materials remediation existing onsite prior to December 1, 2002. In no event shall Operator be required or construed to take title, ownership or responsibility for any oil or Hazardous Materials existing onsite prior to December 1, 2002.

SECTION 5.17 - Grants, Aid, Etc. The Operator shall notify the COUNTY of any identified and available aid and grants from any governmental authority in connection with the Facilities. The Operator shall not apply for any aid or grants on behalf of the COUNTY.

SECTION 5.18 - Obligation to Rebuild. If the Facilities shall be damaged or destroyed at any time or title to, or the use of, any part of the Facilities shall be taken by Condemnation, in a manner not resulting in a Service Failure, the Operator shall, from the proceeds of any Condemnation award or insurance received by the Operator or from moneys received by the Operator from any other person, promptly replace, repair, rebuild or restore the Facilities to substantially the same condition and value as an operating entity as existed prior to such damage or destruction or Condemnation, with such changes, alterations and modifications as may be desired by the COUNTY, provided that such changes, alterations or modifications do not change the nature of the Facilities.

SECTION 5.19 - Standard of Work by Operator. (a) The work performed by Operator shall be conducted in a manner consistent with the degree of care and skill ordinarily exercised by reputable firms performing the same or similar work in the industry acting under similar circumstances and conditions.

(b) All work shall be performed by Operator in conformity and a manner consistent with the COUNTY's policies and procedures.

(c) Operator is not required to conduct safety or other tests, install new devices or equipment or make modifications to any equipment beyond the scope set forth in this Agreement. Any COUNTY request to change the scope or the nature of the work must be in the form of a mutually agreed amendatory agreement, effective only when executed by all parties hereto.

(d) All reports and drawings specifically prepared for and deliverable to COUNTY pursuant to this Agreement ("Deliverables") shall become COUNTY's property upon full payment to Operator. Operator may retain file copies of such deliverables. All other reports, notes, calculations, data, drawings, estimates, specifications, manuals, other documents and all computer programs, codes and computerized materials prepared by or for Operator are instruments of Operator's work ("Instruments") and shall remain Operator's property. The COUNTY, its

employees, contractors and agents ("Permitted Users") shall have a right to make and retain copies of Instruments except uncompiled code, and to use all Instruments, provided however, the Instruments shall not be used or relied upon by any parties other than Permitted Users, and such use shall be limited to the particular project and location for which the Instruments were provided. All Deliverables and Instruments provided to COUNTY are for Permitted Users' use only for the purposes disclosed to Operator, and COUNTY shall not transfer them to others or use them or permit them to be used for any extension of the services or any other project or purpose, without Operator's express written consent. Any reuse of Deliverables or Instruments for other projects or locations without the written consent of Operator, or use by any party other than Permitted Users will be at Permitted Users' risk and without liability to Operator; and COUNTY shall indemnify, defend and hold Operator harmless from any claims, losses or damages arising therefrom.

SECTION 5.20 - Responsibilities of the COUNTY. The COUNTY shall:

- (a) Designate a contact person with authority to make decisions for COUNTY regarding the services performed by Operator and provide Operator with information sufficient to contact such person in an emergency. If such representative cannot be reached Operator will, in its reasonable discretion, act accordingly for such actions;
- (b) Provide or arrange for reasonable access and make all provisions for Operator to enter any Facilities to perform the services;
- (c) Allow Operator to control and/or operate all Facilities controls, systems, apparatus, equipment and machinery necessary to perform the services;
- (d) Furnish Operator with all available information pertinent to the Facilities and the services;
- (e) Notify Operator promptly of any site conditions requiring special care, and provide Operator with any available documents describing the quantity, nature, location and extent of such conditions;
- (f) Comply with all laws and provide any notices required to be given to any government authorities in connection with the services, except such notices Operator has expressly agreed in writing to give; and
- (g) Furnish to Operator any contingency plans related to the Facilities.

ARTICLE VI

REPLACEMENT OF PARTS; ALTERATIONS

SECTION 6.1 - Replacement of Parts. Except after a Service Failure, unless caused solely by or resulting solely from an act or omission of the Operator, the Operator will promptly replace all Parts which may from time to time become worn out, lost, stolen, destroyed, seized, confiscated, damaged beyond repair or permanently rendered unfit for use for any reason whatsoever. The Operator may remove in the ordinary course of maintenance, service, repair, overhaul, rebuilding or

testing, any Parts, whether or not worn out, lost, stolen, destroyed, seized, confiscated, damaged beyond repair or permanently rendered unfit for use, provided that the Operator will replace such Parts as promptly as possible. All replacement Parts shall be free and clear of all Liens and shall be in as good operating condition as, and shall have a value and utility at least equal to, the Parts replaced, assuming such replaced Parts were in the condition and repair required to be maintained by the terms hereof. Any cost incurred by the Operator in complying with this Section 6.1 shall constitute an Ordinary Operating Cost payable by Operator.

SECTION 6.2 - Alterations Required by Law. Except after a Service Failure, unless caused by or resulting solely from an act or omission of the Operator, the Operator shall during the Operating Term make such Alterations to the Facilities as may be required from time-to-time to meet Governmental Requirements as soon as practicable after any such Governmental Requirements shall arise and, in any event, within the period specified by applicable law or by such Governmental Requirement, except to the extent Section 6.6 hereof shall apply. Except after a Service Failure caused by or resulting solely from an act or omission of the Operator, any cost incurred by the Operator in complying with this Section 6.2 shall not constitute an Ordinary Operating Cost and shall be reimbursable from the COUNTY, but may, at the request of the COUNTY, be financed pursuant to Section 6.4 (b) hereof.

SECTION 6.3 - Optional Alterations. The Operator, at its own expense, may from time- to-time during the Operating Term make such other Alterations to the Facilities as the Operator may deem necessary or appropriate for the purpose of providing Energy Service; provided, however, that neither the utility nor condition of the Facilities will be diminished as a result of such Alteration.

SECTION 6.4 - COUNTY Financing of Alterations. The Operator agrees to give the COUNTY at least 120 days' written notice or such maximum or lesser period necessary to comply with Governmental Requirement, of its intention to make any Alteration required pursuant to Section 6.2 hereof. The COUNTY shall pay for the cost of any Alteration required by law, and the COUNTY shall make such payment upon completion of a mutually agreed amendatory agreement, effective only when executed by all parties. The Operator shall provide the COUNTY with a written notice setting forth in reasonable detail the following:

- (a) a description of the nature of and reason for the Alteration desired to be made, which the Operator hereby agrees to furnish if the Alteration is described in Section 6.2 hereof; and
- (b) an estimate of the cost of such Alteration, which the Operator hereby agrees to furnish if the Alteration is described in Section 6.2 hereof.

SECTION 6.5 - Title to Parts. Title to each Part (including any Alteration) incorporated in the Facilities pursuant to this Article 6 shall without further act vest in the COUNTY and constitute a part of the Facilities in the following cases:

- (a) such Part shall be in replacement of or in substitution for, and not in addition to, any Part originally incorporated in the Facilities during the construction thereof or any Part title to which shall have vested in the COUNTY pursuant to this Section;

(b) such Part shall be required to be incorporated in the Facilities pursuant to the terms of Section 6.1 or 6.2 hereof;

(c) such Part cannot be readily removed from the Facilities without adversely affecting or impairing the value, utility or condition that the Facilities would have had at such time had such Part not been so incorporated; or

(d) such Part that is paid for by the COUNTY.

SECTION 6.6 - Permitted Contests. If, to the extent and for so long as (a) any contest with respect to any applicable Governmental Requirement relating to the operation or maintenance of the Facilities shall be prosecuted in good faith by the Operator or (b) compliance with such Requirement shall have been excused or exempt by a valid nonconforming use permit, waiver, extension or forbearance believed in good faith by the Operator to exempt it from such requirement, the Operator shall not be required to comply with such requirement so long as such contest is being prosecuted or so long as such waiver, extension or forbearance from compliance with such requirement shall be in effect but only if such contest shall not, in the reasonable opinion of the Operator, involve any reasonable likelihood of any (i) foreclosure, sale, forfeiture or loss of, any part of the Facilities or of impairment of the operation of the Facilities, (ii) the nonpayment of service fees, or (iii) a Service Failure.

SECTION 6.7 - Plans and Specifications. The Operator shall maintain throughout the Operating Term, and keep on file at the Facilities, a complete set of "as-built" Plans and Specifications of the work which shall reflect all Parts having a value in excess of \$100,000 incorporated in the Facilities and all Alternations made pursuant to this Article 6, except that such Plans and Specifications shall as of any date not be required to reflect any such Parts so incorporated or Alterations so made within 90 days prior to such date.

SECTION 6.8 - Standard Clauses. The Operator agrees to be bound by the Standard Clauses which are attached as Appendix B and made a part of this Agreement. The term "Contractor" in the Standard Clauses shall refer to the Operator.

ARTICLE VII

SERVICE FAILURE, LOSS, DESTRUCTION AND CONDEMNATION

SECTION 7.1 - Notice of Occurrence. If a Service Failure or any material damage to the Facilities shall occur during the Operating Term, the Operator shall give the COUNTY immediate verbal and written notice thereof.

SECTION 7.2 - Application of Certain Payments on a Service Failure. Any payments or proceeds received at any time by the Operator from any governmental authority, insurer or other Person as the result of the occurrence of a Service Failure shall be paid to the COUNTY.

SECTION 7.3 - Application of Insurance or Condemnation -- Proceeds For Other Than Service Failure. Any payments or proceeds received at any time as the result of any loss, Condemnation, confiscation, theft or seizure of, or requisition of title to or use of, or damage to, the Facilities or any part thereof not constituting a Service Failure shall be paid to the COUNTY;

provided, payments or proceeds received by the Operator from an insurer in respect of any damage or loss shall be applied by the Operator toward repair or replacement of such loss or damage. Any moneys received by the Operator and not so used shall be paid by the Operator to the COUNTY.

ARTICLE VIII
INSURANCE

SECTION 8.1 - Insurance Required. Without limiting any of the other obligations or liabilities of the Operator under this Agreement, at all times throughout the Operating Term (except as provided below), the Operator shall maintain or cause to be maintained at least the following minimum insurance coverage with respect to the Facilities.

(a) The policy or policies of insurance required are standard Worker's Compensation and Disability Insurance; general liability insurance (including, without limitation, contractual liability) with single limits of liability in the amount of \$1,000,000 per occurrence, and \$3,000,000 aggregate coverage; automobile liability insurance in the amount of \$1,000,000 with a minimum of \$1,000,000 each occurrence, bodily injury, and property damage. Original certificates and endorsements evidencing such coverage shall be delivered to the COUNTY before final execution of this Agreement. The certificates shall indicate that such coverage will not be cancelled or materially amended in any way without thirty (30) days prior written notice to the COUNTY and original renewal certificates conforming to the requirements of this section shall be delivered to the COUNTY at least fourteen (14) days prior to the expiration of such policy or policies of insurance. The Operator's insurance shall provide for and name the County of Monroe as an additional insured. All policies shall insure the COUNTY for all claims arising out of the Agreement. All policies of insurance shall be issued by companies in good financial standing duly and fully qualified and licensed to do business in New York State or otherwise acceptable to the COUNTY.

(b) If any required insurance coverage contain aggregate limits or apply to other operations of the Operator, outside of those required by this Agreement, in the event of any incident, settlement, or judgment against that insurance which diminishes the protection of such insurance affords the COUNTY, the Operator shall take immediate steps to restore such aggregate limits or shall provide other insurance protection for such aggregate limits.

(c) The Operator will also provide proof duly subscribed by an insurance carrier in a form satisfactory to the Chair of the Worker's Compensation Board that the payment of family leave benefits for all its employees required under New York law to receive such benefits has been secured.

(d) All premiums with respect to the foregoing insurance shall be paid when due by the Operator and shall constitute an Ordinary Operating Cost.

SECTION 8.2 - Additional Provisions Respecting Insurance.

(a) All insurance required by Section 8.1 hereof shall be procured and maintained in financially sound and generally recognized responsible insurance companies selected by the Operator

and approved by the COUNTY and authorized to write such insurance in the State. Such insurance may provide deductible amounts acceptable to the COUNTY upon the Operator's agreement to pay any such deductible amounts in the event of an insurance claim. All insurance policies carried in accordance with Section 8.1 hereof and all policies taken out in substitution or replacement for any such policies shall (a) name the COUNTY as an additional insured, (but without imposing upon the COUNTY any obligation imposed upon the insured, including, without limitation, the liability to pay the premium for such policies), (b) provide that payment for any loss shall be paid as provided in Section 7.2 or 7.3 hereof, as the case may be, (c) provide that in respect to the interests of the COUNTY in such policies, the insurance shall not be invalidated by any action or inaction of the Operator or any other Person and shall insure the COUNTY, regardless of any breach or violation by the Operator or any other Person of any warranties, declarations or conditions contained in such policies, (d) provide that as against the COUNTY the insurers shall waive any rights of subrogation, any right of set-off and counterclaim and any other right of deduction whether by attachment or otherwise (except for claims arising out of the willful misconduct or gross negligence of such insured), (e) provide that if such insurance is cancelled for any reason whatever, or is changed in any material respect in relation to the interest of the COUNTY, or if such insurance is allowed to lapse for nonpayment of premium, such cancellation, material change or lapse shall not be effective as to the COUNTY for 30 days after receipt by the COUNTY of written notice from such insurers of such cancellation, material change or lapse, and (f) provide that, inasmuch as the policy is written to cover more than one insured, all terms, conditions, insurance agreements and endorsements, with the exception of limits of liability, shall operate in the same manner as if there were a separate policy covering each insured.

(b) Each insurance policy required under Section 8.1 hereof shall be primary without right of contribution from any other insurance which is carried by or on behalf of the COUNTY with respect to its interest as such in the Facilities. The COUNTY acknowledges that Operator has deductibles in the amount of \$750,000 under automobile liability, \$30,000 under general liability and \$1,000,000 under professional liability. Upon request, Operator shall provide a letter from its broker certifying its deductibles.

SECTION 8.3 Certificates, Etc. Annually on or before each January 1, the Operator will furnish to the COUNTY an ACORD form certificate of a firm of independent insurance brokers reasonably acceptable to the COUNTY (i) certifying to the insurance then carried and maintained on the Facilities (ii) identifying underwriters, type of insurance, insurance limits and policy term, and (iii) specifically listing the special provisions enumerated for such insurance required by Section 8.2.

SECTION 8.4 - Insurance of County's Interest. Nothing contained herein shall prevent the COUNTY from carrying at its own expense additional insurance in excess of that required hereunder. Any such insurance maintained by the COUNTY shall not provide for or result in a reduction of the coverage or the amounts payable under any of the insurance maintained by the Operator in compliance with the provisions of this Article 8.

ARTICLE IX
LIENS

SECTION 9.1 - Liens. The Operator will not directly or indirectly create, incur, assume or suffer to exist any Lien on or with respect to the Facilities, title thereto or any interest therein or in this

Agreement. The Operator will promptly take such action as may be necessary duly to discharge any Lien not excepted above if the same shall arise at any time.

ARTICLE X

INSPECTION

SECTION 10.1 - Inspection. The Operator shall furnish to the COUNTY such information concerning the condition, use and operation of the Facilities as the COUNTY may reasonably request. Additionally, the Operator shall permit any authorized representative of the COUNTY, at such Person's risk and expense, to visit and inspect the Facilities, its condition, use and operation and the records maintained in connection therewith, provided that such visits and inspections do not interfere with the operations of the Operator and are scheduled at the reasonable request of the COUNTY at times mutually convenient to such Person and the Operator, the Operator hereby agreeing to make all reasonable efforts to arrange for such visits and inspections at times convenient for such Person. The COUNTY shall not have any duty to make any such inspection nor shall incur any liability or obligation by reason of not making any such inspection.

ARTICLE XI

VACATION OF FACILITIES

SECTION 11.1 - Vacation of Facilities. Except as otherwise provided herein, at the expiration of the Operating Term the Operator will vacate the Facilities and deliver to the COUNTY all reports, records and documents referred to in Section 5.12, 5.14, 5.19 (d) and 6.7 hereof.

SECTION 11.2 - Condition. When vacated by the Operator, the Facilities shall (a) be in the condition required of the Operator under Articles 5 and 6 hereof and shall have been maintained throughout the Operating Term as if the Operator were the owner and operator thereof and as if the Operating Term were not then ending, and (b) be free and clear of any Liens.

ARTICLE XII

EVENTS OF DEFAULT

SECTION 12.1 - Operator Events of Default. The following events shall constitute Operator Events of Default (whether any such event shall be voluntary or involuntary or come about or be effected by operation of law or pursuant to or in compliance with any judgment, decree or order of any court or any order, rule or regulation of any administrative or governmental body):

(a) the Operator shall fail to perform or observe any covenant or other provision of the Agreement to be performed or observed by it hereunder and such failure shall continue unremedied for a period of thirty (30) days after written notice thereof;

(b) any representation or warranty made by the Operator herein proves to be false or misleading in any material respect, and such condition shall materially impair the ability of the Operator to perform any material obligation hereunder and shall continue unremedied for a period of thirty (30) days after written notice thereof; or

(c) the Operator shall file any petition for dissolution or liquidation of the Operator, or the Operator shall commence a case under any applicable bankruptcy, insolvency or other similar law now or hereafter in effect, or the Operator shall have consented to the entry of an order for relief in a case under any such law, or the Operator generally shall fail to pay its debts as such debts become due, or the Operator shall fail promptly to satisfy or discharge any execution, garnishment or attachment of such consequence as may impair its ability to carry out its obligations under this Agreement, or a receiver, Trustee or trustee (or other similar official) for the Operator or any substantial part of its property shall have been appointed or taken possession thereof, or the Operator shall make a general assignment for the benefit of its creditors, or the Operator shall enter into an agreement or composition with its creditors, or the Operator shall take any action in furtherance of any of the foregoing; a petition in bankruptcy which results in an order for relief being entered or, notwithstanding that an order for relief has not been entered, the petition is not dismissed within 90 days of the date of the filing of the petition, or there shall be filed under any Federal or State law relating to bankruptcy, insolvency or relief of debtors of a petition against the Operator for reorganization, composition, extension or arrangement with creditors which either (i) results in a finding or adjudication of insolvency of the Operator or (ii) is not dismissed with 90 days of the date of the filing of such petition.

SECTION 12.2 - County Events of Default. The following events shall constitute COUNTY Events of Default (whether any such event shall be voluntary or involuntary or come about or be effected by operation of law or pursuant to or in compliance with any judgment, decree or order of any court or any order, rule or regulation of any administrative or governmental body):

(a) the COUNTY shall fail to perform or observe any covenant or agreement to be performed or observed by it hereunder and such failure shall continue unremedied for a period of thirty (30) days after written notice thereof; or

(b) any representation or warranty made by the COUNTY herein proves to be false or misleading in any material respect, and such condition shall materially impair the ability of the COUNTY to perform any material obligation hereunder and shall continue unremedied for a period of thirty (30) days after written notice thereof.

ARTICLE XIII

REMEDIES

SECTION 13.1 – Operator Event of Default. Upon the occurrence of any Event of Default and at any time thereafter, the COUNTY may, in addition to any other remedies provided herein or under law, exercise any of the following remedies with respect to the Facilities as the COUNTY in its sole discretion shall elect:

(a) at the Operator's risk and expense, suspend or terminate performance of all or a portion of Operator's work and services at the Facilities under this Agreement;

(b) at the Operator's risk and expense, surrender promptly, and the Operator shall surrender promptly, to the COUNTY the Facilities in the condition required by and otherwise in accordance with this Agreement; and

(c) rescind or terminate this Agreement, or, exercise any other right or remedy which may be available to it under applicable law or proceed by appropriate court action to enforce the terms hereof or to recover damages (after notification to the Operator in writing of the specific Event of Default permitting exercise of such right).

All obligations of the Operator accrued or arising through the date of any rescission or termination shall survive such rescission or termination.

SECTION 13.2 - County Event of Default. Upon the occurrence of any COUNTY Event of Default and at any time thereafter, the Operator may, in addition to any other remedies provided herein or under law, exercise any of the following remedies with respect to the Facilities as the Operator in its sole discretion shall elect:

(a) suspend or terminate performance of all or a portion of the work, services or Operator's other obligations under this Agreement; and

(b) rescind or terminate this Agreement, or, exercise any other right or remedy which may be available to it under applicable law or proceed by appropriate court action to enforce the terms hereof or to recover damages (after notification to the COUNTY in writing of the specific COUNTY Event of Default permitting exercise of such right).

All obligations of the COUNTY accrued or arising through the date of any rescission or termination shall survive such rescission or termination.

SECTION 13.3 - Remedies Not Exclusive, Etc. No remedy referred to in the Article 13 is intended to be exclusive, but each shall be cumulative and in addition to any other remedy referred to above or otherwise available to each party at law or in equity; and the exercise or beginning of exercise by either party of any one or more of such remedies shall not preclude the simultaneous or later exercise by such party of any or all of such other remedies. No express or implied waiver by any party of any Event of Default shall be construed as a waiver of any future or subsequent Event of Default.

ARTICLE XIV

MISCELLANEOUS

SECTION 14.1 - Notices. Unless otherwise specifically provided herein, all notices, consents, directions, approvals, instructions, requests and other communications required or permitted by the terms hereof to be given to the COUNTY or Operator shall be delivered in writing and sent to the address specified in Exhibit B by U.S. Mail or personal delivery. From time-to-time, either party may designate a new address or contact person for purposes of communications hereunder by written notice to the other party.

SECTION 14.2 - Binding Effect; Successors and Assigns. The terms and provisions of this Agreement, and the respective rights and obligations hereunder of the Operator and the COUNTY, shall be binding upon their respective successors and assigns and inure to the benefit of their respective permitted successors and assigns.

SECTION 14.3 - No Third Party Beneficiaries. Except as expressly stated herein, nothing contained in this Agreement shall be construed to give any rights or benefits to anyone other than the COUNTY and Operator without the express written consent of both parties. All obligations arising prior to this Agreement and all provisions of this Agreement allocating responsibility or liability between the parties shall survive the completion of the work and the termination of this Agreement.

SECTION 14.4 - Changed Conditions. As the work and services are performed, conditions may change or circumstances outside Operator's reasonable control (including changes of law) may develop which would require Operator to expend additional costs, effort or time to complete the services, in which case Operator will notify COUNTY and an equitable adjustment shall be made to Operator's time for performance; provided further in the event that such changed condition or circumstance results from:

- (a) a change in Governmental Requirements;
- (b) the action or failure to act of the COUNTY or its employees, agents or contractors other than the Operator; or
- (c) any force majeure event as defined in Section 14.5 that occurs after the completion of the work;

then an equitable adjustment shall be made to Operator's compensation.

SECTION 14.5 - Force Majeure. Neither party shall be responsible for loss, delay, injury, damage or failure of system or component performance that may be caused by circumstances beyond its control, including but not restricted to acts or omissions by the other party or its employees, agents or contractors, Acts of God, war, civil commotion, acts or omissions of government authorities, fire, theft from a secure Facilities, corrosion, flood, water damage, lightning, freeze-ups not caused by Operator's improper operations and maintenance, riots, explosions not caused by Operator's improper operations and maintenance, quarantine restrictions, delays in transportation, or shortage of vehicles, fuel, labor or materials. In the event of such delay or failure, the time for performance shall be extended by a period equal to the time lost plus a reasonable recovery period.

SECTION 14.6 - Construction and Applicable Law. Any provision of this Agreement that shall be prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof and any such prohibition or unenforceability in any jurisdiction shall not invalidate or render unenforceable the supplement, amendment or modification thereafter sought. The section headings in this Agreement and the table of contents are for convenience of reference only and shall not control, affect the meaning of or be taken as an interpretation of any provision hereof. This Agreement has been negotiated and delivered in the State of New York and shall in all respects be governed by and construed in accordance with the laws of the State, including matters of construction, validity and performance.

SECTION 14.7 - Jurisdiction / Venue. Any and all litigation concerning the subject matter of this Agreement shall be subject to the Law of the State of New York and venued in Monroe County, New York.

SECTION 14.8 – No Waiver. This Agreement is not intended to waive the rights of either party under any other or former agreement between the parties.

SECTION 14.9 - Warranty of Equipment. Operator warrants to the COUNTY that all materials and equipment furnished shall be new unless otherwise specified, and that all work under this Agreement shall be of good quality, free from faults and defects and in conformance with the Agreement for a period of twelve (12) months after the earlier of substantial completion of the work or first beneficial operation or use. All auxiliary equipment not manufactured by Operator carries only such warranty as given by the manufacturer thereof and which is hereby assigned to the COUNTY. THE WARRANTIES FURNISHED BY OPERATOR AS EXPRESSLY INCLUDED HEREIN CONSTITUTE OPERATOR'S SOLE WARRANTY OBLIGATION HEREUNDER AND ARE IN LIEU OF ANY OTHER WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SECTION 14.10 – Consequential Damage Waiver. Anything herein notwithstanding, in no event shall the COUNTY or Operator be liable to the other party for special, indirect, incidental or consequential damages, including commercial loss, loss of use, or lost profits, even if either party has been advised of the possibility of such damages.

IN WITNESS WHEREOF, the COUNTY and the Operator have each caused this Agreement to be duly executed as of the day and year first above written.



COUNTY OF MONROE
By: [Signature]
Title: Depl. C.E.

State of New York)
County of Monroe) ss:

Thomas Van Strydonck

On the 13th day of December 2019, before me, the undersigned, a Notary Public in and for said State, personally appeared CHERYL DINGOLFO, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is subscribed to the within instrument and acknowledged to me that she executed the same in her capacity, and that by her signature on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

[Signature]
Notary Public

CHARLES G. JOHNSON
Notary Public, State of New York
Qualified in Monroe County
Commission Expires September 18, 2021

SIEMENS INDUSTRY, INC

By: Peters Jr Joseph Digitally signed by Peters Jr Joseph
DN: cn=Peters Jr Joseph, o=Siemens, email=joepeters@siemens.com, Date: 2019.12.10 15:24:11 -05'00'

Title: _____
Gerlach James Digitally signed by Gerlach James
DN: cn=Gerlach James, o=Siemens, email=james.gerlach@siemens.com, Date: 2019.12.10 15:43:23 -05'00'

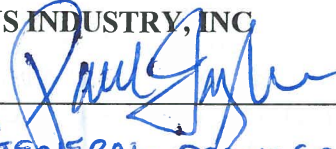
State of New York)
County of Monroe) ss:

On the ___ day of _____, 2019, before me, the undersigned, a Notary Public in and for said State, personally appeared _____, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is subscribed to the within instrument and acknowledged to me that she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Notary Public

Approved By Legal

Digitally signed by Greaney Stephanie
Date: 2019.12.10 14:57:23 -05'00'

SIEMENS INDUSTRY, INC
By: 
Title: GENERAL MANAGER

State of New York)
County of Monroe) ss:

On the 10th day of December, 2019, before me, the undersigned, a Notary Public in and for said State, personally appeared Paul Chehan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is subscribed to the within instrument and acknowledged to me that she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.


Notary Public

SECTION 14.8 – No Waiver. This Agreement is not intended to waive the rights of either party under any other or former agreement between the parties.

SECTION 14.9 - Warranty of Equipment. Operator warrants to the COUNTY that all materials and equipment furnished shall be new unless otherwise specified, and that all work under this Agreement shall be of good quality, free from faults and defects and in conformance with the Agreement for a period of twelve (12) months after the earlier of substantial completion of the work or first beneficial operation or use. All auxiliary equipment not manufactured by Operator carries only such warranty as given by the manufacturer thereof and which is hereby assigned to the COUNTY. THE WARRANTIES FURNISHED BY OPERATOR AS EXPRESSLY INCLUDED HEREIN CONSTITUTE OPERATOR'S SOLE WARRANTY OBLIGATION HEREUNDER AND ARE IN LIEU OF ANY OTHER WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SECTION 14.10 – Consequential Damage Waiver. Anything herein notwithstanding, in no event shall the COUNTY or Operator be liable to the other party for special, indirect, incidental or consequential damages, including commercial loss, loss of use, or lost profits, even if either party has been advised of the possibility of such damages.

IN WITNESS WHEREOF, the COUNTY and the Operator have each caused this Agreement to be duly executed as of the day and year first above written.

COUNTY OF MONROE

By: _____

Title: _____

State of New York)
County of Monroe) ss:

On the ___ day of _____, 2019, before me, the undersigned, a Notary Public in and for said State, personally appeared CHERYL DINOLFO, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is subscribed to the within instrument and acknowledged to me that she executed the same in her capacity, and that by her signature on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Notary Public

APPENDIX A
DEFINITIONS

"Alterations" means reconstruction or construction of additions to or any other structural improvements to the Facilities.

"Business Day" means any day other than a Saturday, Sunday or Federal Holiday.

"Catastrophic Failure" mean a sudden and total failure of a Caterpillar 3516 generator set, Hurst boiler, or distribution piping beyond the exterior walls of Facilities as shown in Exhibit C not caused by action of, or improper operations and maintenance by the Operator as required or suggested by the equipment manufacturer, or per industry standards, from which recovery is impossible.

"Condemnation" means the lawful taking of the Facilities or any part thereof by a governmental body.

"County" means the County of Monroe, New York or its successors or assigns.

"Energy Service" means certain steam and electricity required to be provided by the County for its own use. The County, as its sole discretion, may cause the electric and/or steam generation capacity of the Facilities to cease operation, with commensurate adjustment to the payment of Operating Fees under this Agreement.

"Event of Default" means an event of default provided in Article XII of the Agreement.

"Facilities" means the co-generation ("cogen") facilities located at the "Iola" complex on East Henrietta Road. The facilities produce steam, hot water and electricity for the benefit of the County. The Iola Facility, located at 430 East Henrietta Road, houses three (3) Caterpillar 3516, 1350 KW generators, three (3) Hurst boilers for steam production and associated piping, utilities and equipment. The Iola Facility provides electricity, heat and steam to the Monroe County Hospital and the County-owned Facilities at 111 Westfall Road.

"Governmental Requirements" means Federal, State and local laws, rules, regulations and ordinances applicable at the time to the construction, operation and maintenance of the Facilities.

"Hazardous Material" or "Hazardous Materials" is defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, the regulations promulgated thereunder, and other applicable federal, state or local law.

"Lien" means any sale, transfer, assignment, disposition, mortgage, pledge, security interest, lien, judgment lien, easement or other encumbrances on title, except permitted liens.

"Maintenance" means all site supervision, labor, materials, expertise, and supplies to perform regular, routine maintenance in order to keep equipment up and running, preventing any unplanned

downtime and avoidance of costs from unanticipated equipment failure. This task includes planning and scheduling of maintenance on equipment and keeping of accurate records of inspections and servicing reports. Preventative maintenance includes replacing consumables, adjustments, fluid changes, filter changes, equipment overhauls (e.g., generator top end overhaul), equipment rebuilds, planned, incidental and routine repairs, and all other activities associated with keeping the equipment and appurtenances running in an efficient manner, whether or not specifically identified in maintenance documentation (e.g., manuals, bulletins) supplied by the manufacturer of the equipment. Corrective maintenance is comprehensive and extensive repairs performed to return systems to proper working order as a result of a Catastrophic Failure not associated with improper operations and preventative maintenance. Maintenance shall include performing or arranging for the detection, monitoring, handling, storage, removal, transportation, disposal or treatment of any pre-existing oils or Hazardous Materials existing onsite after December 1, 2002.

"Operations" means all site supervision, labor, materials, expertise, licenses, and supplies to ensure that all equipment and appurtenances are operating at their peak efficiency and at a capacity sufficient to meet the energy, heating and cooling needs of the Facilities, either individually or combined. This task also includes any necessary regulatory and contractual reporting, meetings with the County, and management and maintenance of the Supervisory Control System.

"Operating Fee" means any fee to be paid by the COUNTY to the Operator pursuant to Sections 3.2 and 3.4 of the Agreement for Operations and Maintenance of the Facilities.

"Operating Term" means the term provided in Section 3.1 of the Agreement.

"Operator" means the Operator of the Facilities pursuant to the Agreement, which is SIEMENS INDUSTRY, INC.

"Ordinary Operating Cost" means the expenses incurred or to be incurred by the Operator in connection with the operation and maintenance of the Facilities, including, without limitation, all costs of operating, maintaining, or repairing the Facilities pursuant to the Agreement as may be necessary or proper to maintain Energy Service, fees and expenses incurred or to be incurred by the Operator and payable by the Operator to other Persons in connection with providing Energy Service, and all fees paid by the Operator to other parties in connection with the operation of the Facilities; provided, however, Ordinary Operating Cost does not include corrective maintenance required for comprehensive and extensive repairs performed to return systems to proper working order as a result of a Catastrophic Failure not associated with improper operations and preventative maintenance.

"Parts" means tangible and intangible chattels incorporated in the Facilities.

"Person" means an individual, a corporation, a partnership, an association, a joint stock company, a trust, any unincorporated organization, a governmental body, political subdivision, municipality or authority or any other group or entity.

"Plan and Specifications" means the Plans and Specifications for the Facilities.

"Service Failure" means an interruption in Energy Service to the Facilities not due to routine maintenance or cessation of service requested by the County.

"State" means the State of New York.

"Supervisory Control System" means all hardware, firmware, wiring, communications, and software necessary to collect data, send and receive signals for the operation of equipment, and interface with the process plant or machinery.

EXHIBIT A

Equipment Schedule

Monroe County Cogen Ops and Maint Agreement
 EXHIBIT A - EQUIPMENT SCHEDULE

Item	Service Item Description	Tag	Location	Service	Item Covered Under Scope of Work	Preventive Maint	Repair	Replacement	Notes	
01A Building 31	Mechanical Service Item Description	Tag	Location	Service	Item Covered Under Scope of Work	Preventive Maint	Repair	Replacement	Notes	
	Condensate Recovery Module Schedule	Existing	Basement	Condensate Recovery	Included	Included	Included	Not Included		
	Hot Water Recirculation Pumps	Existing	Basement	MCH Hot Water Supply	Included	Included	Included	Not Included	* Gaslets and Ssals only - tube repair excluded	
	Steam-in-line Heat Exchanger	DHX-1	Basement	MCH Hot Water Supply	Included	Included	Included	Not Included		
	Drain and Return Kit (Energy Domestic - Steam)		Basement	MCH Hot Water Supply	Included	Included	Included	Not Included		
	Three 1500 Gallon HW Tanks		Basement	MCH Hot Water Supply	Included	Included	Included	Not Included		
	Steam Pressure Reducing Valves	Existing	Basement	MCH Hot Water Supply	Included	Included	Included	Not Included		
	Steam/Hot Water Distribution Piping	Existing	Basement	OIA Campus HW Distribution	Not Included	Not Included	Not Included	Not Included	* Gaslets and Ssals only - vessel/repairs excluded	
	600 KW Emergency Generator	Removed	Basement	AST-1 Building 11 /AST2- Various Tanks & MFC-E	Not Included	Not Included	Not Included	Not Included		
	2,000 Gallon Fuel Oil Tank	Removed	Basement	AST-1 Building 11 /AST2- Various Tanks & MFC-E	Not Included	Not Included	Not Included	Not Included		
	Air Compressor - Control Air Piping	Existing	Basement	Control Air	Included	Included	Included	Included		
	Electrical Service Item Description									
	36 KV Utility Service Switchgear (NEMA 3B)		Outside	Utility Service	Included	Included	Not Included	Not Included	Maintenance Only. No Repair or Replace	
	36 KV to 5KV Step Down Transformer		Outside	OIA Campus Power	Included	Included	Not Included	Not Included	Maintenance Only. No Repair or Replace	
	5 KV Utility Service Switchgear (NEMA 3)	SG-1	Basement	ROBE Incoming, Cogen Incoming, Circuits 2160 & 2061	Included	Included	Not Included	Not Included	Maintenance Only. No Repair or Replace	
Automatic Transfer Switch (ATS, ATS2)	Removed	Basement	OIA 2 and 5/11	Included	Included	Not Included	Not Included	Maintenance Only. No Repair or Replace		
Backhaul Protective Team Gear Batteries	Existing	Basement	Emergency Generator	Not Included	Not Included	Not Included	Not Included	Maintenance Only. No Repair or Replace		
2 DC Power System Switch Gear Batteries	Existing	Basement	Utility Service	Included	Included	Included	Included			
Control Service Item Description										
Steam/Hot Water Motors		Basement	Billing Meters	Included	Included	Included	Included	Included		
Steam/Hot Water Valves		Basement	Controlling Valves	Included	Included	Included	Included	Included		
Siemens Automation Equipment		Basement	Gas Collection	Included	Included	Included	Included	Included		
Siemens 5500 Utility Meter		Basement	Billing Meters	Included	Included	Included	Included	Included	* Control panels are related with limited repair parts. Upgrades not included	
01A Distribution Between Buildings										
Service Item Description	Tag	Location	Service	Item Covered Under Scope of Work	Preventive Maint	Repair	Replacement	Notes		
Fan Schedule										
Plant Exhaust	FF-1,2,3	Roof	Exhaust Air from Cogen Equip Rm	Included	Included	Included	Included	Included		
Cogen Rm Make-up Air	MAF-1,2,3,4	Roof	Make-up Air to Cogen Equip Rm	Included	Included	Included	Included	Included		
Steam Boiler	B-1,2,3,4	Boiler Rm	Steam Production for MNP Curt	Included	Included	Not Included	Not Included	Not Included		
Steam Boiler (Added to Plant by 381)	B-4	Boiler Rm	Steam Production for MNP Curt	Included	Included	Not Included	Not Included	Not Included		
Condensate Receiver	Boilers 1-4	Boiler Rm	Condensate Collection	Included	Included	Included*	Not Included	Not Included	* Vessel repairs not included	
Prepare and Prime Heat Exchanger										
Jacket Water Heat Recovery	HK-1,2,3	Cogen Equip Rm	Eng HW Recovery	Included	Included	Included	Included	Included		
Hot Water Loop	HW-1	Cogen Equip Rm	HW from Eng Recovery to Storage	Included	Included	Included	Included	Included		
Blowdown Tank Makeup	HT-1	Cogen Equip Rm	Thermal Expansion in HW Loops	Included	Included	Included	Included	Included	* Vessel repairs not included	
Evaporation Tank	EC-1,2,3	Cogen Equip Rm	Heat Recovery Boilers	Included	Included	Included	Included	Included	* Non catastrophic repairs only. All manufacturer recommended overhulls handled as a separate proposal	
Heat Recovery Steam Generator	HRS-1,2	Cogen Equip Rm	Exhaust Motor Reduction	Included	Included	Included	Included	Included	Removed from service	
Engine Exhaust Silencer	ES-1,2	Cogen Equip Rm	Eng HW Refrigeration if not required	Included	Included	Included	Included	Included	Non Catastrophic repairs only	
Dry Cooler	DC-1,2	Outside Bldg	Engine After Cooler Loop Cooling	Included	Included	Included	Included	Included		
Cooling Tower	CT-1	Outside Bldg	Engine After Cooler Loop Cooling	Included	Included	Included	Included	Included		
Pumps										
Jacket Water Heat Recovery	CGP-1,2,3	Cogen Equip Rm	Jacket Water Pumps	Included	Included	Included	Included	Included		
After Cooler Loop	ACP-1A,1B	Cogen Equip Rm	After Cooler Pumps	Included	Included	Included	Included	Included		
Hot Water Loop	HW-1	Cogen Equip Rm	High Pressure Condensate Pump	Included	Included	Included	Included	Included		
High Pressure Condensate Pump	DHP-1,2	Boiler Rm	High Pressure Condensate Pump	Included	Included	Included	Included	Included		
Drain Abatement Pump	DAP-1,2,3	Boiler Rm	Fuel Oil Supply Pump	Included	Included	Included	Included	Included		
Fuel Oil Pumps	POP-1,2	Boiler Rm	High Pressure Condensate	Included	Included	Included	Included	Included		
Condensate Pumps	CP-1,2,3	Boiler Rm	Return Air from condensate	Not Included	Not Included	Not Included	Not Included	Not Included		
Catalytic Converter	CC-1,2,3	Cogen Equip Rm	Fuel Oil Storage	Included	Included	Included	Included	Included		
Dispersation Tank	DT-1	Boiler Rm	Local, tank and pressure controls	Included	Included	Included	Included	Included		
Fuel Oil Tank			Emergency power for cogen auxiliary's	Not Included	Included	Included	Included	Included	* Vessel repairs not included	
DA Tank and Fuel Oil Tank Controls										
New 150 KW backup generator										
Beckwith & Schweitzer Protection Relays										

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EXHIBIT A-1

EXHIBIT A (to Agreement) Total Equipment Schedule (20191118)FNMAJ.sxk

Monroe County Cogen Ops and Maint Agreement
EXHIBIT A - EQUIPMENT SCHEDULE

Service Item Description (cont'd)	Tag	Location	Service	Item Covered Under Scope of Work	Preventive Maint	Repair	Replacement	Notes
Electrical Energy Switchgear/Control System/Generator Breakers	T-1A	Cogen Equip Rm	MDR (600 Amp Distribution Panel)	Included	Included	Not Included	Not Included	Maintenance only
Main Distribution Center								
Motor Control Center-A	MCC-A	Cogen Equip Rm	Hot Water Pumps/Heat Recovery Pumps	Included	Included	Not Included	Not Included	Maintenance only
Motor Control Center-E	MCC-E	Cogen Equip Rm	CGP, 1, 2, 3, ACT-1A, 1B, 81, 2, 3, 4, FCP-1, 2	Included	Included	Not Included	Not Included	Maintenance only
Heating/Ventilation Panel	HV-1	Cogen Equip Rm	Make-up Air, Exhaust Fans and Engine Block Heater	Included	Included	Not Included	Not Included	Maintenance only
Low Voltage Panel	LV-1	Cogen Equip Rm	120 V Service in Building	Included	Included	Not Included	Not Included	Maintenance only
Emergency Low Voltage Panel	MCC-E-LVP	Cogen Equip Rm	Emergency Lights/UPS Battery Chargers	Included	Included	Not Included	Not Included	Maintenance only
Automatic Transfer Switch	ATS	Cogen Equip Rm	Emergency Diesel Gen with MCC-E	Included	Included	Not Included	Not Included	Maintenance only
Motor Starters	25	Cogen Equip Rm	Various Motor Control Centers	Included	Included	Not Included	Not Included	Maintenance only
Variable Frequency Drives	9	Cogen Equip Rm	Make-up Air, Exhaust Fans Cooling Tower Fans	Included	Included	Not Included	Not Included	
01A Building 22 (Reet Building)								
Control Service Item Description	Tag	Location	Service	Item Covered Under Scope of Work	Preventive Maint	Repair	Replacement	Notes
Parallel Switchgear/Supervisory Control and Data Acquisition (SCADA)		Operations Room	Generator SCADA	Included	Included	Included	Not Included*	* Control panels are retired with limited parts. Upgrades not included.
Fire Alarm/Security System		Operations Room	Building Security and Fire	Not Included	Not Included	Not Included	Not Included*	
Siemens Analog Controls Software / Computers		Operations Room	Cogen Controls and SCADA	Included	Included	Included	Not Included*	* Control panels are retired with limited parts. Upgrades not included.
Analog Sensors & I/O from Various Motors			Utility Meters	Included	Included	Included	Included	
Steam/ Hot Water Valves			Regulating Valves	Included	Included	Included	Included	
Miscellaneous Service Item Description								
Water Treatment for Boilers and Cooling Tower			Chemical Treatment of Water Loops	Included	Included	Included	N/A	
Natural Gas Fuel for Generators			Cell for SS Oil (Fuel to NG)	Included	Included	Included	N/A	Oil included in Proposal
Consumable Oil for Generators		Outside	Boiler Fuel in case of NG disruption	Included	Not Included	Not Included	Not Included	
20000 Gallons of Diesel Fuel Storage			Cleaning and Testing Oil in Storage	Included	Included	N/A	N/A	
ACM/RCM Components for electrical and mechanical systems								
Heating, Ventilation and A/C (from Cogen Reheat)								
Building Water Consumption (Toilet, Sinks, Etc.)								
Electrical Infrastructure								
Lighting								
Building Structure								
Grounds Maintenance								
Garage Doors / Access Doors								
Routine Building Maintenance								
Hazardous Material								
Refuse Collection								

APPENDIX B

STANDARD CLAUSES FOR COUNTY CONTRACTS

The parties to the attached Agreement (hereinafter, "the Agreement") agree to be bound by the following clauses which are hereby made a part of the Agreement (the word "Contractor" herein refers to any party other than the County, whether a contractor, licenser, licensee, lessor, lessee or any other party):

Section 1. AMENDMENTS

This Agreement may be modified or amended only in writing duly executed by both parties. Any modification or amendment shall be attached to and become part of this Agreement. All notices concerning this Agreement shall be delivered in writing to the parties at the principal addresses as set forth above unless either party notifies the other of a change in address.

Section 2. INSURANCE AND FAMILY LEAVE BENEFITS

The Contractor will, at its own expense, procure and maintain a policy or policies of insurance during the term of this Agreement. The policy or policies of insurance required are standard Worker's Compensation and Disability Insurance, if required by law; professional liability and general liability insurance (including, without limitation, contractual liability) with single limits of liability in the amount of \$1,000,000 per occurrence, and \$3,000,000 aggregate coverage; automobile liability insurance in the amount of \$1,000,000 with a minimum of \$1,000,000 each occurrence, bodily injury, and property damage. Original certificates and endorsements evidencing such coverage shall be delivered to the County before final execution of this Agreement. The certificates shall indicate that such coverage will not be cancelled or materially amended in any way without thirty (30) days prior written notice to the County and original renewal certificates conforming to the requirements of this section shall be delivered to the County at least fourteen (14) days prior to the expiration of such policy or policies of insurance. The Contractor's insurance shall provide for and name Monroe County as an additional insured. All policies shall insure the County for all claims arising out of the Agreement. All policies of insurance shall be issued by companies in good financial standing duly and fully qualified and licensed to do business in New York State or otherwise acceptable to the County.

If any required insurance coverage contain aggregate limits or apply to other operations of the Operator, outside of those required by this Agreement, in the event of any incident, settlement, or judgment against that insurance which diminishes the protection of such insurance affords the COUNTY, the Operator shall take immediate steps to restore such aggregate limits or shall provide other insurance protection for such aggregate limits.

The Contractor will also provide a copy of its C.105.2 form that is specific to New York State.

Section 3. INDEMNIFICATION

The Contractor shall defend, indemnify and save harmless the County, its officers, agents, and employees from and against all liability, damages, costs or expenses, causes of actions, suits, judgments, losses, and claims of every name not described, including attorneys' fees and disbursements, brought against the County which may arise, be sustained, or occasioned directly or indirectly by any person, firm or corporation arising out of or resulting from the performance of the services by the Contractor, its employees, agents or subcontractors, the provision of any products by the Contractor, its employees, agents or subcontractors, arising from any act, omission or negligence of the Contractor, its employees, agents or subcontractors, or arising from any breach or default by the Contractor, its employees, agents



or subcontractors under the Agreement. Nothing herein is intended to relieve the County from its own negligence or misfeasance or to assume any such liability for the County by the Contractor.

Section 4. INDEPENDENT CONTRACTOR

For the purpose of this Agreement, the Contractor is and shall in all respects be considered an independent contractor. The Contractor, its individual members, directors, officers, employees and agents are not and shall not hold themselves out as, nor claim to be, an officer or employee of Monroe County nor make claim to any rights accruing thereto, including, but not limited to, Worker's Compensation, unemployment benefits, Social Security or retirement plan membership or credit.

The Contractor shall have the direct and sole responsibility for the following: payment of wages and other compensation; reimbursement of the Contractor's employees' expenses; compliance with Federal, state and local tax withholding requirements pertaining to income taxes, Worker's Compensation, Social Security, unemployment and other insurance or other statutory withholding requirements; and all obligations imposed on the employer of personnel. The County shall have no responsibility for any of the incidences of employment.

Section 5. EXECUTORY NATURE OF CONTRACT

This Agreement shall be deemed executory only to the extent of the funding available and the County shall not incur any liability beyond the funds annually budgeted therefor. The County may make reductions in this Agreement for the loss/reduction in State Aid or other sources of revenues. If this occurs, the Contractor's obligations regarding the services provided under this Agreement may be reduced correspondingly.

Section 6. NO ASSIGNMENT WITHOUT CONSENT

The Contractor shall not, in whole or in part, assign, transfer, convey, sublet, mortgage, pledge, hypothecate, grant any security interest in, or otherwise dispose of this Agreement or any of its right, title or interest herein or its power to execute the Agreement, or any part thereof to any person or entity without the prior written consent of the County.

Section 7. FEDERAL SINGLE AUDIT ACT

In the event the Contractor is a recipient through this Agreement, directly or indirectly, of any funds of or from the United States Government, Contractor agrees to comply fully with the terms and requirements of Federal Single Audit Act [Title 31 United States Code, Chapter 75], as amended from time to time. The Contractor shall comply with all requirements stated in "Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards" (Uniform Grant Guidance) Subpart F and such other circulars, interpretations, opinions, rules or regulations that may be issued in connection with the Federal Single Audit Act.

If on a cumulative basis the Contractor expends Seven Hundred and Fifty Thousand and no/100 Dollars (\$750,000.00) or more in federal funds in any fiscal year, it shall cause to have a single audit conducted, the Data Collection Form (defined in Federal Office of Management and Budget Uniform Grant Guidance) shall be submitted to the County; however, if there are findings or questioned costs related to the program that is federally funded by the County, the Contractor shall submit the complete reporting package (defined in Federal Office of Management and Budget Uniform Grant Guidance) to the County.



If on a cumulative basis the Contractor expends less than Seven Hundred and Fifty Thousand and no/100 Dollars (\$750,000.00) in federal funds in any fiscal year, it shall retain all documents relating to the federal programs for three (3) years after the close of the Contractor's fiscal year in which any payment was received from such federal programs.

All required documents must be submitted within nine (9) months of the close of the Contractor's fiscal year end to:

Monroe County Internal Audit Unit
303 County Office Building
39 West Main Street
Rochester, New York 14614

The Contractor shall, upon request of the County, provide the County such documentation, records, information and data and response to such inquiries as the County may deem necessary or appropriate and shall fully cooperate with internal and/or independent auditors designated by the County and permit such auditors to have access to, examine and copy all records, documents, reports and financial statements as the County deems necessary to assure or monitor payments to the Contractor under this Agreement.

The County's right of inspection and audit pursuant to this Agreement shall survive the payment of monies due to Contractor and shall remain in full force and effect for a period of three (3) years after the close of the Contractor's fiscal year in which any funds or payment was received from the County under this Agreement.

Section 8. RIGHT TO INSPECT

Designated representatives of the County shall have the right to monitor the provision of services under this Agreement which includes having access, at reasonable times and places, to the Contractor's employees, reports, books, records, audits and any other material relating to the delivery of such services. The Contractor agrees to maintain and retain all pertinent records related to this Agreement for a period of ten (10) years after final payment. Contractor may retain all pertinent records in electronic format provided written notice is provided to the County that such method will be used. Retention of electronic records shall be for a period of ten (10) years after final payment.

Section 9. NON-DISCRIMINATION

To the extent required by Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment because of an individual's age, race, creed, color, national origin, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, familial status, marital status or domestic violence victim status. Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, disability, sex, or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in Section 230 of the Labor Law, then, in accordance with Section 239 thereof, Contractor agrees that neither it nor its subcontractors shall by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under



this contract. The Contractor is subject to penalties by the County of \$50.00 per person per day for any violation of Section 220-e or Section 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation.

Section 10. CONTRACTOR QUALIFIED, LICENSED, ETC.

The Contractor represents and warrants to the County that it and its employees is duly and fully qualified under the laws of the state of its incorporation and of the State of New York, to undertake the activities and obligations set forth in this Agreement, that it possesses as of the date of its execution of this Agreement, and it will maintain throughout the term hereof, all necessary approvals, consents and licenses from all applicable government agencies and authority and that it has taken and secured all necessary board of directors and shareholders action and approval.

Section 11. CONFIDENTIAL INFORMATION

a. For the purpose of this Agreement, "Confidential Information" shall mean information or material proprietary to the County or designated as "Confidential Information" by the County, and not generally known by non-County personnel, which Contractor may obtain knowledge of or access to as a result of a contract for services with the County. The Confidential Information includes, without limitation, the following types of information or other information of a similar nature (whether or not reduced to writing): methods of doing business, computer programs, computer network operations and security, finances and other confidential and proprietary information belonging to the County. Confidential Information also includes any information described above which the County obtained from another party which the County treats as proprietary or designates as Confidential Information, whether or not owned or developed by the County. Information publicly known and that is generally employed by the trade at the time that Contractor learns of such information or knowledge shall not be deemed part of the Confidential Information.

1. Scope of Use

- a. Contractor shall not, without prior authorization from the County, acquire, use or copy, in whole or in part, any Confidential Information.
- b. Contractor shall not disclose, provide or otherwise make available, in whole or in part, the Confidential Information other than to those employees of Contractor who have executed a confidentiality agreement with the County, have a need to know such Confidential Information, and who have been authorized to receive such Confidential Information.
- c. Contractor shall not remove or cause to be removed, in whole or in part, from County facilities, any Confidential Information, without the prior written permission of the County.
- d. Contractor shall take all appropriate action, whether by instruction, agreement or otherwise, to insure the protection, confidentiality and security of the Confidential Information and to satisfy its obligations under this Confidentiality Agreement.

2. Nature of Obligation

Contractor acknowledges that the County, because of the unique nature of the Confidential Information, would suffer irreparable harm in the event that Contractor breaches its obligation under this Agreement in that monetary damages would be inadequate to compensate the County for such a breach. The parties agree that in such circumstances, the County shall be entitled, in addition to



monetary relief, to injunctive relief as may be necessary to restrain any continuing or further breach by Contractor, without showing or proving any actual damages sustained by the County.

3. Freedom of Information Law

This paragraph 3 of Section 11 shall apply only after written notice by the Contractor that certain information provided to the County is Contractor's Confidential Information. In the event that the County or any of the County's members, officers, agents or representatives is requested or required (by oral question, interrogatory, request for information or document in a legal proceeding, subpoena, civil investigative demand or other similar process) to disclose any Confidential Information relative to Contractor, the County shall provide Contractor with prompt written notice of any such request or requirement so that Contractor may seek a protective order or other appropriate remedy and/or waive compliance with this provision of the Agreement. Furthermore, in recognition of the fact that the County is subject to laws requiring disclosure of public documents, including the Freedom of Information Law ("FOIL"), the parties agree that in the event that the County receives a request or order for the release of Contractor's Confidential Information, the County shall provide Contractor with prompt notice thereof so that Contractor may seek a protective order or other appropriate remedy prior to such disclosure, if Contractor chooses to do so. If, in the absence of a protective order or waiver from Contractor, the County is nonetheless, in the opinion of the County Attorney and after consultation with Contractor, compelled to disclose some portion of the Contractor's confidential information, the County may disclose such information to such person without penalty under the terms of this Agreement and shall immediately advise Contractor of such disclosure.

Section 12. FEDERAL, STATE AND LOCAL LAW AND REGULATORY COMPLIANCE

a. Notwithstanding any other provision in this Agreement, the Contractor remains responsible for ensuring that any service(s) provided pursuant to this Agreement complies with all pertinent provisions, including but not limited to any and all reporting requirements, of Federal, State and local statutes, rules and regulations, including without limitation, Title VI of the Civil Rights Act of 1964 (CRA Title VI), Federal Executive Order 13166, Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA).

b. The Contractor is responsible for ensuring compliance with New York State Labor Law Section 201-g and Executive Law Section 296-d. Upon request by the County, the Contractor shall provide evidence of compliance with the sexual harassment training required under Labor Law Section 201-g for all its employees performing work under this Agreement.

c. To the extent that State-funds/State-authorized payments (SF/SAP) received are used to pay for program services by covered providers, any subcontractors or sub-awardees shall be made aware of the provisions of the regulations of 9 NYCRR Part 6157 - "Limits on Administrative Expenses and Executive Compensation". Additionally, Contractor and any subcontractors shall review as appropriate Executive Order No. 38, which can be located at <http://executiveorder38.ny.gov>.



Section 13. LAW

This Agreement shall be governed by and under the laws of the State of New York without regard or reference to its conflict of law principles. In the event that a dispute arises between the parties, venue for the resolution of such dispute shall be the County of Monroe, New York.

Section 14. NO-WAIVER

In the event that the terms and conditions of this Agreement are not strictly enforced by the County, such non-enforcement shall not act as or be deemed to act as a waiver or modification of this Agreement, nor shall such non-enforcement prevent the County from enforcing each and every term of this Agreement thereafter.

Section 15. SEVERABILITY

If any provision of this Agreement is held invalid by a court of law, the remainder of this Agreement shall not be affected thereby if such remainder would then continue to conform to the laws of the State of New York.

Section 16. TITLE TO WORK

a. The title to all work performed by the Contractor and any unused materials or machinery purchased by the Contractor with funds provided by the County in order to accomplish the work hereunder shall become legally vested to the County upon the completion of the work required under this Agreement.

b. No information relative to this Agreement shall be released by the Contractor or its employees for publication, advertising or for any other purpose without the prior written approval of the County. The Contractor hereby acknowledges that programs described herein are supported by this Agreement by the County and the Contractor agrees to state this fact in any and all publicity, publications and/or public information releases.

Section 17. WAGE AND HOURS PROVISIONS

If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither Contractor's employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law. Additionally, if this is a public work contract covered by Article 8 of the Labor Law, the Contractor understands and agrees that the filing of payrolls in a manner consistent with Subdivision 3-a of Section 220 of the Labor Law shall be a condition precedent to payment by the County of any County approved sums due and owing for work done upon the project.

Section 18. STATE FINANCE LAW PROVISIONS

a. In accordance with Section 139-d of the State Finance Law, if this Agreement was awarded based upon the submission of bids, Contractor affirms, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. Contractor further affirms



that, at the time Contractor submitted its bid, an authorized and responsible person executed and delivered to the County a non-collusive bidding certification on Contractor's behalf.

b. To the extent this Agreement is a "procurement contract" as defined by State Finance Law Sections 139-j and 139-k, by signing this Agreement the Contractor certifies and affirms that all disclosures made in accordance with State Finance Law Sections 139-j and 139-k are complete, true and accurate. In the event such certification is found to be intentionally false or intentionally incomplete, the County may terminate this Agreement by providing written notification to the Contractor in accordance with the terms of the Agreement.

Section 19. MISCELLANEOUS

a. The Contractor agrees to comply with all confidentiality and access to information requirements in Federal, State and local laws and regulations.

b. This Agreement constitutes the entire agreement between the County and the Contractor and supersedes any and all prior agreements between the parties hereto for the services herein to be provided.

c. Attached to this Agreement and incorporated herein is the Certification Regarding Debarment, Suspension and Responsibility/Certification Regarding Monroe County Procurement Policy and Consequences for Violation.

d. The Contractor agrees that this Agreement may be made available to the public and searchable online in a digital format.

-----END OF PAGE-----



EXHIBIT B

Designated Representatives

MONROE COUNTY

William M. Daly, P.E.
Department of Environmental Services
50 West Main Street, Suite 7100
Rochester, NY 14614-1228
Phone: (585) 753-7538
E-Mail: williamdaly@monroecounty.gov

and

Sean P. Murphy, P.E.
Department of Environmental Services
50 West Main Street, Suite 7100
Rochester, NY 14614-1228
Phone: (585) 753-7541
E-Mail: seanmurphy@monroecounty.gov

OPERATOR

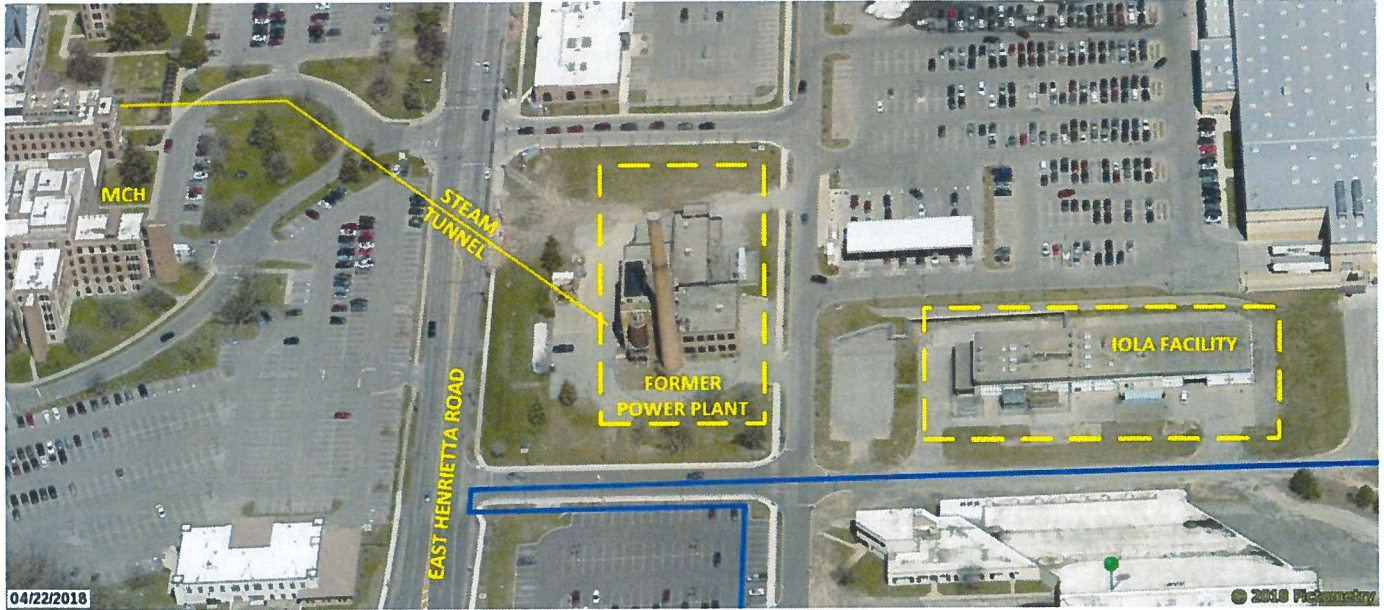
Thomas Broderick
Siemens Industry, Inc.
50 Methodist Hill Drive, Suite 1500
Rochester, NY 14623
Phone: (585) 613-2830
E-Mail: tom.broderick@siemens.com

ROCHESTER GAS & ELECTRIC CORPORATION

Tim Heckman
Marketing & Sales Department
89 East Avenue, 3rd Floor
Rochester, NY 14649
Phone: (585) 771-2290
E-Mail: tim.heckman@rge.com

EXHIBIT C

IOLA Powerhouse Site Plan



MONROE COUNTY CLERK'S OFFICE

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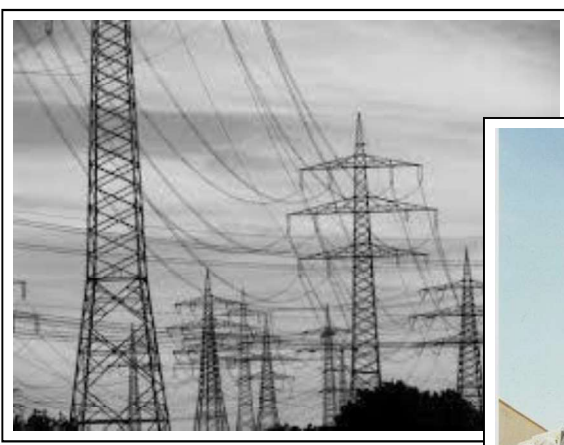
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NIAGARA TRANSFORMER CORP.
Dependable. Power. Solutions.



Liquid Immersed Power and Regulating Transformers
Installation • Operation • Maintenance

An ISO 9001 2008 approved company

NTIB 600 – 2015

Introduction

This manual is intended to assist competent technical personnel in the installation, operation and maintenance of liquid filled transformers manufactured by Niagara Transformer Corp.

The instructions contained in this document do not cover all variations or configurations of equipment. Nor do these instructions provide for every possible contingency that may be encountered during installation, operation, and service.

*The appendices of this manual contain additional **order specific** instructions and data, supplementing the general information provided in the body of the manual.*

If additional information or assistance is required, please contact:

Niagara Transformer Corp.

1747 Dale Road
Buffalo, New York 14225

Phone: (716) 896-6500

Fax: (716) 896-8871

Website: niagaratransformer.com



The instructions contained in this manual are not a substitute for proper training and experience in the safe installation and operation of the equipment described.

Proprietary Statement

This manual contains proprietary information of Niagara Transformer Corp. It is intended solely for the information and use of parties operating and maintaining the equipment described herein. Such proprietary information may not be used, reproduced, or disclosed to any other parties for any other purpose without the expressed written consent and authorization of Niagara Transformer Corp.

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Appendices

The appendices of this manual contain additional, **order specific** instructions, data and reference material for the installation, maintenance and operation of the liquid immersed transformer purchased.

The appendices form an integral part of this instruction manual, and as such, must be reviewed thoroughly in preparation for installation, operation and maintenance of the transformer.

A table of contents is provided on the first page of each appendix section.

Appendix "A" Instructions prepared by Niagara Transformer Corp. These include but are not limited to instructions for component installation, process and operational guidelines.

Appendix "B" Documentation provided by suppliers and manufacturers of the components and materials used in the manufacture of the transformer by Niagara Transformer. These include but are not limited to installation, testing, handling, safety and technical data.

Appendix "C" Drawings prepared by Niagara Transformer for the installation and maintenance of various order specific component assemblies

1 Safety

These instructions are not intended to be a substitute for proper training and experience in the safe installation, operation and maintenance of liquid filled substation and power transformers.

1.1 Safety preparation

1.1.1 Check your supplies and equipment

Read and reference this Installation, Operation and Maintenance manual NTIB 600 to prepare for and determine the equipment and supplies necessary for the work to be performed. Check all tools and supplies before beginning work. Ensure equipment is in good working order, and all required materials are readily available.

- a) Use quality, hardened tools in good condition. Do not use any tools that have been coated and may peel or chip during normal use. Tools with moving parts must be riveted, welded and/or have locked threads to prevent disassembly. Hammers, screwdrivers etc. must have one piece-molded plastic or fiberglass handles. Tags and labels should be removed from tooling. If tooling ID is necessary, use non-metallic material, secured with nonconductive tape.
- a) Prepare a checklist of all tools and materials that will be used inside the transformer and verify all items have been removed from the transformer after work has been completed.
- b) Tie off wrenches and other hand tools before entering the tank.
- c) Enter the transformer wearing clean, dry clothing, including clean cloth or nitrile rubber overshoes. Empty all pockets and remove loose objects such as ID tags, buttons, watches, rings etc.
- d) Do not open the transformer when the weather is inclement, or when condensation is observed on interior surfaces of the transformer.
- e) Use dry air with a dew point of less than minus 40°C to ventilate the inside of the tank in preparation for and during service.

1.1.2 Protect yourself

- a) Observe all safe practices and procedure regulations established by your employer.
- b) Wear all protective gear and clothing (boots, helmets, gloves, masks, goggles, and safety glasses) supplied by your employer or required for safety on the job.
- c) Follow manufacturer's instructions when installing or using any apparatus or attachments. Observe all precautions recommended in manufacturer's literature.
- d) Handle all electrical equipment with respect. Make sure you know circuit and load current conditions before operating or servicing a system-connected transformer.


 **Warning:** Niagara transformers are shipped with a **nitrogen** blanket in the gas space above the liquid level. **Nitrogen gas will not support life.** Before entering the transformer, purge the gas space with dry air. Failure to do so could result in death or injury. Always enter a transformer tank using O.S.H.A. vessel entry procedures.



Figure 1 – Warning Label - Confined Space (applied to all transformer tanks)



IEEE C57.93 CAUTION

After the access-hole cover is removed, the transformer should not be entered until the shipping gas (including dry air) is completely purged with breathable dry air that has a maximum dew point of - 45 °C. The oxygen content must be between 19.5% and 23% before entering the tank. Carbon monoxide levels should also be monitored and maintained at a level less than 25 ppm. The lower explosive limit (LEL) should be less than 20%. This replacement of gas with dry breathable air is necessary to provide sufficient oxygen to maintain good air quality and sustain life. If the unit was initially shipped in dry nitrogen, there is a possibility of trapped nitrogen pockets. In this case, a sufficient vacuum should be held for a predetermined period of time and the vacuum released with and refilled with dry breathable air. Shipping gas can be effectively removed from the tank by temporarily filling with dry oil, or by partially evacuating the tank to remove the shipping gas.

1.1.3 Moving the transformer

Before moving the transformer, check the total weight of the equipment being lifted (refer to transformer nameplate) and check the condition and capacity of all lifting and hoisting equipment. Do not use worn, frayed or damaged hooks, cables, or slings. **Do not use forklifts or cranes with load capacity less than the weight of the transformer.**

Moving heavy equipment such as power transformers, switchgear and related parts should only be undertaken by experienced certified operators and riggers.



Caution: When handling partially or fully assembled transformers be aware that the center of gravity for the mass being handled changes as liquid and components are added or removed. Large heavy, non-removable components, such as On-Load Tap-Changing equipment, significantly affect the transformer center of gravity. The presence of this equipment and/or other heavy components must be considered before removing or adding other parts that may create an unbalanced condition.

1.1.4 Transformer mounting

The transformer must be installed on a level pad or foundation, properly sized for the application. Anchoring of the transformer to the pad is recommended. The method of anchoring is typically specified by the customer as determined by site conditions and regulations, particularly if bolting is required. Bolting, cleating, or welding to steel supports are the most common forms of anchoring. All anchoring must be designed to suit the physical size, mass and location of the transformer.

1.1.5 Make sure the tank is grounded

Ground the tank before making any other system connection. The transformer ground pads must be connected to a permanent, low-impedance ground.

1.1.6 Clean all bushings & terminals

Clean bushings, bushing wells, terminal lugs, and all connection points before making connections. Remove all dirt, grease, or foreign matter.

1.1.7 Make neutral connections first

Connect transformer neutral connections to system neutrals before other system connections.

1.1.8 Keep unused leads isolated from system wiring

Insulate all unused leads from ground and from all other leads and connections.

1.1.9 Observe manufacturer's instructions

Follow manufacturer's instructions for installing accessories or attachments. Make sure all connectors (permanent or separable) are correctly rated for the application.

1.1.10 Check insulating fluid level

Make sure the insulating fluid is at the proper level before the transformer is energized.

1.2 Safety during operation

1.2.1 Do Not Exceed Transformer Ratings

Transformers are designed for loading in accordance with IEEE/IEEE C57.91. Order specific design ratings for each transformer are provided on the transformer nameplate. Refer to IEEE/IEEE C57.91 for information on the risks associated with the application of loads in excess of the nameplate rating.

1.2.2 De-energize the transformer before operating accessories that are not designed to break load.


1.2.3 De-energized tap changer operation


De-energize the transformer before operating a tap changer designed for de-energized operation.

1.2.4 Dual voltage switches or internal link boards

The transformer **must be de-energized** before operating a dual-voltage switch or internal link board. Switch and link board settings, including tap changer position are shown on the transformer nameplate. **Confirm all switch and/or link board settings are correct for the required voltage before re-energizing the transformer.**

 **Warning:** Refer to section 1.3.2 before breaking the tank seal to access an internal link board.

 **Warning:** If an internal link board, dual-voltage switch or delta-wye switch is positioned to connect the transformer windings in parallel, the de-energized tap changer(s) must be set in the position shown on the transformer nameplate. A de-energized tap changer is not always used to adjust the transformer voltage when the transformer windings are connected in parallel. Use the information provided on the transformer nameplate to verify the position of all switches and/or link boards is correct (for the voltage required) before re-energizing the transformer.

 **IEEE C57.93 CAUTION**
The transformer must be de-energized before any de-energized tap changer, series-parallel, dual-voltage, or delta-wye switches are operated. Attempting to change any de-energized tap changer, series-parallel, dual voltage, or delta-wye switches on an energized transformer will result in damage to the equipment and possible serious personal injury.

1.2.5 Dry-well non-load-break fuse holders:


The transformer must be **de-energized** before removing or installing a fuse holder cap. Check the fuse holder before reinstallation; do not exceed the fuse holder rating.

1.2.6 Internal fusing

The transformer must be **de-energized** before opening the transformer tank to service internal fuses. Do not attempt to open an energized transformer.

1.2.7 Separable disconnect bushings

De-energize the transformer before disconnecting **dead break** separable bushing / elbow assemblies.

 **Warning:** Operate all **load break** equipment including **load break bushing / elbow assemblies** with **caution**. Be aware of all circuit connections, circuit conditions and function of the all equipment. Use protective clothing and/or equipment as required by the product manufacturer and local regulations.

1.2.8 Bay-0-Net fusing

Operation during a fault can generate arcing and an explosive reaction. Before operating a Bay-O-Net fuse holder read the manufacturer's instructions carefully and vent the transformer.

1.2.9 Air switches & fusing

In-air fusing or switches may be energized even when in the "open" position. Read the manufacturer's instructions carefully before operation.

1.2.10 Internal load-break switches

An internal load break switch is designed to interrupt **rated current only**; the switch is not designed to interrupt fault currents. Do not exceed switch ratings.


1.3 Safety during repair

1.3.1 De-energize and disconnect the transformer

Never attempt to repair a transformer that is system connected. De-energize, disconnect and isolate the transformer before attempting any service or repair.

1.3.2 If internal service is necessary any internal tank pressure (positive or negative) must be relieved.

Before breaking the tank seal in any way such as opening an inspection port, oil level plug, manhole cover or Bay-O-Net fuse holder any internal tank pressure must be reduced to zero. This can be done by partially opening a liquid fill plug located above the liquid level, opening the gas sampler the pressure-vacuum bleeder or activating the pressure relief device. **Internal tank pressure must be reduced to zero.**

 **Caution:** Vented gases may be combustible.



 **Warning:** Niagara transformers are shipped with a **nitrogen** blanket in the gas space above the liquid level. **Nitrogen gas will not support life.** Before entering the transformer, purge the gas space with dry air. Failure to do so could result in death or injury. Always enter a transformer tank using O.S.H.A. vessel entry procedures.



Figure 1 – Warning Label - Confined Space (applied to all transformer tanks)

 **IEEE C57.93 CAUTION**

After the access-hole cover is removed, the transformer should not be entered until the shipping gas (including dry air) is completely purged with breathable dry air that has a maximum dew point of - 45 °C. The oxygen content must be between 19.5% and 23% before entering the tank. Carbon monoxide levels should also be monitored and maintained at a level less than 25 ppm. The lower explosive limit (LEL) should be less than 20%. This replacement of gas with dry breathable air is necessary to provide sufficient oxygen to maintain good air quality and sustain life. If the unit was initially shipped in dry nitrogen, there is a possibility of trapped nitrogen pockets. In this case, a sufficient vacuum should be held for a predetermined period of time and the vacuum released with and refilled with dry breathable air. Shipping gas can be effectively removed from the tank by temporarily filling with dry oil, or by partially evacuating the tank to remove the shipping gas.

1.3.3 Protect openings in the tank seal


When the transformer tank must be opened, keep the area around the access opening clean, and take precautions to prevent foreign matter and moisture from entering the tank. Do not open the tank in wet or windy condition.

1.4 Safety - Cold Starts

Three characteristics of the insulation/coolant system must be considered relative to cold start. These are dielectric strength versus temperature, specific gravity versus temperature, and the thermal characteristics of the fluid. Most "in service" dielectric fluids exhibit a sharp drop in dielectric strength at lower temperatures as contaminants such as moisture precipitate out causing a dielectric discontinuity. If the specific gravity versus temperature curve of a fluid crosses the ice-water specific gravity versus temperature curve, free ice or free water could exist at any point in the system and cause discontinuity and possible failure.

It is prudent to energize any extremely cold transformer without load and then bring the load on slowly. Short-term, temporary, localized temperatures may exceed the normal values indicated on the transformer nameplate. At very low ambient temperatures, it will be some time before external radiators become effective, but at these low temperatures, the additional cooling should not be needed.

High fire point fluids have viscosities higher than that of mineral oil. Transformers filled with these types of fluids may require the use of an external heat source to facilitate a cold start.

 **Note:** *Cold startup procedures are affected by liquid type and temperature. Refer to the **Appendices** of this manual for specific instructions and data relating to the insulating liquid used for your order.*

2 Receiving and Handling

2.1 Receiving Inspection

Niagara transformers may be shipped completely assembled ready for installation and service, or with some components removed due to shipping limitations. It is important to thoroughly inspect the transformer and all associated components, crates and boxes prior to removing any of the equipment from the transport vehicle. Shipping documentation includes a packing list and Niagara Transformer Receiving Inspection checklist, form NTRI-2015-001, that must be used to record the receipt and condition of all items shipped and received. A copy of the completed checklist (form NTRI-2015-001) must be returned to Niagara Transformer Corp. **as part of the warranty validation process.**

2.2 Shipping damage

Niagara Transformers are manufactured to withstand reasonable shipping forces (impact, shock acceleration) expected for the mode of shipment specified during order placement. During transportation if a transformer is subjected to mechanical shock in excess of the suggested "g" level guidelines the following damage may occur:

- a) Windings/core may become displaced or distorted.
- b) Insulation between turns can be abraded which may lead to a short circuit and damaged windings.
- c) Mechanical vibrations may cause a loss of winding clamp pressure that can result in a winding collapse fault condition.
- d) Safe clearance between active components and the transformer tank may be compromised.

Visible damage sustained during shipment and/or handling may require on site repair or return to the manufacturer. Concealed damage, if undetected can lead to failure, within or beyond the warranty period.

2.3 Shipping forces

- a) **During Loading, Unloading and Rigging:** Generally a low occurrence rate but with potential of producing a high magnitude impact. Shocks can range from 2.5 to 10.0 g. Typical examples include lifting equipment failure, dropped transformer, poor control, and rough handling during placement.
- b) **During truck transport:** Impacts in longitudinal axis during braking operations and vertical and lateral shocks due to road conditions. Normally 0.5 to 1.0 g experienced.
- c) **Onboard a Ship:** Rolling, pitching, and yawing. Low frequency vibrations repeated at regular time intervals, range from 0.3 to 0.8 g.
- d) **Rail shipment:** Impacts are delivered in the longitudinal axis during shunting operations and vertically caused by track deformities and rail joints. Typically, 0.5 to 1.0 g, but can jump to 4.0 g during shunting operations.

2.4 Damage claims

- a) FOB destination shipments: **Shipping damage must be immediately reported to Niagara Transformer Corp., who will actively pursue a damage claim against the carrier.**
- b) FOB point of manufacture shipments: **The customer is responsible for making damage claims against the carrier, and notifying Niagara Transformer Corp. as soon as possible.**

2.5 Impact Indicators and Recorders

The use of suitable impact indicators and recorders provide the customer and manufacturer with data that can assist in determining the existence and magnitude of concealed damage that may have been sustained during shipment.

The transformer shipping documentation will indicate when these devices have been provided. When used, the condition of the indicators and/or recorder readings **must be documented when the transformer arrives at destination**. The devices must remain on the unit until it is unloaded and placed on the transformer mounting pad. Readings are noted before and after unloading from the transport vehicle. If damage is found or suspected, before or after unloading the equipment, notify Niagara Transformer Corp. immediately.

Impact recorders are to be returned to Niagara Transformer Corp. after travel data has been recorded and the device is no longer required at the installation site.

Impact loads are seldom associated with truck transport; however rail shipments can be subjected to significant impact loads during shunting operations. Transformers transported by rail are specifically designed for that mode of shipment.

2.6 Impact limits

Digital or mechanical impact recorders should measure accelerations in three (3) axes, with a recommended range of 0 to 10g. Impacts that exceed the following design limits in any of the three axes may result in damage to the transformer. Appropriate follow-up is required to ensure the transformer is suitable for installation.

- a) Impacts in excess of the three times the force of gravity (3g) are considered rough treatment. The carrier is liable for damage due to rough handling, and a detailed visual inspection is required by a Niagara Transformer representative.
- b) An impact in any direction in excess of four times the force of gravity (4g) requires external and internal inspection by qualified technical personnel.
- c) Evidence of an impact in any direction beyond five times the force of gravity (5g) will require a detailed external and internal inspection, including mechanical and electrical testing, all by qualified technical personnel. This may result in rejection of the shipment and return to the manufacturer for repair.

2.7 Niagara Transformer Receiving Inspection checklist

The Niagara Transformer Receiving Inspection checklist **NTRI-2015-001** is an important part of the shipping documentation included with each transformer.


The form, shown in **Figure 2**, must be completed and a copy returned to Niagara Transformer as part of the **warranty validation process**. A useable copy of form NTRI-2015-001 is provided as the last page of this manual.




Inspection Warnings

- a) Relieve any internal pressure, positive or negative, inside the transformer tank before attempting to loosen and remove the inspection opening cover. Internal tank pressure must be reduced to zero.
- b) When it is necessary to open the transformer use the manhole/inspection openings provided on the tank cover. Minimize exposure of the transformer interior to the atmosphere. Open only one manhole at a time whenever possible. Cover open manholes with clean plastic sheeting and/or tarps to prevent the entrance of moisture and foreign matter.
Open the transformer in dry weather conditions. Do not open the unit in wet weather or if there is a threat of precipitation. The relative humidity of the air should be 80% or less.

- c) The gas space in the transformer tank above the liquid level is nitrogen filled.
Nitrogen gas will not support life. Before entering the transformer, purge the gas space with dry air. Failure to do so could result in **death or injury**. Use O.S.H.A. vessel entry procedures. Purge all air supply hoses to ensure removal of moisture and foreign matter before use.
- d) Vented gases may be combustible.



NIAGARA TRANSFORMER CORP.
 Dependable. Power. Solutions.



Receiving Inspection

checklist for receiving liquid filled transformers

Serial No: _____ Date: _____

Receiver: _____

Transport: Truck Rail Ship Other _____

Condition:

- Transformer received in good condition
- Hold downs and blocking intact and tight
- Protective coverings on bushings and gauges
- Inspect tank for paint damage, dents, leaks and damaged fittings
- Inspect cooling radiators (on transformer, or in crates) for paint damage, dents, cracked welds, leaks if liquid filled
- Check for chipped or cracked bushing porcelains - on transformer or in crates.
- All components, including additional liquid, received in good condition
- Record signs of rough handling
- Damages and shortages noted on freight bill by receiver
- Damage photos taken

Readings:

- Record transformer tank pressure PSI
- Record liquid temperature °C
- Record liquid level in main tank - mark gauge reading on Figure 1 or supply photo
- Record liquid level in on-load tap-changer (if supplied) - mark gauge reading on Figure 2 or supply photo
- Record position of de-energized tap changer(s)
- Record position of On-Load Tap-Changer (if supplied)
- Identify and record position of other operable switches
- Record core meggar reading (if accessible)

Impact Ind:

- Impact indicators armed / tripped
- Impact recorder(s) stopped, signed off and dated
- Impact recorder(s) removed and returned to factory

Other:

- Cabinet doors closed / sealed
- Liquid and components stored indoors
- This document completed and copy sent to Niagara Transformer Corp.
- Installer Qualifications approved by Niagara Transformer Corp. (if assembly is required)

Notes: _____

Signature: _____ Date: _____

A copy of this completed form must be sent to Niagara Transformer Corporation as part of the warranty validation process.
 Niagara Transformer Corporation P.O. Box 233, 1747 Dale Road, Buffalo, NY 14225
 Toll-Free: 800-817-5652 • Phone: 716-896-6500 • Fax: 716-896-8871

form: NTRI-2015-001 Rev C

Figure 2 – Transformer Receiving Inspection checklist (NTR-2015-001)

2.8 Handling

Lifting, jacking and towing facilities are provided on all transformers in accordance with IEEE standard C57.12.10.

Lifting and jacking provisions are designed to provide a safety factor of five (5), based on the ratio of the ultimate stress of the material to the working stress. Working stress is defined as the maximum combined stress developed in the component by the static load being lifted. Towing provisions are designed for a safety factor of two (2).

Lifting lugs are provided for the complete transformer, the transformer tank cover and for the core and coil assemblies.

All lift facilities are designed for use with a **minimum** four (4) vertical straps or cables.

Lifting lugs provided on the tank cover are designed to lift the **tank cover only**.

When lifting the complete transformer, the tank cover must be securely fastened in place. Transformer lifting lugs include holes for guying attachment. **Do not use the guying holes for lifting.**

Lugs designed for lifting the complete transformer are located at the top of the tank, near the tank corners. All lugs must bear the lifting forces simultaneously. Do not attach lifting equipment to any points other than the designated lifting lugs

The use of spreader or lifting beams is recommended to keep lifting cables/straps as close to vertical as possible and reduce the possibility of damage to the tank and other component.

Sling angles must not exceed 30 degrees from vertical.

During handling, the transformer should not be allowed to tilt more than fifteen (15) degrees from vertical.

Caution: When handling partially or fully assembled transformers be aware that the center of gravity for the mass being handled changes as liquid and components are added or removed.

Caution: Transformer weight and liquid weight/volumes are shown on the outline drawing and the transformer rating plate. Ensure all equipment that will be used to handle the transformer and related components are suitably rated for the loads involved. Lifting equipment must have a minimum manufacturer's safety rating of five (5) times load weight.

Caution: Attach crane cable/slugs to all lifting lugs provided on the transformer tank, unless noted otherwise by the manufacturer. **Do not use a two-point lift; a four-point lift is the minimum requirement. Do not attempt to lift the transformer by placing a continuous loop of cable or chain around two lifting lugs.**

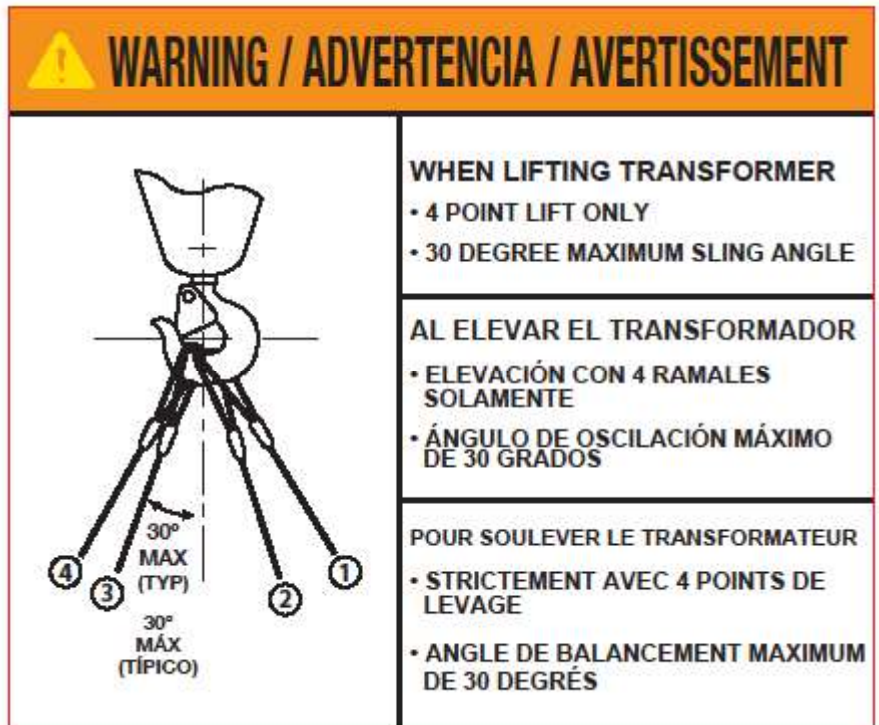


Figure 3 – Warning Label - Four Point Lift (applied to all transformer tanks)



Figure 4 – Caution Label – Lift and Tie down Instruction (applied to all transformer tanks)

Most transformers can be moved safely on rollers or skid plates when a crane lift is not possible. When jacking the transformer to position rollers under the base, use at least two jacks under adjacent jacking provisions to raise the transformer evenly.

When **jacking** of the transformer is required **use the designated jacking facilities only**. Do not jack under sheet-metal components, cooler assemblies, and valves etc. that are not intended for that use.


Towing equipment must use the designated attachment points provided on the transformer tank, in base members or on the jacking components. Do not attach tow cables to other parts of the transformer.


3 Storage

Ideally liquid filled transformers are assembled, inspected, tested and placed into service shortly after delivery to the installation site. When this is not possible and the transformer(s) must be placed in storage for a period of time, the following guidelines should be observed.


3.1 General guidelines:

- a) The transformer should be stored, fully assembled, at its permanent location whenever possible.
- b) The mounting surface must be level and designed to suit the transformer mass and base size.
- c) The transformer should not be stored in the presence of corrosive gases.
- d) Transformers designed for indoor use **must** be stored indoors.
- e) Maintain and clean the exterior surfaces of the transformer to protect against rust and corrosion.
- f) Bushings and other components removed for shipment must be kept in a clean dry location, in the original shipping cartons. Condenser bushings are stored in an upright position.
- g) Space heaters in switch compartments, terminal chambers, control cabinets or any other enclosures should be connected to a power source and energized. If this is not possible, or if heaters are not supplied, use desiccant packets to control moisture levels.
- h) Liquid levels must be maintained within stated design specific limits. Gas space pressure (above the liquid) must be maintained at approximately two (2) PSIG. If necessary replenish the gas space with dry nitrogen. The transformer seal must be maintained to prevent the entrance of air and moisture into the tank.


 Dry nitrogen can be added to the transformer gas space through the sampling valve of the pressure-vacuum bleeder device. When provided, the dedicated gas space purge valve should be used to replenish Nitrogen in the transformer gas space. Target value for gas space Nitrogen content is 97% (3% Oxygen or less).


 Nitrogen gas used in transformers manufactured by Niagara Transformer Corp. must meet the specification shown in **Table 1**.

- i) Perform and document periodic inspections in accordance with the following sections of this instruction.

 **Warning:** A pressure-vacuum gauge that indicates zero pressure for any length of time indicates a leak in the transformer seal that should be located and repaired.

- j) Prior to placing a transformer into service after storage, the dielectric strength and water content of the insulating liquid must be checked, and the functionality of all controls confirmed.
- k) Liquid filled transformers that have been placed into storage should be inspected weekly for the first month of storage and monthly thereafter. Document date, time of day, ambient temperature, barometric pressure, transformer liquid temperature, liquid level, tank pressure and physical condition for comparison purposes. Check heater function and other moisture controls if present. If a leak is discovered it must be repaired immediately.

 While in storage, the gas space pressure in the transformer tank may increase or decrease slightly due to changes in the ambient conditions that the transformer is exposed to. Liquid filled transformers are supplied with a pressure-vacuum bleeder device designed to relieve over pressures automatically. Typically this will occur when the transformer is energized and in service.

 **Note:** Transformers equipped with removable cooling radiators and radiator shut-off valves may be shipped with the cooling radiators mounted on the tank or removed, depending on shipping limitations. To reduce the risk of a leak or spill during shipping and handling, transformers shipped with the radiators mounted on the tank, are shipped with the bottom valve of each radiator fastened in the “closed” position. All top radiator valves are fastened in the “open” position. It is also recommended that the bottom radiator valves remain “closed” while the transformer is in storage.



Warning: If provided, all radiator valves must be open before the transformer is energized! Failure to open all radiator valves will result in thermal damage to the transformer. Warning labels noting such are applied to all transformer tanks supplied radiator valves.

3.1.1 Documented inspection points:

- a) Physical damage, liquid leaks. Leaks must be repaired immediately.
- b) Space heater function and/or the condition of desiccant packets.
- c) Liquid level, liquid temperature and tank pressure readings.
- d) Ambient temperature & barometric pressure.
- e) Date and time.
- f) Method and duration of storage.

Limiting dimensions, total mass and structural integrity are factors that determine the shipping configuration of liquid filled transformers. Components may be removed for shipment, liquid levels in the tank may be increased, or reduced, or the tank may be completely gas filled. The transformer outline drawing typically provides details of the shipping arrangement

3.2 Short term storage, up to 3 months

In addition to the general guidelines of Section 3.1, transformers that will be in storage for a time period of 3 months or less must be liquid or gas filled to protect the internal assembly. The transformer should be maintained as it would be in service, including regular inspections of silica gel breathers, space heater operation and control circuits if those components are installed and operational. The unit should be checked for leaks prior to and during storage. Leaks must be repaired immediately. Documented inspections should be done weekly for the first month of storage and monthly thereafter.

3.2.1 Gas filled units

Transformers that have been shipped dry (liquid drained and the transformer tank filled with dry air or dry nitrogen); can be stored in that condition for up to 3 months. Gas filled units requiring storage for a period of time **longer than 3 months** must be filled with liquid. Refer to the transformer outline and nameplate for the filling method required (vacuum or atmospheric).



Warning: If the transformer insulating liquid is FR3, the gas storage medium must be dry nitrogen. All special precautions and handling instructions for FR3 fluid provided in the **Appendix B** of this manual must be followed.



Nitrogen gas used in transformers manufactured by Niagara Transformer Corp. must meet the specification shown in **Table 1**.

Table 1 – Nitrogen gas specification

Specification	ASTM D1933-1997 Type 3
Dew Point	-59°C (-75°F)
Nitrogen & rare gas	99.993%
Maximum Oxygen content	0.002%
Maximum Hydrogen content	0.005%

A significant disadvantage of prolonged storage in a dry gas medium is the gradual loss of oil impregnation in insulation components. When the unit is removed from storage and prepared for service, additional processing time is required to ensure the full dielectric strength of the insulation system has been restored. Units designed to be filled with mineral oil can be stored in dry air, rather than nitrogen. Storage in dry air reduces internal inspection and assembly times as purging the tank of inert gas and restoring dry breathable air is not necessary. Service personnel can safely enter the work space immediately. However, it should be noted that as an inert gas, Nitrogen is more compatible with (transformer) cellulose-based insulation than dry air.

Units that have been in gas storage require additional vacuum hold time, prior to liquid filling. An extended period of 24 hours is recommended. Additionally, a minimum of 72 hours stand time is required between completion of liquid filling and energizing, to restore oil impregnation of the insulation system. While in gas storage a positive gas pressure of three (3) to five (5) psi must be maintained in the transformer tank. The use of a regulated reserve gas supply is required, if not supplied with the transformer. Monitor both the reserve gas supply and tank pressure daily during the first two (2) weeks of storage. Readings should be recorded and include date, time and ambient temperature. Preferably these checks should be done at the same time each day. The time interval between inspections may be extended once a period of stability has been observed.

3.3 Extended storage for 3 to 6 months

Best practice remains storing the transformer fully assembled and operationally ready, at the installation site, on its permanent level mounting surface.

Fully or partially assembled transformers that will be in extended storage of 3 to 6 months must be liquid filled.

In addition to the general guidelines provided in section 3.1, the transformer should be maintained as it would be in service, including regular inspections of silica gel breathers, space heater operation and control circuits if those components are installed and operational. Motor powered components such as fans and pumps (if installed) should be exercised monthly for 10 to 15 minutes. Check heater function and other moisture controls if present.

The transformer should be checked for leaks prior to and during storage. Leaks must be repaired immediately.

Inspection frequency for units placed into extended storage is weekly for the first month of storage and monthly thereafter. Per section 3.1, inspection documentation should include any evidence of liquid leaks and physical damage, liquid level and temperature, tank pressure, ambient temperature, barometric pressure, date and time of day.

3.4 Long term storage - 6 months or more

Transformers, fully or partially assembled, that must be stored for periods of time in excess of six months must be liquid filled. In addition to the guidelines provided in section 3.1 of this instruction motor powered components such as fans and pumps should be exercised monthly for 10 to 15 minutes. Check heater function and other moisture controls if present. The transformer should be maintained as it would be in service, including regular inspections of silica gel breathers, space heater operation and control circuits if those components are installed and operational.

Oil quality should be checked every six (6) months.

The transformer should be checked for leaks prior to and during storage. Leaks must be repaired immediately.

Documented inspection should be done weekly for the first month of storage and monthly thereafter. Per section 3.1, document any evidence of liquid leaks and physical damage, liquid level, liquid temperature, tank pressure, ambient temperature, barometric pressure, date and time of day.

Storage of insulating liquids shipped separately in containers

Insulating liquid shipped separately in drums or other suitable containers is intended for use within 90 days of receipt. Liquid storage locations must be dry with moderate temperature variation. If containers must be stored outdoors every precaution must be taken to ensure the liquid is protected from moisture contamination.

Liquids stored for longer periods of time should be transferred to containment employing a nitrogen preservation system.

Ideally, liquid that has been in storage, especially for 90 days or more should be heat processed and degassed before being used to refill the transformer tank.

*In all cases the liquid quality must be checked and confirmed as acceptable before filling can proceed. Specifications, handling and safety information for the specific liquid used for each order is provided in **Appendix B** of this manual.*

4 Installation

4.1 Installer Qualifications

For transformers needing field erection, assembly, and testing, our warranty requires that **this work be done by qualified transformer service personnel**. Field assembly may include the handling of fluids, radiators, coolers, pumps, bushings, surge arresters, ground resistors as well as pre-commissioning electrical testing. A customer selected transformer service contractor must have a minimum of five (5) years' experience in transformer specific installation work, and **must be approved by Niagara Transformer Corp. in writing** prior to starting work. Niagara Transformer can quote installation services as an adder or can assist the customer in locating a qualified transformer service contractor in their area, if needed. Contact the factory at 1-716-896-6500 (US Eastern Time) for assistance.

4.2 Location

Mount transformers on a level, concrete pad of sufficient strength to support the weight of the complete unit. Anchoring of the transformer to the mounting pad is recommended. Provisions for anchoring vary with the size, weight, and location of the transformer.

Self-cooled transformers are dependent on the surrounding air for dissipating the heat generated when in operation. For this reason, it is essential that the location of the transformer provide adequate unobstructed ventilation. Space is also necessary for inspection and maintenance access. Allow 24 to 30 inches of unobstructed air space between adjacent transformers or between transformers and adjacent walls.

Niagara transformers are manufactured in accordance with IEEE standards. These standards provide baseline location criteria for altitude (3300 feet), and ambient temperature (30 °C average, 40 °C maximum).

Do not operate a transformer designed for these standards at higher altitudes or temperatures. If in doubt, contact the manufacturer.

Custom designs for special altitude and temperature applications are available **when specified by the customer at time of order**.

Ventilation considerations for self-cooled indoor units include room air inlets at floor level and air outlets as high as the room will permit. The number & size of the air vents depends on the rating of the transformer. In general, about 20 square feet each of inlet & outlet area is required for each 1000 kVA of transformer capacity.

4.3 Components removed for shipping

Limiting dimensions, total mass and structural integrity are factors that determine the shipping configuration of liquid filled transformers. Components may be removed for shipment, liquid levels in the tank may be increased, or reduced, or the tank may be completely gas filled. The transformer outline drawing typically provides details of the planned shipping arrangement. The bill of lading also lists the components that have been shipped separate from the transformer. Instructions for reassembly of components, common to most transformers, which may be removed for shipment, can be found in the main body of this manual. Assembly instructions for other special design options such as conservator tanks, heat exchangers, etc. are provided in **Appendix A** of this manual as required.

In addition to removal of parts, shipping limitations may also require liquid levels in the tank to be increased, reduced, or the tank to be completely gas filled. The transformer outline drawing describes the planned shipping configuration.

Typically, components removed for shipment are reassembled in the following order:



Note: The transformer ground pads must be connected to a permanent, low-impedance ground before work on the transformer can start.

- a) Cooling equipment: removable radiators, heat exchangers, and related piping.
- b) Conservator tank supports
- c) Surge arrester supports
- d) Bushings: 1) Secondary, 2) Primary, 3) Terminal lugs
- e) Neutral and other ground bus
- f) Pressure relief device (if removed)
- g) Conservator tank and fittings
- h) Cooling fans (if not preassembled)
- i) Surge protection: 1) Arresters, 2) Surge counters, 3) Ground connections
- j) Component wiring

4.3.1 Installation of Removable Cooling Radiators

Transformers are completely assembled and tested prior to shipment. The cooling radiators have been liquid filled and leak tested. When radiators are removed for shipment the radiator mounting flanges and the radiator shutoff valves (on the transformer tank) are sealed with gasketed shipping covers. Rad valves are fastened in the closed position.

Radiators should be inspected for damage when received, and when taken out of storage.

Contamination by condensation can occur if a radiator is opened when the temperature of the radiator is lower than that of the ambient air. Avoid opening a radiator under such conditions.

Radiators should be installed on the transformer the same day they are opened and inspected. Minimize the exposure of the rad interior to atmosphere. Remove the shipping covers, one at a time, and check for evidence of moisture or other foreign matter. **Do not leave the radiator open for an extended period of time.** Trace amounts of transformer liquid may be found inside the radiator. The presence of other contaminants will require flushing the radiator per section 4.2.1.2.

A typical radiator assembly is shown in **Figure 6**.



Note: Transformers equipped with removable cooling radiators and radiator shut-off valves may be shipped with the cooling radiators mounted on the tank or removed, depending on shipping limitations. To reduce the risk of a leak or spill during shipping and handling, transformers shipped with the radiators mounted on the tank, are shipped with the bottom valve of each radiator fastened in the “closed” position. All top radiator valves are fastened in the “open” position. It is also recommended that the bottom radiator valves remain “closed” while the transformer is in storage.

Figure 5 shows the orientation of the operating handle of a rad valve relative to the gate (sealing disc) being in the “open” and “closed” positions.



Warning: If provided, all radiator valves must be open before the transformer is energized! Failure to open all radiator valves will result in thermal damage to the transformer. Warning labels noting such are applied to all transformer tanks supplied radiator valves.

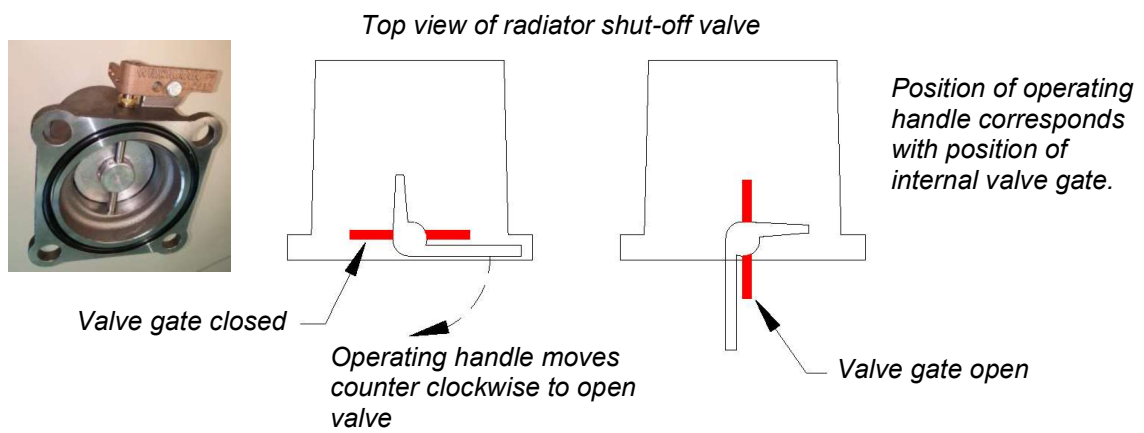


Figure 5 – Radiator Valve Handle Positions

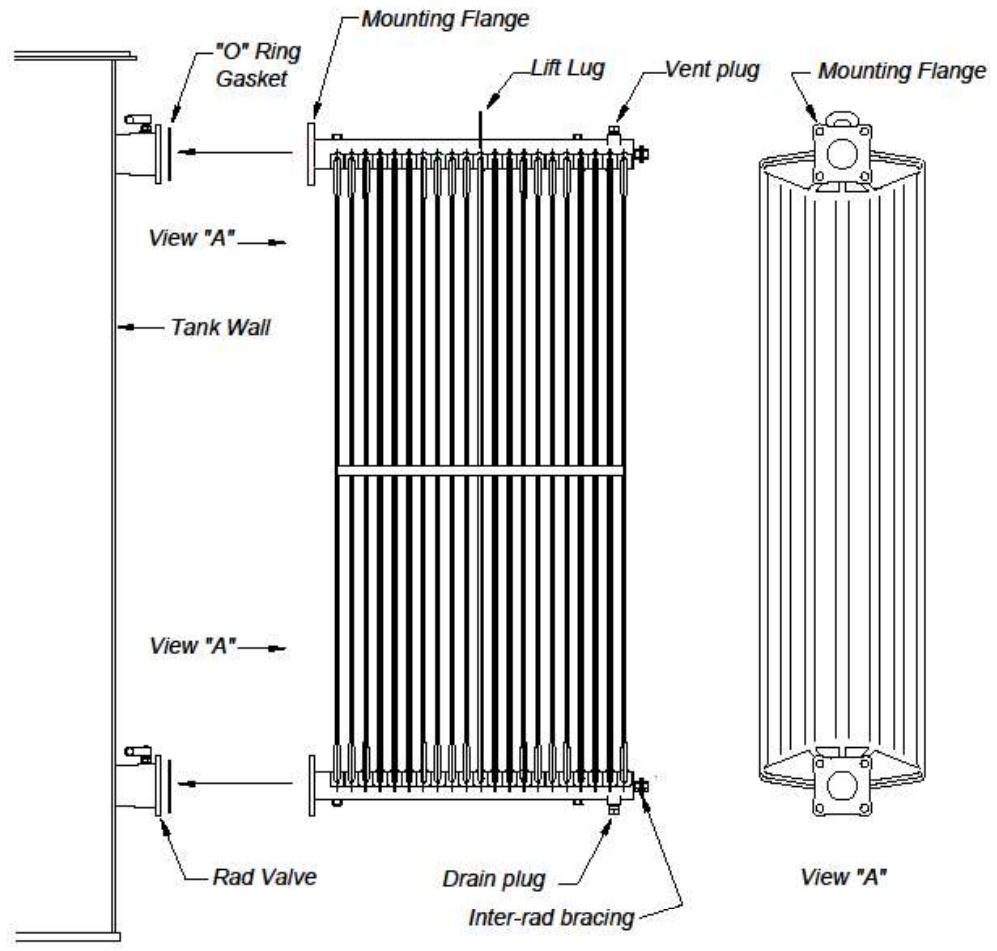


Figure 6 – Typical radiator assembly

4.3.1.1 Radiator Installation procedure



Note: During radiator installation the radiator valves must remain fastened in the closed position. Radiator valves are opened during the radiator filling process and not before. Section 4.2.1.3 outlines the steps to be followed for filling the radiators with liquid, after the rads have been installed on the transformer.

- a) Each radiator and mating valve set on the transformer tank is marked to facilitate installation.
- b) If cooling fans are supplied preassembled on any of the radiators identify the location of those radiators before starting assembly. Fan locations are shown on the transformer outline drawing.
- c) Ensure all rad shut off valves on the transformer tank are in the closed position.
- d) Remove the shipping covers one radiator at a time, as needed
- e) Inspect the interior of each radiator header tube for evidence of contamination by moisture or foreign matter. Remove dehydrating packets (if supplied), if there is evidence of contamination the radiator must be flushed out.
- f) Remove the shipping covers from the corresponding rad valves on the transformer tank. The shipping covers and gaskets can be saved for future use or recycled.
- g) Clean the gasket groove and mating surfaces of the valves and radiator mounting flanges.
- h) "O" ring gaskets are supplied for each rad flange to rad valve connection. The gasket is installed in the gasket groove of the rad valve flange. Petroleum jelly may be used (sparingly) to hold the gasket in place for assembly, and as a gasket lubricant.
- i) Lift the radiator by crane using the lifting lug provided on the top of the radiator. Handle with care to avoid damaging the radiator or rad valves.
- j) Open the bottom drain plug and allow any residual liquid to drain from the radiator.
- k) Close the bottom drain plug. Final drain plug torque values are 35 ft-lb for 3/4 inch NPT plugs and 75 ft-lb for 1 inch NPT plugs.
- l) Align the radiator mounting flanges and valves, and ensure the "O" ring gasket is properly seated and will not be pinched
- m) Corrosion resistant hardware is supplied to mount the radiators (3/4 UNC x 3 inch long bolts, washers and nuts). Hardware is to be tightened evenly in an alternating diagonal pattern as shown in **Figure 7**. Stop tightening when the spring lock washers are fully compressed and metal-to-metal contact of the mating surfaces is achieved. The final torque value applied to the 3/4 inch mounting hardware is 120 ft-lb.
- n) Install the inter-rad bracing at the ends of the radiators after all rads have been installed. The location of the bracing is shown on the transformer outline. Corrosion resistant hardware is provided. The type and size of hardware required can vary by radiator manufacturer. Longer bolts are provided for bracing bars that overlap.



Warning: Radiator damage may result if the rad bracing hardware is overtightened.

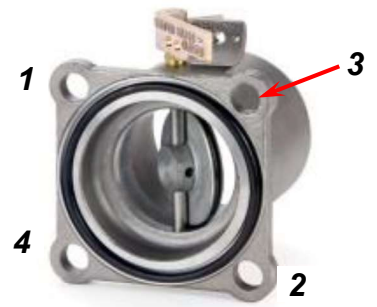


Figure 7 – Typical rad valve, hardware tightening sequence

4.3.1.2 Flushing Radiator with dielectric liquid

The interior of a cooling radiator must be flushed with transformer liquid if evidence of internal contamination is found.

- a) The radiator is flushed after it has been mounted on the transformer tank.
- b) A portion of the liquid shipped in separate containers is used for the flushing process. If the radiator makeup liquid is supplied in the transformer tank by overfilling (rather than in separate containers), a volume of liquid must be drained from the transformer tank for the flushing process. The liquid used for flushing must be stored in a separate container. The liquid is filtered during the flushing process and before it is reused in the transformer.
- c) **Do not open the radiator shut off valves.** The radiator must remain isolated from the main tank.
- d) Remove the top vent plug and bottom drain plugs from the radiator headers.
- e) Circulate clean filtered insulating fluid through the radiator, using a filter press. Flush the radiator top to bottom, and then reverse the connections flushing bottom to top.
- o) When flushing has been completed, reinstall the vent and drain pipe plugs. Seal the pipe threads with Teflon tape. Final drain plug torque values are 35 ft-lb for 3/4 inch NPT plugs and 75 ft-lb for 1 inch NPT plugs.

4.3.1.3 Filling the radiators with liquid



Warning: Radiators are filled with liquid from the main transformer tank. During this process the liquid level in the main tank must not fall below the top of the core and coil assembly.

If the radiator makeup liquid is contained in the main transformer tank (by overfilling), the radiators can be safely filled using the additional liquid provided in the main tank. The liquid level will not drop below the top of the core and coil assembly.

If the radiator makeup liquid is supplied in separate containers the liquid level in the main tank must be monitored and liquid added to the main tank as needed, during the filling operation, to prevent the liquid level from falling below the top of the core and coil assembly.

- a) Radiators are filled one at time, to control the liquid drop in the transformer tank.
- b) The center of gravity of the transformer will change as the radiators are filled with liquid. Install all radiators on the transformer tank before filling any of the radiators. If anchoring provisions are provided, the transformer must be anchored to the mounting structure before starting radiator installation and filling.
- c) Remove the vent plug from the top of the radiator.
 - d) Unbolt the bottom rad valve handle and open the valve allowing liquid to enter the rad. Bolt the rad valve handle in the open position.
 - e) Replace the top vent plug when liquid is observed through the top vent plug opening.
 - f) Unbolt the top rad valve handle and open the valve.
 - g) Monitor the liquid level in the main tank and add liquid as required per section 5.8 of this manual "Filling Transformers with Liquid".
 - h) Check for leaks around all rad valves, and the rad vent and drain plugs during the filling process and following the stand times specified in **Table 5**.

4.3.1.4 Radiator Removal

- a) Prepare liquid containment equipment.
- b) Close the top and bottom radiator valves of each radiator. Fasten the radiator valve handles in the closed position.
- c) Open the liquid drain plug at the bottom of the radiator.
- d) Open the vent plug at top of the radiator.
- e) Drain liquid from radiator.
- f) Replace both the drain and vent plugs when the radiator has been completely drained.
- g) Support the radiator with lifting equipment attached to the top lifting lug of the radiator.
- h) Remove inter-radiator bracing

- i) Remove mounting hardware from top & bottom rad valves.
- j) Slowly move the radiator away from the transformer tank.
- k) Carefully lay the radiator on its side (cooling fin edges down) on a wood pallet or other protective material suitable for storage or shipping.
- l) Remove the "O" ring gasket from the radiator valves.
- m) Cover valve and radiator flanges with gaskets and cover plates suitable for storage or shipment.

4.3.2 Bushing Installation

Cover mounted bushing are commonly removed for shipping, particularly at higher voltage and MVA ratings. Given increased current ratings and location, sidewall mounted bushings are rarely removed for shipment. If reinstallation of sidewall bushings, or accessing the tank interior through a sidewall manhole, is required, the liquid level in the tank must be lowered at least two (2) to three (3) inches below the lowest opening. Bushings are typically one of two designs, draw lead, or bottom connected.

Draw lead bushings are used for higher voltage / lower current applications that can be safely be handled a cable lead. The line conductor from the winding assembly is extended to and terminated at the top of the bushing porcelain. A terminal stud, factory installed at the end of the cable lead, is secured to the bushing porcelain by a locking pin. A gasketed top terminal cap threads onto the terminal stud sealing the complete assembly. Draw lead bushings can be installed with minimal access to the transformer tank interior.

Bottom connected bushings are used for lower voltage / higher current applications. The bushing conductor, which is integral to the bushing, is fabricated from bar or rod sized to suit the current rating of the bushing. Phase connections to the bushing, from the windings, are made with heavy cable or flexible copper straps. Installations of bottom-connected bushings require more access to the tank interior than draw lead bushings. Installers must be able to reach connection points at the bottom of the bushings, and are working with heavier connection materials. Some installations may require lowering the liquid level in the tank to facilitate installation.

A hybrid bushing, that can be configured for draw lead or bottom connection, is shown in **Figure 8**. A bottom connected, high current bushing assembly is shown in **Figure 9**.

4.3.2.1 Preparation

- a) The external body and internal conductor cavity of the bushing must be clean and dry for installation. Clean bushings with dielectric solvent.
- b) Gaskets grooves in mating surfaces must be clean and free of foreign matter
- c) Gaskets must be properly seated to ensure even clamping and a uniform seal.
- d) Conductor connections must be clean and solidly bolted.



Note: Do not use split or star type lock washers inside the transformer tank. These washers are more susceptible to fracture and breakage, leaving metal fragments inside the transformer tank. Electrical connections should be secured with more durable spring-disc lock washers

- e) Special handling and installation instructions for high voltage (condenser) bushings are included in **Appendix B** of this manual and with the bushing in its shipping container.
- f) Connection to rigid bus or tubing must include provision to allow for the thermal expansion of those parts and prevent excessive mechanical stress on the bushing.
- g) Mechanical loading on bushing termination points must not exceed the cantilever design limits of the bushing.
- h) Condenser bushings should be tested for power factor and capacitance before installation.
- i) Condenser bushings must be handled carefully maintaining an upright position to avoid creation of gas bubbles in the insulation system of the bushing.



Warning: The transformer gas space is pressurized with nitrogen gas. Relieve the internal tank pressure (positive or negative) before opening any access openings. Purge the gas space with dry air, Nitrogen gas does not support life. Enter the tank using O.S.H.A. vessel entry procedures.



IEEE C57.93 CAUTION

After the access-hole cover is removed, the transformer should not be entered until the shipping gas (including dry air) is completely purged with breathable dry air that has a maximum dew point of - 45 °C. The oxygen content must be between 19.5% and 23% before entering the tank. Carbon monoxide levels should also be monitored and maintained at a level less than 25 ppm. The lower explosive limit (LEL) should be less than 20%. This replacement of gas with dry breathable air is necessary to provide sufficient oxygen to maintain good air quality and sustain life. If the unit was initially shipped in dry nitrogen, there is a possibility of trapped nitrogen pockets. In this case, a sufficient vacuum should be held for a predetermined period of time and the vacuum released with and refilled with dry breathable air. Shipping gas can be effectively removed from the tank by temporarily filling with dry oil, or by partially evacuating the tank to remove the shipping gas.



Warning: Take precautions to avoid dropping conductors, hardware, or tools into the transformer.

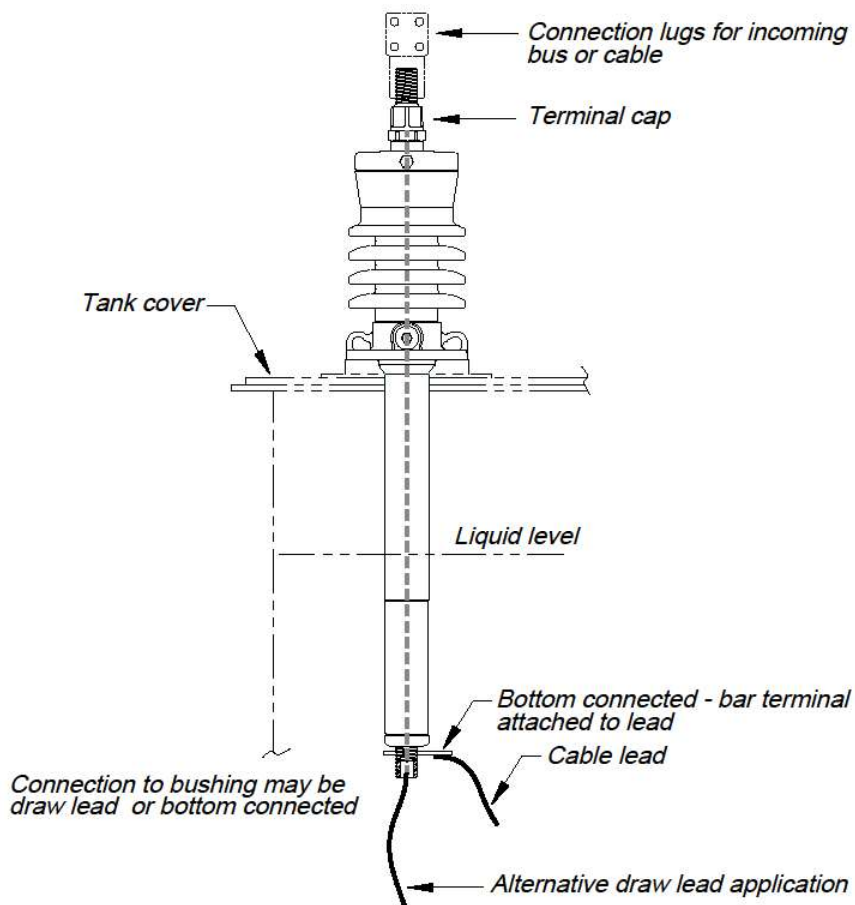


Figure 8 – Draw lead Bushing Assembly

4.3.2.2 Draw Lead Bushings - Installation

- a) Remove the shipping cover from the bushing-mounting pad. Take care to avoid damaging the gasket.
- b) Inspect the bushing gasket and replace if damaged.
- c) The internal cable leads for each draw lead bushing are fastened to the underside of the bushing flange shipping cover. The terminal stud that threads into the top terminal cap of the bushing is preassembled on the end of the lead.
- d) Remove the draw lead from the shipping cover. Take precautions to avoid dropping the lead, hardware, or tools into the transformer.
- e) Attach a pull wire to the terminal stud at the end of the lead. The wire length should be at least sixteen (16) inches longer than the length of the bushing body. Remove the top cap of the bushing and insert the wire through the bushing, from bottom to top.
- f) Pull the wire and attached draw lead through the bushing to the top of the bushing body while lowering the bushing into place on the mounting flange. When the bushing is in place on the mounting flange install the locking pin in the terminal stud (at the top of the bushing) thereby securing the lead in position. Remove the pull wire from the terminal stud / lead assembly.
- g) Secure the bushing to the tank mounting provisions with the mounting hardware provided. Tighten hardware evenly in an alternating diagonal pattern. Recommended torque values are shown in **Table 6**.
- h) Install the bushing top cap with gasket. Petroleum jelly may be used (sparingly) to hold the gasket in place, and as a gasket lubricant.

4.3.2.3 Bottom Connected Bushings - Installation

These bushings can be located on the tank cover or sidewall depending on design requirements and rating factors.

The bushings are mounted on the tank before conductors from the windings are attached to the bushing. The liquid level in the transformer tank may have to be lowered to facilitate making connections and/or prevent loss of liquid if the bushing or manhole openings are in the sidewall of the tank. Refer to **Figure 9**.

- a) Remove the shipping cover from the bushing-mounting flange. Take care to avoid damaging the gasket.
- b) Open a manhole nearest to bushing(s) being installed.
- i) Note the required orientation of the bushing spades (if any), insert the bushing into the tank mounting provision and secure in place with the mounting hardware provided. Tighten hardware evenly in an alternating diagonal pattern. Recommended torque values are shown in **Table 6**.
- c) Note the phase identification markings on the bushings and connecting leads.
- d) Fasten the leads from the winding assembly to the bottom stud or bar spade of the appropriate bushing. The connection conductors are usually heavy flexible copper straps or cable(s). The required torque values for electrical connections are shown in **Table 7**.
- e) Replace the manhole cover.
- f) Restore the liquid level following the liquid fill procedures documented in this manual.

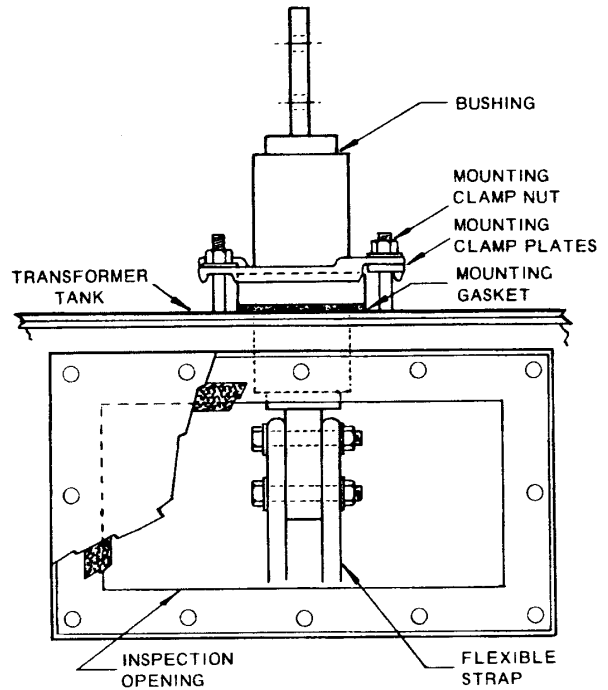


Figure 9 – Bottom Connected Bushing Assembly

4.3.3 Surge Arrester Installation

Surge arresters are installed on a transformer to protect it from over-voltage transients caused by atmospheric conditions (lightning) or switching operations. A surge arrester is connected to each phase conductor just before it enters the transformer. The opposite end of the surge arrester is connected to ground. At normal operating voltages, the surge arrester behaves like an insulator, isolating the phase conductor from ground. During a fault condition, the arrester provides a low impedance path to ground for the energy from the over-voltage transient. These two opposing characteristics are achieved through the use of a Varistor (MOV arresters), which has different resistances at different voltages.

Transformers may be supplied complete with arresters and mounting provisions, or with mounting provisions only. When arresters are supplied with the transformer, they may be removed for shipment to suit shipping limitations or to protect the components.

Arresters are installed as close as possible, electrically, to the equipment being protected. Connections to the arrester should be kept short and direct.

Arrester ground connections are made per customer specification. When not specified by the customer ground connections made at the factory are as follows:

- a) Distribution class arresters: single ground conductor (to each arrester) #6 AWG copper, grounds connected in series are made with #2/0 AWG copper conductor
- b) Intermediate and Station class arresters: single ground conductor (to each arrester) #2 AWG copper, grounds connected in series are made with #3/0 copper conductor.

Specific installation documentation covering handling, assembly, mounting and connections is provided by the surge arrester manufacturer. This documentation can be found in the arrester shipping container and in **Appendix "B"** of this manual, when arresters are supplied with the transformer.



Warning: Before connecting the arrester to an energized line;

- a) Ensure a good ground connection has been made.
- b) If an insulating base is used at the ground end of the arrester to permit use of a discharge counter, the discharge counter must be connected, or the insulating base shorted out.

4.4 Connections

4.4.1 General

- a) Connections must be made without placing undue stress on the bushing terminals. Conductors should be securely fastened in place and supported properly, with allowance for thermal expansion and contraction.
- b) Make sure that the tap connection is set correctly for the required voltage. **De-energize the transformer to change taps.**
- c) For safety reasons, transformers equipped with an internal terminal board are typically shipped connected for the higher voltage, unless specified otherwise by the customer.
- d) A secure, effective low resistance ground is essential for protection. The transformer must be grounded permanently by connecting a heavy ground cable to the ground pad located at the bottom of the tank. If the transformer is designed for operation in a solidly grounded neutral system, the neutral connection must be solidly and permanently grounded with minimum resistance.
- e) Surge arresters are recommended for every transformer installation. Properly sized arresters should be located as close as possible to the transformer terminations.
- f) The contacts of accessory devices used for alarm, protection and monitoring are wired to terminal blocks in the transformer control cabinet which is mounted on the transformer tank. Customer connections to these devices and for customer supplied power sources are housed in this cabinet.



Note: The customer is responsible for all connections to the transformer, which includes primary and secondary line connections, neutral connections, grounding, and transformer alarm, protection, and monitoring equipment outputs.

4.4.2 External Electrical Connections

The primary and secondary customer connection terminals of the transformer may be copper, aluminum or bronze alloy. The connection surfaces of these terminals are plated to resist oxidization and improve the conductivity of the bolted connection.

Supply connections should be made as follows:

- a) The plated contact surface of the bus bar, terminal or cable connector should be wiped clean. Do not use sandpaper or other abrasive cleaning methods. Avoid handling the cleaned surface as much as possible.
- b) Join the clean contact surfaces of the connection using the appropriate hardware and torque values as described in the **Fasteners** section of this manual.
- c) Heavy bus bar connections may require the use of additional spring disk washers. The quantity of washers required for specific applications is determined by the characteristics of the washers and the size of the bus. Refer to supplier documentation.
- d) Plating reduces oxidization at bolted connections; however, care must be taken to avoid galvanic corrosion between materials that are not compatible. Bars without plating, either copper or aluminum, should not be connected to silver-plated or tin-plated bars. Tin-plated bars and silver-plated bars should not be connected together. In the absence of plating, bolted joints can be protected from oxidization by the use of protective grease compounds. Plated joints can also be improved by cleaning and applying protective grease prior to assembly.



IEEE C57.93 CAUTION

If external bushing connections are made be certain there is sufficient slack in the external line connection to allow for bushing movement caused by flexing of the transformer cover and/or walls. Failure to relieve this stress at the bushing connection may result in damage to the bushing seals and loss of oil.

4.4.3 Internal Electrical Connections

Internal electrical connections are made using the same fasteners that are used for external electrical connections with the exception that the hardware is **not plated**.

Internal bus connections are cleaned prior to fastening, but are not plated. Protective greases are not used inside the transformer.



Note: Do not use split or star type lock washers inside the transformer tank. These washers are more susceptible to fracture and breakage, leaving metal fragments inside the transformer tank. Electrical connections should be secured with more durable spring-disc lock washers.

4.5 Final Inspection (before applying Voltage to the transformer)

4.5.1 Electrical inspection

- a) Correct phasing.
- b) Connections are tight and secure.
- c) Accessories tested and operational.
- d) Current transformer circuits are either shorted or connected through their load.

- e) Tap changer is operative and in correct position.

- f) Terminal board connection, if supplied, is correct for the expected output.
- g) Windings that are not intended to be grounded are not grounded. A 500-volt megger test is recommended.
- h) Winding continuity confirmed.
- i) Dielectric strength of the insulating liquid confirmed.
- j) Neutral and ground connections properly made.
- k) Pre-operational testing per this manual performed and confirms the transformer is suitable for energizing.

4.5.2 Internal inspection (if required)

- a) Check for evidence of moisture inside the tank.
- b) All accessible bolted connections are tight.
- c) Check for shifting of any parts, broken leads signs of damage.

4.5.3 External inspection

- a) Damaged paint has been repaired.
- b) The bushings are clean.
- c) All gauges and mechanical accessories are operative.
- d) Tools and other installation equipment have been removed. Check the top of the transformer.
- e) Liquid levels are correct in transformer tank and any other liquid filled compartments.
- f) The transformer tank holds positive pressure.
- g) Manhole covers have been replaced and are tightly bolted.
- h) Protective covers are closed and bolted tight.
- i) The mechanical pressure relief device is reset.
- j) Temperature indicators (liquid, winding etc.) have drag hand reset aligned with indicating pointer.
- k) All radiator valves are fastened in the **"open"** position.



Note: Transformers equipped with removable cooling radiators and radiator shut-off valves may be shipped with the cooling radiators mounted on the tank or removed, depending on shipping limitations. To reduce the risk of a leak or spill during shipping and handling, transformers shipped with the radiators mounted on the tank, are shipped with the bottom valve of each radiator fastened in the **"closed"** position. All top radiator valves are fastened in the **"open"** position. It is also recommended that the bottom radiator valves remain **"closed"** while the transformer is in storage.



Warning: If provided, all radiator valves must be open before the transformer is energized! Failure to open all radiator valves will result in thermal damage to the transformer. Warning labels noting such are applied to all transformer tanks supplied radiator valves.

4.5.4 Important Notes

- a) When it is necessary to open a liquid-filled transformer, the liquid temperature should be higher than the ambient air temperature to prevent internal condensation which can lead to transformer failure.
- b) Do not break the tank seal in fog, rain, snow, or if there is evidence of condensation on the transformer tank. The dielectric strength of the transformer liquid can be compromised, to dangerous levels, with slight increases in moisture content.
- c) **Internal tank pressure must be reduced to zero before breaking the tank seal.**
- d) Precautions must be taken to prevent dropping foreign objects or matter into the transformer. Remove pens, pencils, coins, etc. from pockets; check clothing for loose metal buttons, badges, buckles, etc. Wristwatches and jewelry should be removed.
- e) **If the transformer tank bracing is used for gas space expansion**, the gas space control valve(s) must be **closed** for vacuum processing and **open** when the transformer is in service. The valves are located near the top of the tank, on one or more walls, and are identified with a label. Refer to the transformer outline drawing to verify existence and location of the gas space control valves.
- f) Tank bracing used for gas space expansion is purged with dry nitrogen at the factory. If the bracing gas space has been opened to the atmosphere for an extended period of time, the bracing gas space must be purged with dry nitrogen to remove oxygen and moisture.

4.6 Pre-operational Testing

Following delivery, assembly and liquid filling the transformer must be tested to confirm it is ready for service. Pre-operational tests also provide benchmark data for future comparison.

Mandatory testing described below represents the minimum tests required to **validate and maintain product warranty**.

Optional tests listed below describe other tests recommended by Niagara Transformer Corp. which provide useful reference data and confirm operational readiness.

4.6.1 Mandatory testing

- a) Insulation resistance test on each winding to ground, and between phases.
- b) Power factor test on each phase to ground and between phases, in accordance with section 7 of IEEE/IEEE C57.12.90.
- c) Winding ratio test on each tap position. Transformers with Load tap changers should be tested for winding ratio on all load tap positions.
- d) Check the winding resistance of all windings and compare results with factory test results.
- e) Dielectric strength: confirm the dielectric strength of the liquid in transformer meets or exceeds minimum acceptable value.

Note: This test is mandatory if the transformer tank seal has been broken prior to energizing, or for transformers with cooling radiators that have been removed for shipping and reinstalled at site. Otherwise, this test is optional.

4.6.2 Optional testing

- a) Single phase excitation test on the rated voltage connection on HV side compared to factory test results, if applicable.
- b) Sweep Frequency Response Analysis compared to factory benchmark test results, if applicable.
- c) Operational testing of control and indicating devices such as liquid and winding temperature, control relays, gas detectors, position indicators and pressure relief etc..
- d) Power factor, interfacial tension and neutralization number of the liquid in transformer.
- e) Oxygen content and total-combustible-gas content of nitrogen gas blanket above the liquid.
- f) Power factor test on all bushings equipped with a test or capacitance tap.
- g) Dissolved gases in oil.
- h) Operational testing of auxiliary equipment such as oil-circulating pumps, fans, oil and water flow meters. All in accordance with manufacturer's instructions.

4.6.3 Periodic Tests

Niagara Transformer also recommends performing most of the preceding tests as part of a regular maintenance program to confirm proper operation and alert operators of abnormal performance issues.

4.7 Protection for Switching Device Applications

High frequency switching transients produced during switching device operation can interact with the transformer winding and the system to produce a resonant condition that could result in transformer failure. Typical high speed switching devices are SF6 and vacuum breakers, but the phenomenon is not limited to just them. Since all transformer windings and the systems they are applied to have a resonance at some frequency this type of failure can occur on any type of transformer winding. The failure produced typically occurs at the first resonance (mid-point) or the second resonance (quarter-point) in the transformer winding. This failure is different from the classical transient line end failure mode most normally expected, which is protected by surge arresters.

To protect the transformer from this type of failure, a **snubber circuit** consisting of surge capacitors and non-inductive resistors is recommended. The **snubber circuit** is applied in conjunction with surge arresters. **Surge arresters alone will not protect a transformer from a resonance failure.**

Although difficult to predict, probability plays a key role in determining the need for this type of protection. Transformers repeatedly switched on and off with vacuum breakers, and transformers closely coupled to vacuum breakers are more prone to this type of failure and should be protected. Transformers and loads with other characteristics, such as high impedance, low winding loss, high X/R ratios, or serving inductive loads are more prone to this type of failure, also. A typical example of this application is a furnace transformer.

The existence of conditions that could make the transformer vulnerable to such a failure should be discussed at the time of quotation. Niagara Transformer can recommend or arrange for a system analysis by consultants familiar with this phenomenon to determine the need for **snubber circuit protection.**

5 Operation Instructions

5.1 Startup


The following instructions are for **normal** startup conditions in an ambient temperature of -10°C or higher. Transformer startups in ambient temperatures below -10°C may require special **Cold startup procedures** to ensure a successful installation. Cold startup procedures are also affected by the type of liquid used in the transformer. Specific handling, testing and cold startup instructions for mineral oil and Envirotemp FR3 are provided in the Insulating / Cooling Liquids section of this manual. Similar documentation for other alternative liquids that may be used for a specific order can be found in Appendix B, when required.


- a) Following the application of full voltage, the transformer should stand for 2 hours without load.
- b) Check the transformer at regular intervals during the 2 hour "stand" time. The sound emitted during this time should be a steady "hum". There should not be any evidence of discharges indicated by a "ticking" sound when listening in close proximity to the tank wall.
- c) During the first 3 hours of operation under load, check the transformer for any abnormal conditions related to temperature, pressure, or noise.
- d) Niagara Transformers are shipped with a nitrogen blanket of approximately 2 PSIG above the liquid level. Sealed tank units may experience a pressure increase and possible operation of the pressure-vacuum bleeder valve before stabilizing after being in operation for a period of time.
- e) The transformer may also operate indefinitely in the vacuum range if the liquid has absorbed sufficient gas during shipment or storage, and loading conditions are light. Operation in this situation is not cause for concern provided the pressure gauge does not remain on zero.
- f) A continuous gauge reading of zero indicates the presence of a leak, which should be located and repaired. Refer to the Maintenance section of this manual for repair instructions. The pressure-vacuum gauge should be checked daily for the first week of operation, then monthly thereafter. The pressure vacuum bleeder device is preset at the factory to operate at pressures of 8 PSI positive and 5 PSI negative.

5.2 Loading

The full load **temperature rise** of a transformer is shown on the transformer nameplate. Transformers are suitable for **full load operation** under the following standard conditions.

- a) The ambient temperature does not exceed 40 °C or average more than 30 °C in one 24-hour period.
- b) The site elevation does not exceed 3300 feet (1000 meters). IEEE C57.12.00 provides **de-rating** factors for installations at higher altitudes.

 **Note:** Refer to the transformer nameplate to determine the ratings of units designed for operation in non-standard conditions such as altitudes **above** 3300 ft., or unusual ambient temperatures.

 **Note:** The transformer temperature rise, above ambient, is specified by customer at time of order. **Continuous overloads** can shorten the life of the transformer. Refer to the IEEE loading guide C57.92 for permissible short time overloads.

6 Maintenance

6.1 Periodic inspection

Check all gauges and indicators regularly to ensure the transformer is operating properly within the limits of safe operation.

The liquid temperature gauge indicates the actual temperature of the liquid. That value is the sum of the ambient temperature and the rise in liquid temperature during operation. For example, a fully loaded transformer designed for a maximum liquid temperature rise of 65°C, should have a liquid temperature **rise** of approximately 60°C (during operation). With an ambient temperature of 25°C the gauge will read approximately 85°C (60°C + 25°C) at full load.

Maintenance inspections must be done regularly. As a minimum, inspect the transformer after the first six (6) months of operation, and yearly thereafter, to confirm the following:

a) Dielectric strength of the liquid in the transformer.

Liquid handling and test procedures, including dielectric strength data, for mineral oil and Envirotemp FR3 are provided in the "Insulating / Cooling Liquids" section of this manual. Similar documentation for other alternative liquids that may be used for a specific order can be found in Appendix B. If the test results indicate a dielectric strength below the minimum safe limit for the type of liquid used, the liquid must be filtered and/or reprocessed, in accordance with the "Filling Transformers with Liquid" section of this manual.

b) Correct liquid levels.

Check the liquid levels in the main transformer tank and all other liquid filled components such as liquid filled junction boxes, conservator tanks and liquid filled switch equipment. Top up liquid levels with clean filtered liquid when necessary. Leaks must be located and repaired immediately.

c) Fan operation (if present).

Check the operation of all fans and controls.

d) Insulator condition.

Visually inspect the insulator bodies of all bushings, arresters, fuse, and switch mechanisms for contamination or evidence of flashover. Use extreme caution around live parts and maintain safe clearances to all maintenance equipment, tools and human contact.



Caution: Inspection of components near energized parts should only be done with the transformer de-energized.

e) Damage.

Inspect the tank and components for signs of leaks, deterioration, or damage that could impact performance or long term durability. All devices located below the liquid level that penetrate the tank seal are susceptible to leakage; these include tap-changer operating handles, temperature gauges, bushings and valves. Leaks and damages must be repaired as soon as possible.

f) Breather condition

Check the condition of all breathers and filtering devices regularly for proper operation. This includes the desiccant in dehydrating breathers, filters and vents in control boxes and interface compartments, and bug-proof breathers (if supplied) on conservator tanks.



Caution: Before servicing a transformer that has been in service, lock the line switches on the primary and secondary sides in the open position. Connect a ground cable to the line terminals of the transformer to discharge any energy stored in the windings, and prevent accidental re-energization of the transformer.

6.2 Maintenance during transformer shutdown

During the period of time a transformer is in shutdown mode maintenance activities can be undertaken that would otherwise be unsafe or impossible to do when the transformer is energized. Ensure the transformer is locked out and ground cables have been attached to the line terminals of the transformer. When work is complete remove all maintenance equipment and tools from the transformer and installation site. Check that the de-energized tap-changer is in the correct position and locked in place.

6.2.1 Cleaning

Clean any accumulations of dust, liquid residue and other contamination from all bushings, arrestors and insulators. Clean the exterior of the transformer tank and cooling components regularly as determined by site conditions. Dust and dry contamination can be removed using a vacuum or by compressed air not exceeding 29 PSI.

6.2.2 De-energized Tap-changer

Rotate the operating handle of the de-energized tap-changer through all positions three (3) or four (4) times to exercise and clean the contacts of the switch. Return the operating handle to its original position if a change in ratio is not required.



Caution: The transformer must be de-energized before operating the off-circuit tap-changer.

6.2.2.1 De-energized Tap-changer maintenance for transformers filled with Silicone liquid

It is important to periodically exercise and clean the contacts of de-energized tap-changers immersed in any of the industry standard dielectric liquids, but especially so for transformers filled with **silicone liquid**. De-energize the transformer and rotate the operating handle of the tap-changer through the entire range of tap positions, a minimum of ten (10) times. The frequency of performing this maintenance activity can be related to transformer application and loading. Recommended guidelines are provided in **Table 2**.

Table 2 - Tap-changer maintenance guidelines for transformers filled with Silicone liquid

Application	Frequency
Commercial and residential	every 12 months
Industrial installations	every 6 months
Heavy loading such as in rolling mills or furnace applications	every 3 months

Tap-changer maintenance must be performed regularly on all transformers filled with silicone fluid.

6.3 Insulating / Cooling Liquids

Several different dielectric liquids are available for use in liquid filled transformers. Selection of a transformer liquid is influenced by a number of factors and concerns related to the transformer application such as performance, location, safety, the environment and cost.

The transformer nameplate identifies the type and volume of liquid used. A liquid specific identification and warning label is also applied to the exterior of all liquid filled transformers. A typical label is shown in Figure 10.

Mineral oil is commonly used for outdoor applications where the risk of fire does not constitute a hazard to life and property. Envirotemp FR3 Fluid is a biodegradable, fire-resistant, seed oil-based dielectric coolant, developed for applications requiring high margins of fire and environmental safety. The fluid is fully miscible and compatible with conventional mineral oil.

Mineral oil variants have also been developed to suit cold climate applications. These liquids are formulated to provide good low temperature properties which allow the transformer to start at the lowest possible temperature, without using pour point depressants.

Midel 7131, Silicone, R-Temp, and Beta Fluid are other high fire point fluids that are also suitable for indoor and outdoor locations with stringent fire regulations.

Technical data and handling procedures for **mineral oil** follow in the main body of this manual. Data and handling information for other order specific liquids are provided in **Appendix A** of this manual when used.

6.3.1 Mineral Oil

The mineral oil supplied in Niagara transformers meets ASTM D3487 and D4059 standards. It is a quality checked product that has the oxidation stability required to resist the formation of acids that may attack construction materials, and resist the formation of other oxidation products that can reduce its ability to insulate and cool electrical windings.

Additional detailed instruction and guidelines for health, environmental care, storage, handling and testing of oil can be found in **IEEE Standard C57.106-2002 Guide for Acceptance and Maintenance of Insulating Oil in Equipment**.

6.3.1.1 Mineral Oil Terminology (Definitions per ASTM D 3487)

Type I Mineral Oil (common reference: uninhibited mineral oil): An oil for apparatus where normal oxidation resistance is required. Some oils may require the addition of a suitable oxidation inhibitor to achieve this.

Type II Mineral Oil (common reference: inhibited mineral oil): An oil for apparatus where greater oxidation resistance is required. This is achieved with the addition of a suitable oxidation inhibitor.

Oil immersed transformers manufactured by Niagara Transformer Corp. are filled with Type II mineral oil as standard practice. Type I mineral oil is supplied as a special order item, per customer specification at time of order.

6.3.1.2 Physical properties of mineral oil in a new transformer

Color (Visual appearance):	Clear and bright
Water Content (ppm), ASTM D1533	10
Dielectric Strength (kV), 25°C, 0.1-inch gap, ASTM D877	48
Viscosity at 40° C, ASTM D445 (cSt)	9.76
Specific Gravity	0.893
Weight per U.S. gallon (lb)	7.4
PCB content (ppm)	< 1
Pour point (°C), ASTM D 3487	-40 (Type I & Type II mineral oil)



IDENTITY <small>(AS SHOWN ON MSDS)</small> HYVOLT II HYDROTREATED LIGHT DISTILLATE CAS NO. 64742-53-6		HEALTH 1 FLAMMABILITY 1 INSTABILITY 0 PROTECTIVE EQUIPMENT B
<small>(CHECK OFF APPROPRIATE BOXES)</small> ROUTE OF ENTRY <input checked="" type="checkbox"/> INHALATION <input checked="" type="checkbox"/> SKIN ABSORPTION <input checked="" type="checkbox"/> INGESTION <input checked="" type="checkbox"/> SKIN OR EYE CONTACT		PHYSICAL HAZARDS <input checked="" type="checkbox"/> NO PHYSICAL HAZARDS <input checked="" type="checkbox"/> COMBUSTIBLE LIQUID <input type="checkbox"/> COMPRESSED GAS <input type="checkbox"/> OXIDIZER <input type="checkbox"/> FLAMMABLE GAS <input type="checkbox"/> EXPLOSIVE <input type="checkbox"/> FLAMMABLE LIQUID/SOLID <input type="checkbox"/> PYROPHORIC <input type="checkbox"/> ORGANIC PEROXIDE <input type="checkbox"/> WATER REACTIVE <input type="checkbox"/> UNSTABLE (REACTIVE)
HEALTH HAZARDS <input type="checkbox"/> TOXIC <input type="checkbox"/> HIGHLY TOXIC <input type="checkbox"/> REPRODUCTIVE TOXIN <input checked="" type="checkbox"/> IRRITANT <input type="checkbox"/> CORROSIVE <input type="checkbox"/> SENSITIZER <input type="checkbox"/> CARCINOGEN 		TARGET ORGANS & EFFECTS <input type="checkbox"/> LUNGS <input type="checkbox"/> HEART <input type="checkbox"/> KIDNEY <input type="checkbox"/> EYES <input type="checkbox"/> SKIN <input type="checkbox"/> PROSTATE <input type="checkbox"/> BLOOD <input type="checkbox"/> LIVER <input type="checkbox"/> CENTRAL NERVOUS SYSTEM <input type="checkbox"/> CARDIOVASCULAR SYSTEM <input type="checkbox"/> MUCOUS MEMBRANES <input type="checkbox"/> AUTONOMIC NERVOUS SYSTEM <input type="checkbox"/> RESPIRATORY SYSTEM <input type="checkbox"/> BLOOD <input type="checkbox"/> MUTAGEN <input type="checkbox"/> TERATOGEN
COMPANY NAME <u>NIAGARA TRANSFORMER CORPORATION</u> ADDRESS <u>1747 DALE ROAD</u> CITY <u>BUFFALO</u> STATE <u>NY</u> ZIP <u>14225</u>		

Figure 10 - Warning Label - Liquid Identification and Hazardous Material Information (HYVOLT II inhibited mineral oil)

 **Note:** The transformer nameplate identifies the type and volume of liquid in the transformer. A liquid identification and warning label is also applied to the exterior of all liquid filled transformers. The label shown in **Figure 10** is **typical**, showing a liquid from one of several possible suppliers. Refer to **transformer specific labeling and MSDS information** for the details of the liquid used in a particular transformer.

6.3.1.3 Electrical Properties

The dielectric strength of mineral oil is affected by moisture, oxidation and other contaminants. Testing the dielectric strength of the oil is important to determine the cleanliness and moisture content of the transformer liquid.

The standard test uses 1" diameter disc electrodes spaced 0.10" apart. The dielectric strength of the oil should be at least 26000 volts. Refer to section 6.3.1.10 for acceptable test values for new mineral oil.

6.3.1.4 Power Factor, Acidity, Interfacial tension and Moisture Content (Mineral oil)

Other tests can also be performed to determine the condition of the oil in a transformer. The following test values are typical comparative values for oil in new transformers.

- a) Dissipation factor (Power Factor): ASTM D924, <0.001% at 25°C maximum
- b) Neutralization number (Acidity): ASTM D974, neutral
- c) Interfacial Tension: ASTM D971, 49 dynes/cm

6.3.1.5 Insulation Resistance

Check the condition of the insulation system of liquid filled transformers by taking megger readings. The values obtained will vary with the transformer=s age, voltage and temperature. It is important to record readings obtained through regular maintenance testing to detect abnormalities. Decreasing resistance values are an indication of insulation deterioration.

6.3.1.6 Transformer Power Factor

Power factor tests are also used to check the insulation system of a transformer for moisture content. The test is a more sensitive detection method that is also affected by temperature. The insulation system should be tested regularly to monitor its condition. Tested values obtained at the factory prior to shipment are available upon request.

6.3.1.7 Handling of Transformer Oil

Metal or oil-proof hose and pipes must be used for handling transformer oil. Sulphur in natural rubber dissolves in oil, lowering its dielectric strength and will attack copper in the transformer. All containers, piping and equipment used in handling oil must be clean and free of contaminating materials. Apparatus used in handling should be maintained for its exclusive use. Do not expose oil to the atmosphere when its temperature is lower than the surrounding air or when the relative humidity exceeds 75%. If oil is shipped separately or removed from the transformer it should always be kept dry in sealed drums. Soil acts as an absorbent and should not be allowed to become saturated with mineral insulating oil. Consult the appropriate government agencies for spill and cleanup procedures.

6.3.1.8 Inspection and Testing Transformer Oil

The liquid in a transformer should be sampled and tested at regular intervals, and the results recorded for future comparison. The process allows technicians to determine the condition of both the dielectric liquid and solid insulation in the transformer, without having to de-energize and open the transformer to the atmosphere.

Liquid that has been in storage should also be sampled and tested to verify quality and dielectric strength before it is used in a transformer.

6.3.1.9 Sampling Transformer Oil

Sample test results for dielectric strength, moisture content, metal particulate, particle counts, DGA and power factor are susceptible to contaminants that can accumulate at the bottom of the transformer tank and in the drain valve, both internally and externally. The simple act of removing the pipe plug in a drain valve can create metal particles, which can skew test results. Care must be taken to ensure the all fittings in contact with the liquid such as drain valves, sampling valves, sampling equipment, and sample containers are clean. The exterior of the valve(s) used for sampling and the surrounding tank surfaces must be wiped down and clean. Internal valve cleaning should include all accessible parts of the valve body and threads. The use of a small brush, such as a tooth or bottlebrush, is helpful for this purpose.

Oil samples to be tested must be representative of the bulk liquid in the transformer or storage container. Much of the contamination in the transformer such as moisture and fibers of paper and metal, settle to the bottom of the tank. Consequently, it is important to flush out this material as much as possible to obtain a good representative sample. The flushing process also aids in the removal of trapped contaminants from the drain and sampling valves. Flushing typically requires removal of 2 to 4 liters of liquid from the transformer. The drain valve should be flushed first, and then capped, followed by flushing of the sampling valve.

Dissolved gas-in-oil analysis (DGA) testing can be affected by component materials found in sampling and drain valves. Galvanic fittings (zinc coated) will react with water to produce hydrogen. These fittings must be flushed thoroughly as this residue can be easily transferred to the liquid sample. Compatible valve materials such as brass, bronze, stainless steel, and black iron should be used whenever possible. The use of dissimilar metals, which can corrode, must also be avoided.

Power factor testing can be affected by foreign matter, water and other contaminants such as valve stem packing and thread sealants, which will increase dielectric loss.

The transformer must be under a positive pressure to obtain a liquid sample. Attempting to sample liquid in a transformer that is under a negative internal pressure will allow air to be drawn into the transformer. This can result in reduced dielectric strength and equipment failure due to flashover. Most transformers are equipped with a pressure gauge that indicates the actual internal tank pressure. If a pressure gauge is not present, or is damaged, follow the procedure outlined in ASTM D 923 to determine the pressure condition in the transformer. The procedure uses a slug of oil in clear tubing attached to the sampling valve. A positive internal tank pressure can be restored by adding dry nitrogen to the gas space of the transformer, or by waiting until the ambient temperature increases sufficiently to warm the dielectric liquid causing it to expand and create a positive pressure.

Check the liquid level in the transformer before and after sampling. Typically, the amount of liquid drawn from the tank for flushing and sampling does not affect the operation of larger transformers, which contain a significant volume of liquid. However, smaller units and components such as On-Load Tap-Changers are more sensitive to reduced liquid volumes, which could affect the dielectric integrity of the equipment. Check the liquid level before and after sampling to ensure suitability for safe operation.

Protect the environment from any spillage that may occur during the sampling process. Most countries have regulations in place that deal with the release of dielectric liquids into the environment. It is easier to take the necessary precautions and be prepared for some accidental spillage, than to clean up an uncontrolled spill. Use plastic and absorbent materials under the drain valve and sampling equipment. Appropriate sized containers should be used to trap the larger volumes of liquid associated with flushing.



Warning: Soil acts as an absorbent. It should not be allowed to become saturated with mineral insulating oil. Consult the appropriate government agencies for spill and cleanup procedures.

*The side sampling port on the drain valve, while intended to be a convenience for liquid sampling, is very susceptible to contamination due to its location and design. The sampling port is connected by a very small channel to the chamber between the drain plug and the valve seat of the drain valve. This channel is easily contaminated by accumulations of foreign matter and moisture. It is difficult to ensure the sampling valve is clean, even repeated flushing. Many service professionals prefer to draw a sample from the drain valve rather than using the side sampling port. Sampling from the drain valve requires the use of a modified pipe plug with hose barb as shown in **Figure 12**. When this method is used, the sampling port should still be flushed several times to maximize removal of contaminants from the entire drain valve.*

Ambient environmental conditions must be considered when preparing to sample the oil in a transformer. Samples can be easily contaminated by moisture and airborne containments. Ideally, sampling should be done in dry, calm weather conditions preferably when the humidity is less than 50%. When this is not possible, special precautions such as temporary enclosures and protected sampling equipment can minimize the possibility of outside contamination. Avoid taking samples in rain, hail, or snow.

The use of appropriate sample containers is important to prevent contamination and preserve sample quality. Guidelines for containers are provided in ASTM D 923, D 3613, and IEC Methods and Guides 60475 and 60567.

The container must be large enough to hold the required volume of oil for testing, not impart any chemical or particulate contamination to the sample, seal the sample from external contamination, shield the sample from sunlight causing photo-degradation, and prevent the loss or gain of gases or moisture.

Container sizing must also be considered, as some tests require very different sample volumes.

For general oil quality tests, glass bottles, either amber or clear are acceptable. Amber bottles protect samples from photo-degradation, while clear bottles enable visual inspection of the sample. Bottle cap materials must be compatible with the liquid sample to prevent contamination.

Ground glass syringes (with 3-way valve) are the most appropriate container for taking samples that will be used for dissolved gas-in-oil and water content analyses. Syringes are easy to handle and have very tight tolerances, which protect the sample. Samples collected in syringes must be protected from light degradation in a timely manner.

Niagara Transformer Corp. recommends the use of ground glass syringes for all oil-sampling procedures.

6.3.1.9.1 Materials and tools required for the sampling process

- a) Environmental protection
 - 1) Absorbent pads and plastic ground sheets
 - 2) Clean towels and rags
 - 3) Containers for waste oil and spillage control
- b) Personal protection
 - 1) Latex or neoprene gloves
 - 2) Safety glasses
 - 3) Safety equipment as required by site location
- c) Sampling tools
 - 1) Tygon tubing, 1/4" diameter, minimum of 3 feet in length
 - 2) Sampling syringe with 3-way valve, all clean and sealed
 - 3) Laboratory sampling document to identify and record sample data
- d) Mechanical tools
 - 1) Crescent wrenches or similar open wrenches to assemble sampling connections
 - 2) Pipe wrench to remove and install pipe plugs in drain valve
 - 3) Teflon sealing tape for pipe threads



Figure 11 - Sampling syringe with 3-way valve

6.3.1.9.2 Procedures

- a) Sampling procedure
 - 1) Check ambient conditions to ensure good clean samples can be taken.
 - 2) Check the internal tank pressure of the transformer. Sampling can only be done if the transformer is under positive pressure. If the pressure-vacuum gauge on the transformer has been damaged or a gauge has not been provided follow the procedure documented in ASTM D 923 to determine positive or negative tank pressure. A positive tank pressure can be restored by adding dry nitrogen to the gas space of the transformer, or by waiting until the ambient temperature increases sufficiently to warm the dielectric liquid causing it to expand and create a positive pressure.
 - 3) Prepare the area under and around the drain valve for possible spills. Protect the area with plastic ground sheets and absorbent pads.
 - 4) Check the transformer nameplate to ensure the transformer is filled with mineral oil with no detectable levels of PCB.
 - 5) Check and record the top oil temperature and liquid level.
 - 6) Clean the outside of the drain valve and surrounding tank surface with clean rags.
 - 7) Check that the valve hand wheel is closed.

- 8) Slowly remove the plug in the drain valve. Have a container available to catch any residual oil that may be present in the valve.
- 9) Clean the interior of the valve with a lint free cloth. The bottom of the valve is particularly susceptible to the collecting moisture and foreign matter. Clean the threads of the valve with a small brush.
- 10) Clean and reinstall the drain plug.
- 11) Uncap and clean the side sampling port.
- 12) Flush the sampling valve by opening the drain valve then opening the sampling valve on the side of the drain valve. Allow approximately 1/2 a liter of oil to flow out, and then close the sampler. The liquid removed is waste and must be properly disposed of.
- 13) Turn the hand wheel of the drain valve to the closed position.
- 14) Remove the valve drain plug again, catch any residual oil, and clean the valve interior and threads a second time.
- 15) Clean and reinstall the drain plug.
- 16) Flush the sampling valve a second time (as described in the preceding step 12).
- 17) Close the drain valve.
- 18) If sampling is to be done through the drain valve plug rather than the sampling valve, remove the original pipe plug (catching residual oil and cleaning threads) and replace with a modified drain plug assembly consisting of a bronze or stainless steel bushing adapter and hose barb for 1/4 inch tube. See Figure 12.

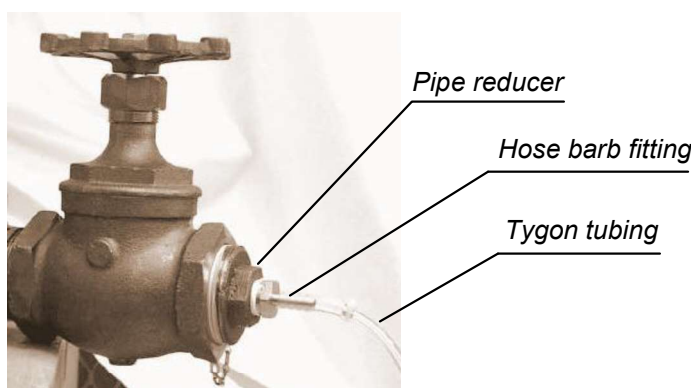


Figure 12 – Drain valve with pipe plug modified for sampling attachment

- 19) Attach a 12 to 14 inch length of 1/4-inch Tygon vinyl tube to the hose barb of the drain plug or sampling port, whichever will be used, and train the other end of the tube into a waste oil container.
- 20) Open the sampling valve (if used).
- 21) Slowly open the drain valve and allow a small amount of oil to flow out through the tube, into the waste oil container.
- 22) Close and open the drain valve a few times to dislodge and remove any trapped water and dirt. Removal of one (1) gallon or four (4) liters of oil may be required to flush the valve clean. The oil removed is waste.
- 23) Following the flushing process, remove the vinyl tubing.
- 24) Install new tubing between the sampling connection of the transformer and the 3-way valve of the oil-sampling syringe.



Note: The handle of the plastic 3-way valve points toward the closed port, leaving the other two ports open. Check to ensure the 3-way valve is firmly seated on the syringe.

- 25) Position the handle on the 3-way valve to direct the flow of oil out of the valve flushing port into the waste oil container. The valve handle will be pointed toward the syringe as shown in Figure 13.
- 26) Open the drain valve and let approximately quarter a liter of oil run through the tubing and 3-way valve into waste oil container, to flush both.
- 27) Close the drain valve.
- 28) Reposition the 3-way valve handle to allow the air in the syringe to be expelled when the syringe plunger is depressed (handle toward the tubing).

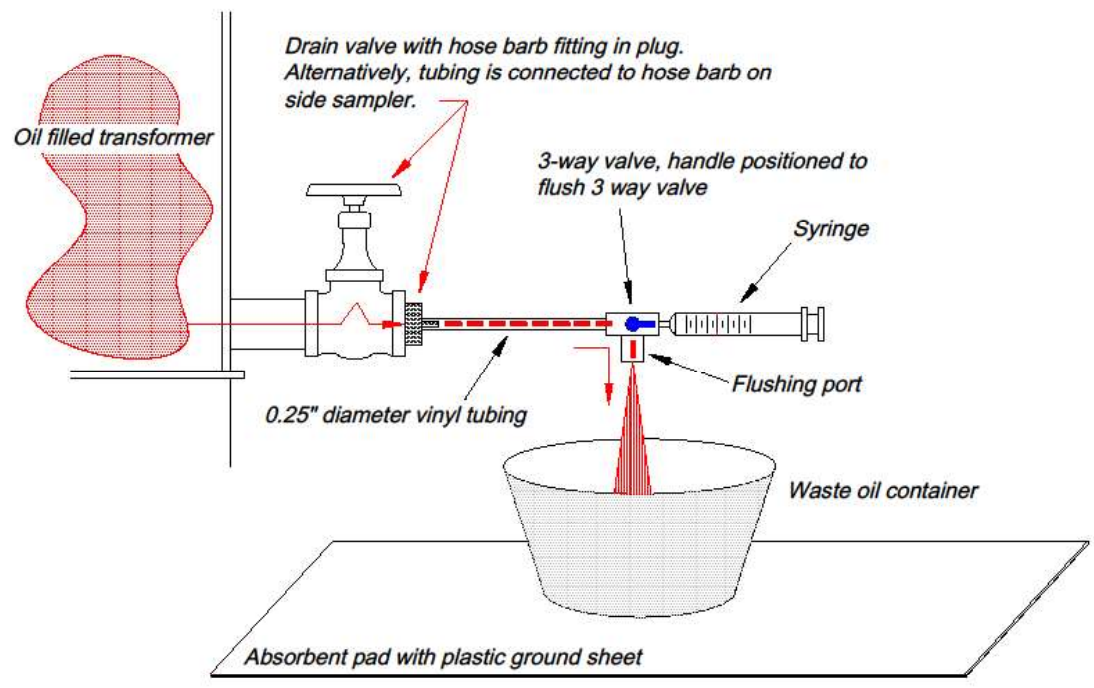


Figure 13 – Flushing of Tygon tube and 3-way valve

- 29) Reposition the 3-way valve handle to allow oil to flow into the syringe when the drain valve is opened (handle toward valve flushing port - see Figure 14).
- 30) Open the drain valve and maintain backpressure on the syringe plunger while oil fills the syringe to a point 1/16" past the last graduation on the syringe body.
- 31) Reposition the 3-way valve handle to shutoff the oil flow into the syringe and allow the oil in the syringe to be expelled into the waste oil container, through the flushing port, when the syringe plunger is depressed – see Figure 15.
- 32) Fill and flush the syringe in this manner three (3) times.
- 33) Reposition the 3-way valve handle and fill the syringe for the final time to obtain the sample.
- 34) Reposition the 3-way valve handle after the syringe has been filled to allow the expulsion of any air bubbles (with some fluid) from the sample. To facilitate the process it may be necessary to hold the syringe vertically (tubing end up) while this is done.
- 35) Close the drain valve.

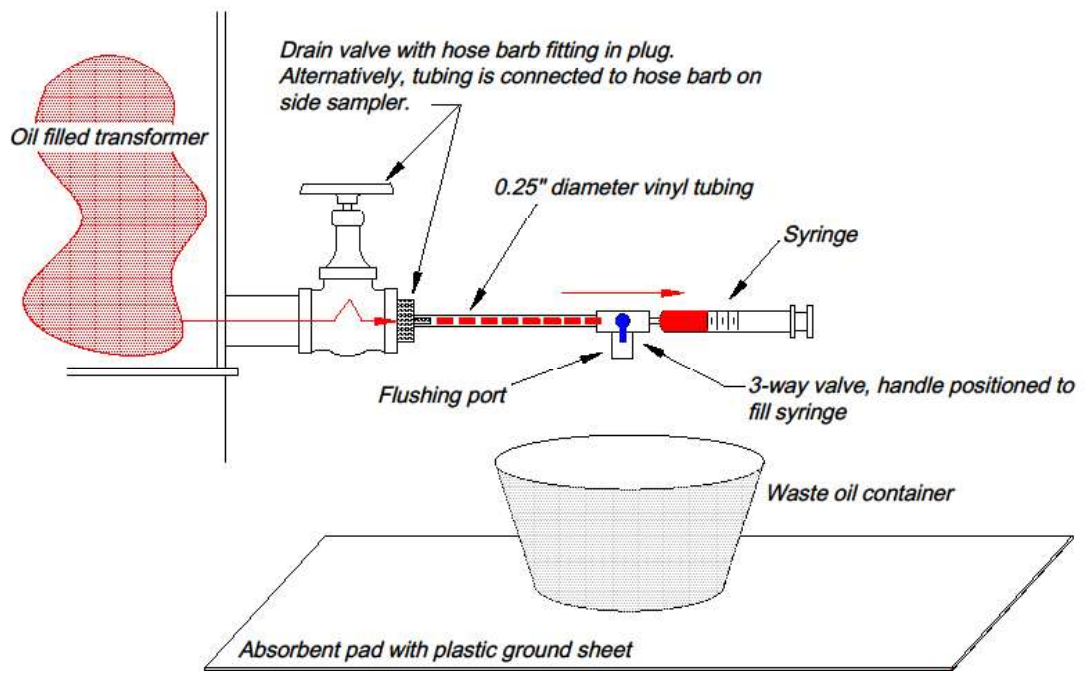


Figure 14 – Filling of sampling syringe

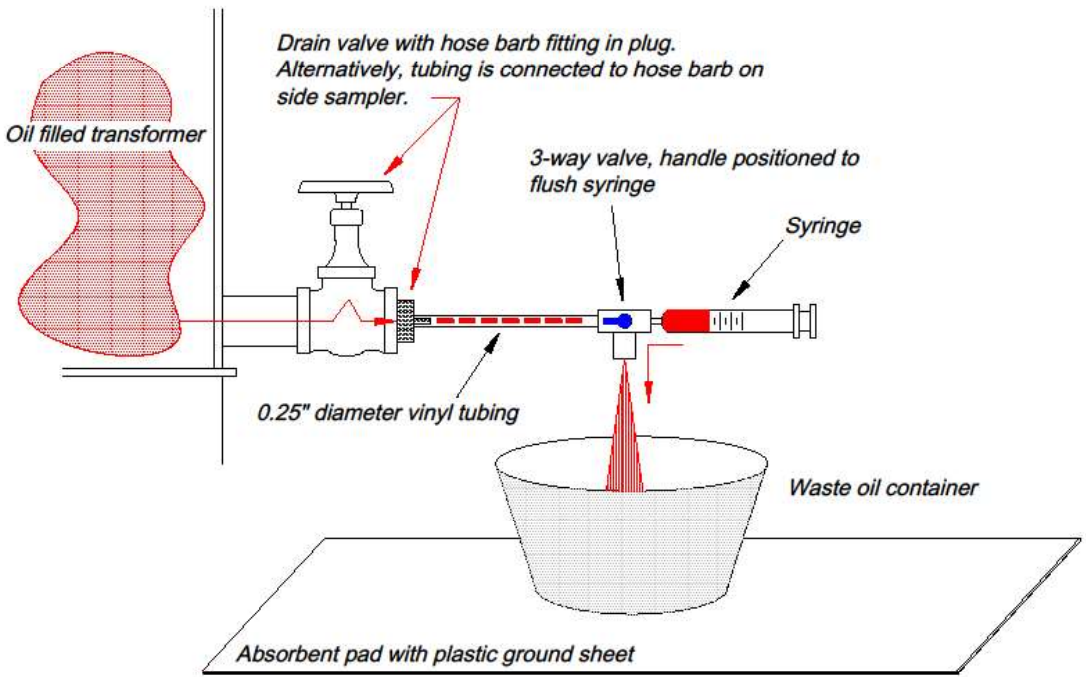


Figure 15 – Flushing of sampling syringe

b) Clean-up procedure

- 1) Protect samples from the light. Photo-degradation occurs quickly.
- 2) Check bottle caps (if used) to ensure they are tight and not leaking.
- 3) Bubbles that develop in a syringe after it has been sitting undisturbed for a while are part of the sample. Do not attempt to remove the bubbles.
- 4) Ensure all the samples are labelled correctly.
- 5) Arrange for delivery of samples to the designated laboratory for testing.
- 6) Recheck and record tank pressure, liquid level, and liquid temperature
- 7) Add additional make-up liquid (if required) when unit is de-energized. Refer to the Section 6.7 of this manual (Filling Transformers with Liquid).
- 8) If the sampling valve was used, close the sampling valve by tightening the fitting nut, and replace and tighten the protective cap.
- 9) Alternatively, if the drain valve was used for sampling, remove the temporary sampling plug with hose barb from the drain valve, catching any residual oil that may come out of the valve.
- 10) Clean out any oil residue from inside the drain valve.
- 11) Install the original pipe plug in the drain valve using Teflon sealing tape. Do not use or install any galvanic fittings on a transformer.
- 12) Ensure the hand wheel of the drain valve is completely in the closed position. Lock in place if locking provision is present.
- 13) Clean up any oil residue from the drain valve, transformer, and protective sheeting. Dispose of all waste in the appropriate manner.
- 14) Remove all tools and equipment from the area.

6.3.1.9.3 References

- a) ASTM D 923: Standard Practice for Sampling Electrical Insulating Liquids
- b) ASTM D 3613: Standard Practice for Sampling Electrical Insulating Oils for Gas Analysis and Determination of Water Content
- c) IEC 60475: Method of Sampling Liquid Dielectrics
- d) IEC 60567: Guide for the Sampling of Gases and of Oil from Oil-filled Electrical Equipment and for the Analysis of Free and Dissolved Gases
- e) Doble Engineering Company (www.doble.com)

6.3.1.10 Testing Transformer Oil Sample for Dielectric Strength

Transformer oil is tested in accordance with **ASTM Specification D1816**. Some general information is contained in the following paragraphs.

The standard oil testing spark gap has disc terminals one inch in diameter, spaced 0.1 inch apart. Clean the testing cup thoroughly and rinse with a portion of the oil to be tested.

The temperature of the gap receptacle and oil should be approximately 25 °C (77 °F). Gently tip the sample container and swirl the oil a few times before filling the test cup. This aids in distributing any impurities present uniformly throughout the sample. Avoid agitation, which might introduce air into the oil. Fill the test cup completely and allow three minutes for entrapped air to escape before applying voltage.

The rate of voltage increase should be about 3000 volts per second. One break down should be made on each of five fillings of the test cup. Any individual test, which deviates from the average by more than 25%, should be disregarded and replaced by an additional test. The average of the first five tests within the allowable deviation can be taken as the dielectric strength of the oil.

If the sample tests below 26 kV, collect a new sample, taking every precaution against contamination during and after collecting. Drain approximately one gallon of oil from the transformer before taking the second sample.

The dielectric strength of the oil in a transformer at time of shipment is at least 30 kV. Do add oil to a transformer that tests below this benchmark dielectric strength.

If the dielectric strength of the oil in a transformer that is in service tests below 26 kV, the transformer oil should be filtered to obtain a minimum standard dielectric strength of 26 kV, or better.

6.3.1.11 Drying and Filtering Transformer Oil

A standard filter press is effective for removing all types of foreign matter including finely divided carbon and small amounts of moisture. To avoid a dangerous buildup of static electricity during filtering, ground the tank, filter press and piping. Ground the bushings as well if the transformer is de-energized.

Begin the filtering process with new filter paper and replacing the filter as needed. Filter paper must be thoroughly dried and kept warm until it is required. Replace filter paper without delay - hours of drying time can be wasted if the filter paper is exposed to the air for more than a few minutes.

A close check on the dielectric strength of the filtered oil should be maintained. If tests indicate moisture in suspension after a reasonable filtering period, all the filters must be replaced before filtering is continued.

A centrifuge is more practical than a filter press when sizeable amounts of moisture are present. If the oil is in poor condition, much better results can be obtained with a centrifuge and filter press in combination, the oil passing through the centrifuge first.

When filtering transformer oil, draw oil from the bottom filter press connection and return it through a top connection after filtering. The filter system must be liquid and airtight. Avoid aerating the oil.

If tests show the presence of a large quantity of moisture and other contaminants, filter the bottom oil separately using a separate holding tank.

When water and contaminants have been removed to a point where the oil tests 26 kV or better, filter the oil remaining in the transformer until it also tests at least 26 kV. Return any oil filtered separately to the transformer tank. If tests on the oil mix do not meet the required minimum rating continue the filtering process.

6.3.1.12 Cold Startup Procedures for transformers filled with mineral oil

- a) Transformer protection: Over temperature alarm and trip contacts must be wired, tested and operational.
- b) At fluid temperatures below -20°C, energize the transformer without load, warming the fluid to ≥ -20°C.
- c) Load can be applied to transformers with fluid temperatures ≥ -20°C.
- d) If the applied loads result in an over-temperature condition, additional heat will be required to reduce the fluid viscosity. Space heaters or torpedo heaters may be used to gradually heat the transformer tank and cooling panels. In extreme conditions, a temporary transformer shelter may also be required.



Warning: Do not apply excessive heat that may damage the tank and cooling panels, and cause local overheating of the contained fluid.

6.4 Checking for Leaks (on sealed tank transformers)

Leaks may occur at gasket seals or welded seams above or below the liquid level. Leaks below the liquid level are evident by the obvious signs of liquid seepage. Leaks above the liquid level are not as visibly obvious, making them more difficult to locate. The presence of a leak in the gas space of a transformer is indicated by a pressure-vacuum gauge that has been indicating zero pressure for a period of time. Once it has been determined that the tank seal has been broken, the leak should be located and fixed immediately.

Use the following procedure to locate a leak.

- a) De-energize the transformer.
- b) Slowly add dry nitrogen at low pressure to the transformer gas space until a pressure of 5 PSI is indicated on the pressure-vacuum gauge.
- c) Apply leak-detecting solution to all seals and welds above the liquid level with a small brush.
- d) The appearance of bubbles in the treated areas indicates the location of a leak.
- e) Repair the leak, per section 6.5.



Note: The transformer may operate for an indefinite period of time in the vacuum range of the pressure-vacuum gauge. This may be due to reduced loading and/or the volume of air that the transformer liquid may have absorbed during shipment, storage or repair. This operating condition is not uncommon. The transformer should be monitored regularly to confirm the operating pressure is gradually returning to a normal positive value. An internal tank pressure reading of zero, for an extended period of time, indicates the presence of a leak in the tank seal.



Note: If the transformer is opened for inspection or other internal work and re-sealed in the field, all seals made in the Field should be checked using the procedure described in section 6.4.

6.5 Repairing Minor Leaks

Minor leaks in the transformer tank or cooling radiator are repairable in the field using an epoxy repair kit. The following repair instructions are for the repair of **sealed transformers only**.

6.5.1 Equipment and materials;

- a) Vacuum pump
- b) Epoxy repair kit
- c) Cleaner / De-greaser
- d) File, sandpaper, emery cloth
- e) Touch-up paint

6.5.2 Procedure:

- a) Connect the vacuum equipment to the transformer using the pipe flanges provided on the transformer tank cover for the vacuum / fill connections.
- b) The **approximate** vacuum required (PSI) = the distance from the top of the radiators to the leak x 0.04




Note: The vacuum calculation is a guide to determine the approximate value required. Applying a vacuum greater than necessary will draw outside air into the tank. Monitor the process to ensure this does not occur.

- c) Prepare damaged area for repair by removing the paint with a file and emery cloth.
- d) If liquid is still evident in the area of the leak, increase the vacuum until dripping stops.
- e) Wipe the surface clean with cleaner / de-greaser.
- f) Roughen the area roughen with a file, and remove residue with a dry cloth.
- g) The repair surface must be clean and dry.

- h) *Mix a small amount of epoxy and apply sparingly.*
- i) *Allow time for epoxy to cure, cure time can be improved with a warming lamp.*
- j) *Roughen the cured surface with sandpaper and apply a second coat of epoxy.*
- k) *Allow second coat of epoxy to dry and repaint the repaired area with the touchup paint supplied with the transformer.*
- l) *Release the partial vacuum on tank with dry nitrogen.*
- m) *When the internal tank pressure reaches zero (0) PSI open the control valves to the bracing gas space (if present).*

- n) *Continue the flow of nitrogen gas and apply a 3 PSI blanket of nitrogen to the gas space above the liquid. If a nitrogen gas preservation system is supplied vacuum can also be broken with the system gas supply.*
Target value for gas space Nitrogen content is 97% (Oxygen content 3% or less)

 **Warning: Many transformer designs use the available sealed space inside tank channel braces to supplement the gas space in the transformer tank. When this is the case control valves are supplied to isolate the bracing gas space from the main tank during vacuum processing and shipment. The control valves are closed for shipment and must be closed during vacuum processing. The valves must be open when the transformer is in service.**

The control valves are located near the top of the tank, on one or more of the tank walls. The valves are identified by a label and tubing that connects them to a channel brace.

Refer to the transformer outline drawing to verify the existence and location of gas space control valves.

*Tank braces that are used for gas space expansion are purged with dry nitrogen at the factory. If the bracing gas space has been open to the atmosphere for an extended period of time, the space should be purged with dry nitrogen to reduce oxygen and moisture content. Purging instructions are provided in **Appendix A** of this manual for such units.*

6.6 Tank Covers

6.6.1 Cover Removal

For most sealed units the cover is welded in place to provide a positive lifetime seal. If internal inspection beyond what is possible through a manhole opening, or if removal of the core and coil unit is necessary, the transformer tank cover must be removed.



Caution: Cover removal should be done indoors, by trained transformer technicians. Reprocessing of the core and coil unit(s) and insulating liquid may be necessary following the inspection / repair and reinstallation of the tank cover.

Removal procedure:

- a) Relieve internal tank pressure (positive or negative). The pressure-vacuum gauge should read zero.
- b) Lower the liquid level in the tank below any seals that will be opened in the tank wall.
- c) Purge the gas space with dry nitrogen to remove combustible or toxic gases from the tank before starting cover removal. Maintain a flow of nitrogen into the tank during all cutting operations.
- d) Clamp the cover with to the tank flange with "C" clamps, spaced approximately twelve (12) inches apart, to prevent the cover from springing and foreign matter from falling into the tank.
- e) Remove the cover weld at the joint of the tank cover and the tank flange by chipping, flame gouging or Arcair (carbon arc) gouging.
- f) Remove the terminal connectors and fastening pins on all cover mounted draw lead bushings and remove the bushings.
Cover mounted bushings that are bottom connected must be disconnected internally, working through a manhole.
- g) Disconnect any other connections between the core and coil assembly and tank cover that may be present, such as core ground and test connections.
- h) Cover all openings in the tank cover to prevent the entrance of contaminants and moisture into the tank.
- i) Break the residual weld fragments with a chisel. Remove the "C" clamps from the tank flange.
- j) Lift the cover from the tank, as straight as possible in a controlled slow manner to minimize sway.

6.6.2 Reinstallation of cover

- a) The mating tank flange and cover surfaces must be smooth and free of irregularities that would prevent a tight fit. Weld surfaces must be clean dry bare metal, free of oil and grease.
- b) Bond a glass fiber gasket (1/8" diameter, or 1/8" x 1/2" flat), to the tank flange with a suitable adhesive. The gasket should be positioned approximately 1/2" in from the edge of the cover.
- c) Clamp the cover to the tank flange tightly with "C" clamps spaced approximately six (6) inches apart around the perimeter of the tank flange.
- d) Cover all openings in the tank cover to prevent the entrance of contaminants and moisture into the tank.
- k) Purge the gas space with dry nitrogen to remove combustible or toxic gases from the tank before welding. Maintain a flow of nitrogen into the tank during the welding process.
- e) Tack-weld the tank cover to the tank flange with 1-1/2" long tacks on 12" centers.
- f) Remove "C" clamps from the tank flange.
- g) To weld carbon steel use coated low carbon steel electrodes such as American Welding Society types E-6013 and S-6016 or equal.
- h) Welder current setting should be 165 amps +/- 10% for a 3/16" electrode or 280 amps +/- 10% for a 1/4" electrode.
- i) Chip the slag from all tack-welds, and clean with a wire brush.
- j) Apply a full fillet weld. Chip and wire brush all weld stops before continuing. Avoid stopping or starting welds at corners.
- k) When re-welding is complete, clean and dress the weld.
- l) Apply an internal tank pressure of 5 PSI with dry nitrogen.
- m) Leak test the weld soapy water or glycerin.
- n) Prime and paint the repaired surfaces.

6.7 Filling Transformers with Liquid

Transformers are shipped in various configurations, usually to suit the limitations associated with transport. Whenever possible, transformers are shipped completely assembled, filled with insulating liquid and ready for service. This method of shipment eliminates the need to handle dielectric fluids, unless it is suspected that internal damage may have occurred during shipment. Transformers that cannot be shipped completely assembled are partially disassembled, with some or all of the dielectric fluid shipped separately in containers.

This instruction documents the guidelines and precautions that should be followed when refilling a completely assembled transformer with liquid at the installation site.

The equipment used to handle and process transformer liquids must be suitable for the type of liquid used and maintained specifically for that purpose. The equipment must be clean and dry. Suitably lined hose, metal hose and/or pipe, should be used instead of rubber. Threaded couplings and fittings must be sealed using appropriate sealants or Teflon tape.

IEEE standard C57.12.10 requires transformers with high voltage insulation levels of 350 kV BIL or higher, and kVA ratings of 10000 kVA and greater, regardless of BIL, to be designed for vacuum filling. Additionally, Niagara Transformer standard design & manufacturing practices may require vacuum filling of specific designs not within the scope of IEEE C57.12.10 standard requirements. Vacuum filling requirements are typically stated in customer specifications and confirmed on the transformer outline drawing and nameplate.



All transformer tanks are **not** designed for vacuum filling. The strength of each transformer tank is noted on the **transformer nameplate. Verify the tank strength before proceeding with vacuum filling.**



Transformers with conservator tanks are typically shipped with the conservator tank removed and the liquid level in the main tank a few inches below the tank cover. Conservator tanks are **not** designed to withstand **full vacuum** and must be isolated from the main tank if a full vacuum is applied to the main tank. When a conservator tank is supplied, assembly and filling instructions are provided in the Appendix A of this manual.



Warning: Always relieve an internal tank pressure (positive or negative) before attempting to open the transformer tank in any way (e.g. inspection port, vent plug, oil level plug, access openings or Bay-O-Net fuse holders). An internal tank pressure can be relieved by opening the sampling valve on pressure-vacuum bleeder device, or loosening a cover mounted vent plug. The Internal tank pressure must be reduced to zero. Exercise caution when venting, as the internal gases maybe combustible.



Warning: Niagara transformers are shipped with a nitrogen blanket in the gas space above the liquid level. Nitrogen gas will not support life. Before entering the transformer tank, purge the gas space with dry air. Failure to do so could result in death or injury. Always enter a transformer tank using O.S.H.A. vessel entry procedures.

6.7.1 Preparation for Liquid filling

Check the dielectric strength of the liquid to be used. Refer to the supplemental documentation provided in **Appendix B** of this manual for liquid specific dielectric strength values, and other handling and processing guidelines. Liquid filling cannot proceed if test results indicate a dielectric strength below specified minimums. In such cases, further processing and drying of the liquid is required.

The use a filter press and hot oil degassing equipment is the preferred method of preparing liquid for the filling operation. As a minimum, a filter must be used to clean the liquid before filling.

A filter press is effective for the removal of all types of foreign matter including finely divided carbon and moisture, if the filter media is properly maintained. Start with new filter paper. All filter paper must be kept dry until required. Replace filter paper without delay - hours of drying time can be lost if the paper is exposed to the air for more than a few minutes.

If the filling process is to be done outdoors, the weather should be reasonably clear with humidity not exceeding 70%. The liquid temperature should be 0°C or higher.



Static charges can develop in piping, hose, and tanks as liquid flows through those components. Ground all metallic surfaces, including bushings, hose and processing equipment during the filling operation. Installation of a properly sized permanent transformer ground must be done as soon as the transformer is placed in its final location, and before further inspection, assembly and filling can be started.



IEEE C57.93 CAUTION

Dielectric liquid passing through filter papers or ungrounded or unbonded hoses may acquire an electrostatic charge that will be transferred to the transformer windings as the transformer is filled. Under some conditions, the electrostatic voltage on the winding may be hazardous to personnel or equipment. To avoid this possibility, all externally accessible transformer bushing terminals, as well as the tank and liquid filtering equipment including oil hoses, should be properly grounded during filling.

6.7.2 Non-vacuum (atmospheric) filling

Vacuum filling, if only with a partial vacuum, is preferable to atmospheric filling. Filling at atmospheric pressure is acceptable for those designs that do not fall within the scope of the IEEE standard C57.12.10 vacuum fill requirements and have been designated for atmospheric filling by the manufacturer.

IEEE standards require transformers greater than 2500 kVA to have a top filter press valve, which can be used for liquid filling. Transformers 2500 kVA and below are required to have a 1" NPT opening and plug above the 25°C liquid level, usually on the tank cover, that can be used for liquid filling.

Alternatively, aeration of the liquid for large or smaller units can be avoided by filling the transformer through the bottom drain valve.

Venting provisions are provided above the 25°C liquid level, for all designs, to relieve the internal gas pressure created as liquid fills the tank. Ensure the tank is vented during the filling process.

Do not open any liquid drums or containers before the contained liquid is required.

During the fill process, liquid is pumped from the liquid storage container through a filter press into liquid degassing equipment, then into the transformer tank. If degassing equipment is not available, liquid can be pumped from the container, through a filter press and into the transformer tank.

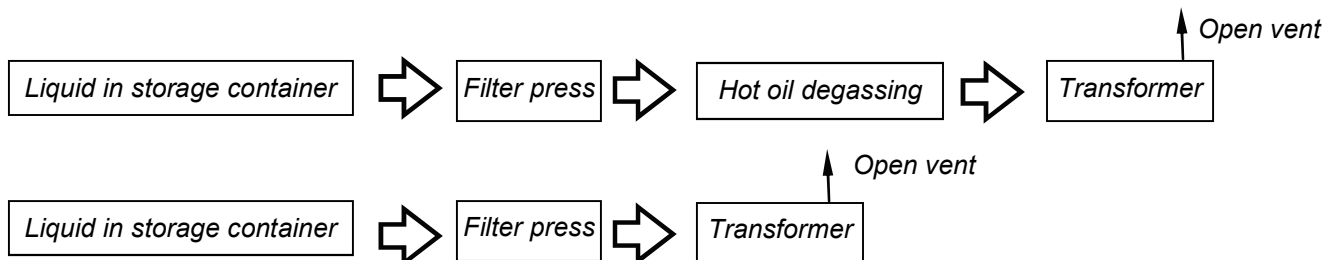



Figure 16 – Fill process at atmospheric pressure

When the tank has been filled to the required level, close all valves and vent openings on the transformer tank, and processing equipment. Disconnect the filling equipment. Purge the transformer gas space with dry nitrogen using the sampling valve on the pressure-vacuum bleeder, and the tank venting provision. Target value for gas space Nitrogen content is 97% (3% Oxygen or less). When purging is complete, close the vent plug and apply a final three (3) PSI positive pressure dry nitrogen blanket (through the sampling valve of the bleeder device) to the gas space of the transformer. When specified (at time of order), dedicated gas space sampling and purge valves can be supplied on the transformer.

Allow the transformer to stand for 48 hours, before applying voltage. **Refer to the Final Inspection and Pre-operational testing sections of this manual before energizing.**

 Nitrogen gas used in transformers manufactured by Niagara Transformer Corp. must meet the following specification:

ASTM D1933-1997 Type 3

Dew Point:.....-59°C (-75°F)

Nitrogen & rare gas:.....99.993%

Maximum Oxygen content:.....0.002%


Maximum Hydrogen content:.....0.005%


6.7.3 Vacuum filling


This section documents the filling procedure for **transformers that are designed for, and require vacuum filling**. The use of correct processing and fill procedures will ensure complete (liquid) impregnation of the insulation system and elimination of free undissolved gas bubbles that can reduce dielectric strength and possibly lead to failure.

All pressure sensitive devices must be removed or isolated from the transformer tank, specifically the pressure-vacuum gauge and pressure-vacuum bleeder device located behind the PV gauge. Openings in the tank used to mount these devices must be sealed with suitable plugs or cover plates **The mechanical pressure relief device and cooling radiators used on Niagara Transformers are designed to withstand full vacuum.**

Transformer tanks and **external On-Load Tap-Changer compartments** are designed to withstand complete vacuum individually or together. While vacuum is applied to either one, the pressure in the other must not be greater than atmospheric pressure.

 When pulling vacuum on the transformer tank, the radiator, pump and OLTC equalizing tube valves (if present) must be **open**.

 When pulling vacuum on the transformer tank, drain, fill and Hydran monitor valves must be **closed**.

 **Warning:** Many transformer designs use the available sealed space inside tank channel braces to supplement the gas space in the transformer tank. When this is the case control valves are supplied to isolate the bracing gas space from the main tank during vacuum processing and shipment.

The control valves are closed for shipment and must be closed during vacuum processing. The valves must be open when the transformer is in service.

The control valves are located near the top of the tank, on one or more of the tank walls. The valves are identified by a label and tubing that connects them to a channel brace. Refer to the transformer outline drawing to verify the existence and location of gas space control valves.

Tank braces that are used for gas space expansion are purged with dry nitrogen at the factory. If the bracing gas space has been open to the atmosphere for an extended period of time, the space should be purged with dry nitrogen to reduce oxygen and moisture content. Purging instructions are provided in **Appendix A** of this manual for such units.

⚠ IEEE C57.93 CAUTION

a) Ensure the transformer tank and all fittings are suitable for vacuum, including:

- 1) Conservator tank (tank and bladder, if equipped, have to be pressure-equalized)
- 2) Radiators, pumps, and their valves

If any of these fittings are not designed to withstand vacuum, they need to be removed or valved off.

b) Ensure the LTC is suitable for vacuum or has its pressure equalized.

c) Ensure instrumentation is suitable for vacuum (older combustible gas sensor units must not only be isolated but usually removed from the transformer during application of a vacuum).

d) Ensure no additional structure load is to be put on top of the transformer under vacuum. Work on top of the transformer while under vacuum should be avoided due to personnel safety concerns in the event that vacuum is suddenly lost and the tank surface moves abruptly. A transformer under vacuum should not be moved.

⚠ IEEE C57.93 CAUTION

Caution must be taken with the pressure-relief device blanked off. Overfilling without pressure relief can cause tank damage.

ⓘ Note: The mechanical pressure relief device and cooling radiators used on Niagara Transformers are designed to withstand full vacuum.

⚠ IEEE C57.93 CAUTION

Do not allow dielectric liquid to enter the vacuum pump. For transformers with nitrogen pressure systems, fill the tank to the indicated level; for conservator-type transformers, fill as high as possible [perhaps 100 mm (4 in) from the top] before removing the vacuum. Break the vacuum with dry bottled gas to a positive pressure. For nitrogen pressure systems, this should be a gauge pressure of 14–35 kPa (2–5 lbf/in²).

During the vacuum fill process, liquid is pumped from the liquid storage container through a filter press into liquid degassing equipment, then into the transformer tank. If degassing equipment is not available, the liquid can be pumped from the container, through a filter press and into the transformer tank.

Filling attachment to the transformer tank is at the top filter press connection – a 1" valve on units greater than 2500 kVA, or a 1" NPT fill plug (usually located on the tank cover) for transformers rated 2500 kVA and below.

The top liquid inlets should be separated as much as possible from the vacuum line attachment to avoid liquid spray from entering the vacuum line.

Alternatively, aeration of the liquid for large or smaller units can be avoided by filling the transformer through the bottom drain valve.

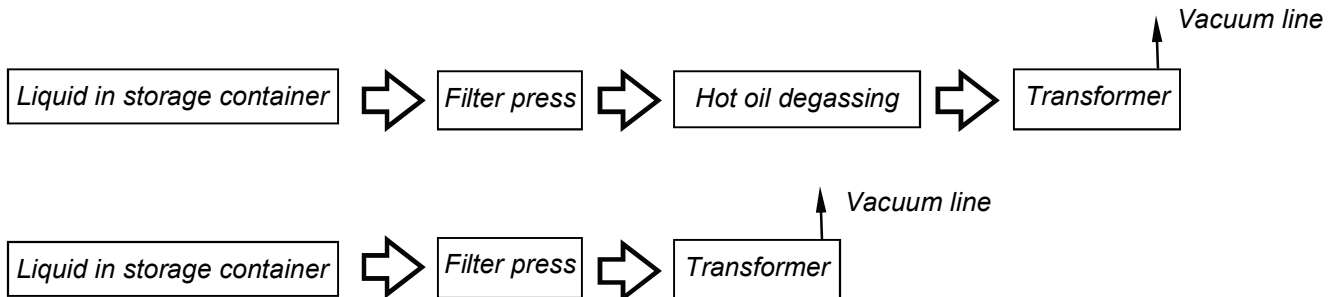


Figure 17– Vacuum fill process

**IEEE C57.93 CAUTION**

If ambient temperatures are 5 °C (41 °F) or less, the oil should be heated gradually and directed so that it does not splash on porcelain bushings. Failure to comply may break the bushing porcelains due to thermal shock.

**IEEE C57.93 CAUTION**

Most field processing units are capable of heating transformer oil above 85 °C (185 °F) using resistive heating elements or other means through heat exchangers. Field heating of transformer oil above 85 °C (185 °F) may scorch the oil causing combustible gases to dissolve in the oil. These gases may misrepresent the baseline of future dissolved gas analysis (DGA).

— Vacuum connections should be at the top of the transformer tank as far away as possible from the oil entrance.

**IEEE C57.93 CAUTION**

Review the transformer instruction literature to be sure that the main transformer tank, auxiliary tanks, terminal boards between compartments and all ancillary items are rated for designated full vacuum [101.3 kPa (14.7 PSI)] at elevated temperatures. Epoxy or non-metallic terminal boards may not be rated for full vacuum at elevated temperatures. Ancillary devices such as fault pressure relays or monitoring devices may require removal or valving off, if not rated for full vacuum.

**IEEE C57.93 CAUTION**

Conservator tanks with rubber bladders may be designed for full vacuum. Prior to applying vacuum to a conservator tank designed for full vacuum, ensure conservator tank and the rubber bladders are in equalization. Vacuum applied to the conservator tank without equalization to the rubber bladder may damage or weaken the rubber bladder.

6.7.3.1 Vacuum fill procedure

- a) Connect the vacuum pump to the vacuum connection fitting provided on the transformer tank cover. Use pipe or reinforced hose of sufficient size to minimize pressure losses.
- b) The vacuum pressure in the transformer tank must be monitored with a suitable gauge, located as far as possible from the vacuum line attachment point. The mounting flange for pressure-vacuum gauge/bleeder device, or a cover mounted vent provision may be used for this purpose.
- c) All joints and fittings in the vacuum filling system must be tight and leak proof.
- d) Close all liquid and gas valves and start to draw a vacuum on the tank. Continue vacuum pumping until the vacuum level shown in **Table 3** has been reached.
- e) Close the vacuum control valve, and temporarily stop the vacuum pump.
- f) Conduct a vacuum leak test. The internal tank pressure rise is observed over a period of thirty (30) minutes. The rate of rise is dependent on the volume of liquid (if any) in the tank and the integrity of the tank seal. Acceptable test values are shown in **Table 4**. Unacceptable results indicate a leak that must be located and repaired. Restart the fill procedure at step "d".
- g) Following an acceptable pressure rise test, restart the vacuum pump and open the vacuum valve. Maintain a vacuum level per **Table 3** for one (1) hour.
- h) Start filling the tank with liquid. A positive liquid pressure should be maintained throughout the filling process.
- i) If transformer was shipped dry, filling to at least the top of the core and coil assembly should be done in one continuous operation. Ensure sufficient liquid is ready and available.
- j) Vacuum must be maintained during the filling operation. Regulate the liquid flow to prevent the internal pressure from rising beyond the limits shown in **Table 3**. If this does occur temporarily stop the liquid flow into the tank and continue to draw vacuum until the appropriate vacuum (or better) has been restored.

- k) Stop the filling process when the transformer tank has been filled to the correct level. Sealed tanks with or without a nitrogen gas preservation system, are filled to the proper level as indicated by the transformer liquid level gauge. Transformers with conservator tanks are filled as high as possible, typically within four (4) inches of the top flange of the tank. Complete conservator tank assembly and filling instructions are provided in the Appendix A of this manual for transformers equipped with a conservator tank.
- l) Close all liquid control valves and break the vacuum with dry nitrogen gas.



Nitrogen gas used in transformers manufactured by Niagara Transformer Corp. must meet the following specification.

ASTM D1933-1997 Type 3

Dew Point:.....	-59°C (-75°F)
Nitrogen & rare gas:.....	99.993%
Maximum Oxygen content:.....	0.002%
Maximum Hydrogen content:.....	0.005%

- m) When the internal tank pressure reaches zero (0) PSI, reinstall the pressure-vacuum gauge and bleeder device, and open the bracing gas space control valves.
- n) Continue the flow of nitrogen gas and apply a 3 PSI blanket of nitrogen to the gas space above the liquid. If a nitrogen gas preservation system is supplied vacuum can also be broken with the system gas supply.
 Target value for gas space Nitrogen content is 97% (Oxygen content 3% or less)
- o) A minimum stand (soak) times, per **Table 5**, must be observed between the completion of vacuum filling and the application of voltage. **Refer to the Final Inspection and Pre-operational testing sections of this manual before energizing.**

Table 3 - Vacuum level during filling, determined by Primary voltage class

Primary voltage class (kV)	Vacuum (mmHg)
Less than 138	2.0
138 and greater	1.0

Table 4 - Vacuum leak test - acceptable internal pressure increase

Primary Voltage (kV)	Max. pressure increase (mmHg)
115 and below	3.0
138 to 161	1.5
230 and greater	1.0

Table 5 – Stand time (after filling) before applying voltage

Primary Voltage (kV)	Vacuum hold time (hours)
69 and below	18
115 to 138	24
230 and greater	48

7 Accessories and components

7.1 Bushings

Bushings used on transformers manufactured by Niagara Transformer Corp. are carefully researched and selected to meet all design and customer requirements.

7.1.1 Bushing Types

Bushings are typically one of two designs, draw lead, or bottom connected.

Draw lead bushings are used for higher voltage / lower current applications that can be safely handled by a cable lead. The line conductor from the winding assembly is extended to and terminated at the top of the bushing porcelain. A terminal stud, factory installed at the end of the cable lead, is secured to the bushing porcelain by a locking pin. A gasketed top terminal cap threads onto the terminal stud sealing the complete assembly. Draw lead bushings can be installed with minimal access to the transformer tank interior.

Bottom connected bushings are used for lower voltage / higher current applications. The bushing conductor, which is integral to the bushing, is fabricated from bar or rod, sized to suit the current rating of the bushing. Phase connections to the bushing, from the windings, are made with heavy cable or flexible copper straps. Installations of bottom-connected bushings require more access to the tank interior than draw lead bushings. Installers must be able to reach connection points at the bottom of the bushings, and are working with heavier connection materials. Some installations may require lowering the liquid level in the tank to facilitate installation.

Hybrid bushings, suitable for draw lead or bottom connection are frequently used for applications above 34 kV. The bushings are oil filled and sealed by the manufacturer and have an internal stress equalizing condenser.

A hybrid bushing is shown in **Section 4.3.2 Figure 8**.

A bottom connected, high current bushing assembly is shown in **Section 4.3.2 Figure 9**.

The insulating body of bushings designed for higher voltage applications (5 kV and above) is commonly wet process porcelain, although other materials such as silicone rubber are available.

The insulating body of fixed stud type bushings can be molded epoxy or wet process porcelain. Material selection is determined by site location, bushing location (on the transformer tank), and current and voltage ratings.

7.1.2 Handling of Bushings

Bushings are ready for use as received, and should be handled with care to avoid damaging the porcelain or epoxy bodies. Porcelains should be wiped clean with alcohol or dielectric solvent before installation.

Store bushings in the packaging used for shipment. Detailed instructions for storage, handling, maintenance and installation are provided for all bushings in the shipping container and in **Appendix B** of this manual. It is important to note that many bushings, particularly those that are oil filled, have specific storage instructions that must be followed.

Transformers with exposed bushings, unprotected by a throat interface or terminal chamber, must be handled carefully to avoid contact with cables or slings or adjacent structures and equipment.

Bushings must not be used as a structural support for conductors or other components. Excessive loading will compromise the cantilever strength of the bushing and gasket seal.

Minimize mechanical loading of bushings by using supplemental cable or bus supports and flexible connections to bushing terminals.

7.1.3 Bushing maintenance

Porcelain and epoxy bushings require little maintenance when in service. Periodic inspection should be done based on site conditions. Regular cleaning prevents accumulation of contaminants that can increase the possibility of a flash over.

7.2 Gaskets

The gasket material used for the bushing and inspection openings of oil filled transformers is cork-rubber composition, Armstrong type NC-711, or equivalent. The material has a low sealing point and is fatigue resistant with controlled flow characteristics. It is also compatible with most if not all other transformer liquids.

When replacing gaskets it is important to verify that the gasket material is compatible with the liquid in the transformer. The following is a brief summary of compatibilities and requirements.

- a) Cork-synthetic rubber compound is compatible with oil, silicone, R-Temp fluid**, or Envirotemp FR3. Gasket stops are optional with this material.
- b) Buna "N" (Nitrile) gaskets are compatible with oil, R-Temp fluid** and Envirotemp FR3, **but not silicone**. Gasket stops must always be used.
- c) Neoprene (Chloroprene) gaskets are suitable for use with silicone and R-Temp fluid**, **not oil**. Used for special molded gaskets, compression control is required.
- d) Sponge rubber (closed cell structure) is used for air filled compartment covers etc. It is not suitable for use with transformer coolants.

Most factory installed gaskets factory are reusable and do not require cement. Non-standard materials, gaskets and cements, that have been factory installed, should be replaced, using the same materials. If in doubt contact the manufacturer.

Radiator shut-off valves are supplied with "O" ring gaskets. Spare gaskets are shipped with the transformer.

Other available fire resistant fluids such as Alpha and Beta fluids have similar physical characteristics to R-Temp fluid**. Generally, gaskets chosen for use with R-Temp fluid** are also suitable for use with those other high fire point fluids, **however, consultation with the manufacturer is recommended**.

Gasket and packing materials used for transformers filled with **Midel** and **Envirotemp FR3 fluid** should be compatible with vegetable oils. Buna-N and Nitrile seals are satisfactory for temperatures up to 212°C (100°C). For extended service at higher temperatures, Viton or fluorocarbon-based seals are recommended.

Consult the manufacturer for fluids not covered in this section.



** Note: R-Temp fluid is no longer used or available.

7.3 De-energized Tap-changers

A de-energized tap-changer provides a means of changing the voltage ratio of a transformer without breaking the transformer seal. The operating handle is usually located on a side wall of the transformer tank. Tap-changer positions and associated voltage and current ratings are provided on the transformer nameplate. A position indicating or index plate is part of the operating handle assembly and references the positions shown on the transformer nameplate.

All tap-changer handles include provision for padlocking. Padlocks are typically supplied by the Customer, but can be included in the transformer scope of supply if specified at time of order. If the padlock option is not used, it is recommended that a fastener is used to secure the handle in position.

7.3.1 Tap Changer operation

- a) **De-energize** the transformer.
- b) Remove the padlock or fastener securing the handle in position.
- c) Pull the release pin on the handle and rotate to the desired position, ensuring that the release pin re-engages the index plate at the new position.
- d) Secure the handle in position with padlock or other fastener.

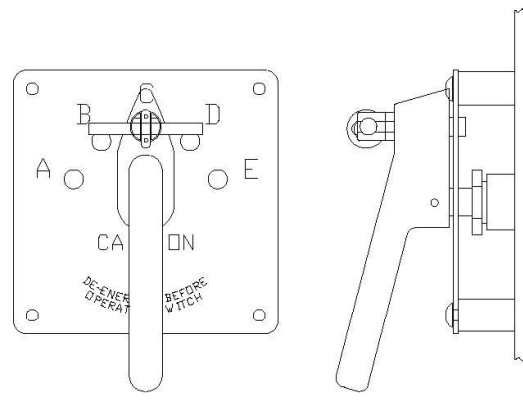


Figure 18– De-energized Tap Changer Operating Handle

7.3.2 Tap-changer Maintenance

The tap-changers of transformers in service do not require attention other than periodically checking for leaks around the sealing gland of the operating handle shaft.

During transformer shutdown service the tap changer per the following instructions.

- a) **Tap-changer maintenance for transformers filled with mineral oil or Envirotemp FR3**
 Rotate the operating handle of the de-energized tap-changer through all positions three (3) or four (4) times to exercise and clean the contacts of the switch. Return the operating handle to its original position if a change in ratio is not required.



Caution: The transformer must be de-energized before operating the off-circuit tap-changer.

- b) **Tap-changer maintenance for transformers filled with Silicone liquid**

It is important to periodically exercise and clean the contacts of de-energized tap-changers immersed in any of the industry standard dielectric liquids, but especially so for transformers filled with **silicone liquid**. De-energize the transformer and rotate the operating handle of the tap-changer through the entire range of tap positions, a minimum of ten (10) times. The frequency of performing this maintenance activity can be related to transformer application and loading. Recommended guidelines are provided in **Table 2**.

Table 2 - Tap-changer maintenance guidelines for transformers filled with Silicone liquid

Application	Frequency
Commercial and residential	every 12 months
Industrial installations	every 6 months
Heavy loading such as in rolling mills or furnace applications	every 3 months

Tap-changer maintenance must be performed regularly on all transformers filled with silicone fluid.

7.4 On-Load Tap-Changers

The On-load Tap-Changer is a switching device, designed to change the ratio of the transformer, while under load. The ratio change is made to compensate for voltage changes that occur due to changing load demands on the transformer.

The transformer ratio is changed in steps; each step represents a number of turns in the transformer winding. The total number of steps required is determined by the Customer and specified at time of order.

When the On-Load Tap-Changer operates, arcing occurs. The Tap-Changer is housed in a liquid filled compartment, separate from the transformer tank, to prevent contamination of the transformer oil. All components that make or break the current during the operation of the Tap-Changer are located in the Tap-Changer compartment.

On-Load Tap-Changers are typically mounted on the outside of the transformer tank. The Motor-Drive mechanism can be directly attached to the OLTC housing or housed in a separate shaft connected compartment. Self-contained "in tank" versions of on-load tap-changers are also available.

On-Load Tap-Changers can be supplied with a variety of options such as remote position indication, multi-position switches, step-by-step operation, conservator tanks, liquid filtration and special instrumentation, all as specified by the customer at time of order.


Complete installation, commissioning, and maintenance guides are provided with each On-Load Tap-Changer, and are included in **Appendix B** of this manual.



Figure 19 - On-Load Tap-Changer

7.5 Liquid Temperature Indicator

The liquid temperature indicator is furnished as standard equipment to indicate the top liquid temperature in the transformer, measured in degrees Celsius.

 The gauge temperature reading is the sum of the ambient air temperature plus the temperature rise of the transformer liquid.

The device can be supplied with or without SPDT contacts for alarm, trip and/or fan actuation. The temperature sensing element is mounted in a leak-proof well, permitting removal of the gauge without lowering the liquid level or relieving the pressure in the transformer tank.

The indicator is equipped with an additional red drag hand which indicates the highest temperature reading since the last reset. The reset button is located in the center of the dial face for gauges without contacts or at the side of the gauge case for units with contacts.

Contact settings (if provided) are field adjustable by removing the dial bezel and repositioning the small red, trip position indicators.

Temperature gauges can be supplied for direct mounting on the leak proof well or for remote mounting on the transformer tank to improve visibility and facilitate access for wiring connections. Remote mounted gauges are connected to the temperature sensing bulb & well by a capillary tube protected by stainless steel spiral interlocked armor.

Optional electronic temperature monitors featuring RTD sensing elements, digital displays and SCADA outputs are also available. When specified and supplied, operation and maintenance instructions specific to the monitor are provided in **Appendix "B"** of this manual.

Standard switch ratings are:

10 A at 125/250/480 VAC

0.5 A at 125 VDC, non-inductive

0.25 A at 250 VDC, non-inductive

Refer to the project wiring diagrams for unit specific ratings.

The recommended contact settings for the top liquid temperature Indicator are:

Switch 1, for fan operation closes at 70°C for 55°C rise transformers

Switch 1, for fan operation closes at 80°C for 65°C rise transformers

Switch 2, for alarm operation closes at 105°C for 55 and 65°C rise transformers

Switch 3, for trip operation closes at 115°C for 55 and 65°C rise transformers

Other settings may be used to suit customer specifications and special design requirements.



Figure 20 – Liquid Temperature Indicator – remote mount type

7.6 Winding Temperature Indicator

Winding temperature indicators are supplied when specified, or for transformers with forced-cooled ratings of 133 percent or greater of the self-cooled (ONAN) rating.

The winding temperature is simulated by using a proportional current transformer output to power a heating element contained in a thermal well. The temperature rise due to the heater output is added then added to the top liquid temperature.

The temperature sensing probe is mounted in a leak proof well which permits removal of both the indicator and the sensing probe without lowering the liquid in the transformer or relieving the pressure within the transformer tank.

The thermal well is heated by both the surrounding liquid and the heater element energized by a current transformer inside the transformer tank. The combination of the two temperatures is indicated on the winding temperature gauge. An additional red drag hand indicates the highest temperature reading since the last reset. The drag hand can be reset by a push-button at the bottom of the dial bezel.

Contacts can be specified to activate fan, alarm and trip circuits. Contact settings are field adjustable by removing the dial bezel of the gauge and repositioning the small, red trip indicators.

The equipment is calibrated to indicate the hottest spot of the transformer windings. All contacts are factory set to operate at the temperatures shown on the project wiring diagrams.

Should an accuracy and calibration check be required, remove the instrument from the well, and immerse the stem in a small container of insulating liquid or water. Heat the container and compare temperature readings with those shown on a good quality thermometer. Contact operation and calibration may be tested by direct action or with an ohmmeter. If readjustment of the contacts is necessary consult the manufacturer.

Winding temperature indicators like liquid temperature indicators can be mounted remotely on the transformer tank to improve visibility and facilitate wiring connections. The gauge is connected to the temperature-sensing bulb by a capillary tube protected by stainless steel spiral interlocked armor.

Optional electronic winding temperature monitors featuring RTD sensing elements, digital displays and SCADA outputs are also available. When provided, operation and maintenance instructions specific to the equipment supplied are provided in Appendix "B" of this manual.

Direct reading winding temperature indicators require the insertion of a sensing probe or element into the transformer winding. In addition to the inherent dielectric concerns, these devices may be affected by the presence of harmonic currents producing eddy current heating in the sensing element, making the temperature reading output slightly higher than the actual winding temperatures.

If the direct reading temperature output is necessary, Niagara Transformer Corp. recommends the use of fiber optic devices.

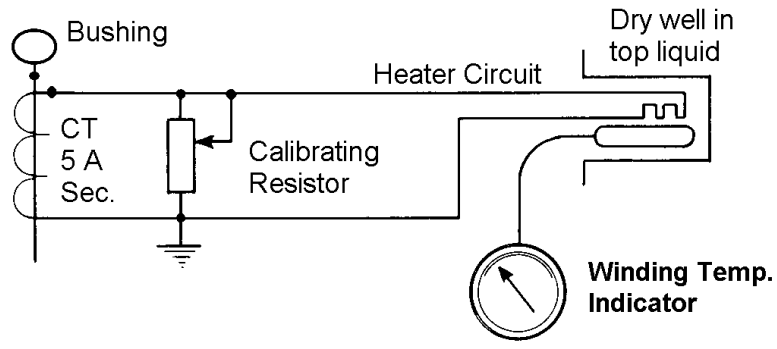


Figure 21 – Winding Temperature Simulation Diagram

Standard switch ratings for winding temperature indicator:
10 A at 125/250/480 VAC.
0.5 A at 125 VDC, non-inductive.
0.25 A at 250 VDC, non-inductive

Refer to the project wiring diagrams for unit specific ratings.

The recommended contact settings for the winding temperature Indicator are:
Switch 1, for fan operation closes at 80°C for 55°C rise transformers
Switch 1, for fan operation closes at 90°C for 65°C rise transformers
Switch 2, for alarm operation closes at 120°C for 55 & 65 °C rise transformers
Switch 3, for trip operation closes at 125°C for 55 & 65°C rise transformers

Other settings may be used to suit customer specifications and special design requirements.



Figure 22 – Thermal plates (wells) for winding temperature simulation



Figure 23 – Liquid / Winding Temperature Gauge

7.7 Liquid Level Gauge

All liquid filled transformers are equipped with liquid level indication. Transformer liquid levels should be checked and documented regularly as part of scheduled maintenance program.

The gauge float arm assembly inside the tank is magnetically coupled to the gauge across a sealing flange for leak free operation. The sealing flange and gauge assembly are mounted on a flange welded to the transformer tank. The pointer on the gauge face provides visual indication of the current liquid level relative to 25°C, HI and LO reference marks.

Gauges are supplied with or without contacts for alarm or trip purposes as specified by the customer. The diameter of the gauge dial can vary depending on the location of the gauge on the transformer and if contacts are provided.

The magnetic coupling across the sealing flange permits removal of the gauge assembly in the field for repair or replacement without having to break the tank seal or lower the liquid level. The gauge assembly is easily removed from the mounting and sealing flange by removing the screws at the side of the gauge body.

Special requirements such as alarm contacts, non-standard dial face markings, SCADA output and conduit attachment are available and supplied per customer specification.

Standard switch ratings are:

10 A at 125/250/480 VAC.

0.5 A at 125 VDC, non-inductive.

0.25 A at 250 VDC, non-inductive

Refer to the project wiring diagrams for unit specific ratings.

Warning: Do not energize a new transformer, or re-energize a unit that has been shut down, if a low liquid level is indicated. Determine the cause and take corrective action. For energized "in service" transformers that indicate a low liquid level, check for leaks and review maintenance records to determine cause and need for corrective action.






Figure 24 – Liquid Level Gauge Assembly

7.8 Pressure Vacuum Gauge, Bleeder, Switches

7.8.1 Pressure Vacuum Gauge

The pressure vacuum gauge indicates the internal gas space pressure in a liquid filled or gas filled transformer tank. The gauge pressure range is typically 10 PSIG vacuum to 10 PSIG positive pressure. The pressure in a liquid filled transformer varies depending on the transformer operating temperature and ambient conditions. If the transformer is de-energized or operating under light load in a low ambient, the pressure may be negative range.

The gauge is constructed for long life under indoor or outdoor conditions and requires no maintenance.

-  **Note:** The transformer should be checked for a leak in the tank seal if the pressure vacuum gauge reads zero for a period of time, unaffected by load conditions.
-  **Note:** The pressure vacuum gauge is not designed to withstand the pressures associated with vacuum filling. Remove the gauge (and plug the opening in the tank) prior to vacuum processing. Replace the gauge during the fill process when the internal tank pressure reaches zero. **Refer to section 6.8 "Filling Transformers with Liquid" for more detail.**
-  **Note:** Pressure-vacuum gauge readings should always be done in conjunction with the reading of the top liquid temperature indicator. Internal tank pressure is affected by liquid expansion and contraction, which is a function of liquid temperature.

7.8.2 Pressure Vacuum Bleeder Valve

A pressure vacuum bleeder device with purge valve is supplied on transformers over 2500 kVA or when specified by the Customer.

The bleeder is designed to balance pressure and vacuum conditions inside the sealed tank by releasing gas or admitting air at pre-determined settings.

The device is designed for indoor or outdoor applications, and has a sampler valve & hose fitting built into the body of the bleeder. Screened openings inhibit the entry of contaminants.

The sampling valve and hose barb may also be used to add nitrogen to the transformer gas space.

The bleeder valve can be mated with a pressure vacuum gauge for simplified installation.

Adjustment screws located in the center of each bell (pressure & vacuum) permit adjustment of the pressure and vacuum settings from 1 to 10 PSI. The device is preset at the factory to operate at pressures of 8 PSI positive and 5 PSI negative.

The purge valve is operated using the thumbscrew located on the vacuum side of the device. This valve can be used to equalize pressure before removing inspection covers or to obtain gas samples.


-  **Caution:** Due to the relatively low flow rate of gas through the valve, it should not be depended on solely to limit pressure during transformer pressure tests. It should also be noted that the device will not relieve a sudden pressure rise such as that caused by a major fault. A separate mechanical pressure relief device should be used for this purpose.



Figure 25 – Pressure Vacuum Gauge and Bleeder

7.8.3 Pressure Vacuum Switches

These switches provide additional control and alarm options for transformer installations. The switch contacts are set to close at predetermined pressure limits providing inputs to alarm and control circuits monitoring the transformer.

Switch contacts are factory set, but can be adjusted if necessary. Calibration in the field is not recommended; when necessary contact the manufacturer for instructions. Pressure/vacuum switches can be mounted separately or combined in assembly with related pressure gauges and bleeders. The switches typically have SPDT contacts, rated for 15 A at 125/250 VAC resistive.

Refer to the project wiring diagrams for order specific settings and ratings

7.9 Pressure Relief Device

The pressure relief device is designed to sense and relieve a dangerous pressure increase in the transformer tank that may be a result of a fault or short circuit condition.

The pressure relief device is essentially a valve consisting of a stainless steel diaphragm held in a gasket sealed position by springs compressed to design values. The diaphragm maintains its seal until the tripping pressure is reached, at which point the valve snaps open. Sensing and full valve opening occurs within 2 milliseconds, allowing excess gas or liquid to be released.

The device automatically re-closes and re-seals when the internal pressure drops to approximately 4 PSI. The pressure relief device is mounted above the liquid level on sealed transformers and below liquid level on conservator type transformers. An optional gas bleed system is provided on pressure relief device when used below the liquid level.

An optional sealed, weatherproof operation alarm switch can be mounted on the cover of the pressure relief device. The SPDT switch is wired to terminal blocks in the transformer control box. The switch is actuated by movement of the sealing/operating disc of the device; during operation the switch is latched and must be manually reset using the reset lever under the switch.

Standard switch ratings are:

- 15 A at 125/250/480 VAC.
- 0.5 A at 125 VDC, non-inductive.
- 0.25 A at 250 VDC, non-inductive

Refer to the project wiring diagrams for unit specific ratings.

A brightly colored indicator pin (mechanical) in the cover of the device indicates device has operated. The pin will remain in the raised position, indicating the unit has functioned, until manually reset by pushing it down until it rests on the sealing/operating disc.

An optional long arm semaphore provides visual indication of operation at greater distances.

Directional discharge covers that control the spray of liquid or gas during operation of the pressure relief device are available for installations with more stringent protection and containment requirements.



Figure 26 – Pressure Relief Device

7.10 Rapid Pressure Rise Relay

Severe arcing in the liquid of a transformer under fault conditions will generate a high volume of gas in a relatively short period of time. Rapid pressure rise relays are designed to detect, but not relieve, those types of rapid pressure increases in excess of established safe limits. Upon detection a momentary contact in the device closes to provide a control signal to protective breaker and alarm circuits.

The standard model supplied on a Niagara transformer is a Qualitrol series 910. It features high sensitivity and repeatability with temperature compensation for consistent performance over a wide range of temperature variations. The relay is unaffected by vibration, mechanical shock or pump surges. It will also withstand full vacuum or 20 PSI positive pressure without damage, making it possible to vacuum fill the transformer without removing the relay.

The switch in the relay has momentary contacts. An optional latching relay will “seal-in” the momentary switch signal for alarm and trip purposes.

- Standard switch ratings are:
- 15 A at 125/250/480 VAC.
 - 0.5 A at 125 VDC, non-inductive.
 - 0.25 A at 250 VDC, non-inductive

The relay is available in two versions. The series 900 relay is designed for mounting under the liquid level, with a bleeder valve provided on top of the relay housing. The Series 910 relay is for use in the gas space of a transformer.

7.11 Latching (Seal-in) Relay

The seal-in relay (schematic device 63X) designed for use with the rapid pressure rise relay, automatically maintains the alarm and trip circuit signals after the momentary contacts of the pressure rise relay has operated.

The signals are electrically maintained until the manual reset button is operated.

The relay is available in two models varying by suitability for different AC and DC power supply ranges. The internal circuitry is on printed circuit board, and external connections are made on screw-type terminal blocks suitable for a 12 to 22 AWG wire range.

Two LED indicating lights are provided on the relay. The red LED indicates the seal-in circuit is latched, and is de-energized when the circuit is released and all contacts return to their normal positions. The yellow LED indicates a short in the device or faulty wiring.

Refer to project drawings for supply voltage and contact ratings.



Figure 27 – Qualitrol Rapid Pressure Relays



Figure 28 – Latching (Seal-in) Relay

7.12 Cooling Fans and controls

Fan forced air cooling is supplied to supplement limited radiator cooling at base capacity ratings or increase cooling and transformer capacity over the self-cooled rating. When used to increase transformer capacity over base self-cooled ratings, other components such as tap changers, bushings, temperature controls and wiring must be designed to suit the increased capacity.

Fan controls include a signal contact on the liquid temperature indicator and/or winding temperature gauge, circuit breakers, a manual/auto/off control switch and a contactor to start the fans.

Fans are typically mounted on the sides of the cooling radiators, blowing horizontally across the panels of the radiator. If space is limited, fans can be mounted above the radiators blowing down, or, below the radiators blowing up.

Transformers not affected by shipping limitations are shipped with fans mounted on the cooling radiators, completely wired and ready for use.

Larger transformers may require removal of the radiators and fans for shipping. When this is the case, the fan controls are supplied completely wired and the fans must be reconnected to the terminal blocks in the transformer control cabinet, when the transformer is reassembled at the installation site.

IEEE Standard fan motors are 230 V, single phase; however other voltages, and three phase motors can be supplied.

The fan motors are capacitor start and run type with a built-in thermal overload relay. The relay is designed to automatically open circuit the motor in case of overheating, without affecting the operation of the other fans installed on the transformer.

The overload relay will automatically reset when the normal operating temperature is restored. In addition to the thermal overload protection, each fan circuit is individually fused.

The forced air rating of the transformer is based on all fans operating. Should one or more fans be out of service with others running, the forced air rating of the transformer is reduced accordingly.

The bearings of the fan motors are sealed, requiring no maintenance, however it is good maintenance practice to inspect and run the motors monthly while in storage and at least once a year when in service. Complete motor data is provided on the motor nameplate and project wiring drawings.

7.12.1 Provision for Future Fan Cooling

Transformers can be ordered with the **provision** to add fan cooling in the future, to increase the transformer's capacity. When this is the case, all current carrying components of the transformer are designed and supplied to meet the higher ratings associated with the increased capacity of the unit. In addition, thermal control device(s), such as liquid and winding temperature indicators, are supplied with the necessary contacts for fan control.

Wiring components such as circuit breakers, motor starters and fan terminal blocks are not supplied as standard practice, but can be added at time of order. If an additional control cabinet or junction box will be required to house the future fan controls, mounting brackets for those enclosures will also be supplied.

Note: The transformer nameplate will indicate if the unit has been designed for future forced air cooling and note the new fan cooled kVA rating.

The up-rating factors for fan-cooled ratings over self-cooled ratings are determined by IEEE Standard C57.12.10 and vary by base kVA.



Figure 29 – Cooling Fans on a Niagara transformer

7.13 Forced Oil / Forced Air Liquid Coolers

Oil Forced / Air Forced Liquid Coolers are oil to air heat exchangers used on larger power and rectifier transformers when other conventional cooling options are considered to be less effective or simply not possible.

The cooling process consists of circulating the transformer liquid through the inside of efficient, integral-finned tubes, while air is blown over the fins by propeller fans. The cooled liquid is then returned and recirculated throughout the transformer tank.

The cooling system components include the cooler, a pump, and piping connecting the cooler and pump to the transformer. Shut-off valves are included in the piping to isolate the pump and cooler from the transformer tank for maintenance and removal for shipping.

Flow indicators in the piping indicate correct flow direction and provide electrical switch contacts for control circuits.

The cooler can be protected from harsh site conditions such those that exist in coastal or chemical environments with optional paint finishes. This is an important requirement that must be identified at time of quotation.

Refer to the project wiring diagrams for fan and pump connections and ratings.

The cooler, piping and supports are normally removed for shipping. Special assembly instructions are included in **Appendix A** of this manual when the equipment is supplied. The Cooler manufacturer also produces detailed operation and maintenance guides, which are shipped with the cooler and copied in **Appendix B** of this manual.

The following are general installation, operation and maintenance notes.

- a) The coolers are designed to be supported by the inlet pipe connections and side or bottom supports mounted on the transformer tank. The top pipe connection is reinforced to prevent deflection.
- b) The cooler should be vented when filling with liquid. Generally, coolers are suitable for vacuum filling unless noted otherwise.
- c) Correct pump rotation must be verified. Remove the plug at the back end of the motor housing, energize motor briefly (no more than 5 seconds) and observe the shaft rotation.
- d) Pump rotation on oil-immersed pumps can also be checked using the flow indicator or the input current to the pump motor. If the pump rotation is reversed, flow will be reduced, and load on the motor will be below normal.
- e) Cooler fan rotation should be as indicated by the arrows on the cooler housing.
- f) The tube side of the cooler must be properly vented before starting. To prevent unnecessary thermal stress during startup, fluid on the tube side of the cooler is circulated before energizing the transformer.
- g) Do not cycle the pump(s) on and off for temperature control. The fans may be shut off, but the pumps should run continuously to avoid temperature differentials between the tubes and the transformer that will stress the tube joints.
- h) The cooling coil and cabinet should be inspected annually, and cleaned and painted when necessary.
- i) The cooling section fins should be cleaned using a high pressure steam of water or air. Use a brush and detergent to remove scaling deposits.
- j) If the liquid in the transformer is properly maintained, the inside of the cooler tubes should not require cleaning. If cleaning is necessary, flush the coil with a mixture of detergent and solvent.
- k) Cooling tubes may be re-expanded or replaced using special equipment available from the cooler manufacturer.
- l) The fan blades are aluminum and may have to be wiped clean with a solvent to prevent



Figure 30 – OFAF Cooler

- accumulation of dust or oil that may cause an imbalance.*
- m) *Lifting lugs are provided on the steel cabinet for lifting the complete unit. These lugs can also be used to remove the cabinet from the coil for maintenance purposes.*

7.14 Oil - Water Coolers

An oil-water cooler is a cooling option that provides high capacity cooling in a compact package. The coolers are available for natural convection oil flow or forced oil flow. Both types of coolers are available with a leak detector feature that allows immediate detection of any water leaks before the safety of the apparatus being cooled is endangered by water penetrating the oil.

Heat exchanger construction is shell and tube type, with oil circulation on the shell side and water flow through the tube.

Forced oil-water coolers may be mounted in either vertical or horizontal positions.

The natural convection cooling system consists of the cooler, piping connecting the cooler to the transformer tank, a piped water supply and shut-off valves to isolate the cooler from the transformer tank for cooler maintenance or removal.

Forced oil flow systems add a pump for oil circulation and flow indicators in the piping between the cooler and the transformer tank. Shut-off valves on the transformer tank isolate the pump and cooler for maintenance or removal.

Detailed assembly instructions for mounting and piping the cooler are provided in Appendix A of this manual when the equipment is supplied. Operation and maintenance guides, published by the cooler manufacturer, are also included. Refer to the cooler nameplate for required water temperatures and flow rates.

Refer to the project wiring diagrams for pump connections and ratings.

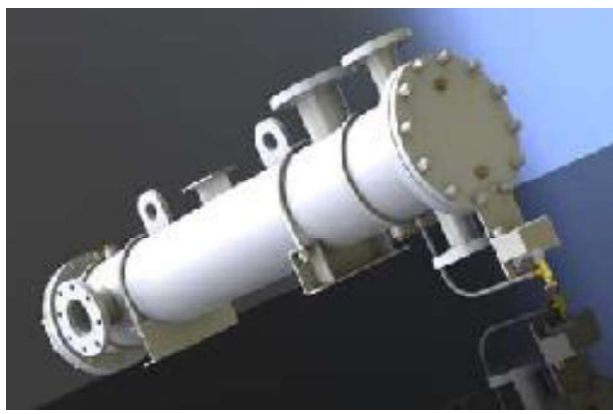


Figure 31 – OFWF Cooler (Oil Forced – Water Forced)

7.15 Conservator Type Transformers

Mineral oil and other transformer liquids can rapidly deteriorate when exposed to the atmosphere. The surface area and temperature of the liquid are key factors that directly affect the rate of deterioration. Sealed tank transformer designs with inert gas blankets above the liquid level minimize this exposure, but have other potential disadvantages. A leak in the transformer seal can allow air and moisture to be drawn into the tank, and moisture shed by the insulation system cannot be easily be dissipated.

Conservator type transformers offer a different approach to control this type of contamination. The design adds a liquid expansion tank, located above the transformer tank, allowing the transformer tank to be completely filled with insulating liquid. The expansion and contraction of liquid, and air exchange with the atmosphere (breathing), occur away from the large volume of liquid in the transformer tank. Because only a small amount of liquid is exchanged between the main tank and conservator tank, contamination of the transformer liquid, by oxygen and moisture exposure, is reduced. The reduction in liquid deterioration is also affected by daily temperature cycles.

The supply of a conservator tank system, and related accessories, is per customer specification. Considerations affecting requirement include site and duty conditions such as loading, cycle duration, ambient temperatures, ventilation, and liquid type.

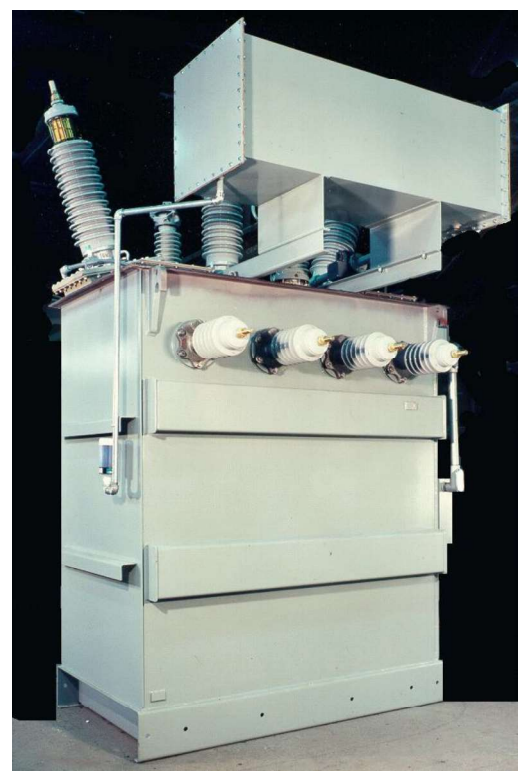


Figure 32 – Transformer with conservator tank

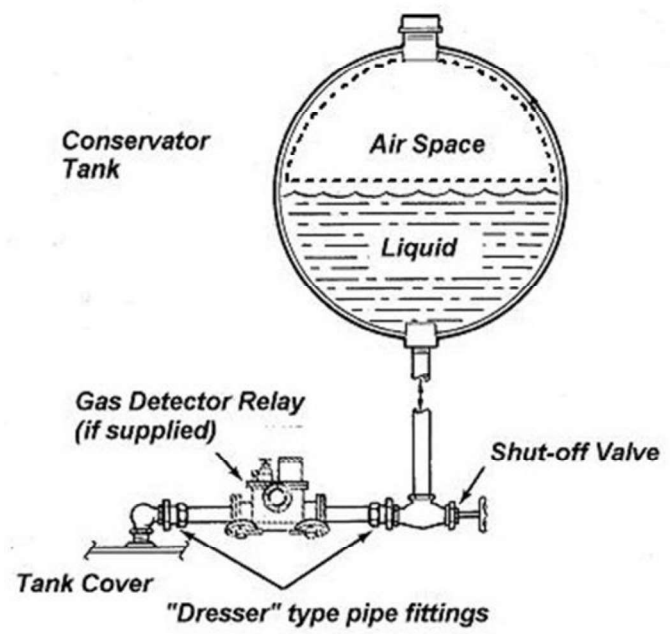


Figure 33 - Typical conservator tank configuration with piping and gas detector

Free breathing conservator design

This design allows the conservator tank to vent directly to the atmosphere, or vent through a dehydrating breather to atmosphere. Most, if not all, transformer manufacturers recommend the use of a dehydrating (desiccant-type) breather with this type of conservator design.

Over time, liquid in the conservator tank is gradually mixed with the liquid in the main tank. The liquid in the conservator tank often includes dissolved gas (oxygen) and other contaminants that can adversely affect the transformer insulation system. The use of a properly sized and well maintained dehydrating breather can reduce contaminant levels in the conservator tank liquid.

A “free breathing” conservator tank design is shown in **Figure 34**.

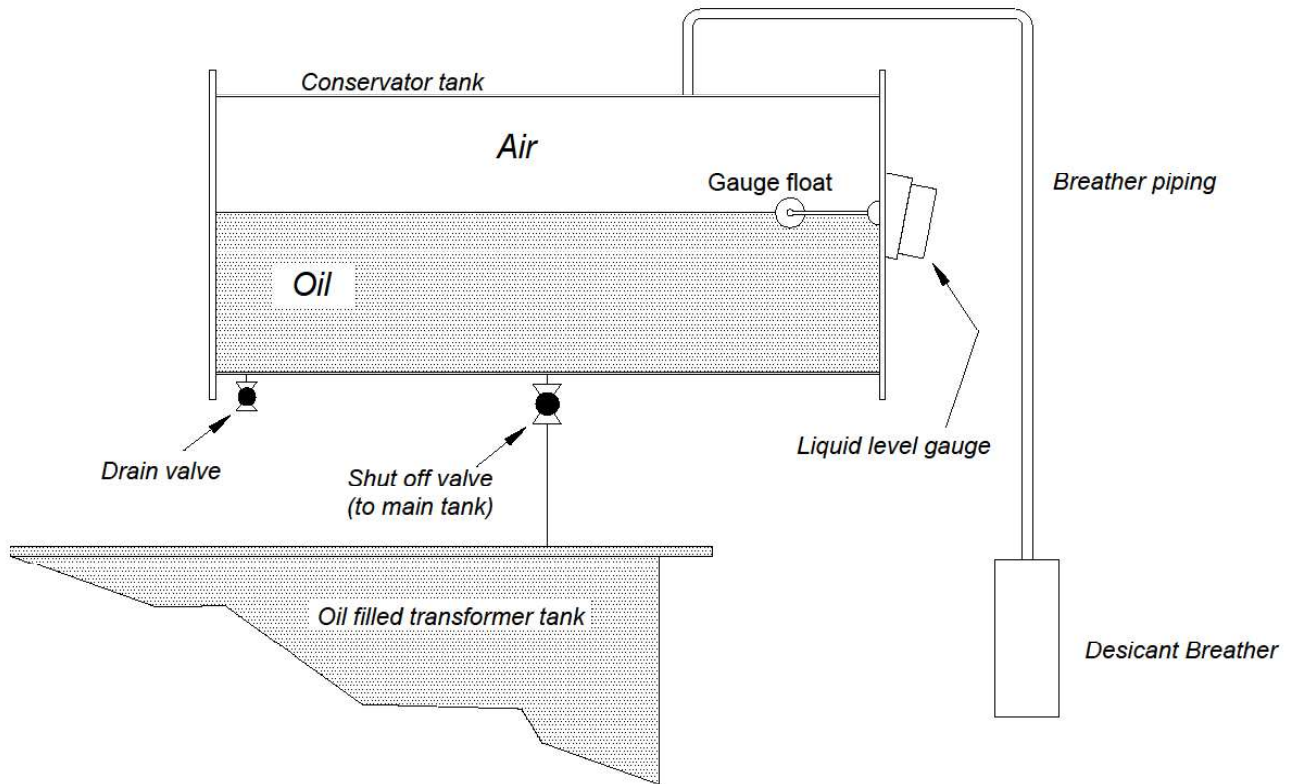


Figure 34 – Free breathing conservator tank

Conservator tank with air cell

Contamination of the liquid through the liquid/air interface can be further reduced by the use of an air cell or bladder inside the conservator tank. The exchange of air between the conservator tank and the atmosphere is completely contained within the air cell, isolating the transformer liquid from the atmosphere. The interior of the air cell is open to atmospheric pressure through a dehydrating breather. As the liquid in the transformer expands/contracts and atmospheric pressure changes, the air cell contracts/expands, “breathing” air in and out.

A conservator tank with air cell is shown in **Figure 35**.

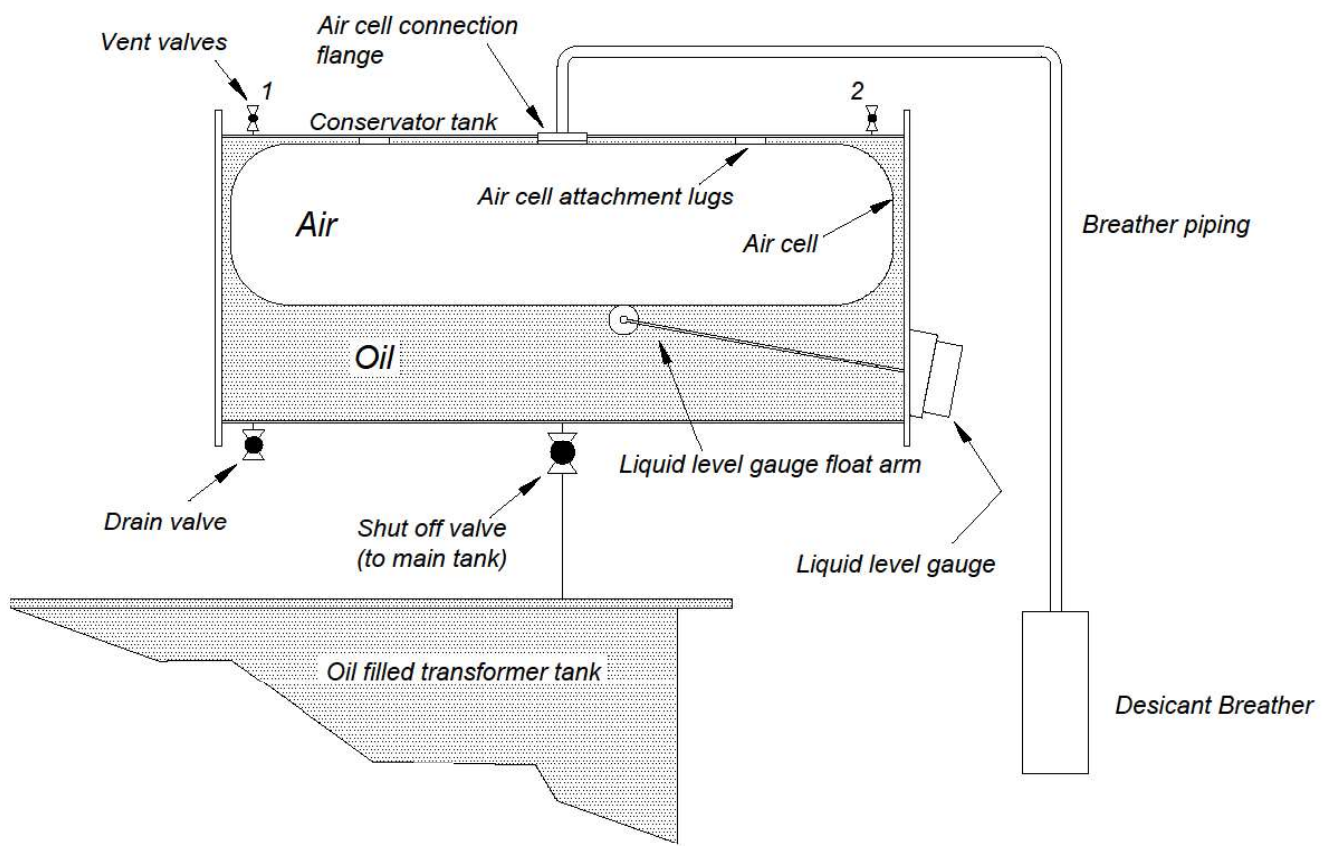


Figure 35 – Conservator tank with air cell

General construction

Conservator type transformers are similar in design to sealed transformers, except for the location of a few accessories and the addition of the auxiliary liquid expansion tank (conservator). The conservator tank is located above the transformer tank cover. The main tank of the transformer is completely filled with liquid at all times, eliminating any air space over the liquid. A pipe connection with a shut-off valve connects the conservator tank to the main tank, permitting liquid movement between the main tank and conservator. If an optional gas detector relay is supplied, it is located in the pipe connection between the main tank and the conservator (see Figure 33).

Atmospheric pressure is maintained in the conservator tank by allowing the tank to breathe through the dehydrating breather.

The conservator tanks are usually mounted on the transformer with structural steel supports that may be bolted or welded to the tank cover or walls. The tank, piping and some supports are typically removed for shipping.

Assembly

The supply of a conservator tank system, and related accessories, is per customer specification.

Assembly instructions for special design options such as conservator tanks and related components are provided in **Appendix A** of this manual when a conservator is supplied.

7.16 Fasteners

Installation and maintenance procedures may require some assembly and/or disassembly of various component parts of the transformer. When this is the case, care should be taken to ensure correct assembly/re-assembly, using suitable hardware tightened to correct torque values.

The following describes some general guidelines followed by transformer manufacturers.

7.16.1 Materials

- ⓘ Metallic parts and fasteners located in close proximity to high current conductors, **inside or outside** of the transformer, require the use of special clearances and/or non-magnetic materials, including fasteners, to prevent or reduce the effects of magnetic heating in those components.
- ⓘ Do not use a stainless steel nut on a stainless steel bolt or stud. Galvanic corrosion between the stainless steel parts will make the connection difficult, if not impossible, to disassemble.
- ⓘ Do not use split washers or star type lock washers inside the transformer tank. These washers are more susceptible to fracture and breakage, leaving metal fragments inside the transformer tank. Electrical connections should be secured with more durable spring-disc lock washers

7.16.2 Hardware external to the transformer tank - electrical and non-electrical applications

- a) **Requirements:**
Hardware must be corrosion resistant. Non-magnetic hardware may be required for assembly of high current conductors or for component assemblies in close proximity to high current conductors.
- b) **Hardware:**
Niagara factory standard hardware is corrosion resistant, non-magnetic, 300 series stainless steel bolts and washers, with silicon bronze nuts. Stainless steel split lock washers are acceptable for use on **external non-conducting** parts.

7.16.3 Hardware used inside the transformer tank - non-electrical applications

- a) **Requirements:**
Resistance to corrosion is not necessary in the gas space above the liquid, or when immersed in the transformer liquid.
Plated hardware is **not compatible** with transformer liquids, and **must not be used**.
Non-magnetic properties are required for fasteners and components in close proximity to high current conductors, or that form part of a high current assembly, to minimize magnetic heating.
- b) **Hardware:**
Use **unplated** low and medium carbon steel fasteners for typical assemblies and connections that are not affected by magnetic heating.
Use non-magnetic 300 series stainless steel bolts and washers with silicon bronze nuts for assemblies and connections that will be affected by magnetic heating.
Use double nut locking or equivalent.

7.16.4 Hardware used inside the transformer tank - electrical applications

- a) **Requirements:**
Resistance to corrosion is not necessary in the gas space above the liquid, or when immersed in the transformer liquid.
Plated hardware is **not compatible** with transformer liquids, and **must not be used**.
Non-magnetic characteristics are necessary for fasteners and components in close proximity to high current high current conductors, or that form part of a high current assembly.

b) **Hardware:**

Use **unplated** low and medium carbon steel fasteners for assemblies and connections not subject to magnetic heating.
Non-magnetic 300 series stainless steel bolts and washers, with silicon bronze nuts, should be used when magnetic heating is a concern.

7.16.5 Current rating guidelines for hardware selection

Connections with rated current levels **below 1000 amperes** can be fastened with standard, **un-plated**, carbon steel hardware.
High current connections, rated at **1000 amperes or more**, require **non-magnetic** 300 series stainless steel bolts and washers with silicon bronze nuts.

7.16.6 Bushing Mounting Hardware

Bushing mounting hardware must be tightened carefully to ensure a good tank seal and to avoid damaging the bushing body and mounting provision.
Tighten hardware slowly, a fraction of a turn at a time, working progressively in one direction around the bolt circle, until all fasteners are uniformly tight.

Table 6 – Safe torque values for bushing assemblies fastened with bolt or nut

1/4" dia. - 10 ft-lb	3/8" dia. – 12 ft-lb	1/2" dia. – 25 ft-lb	5/8" dia. – 30 ft-lb
----------------------	----------------------	----------------------	----------------------

7.16.7 General fastener guidelines

- a) The minimum bolt length used must be such that a minimum of 1-1/2 threads project beyond the nut when tightened.
- b) Joints assembled with cork or cork neoprene gaskets, without a gasket stop provision, should be tightened evenly to ensure uniform gasket compression. An even application of the correct torque to the fastening hardware should result in gasket compression of 25 to 50%, depending of the durometer of the gasket material. Use the torque values shown in **Table 6** for bushing mounting hardware
- c) Joints with gasket stop provisions are tightened until there is metal-to-metal contact. Buna "N" (nitrile) and neoprene gaskets typically require this form of compression control.
- d) **Do not use split or star type lock washers inside the transformer tank.**
- e) Flat washers must be used when joining soft materials such as pressboard, wood, copper, and aluminum.
- f) Flat washers must be used in conjunction with spring-disk lock washers. Flat washers are placed between the spring disk washer and the surface of the part or bar conductor being assembled.
- g) Jam nuts used for position locking should be located **between** a standard hex nut and the surface of the component being fastened. This ensures the full hex nut bears the load rather than the jam nut.

Table 7 – Torque Values for Electrical Connections (internal or external)
Dry unlubricated hardware, torque value in ft-lb for bolt diameter indicated

Hardware	1/4" Dia.	5/16" Dia.	3/8" Dia.	1/2" Dia.	5/8" Dia.	3/4" Dia.
Steel (Gr. 2)	6	15	20	40	55	85
Silicon Bronze	6	15	20	40	55	85
Aluminum	4	10	15	25	40	54
Stainless Steel	6	10	15	25	40	54

7.16.8 Bolting sequences

Sealing problems can result if hardware is not tightened to the correct torque value and in the proper sequence. Recommended torque values are shown in Table 7. Proper bolting sequences are illustrated for various types of hardware patterns in Figure 36. Bolt numbers indicate the correct tightening sequence. It is not critical to follow the sequence numbers exactly; however, the diagonal tightening patterns should be followed.

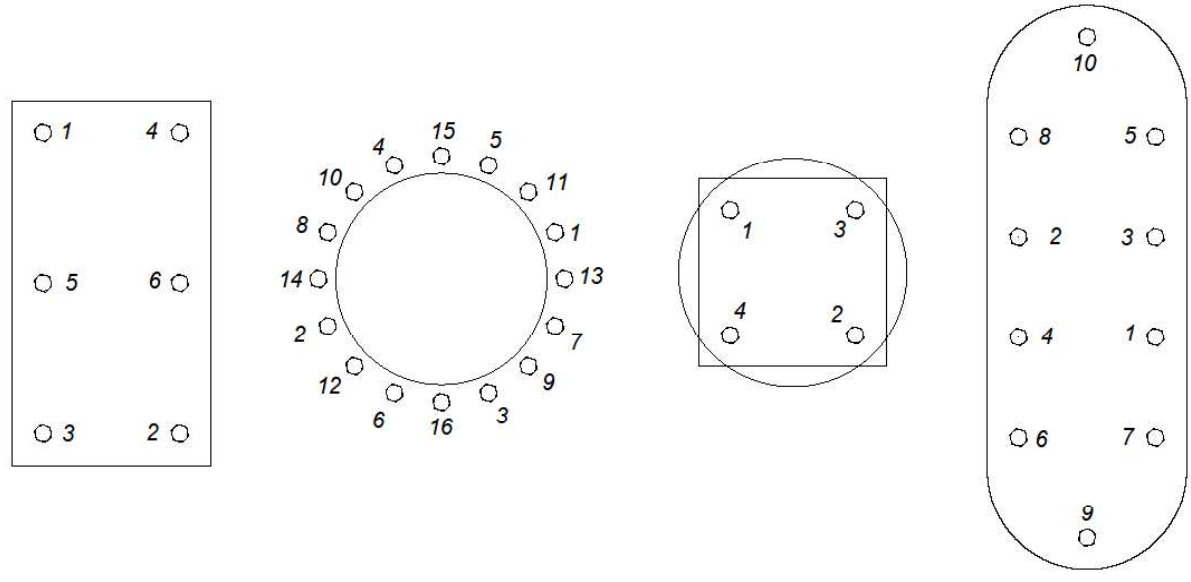


Figure 36 – Bolt tightening sequence for various hardware patterns

8 Spare Parts & Service

Replacement or spare parts are available from the factory. When ordering parts or requesting information regarding an existing Niagara transformer, please provide the following identification information:

- a) Transformer serial number: The serial number is shown on the transformer nameplate, and is stamped on the transformer tank near the top of the accessory wall and on the tank cover.
- b) Transformer rating: The kVA or MVA rating of the transformer as shown on the transformer nameplate and the transformer approval / record drawings.
- c) Customer name and installation site.

Contact:

Niagara Transformer Corp.

1747 Dale Road
Buffalo, NY 14225

Phone: (716) 896-6500

Fax: (716) 896-8871

www.niagaratransformer.com



9 ANSI / IEEE Reference

IEEE C57.12.00

Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

ANSI / IEEE C57.12.10

Standard for Transformers - 230 kV and Below 833/958 through 8333/10 417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three Phase Without Load Tap Changing; and 3750/4687 Through 60 000/80 000/100 000 kVA with Load Tap Changing - Safety Requirements

IEEE C57.91

Guide for Loading Mineral-Oil-Immersed Overhead and Pad-Mounted Distribution Transformers Rated 500 kVA and less with 65° C or 55° C Average Winding Rise

IEEE C57.93

Guide for Installation of Liquid-Immersed Power Transformers

IEEE C57.105

Guide for Application of Transformer Connections in Three-Phase Distribution Systems

IEEE C57.106

IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment

IEEE C57.131

IEEE Standard Requirements for Tap Changers

10 Unit Conversions

Pressure: 1 Pound per square inch (psi) = 6.89 kilopascals (kPA) = 68.9 millibars (mb)
1 psi = 2.03 inches of mercury (inHg) = 5.17 centimeters of mercury (cmHg)
1 psi = 27.66 inches of water (inH₂O) = 0.7 meters of water (mH₂O)
1 psi = 0.07 kilogram per centimeter² (kg/cm²) = 0.07 atmospheres (atm)
1 atm = 760 torr = 14.696 psi
1 torr = 1 mmHg

Volume: 1 US Gallon (USG) = 8 US pints (pt) = 16 cups (c) = 128 fluid ounces (fl oz)
1 USG = 0.83 Imperial Gallons = 6.66 Imperial Pints = 133.23 Imperial Fluid Ounces
1 USG = 3.79 Liters (l) = 3785.41 milliliters (ml)
1 USG = 0.13 cubic feet (ft³) = 231 cubic inches (in³) = 3785.41 cubic centimeters (cm³)

Weight: 1 pound (lb) = 16 ounces (oz) = 0.45 kilograms (kg) = 453.59 grams = 453592.4 milligrams (mg)
1 lb. = 4.45 Newtons (N)
1 short ton (T) = 2000 lb. 1 long ton (LT) = 2240 lb. 1 metric ton (MT) = 1000 kg = 2200 lb.

Temperature: degrees Fahrenheit (°F) = degrees Celsius (°C) x 1.8 + 32
Degrees C = (degrees F - 32) / 1.8
Kelvins = degrees C + 273.15, degrees C = kelvins - 273.15

Torque: foot-pounds (ft-lb) x 1.356 = Newton meter (Nm)
Nm x 0.7376 = ft-lb

Notes





Receiving Inspection

checklist for receiving liquid filled transformers

Serial No: _____

Date: _____

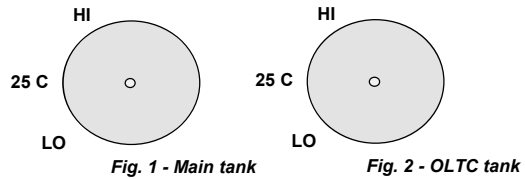
Receiver: _____

Transport: Truck Rail Ship Other _____

- Condition:
- Transformer received in good condition
 - Hold downs and blocking intact and tight
 - Protective coverings on bushings and gauges
 - Inspect** tank for paint damage, dents, leaks and damaged fittings
 - Inspect** cooling radiators (on transformer, or in crates) for paint damage, dents, cracked welds, leaks if liquid filled
 - Check** for chipped or cracked bushing porcelains - on transformer or in crates.
 - All components, including additional liquid, received in good condition
 - Record** signs of rough handling
 - Damages and shortages noted on freight bill by receiver
 - Damage photos taken

Readings: **Record** transformer tank pressure PSI

Record liquid temperature °C



- Record** liquid level in main tank - mark gauge reading on Figure 1 or supply photo
- Record** liquid level in on-load tap-changer (if supplied) - mark gauge reading on Figure 2 or supply photo
- Record** position of de-energized tap changer(s)
- Record** position of On-Load Tap-Changer (if supplied)
- Identify and record** position of other operable switches

Impact Ind: **Record** core meggar reading (if accessible)

Impact indicators armed / tripped

Impact recorder(s) stopped, signed off and dated

Impact recorder(s) removed and returned to factory

- Other:
- Cabinet doors closed / sealed
 - Liquid and components stored indoors
 - This document completed and copy sent to Niagara Transformer Corp.
 - Installer Qualifications** approved by Niagara Transformer Corp. (if assembly is required)

Notes: _____

Signature: _____

Date: _____

A copy of this completed form must be sent to Niagara Transformer Corporation as part of the warranty validation process.

Niagara Transformer Corporation P.O. Box 233, 1747 Dale Road, Buffalo, NY 14225

Toll-Free: 800-817-5652 • Phone: 716-896-6500 • Fax: 716-896-8871

MONROE COUNTY CLERK'S OFFICE

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Time: 12:29:56 PM

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County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee:

State of New York

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SECTION 319 OF THE REAL PROPERTY LAW OF THE
STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

JAMIE ROMEO

MONROE COUNTY CLERK



NYSCEF DOC. NO. 9

SUPREME COURT OF THE STATE OF NEW YORK

COUNTY OF Monroe

County of Monroe X

Index No:

RJI No. (if any):

-against- Plaintiff(s)/Petitioner(s) Siemens Industry, Inc.

COMMERCIAL DIVISION Request for Judicial Intervention Addendum

Defendant(s)/Respondent(s) X

COMPLETE WHERE APPLICABLE [add additional pages if needed]:

Plaintiff/Petitioner's cause(s) of action [check all that apply]:

- Breach of contract or fiduciary duty, fraud, misrepresentation, business tort (e.g. unfair competition), or statutory and/or common law violation where the breach or violation is alleged to arise out of business dealings (e.g. sales of assets or securities; corporate restructuring; partnership, shareholder, joint venture, and other business agreements; trade secrets; restrictive covenants; and employment agreements not including claims that principally involve alleged discriminatory practices)
Transactions governed by the Uniform Commercial Code (exclusive of those concerning individual cooperative or condominium units)
Transactions involving commercial real property, including Yellowstone injunctions and excluding actions for the payment of rent only
Shareholder derivative actions — without consideration of the monetary threshold
Commercial class actions — without consideration of the monetary threshold
Business transactions involving or arising out of dealings with commercial banks and other financial institutions
Internal affairs of business organizations
Malpractice by accountants or actuaries, and legal malpractice arising out of representation in commercial matters
Environmental insurance coverage
Commercial insurance coverage (e.g. directors and officers, errors and omissions, and business interruption coverage)
Dissolution of corporations, partnerships, limited liability companies, limited liability partnerships and joint ventures — without consideration of the monetary threshold
Applications to stay or compel arbitration and affirm or disaffirm arbitration awards and related injunctive relief pursuant to CPLR Article 75 involving any of the foregoing enumerated commercial issues — without consideration of the monetary threshold

Plaintiff/Petitioner's claim for compensatory damages [exclusive of punitive damages, interest, costs and counsel fees claimed]:

1240593.12

Plaintiff/Petitioner's claim for equitable or declaratory relief [brief description]:

Defendant/Respondent's counterclaim(s) [brief description, including claim for monetary relief]:

I REQUEST THAT THIS CASE BE ASSIGNED TO THE COMMERCIAL DIVISION. I CERTIFY THAT THE CASE MEETS THE JURISDICTIONAL REQUIREMENTS OF THE COMMERCIAL DIVISION SET FORTH IN 22 NYCRR § 202.70(a), (b) and (c).

Dated: 06/06/2023

ROBERT JOHN SHOEMAKER SIGNATURE

ROBERT JOHN SHOEMAKER PRINT OR TYPE NAME

MONROE COUNTY CLERK'S OFFICE

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Time: 2:17:41 PM

Return To:
County of Monroe Department of Law

County of Monroe

Siemens Industry, Inc.

Total Fees Paid: \$0.00

Employee:

State of New York

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ENDORSEMENT, REQUIRED BY SECTION 317-a(5) &
SECTION 319 OF THE REAL PROPERTY LAW OF THE
STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

JAMIE ROMEO

MONROE COUNTY CLERK



ATTORNEY(S) :
INDEX # : E2023005870
PURCHASED/FILED : June 6, 2023
STATE OF : NEW YORK
COURT : Supreme
COUNTY/DISTRICT : Monroe

AFFIDAVIT OF SERVICE - SECRETARY OF STATE

County of Monroe

Plaintiff(s)

against

Siemens Industry, Inc.

Defendant(s)

STATE OF NEW YORK)
COUNTY OF ALBANY) SS
CITY OF ALBANY)
DESCRIPTION OF PERSON SERVED: Approx. Age: 70 Yrs.
Weight: 120 Lbs. Height: 5' 0" Sex: Female Color of skin: White
Hair color: Blonde Other: _____

Robert Guyette, being duly sworn, deposes and says: deponent is over the age of eighteen (18) years; is not a party to this action, and resides in the State of NY, and that on June 21, 2023, at 1:40 PM, at the office of the Secretary of State of the State of NY, located at 99 Washington Ave, 6th Fl, Albany, New York 12231 deponent served:
Notice of Electronic Filing with Affirmation in Support of Claim for Exemption Pursuant to CPLR 306(b)(1), Summons, Complaint with Attached Exhibits A-E and RJ1 with Commercial Division Addendum

on Siemens Industry, Inc.

the Defendant in this action, by delivering to and leaving with Sue Zouky AUTHORIZED AGENT in the Office of the Secretary of State, of the State of New York, personally at the Office of the Secretary of State of the State of New York, two (2) true copies thereof and that at the time of making such service, deponent paid said Secretary of State a fee of \$0 dollars; That said service was made pursuant to Section **BUSINESS CORPORATION LAW §306.**


Deponent further says that deponent knew the person so served as aforesaid to be the agent in the Office of the Secretary of State of the State of New York, duly authorized to accept such service on behalf of said defendant.

Sworn to before me on this
21st day of June, 2023



Robert Guyette

Invoice Work Order # 2326741
Attorney File # County of Monroe



FAITH COZZY
NOTARY PUBLIC, State of New York
No. 01CO6158874, Albany County
Commission Expires Jan 8, 2027