

## Table of Contents

### Commissioning

- Delivery, Installation, Pre-Commissioning and Commissioning Protocols
- Installation Check List
- Training Protocol

**NOTE:** Engines require the proper amount of specified gas in order to run engines at full load to set the emissions and Leanox Curve.

This is also required on Dual Fuel applications, engines must be able to run independently on each gas

## Delivery, Installation, Pre-Commissioning and Commissioning Protocols

1. NES-WES will perform on-site inspections during delivery of major equipment. The objective during these inspections is as follows:
  - a. Validate scope of supply delivered to site. Determine all materials and equipment ordered have been delivered, are in good condition, and are receipted by the owner or owner’s representative.
  - b. Monitor rigging and removal of equipment to jobsite or storage yard. All rigging and removal equipment, manpower, and insurance liability is by owner or owner’s contractors and must be in accordance with manufacturer’s rigging, storage, and installation requirements.
  - c. Assist customer, engineer, and installing contractors with information required to install equipment per manufacturer’s requirements and recommendations.
  - d. Landfill and bio-gas installations will include the extraction of a gas sample at the blower. Gas samples will be analyzed for Si (Siloxanes) and general gas chemistry. This will become part of the commissioning documentation for landfill and bio-gas projects.

This inspection is to be coordinated by NES-WES Engineering and Project Management with owner or owner’s representatives and NES-WES representatives.

2. The owner or owners’ representative is responsible to provide NES-WES Engineering and Project Management with target dates for startup and commissioning as well as commercial operation of the equipment. Subject to the size of the plant NES-WES will tentatively schedule the following:
  - a. Installation Inspection- four (4) to six (6) weeks prior to planned startup and commissioning
  - b. Pre-commissioning- two (2) to three (3) weeks prior to planned startup and commissioning
  - c. Startup and Commissioning- two (2) weeks prior to commercial operation target date.
  - d. Training- forty (40) hours of continuous on-site training will be provided by NES-WES once startup and commissioning has been completed. This training will be scheduled to coincide with the initial 100 OPH GEJ service interval.
3. NES-WES Pre-Commissioning activities will include a through review of the installation approximately four (4) to six (6) weeks prior to planned Startup-Commissioning of the GE Jenbacher equipment. An “Installation Checklist” will be completed, reviewed with the owner or owner’s representative and submitted to GE Jenbacher (GEJ) along with digital photographs of the installation. The “Installation Checklist” is based on GEJ and other manufacturer’s recommended installation instructions and requirements. All manufacturers’ installation requirements must be complied with in order for startup and commissioning to proceed as well as for manufacturer’s warranties to be applicable. Any and all exceptions must be in writing directly from the specific manufacturer.
4. Owner responsibilities include a complete installation in accordance with manufacturer’s installation requirements. Final Pre-Commissioning and Startup-Commissioning will be scheduled two (2) calendar weeks after the “Installation Checklist” has been substantially completed and the installation found “substantially complete”.

“Substantially complete” means completion of or owner provided firm dates in writing for completion of gas piping, blowers, and gas availability; coolant piping and coolant systems; exhaust piping and exhaust systems, electrical interconnect and provision for utility parallel; electrical wiring and distribution; emissions permits and approval to operate.

Final Pre-Commissioning and Startup-Commissioning will not be scheduled until the installation is substantially complete or the owner has formally provided firm dates by which the installation will be substantially complete. Delays to Pre-Commissioning and Startup-Commissioning activities resulting from lack of completion may result in additional charges at the rate of \$1600 per day per technician.

*A Division of Penn Detroit Diesel Allison*  
SALES • RENTALS • PARTS • SERVICE

<b>PHILADELPHIA</b> 8330 State Road Philadelphia, PA 19136 215-335-5010 Fax: 215-335-2163	<b>PITTSBURGH</b> 11 Progress Avenue Cranberry Twp., PA 16066 724-742-0022 Fax: 724-742-0040	<b>SYRACUSE</b> 7044 Interstate Island Rd Syracuse, NY 13209 315-451-3838 Fax: 315-461-8662	<b>BUFFALO</b> 350 Bailey Avenue Buffalo, NY 14210 716-822-0051 Fax: 716-826-1544	<b>BOSTON</b> 65B Mathewson Drive Weymouth, MA 02189 781-340-9640 Fax: 781-340-9649
---	--	---	---	---

5. After being scheduled NES-WES field service technicians will perform the following Pre-Commissioning activities:
  - a. Remove shipping brackets from the engines.
  - b. Inspect installation of the sylomer strips under the structural base frames.
  - c. Inspect engine, generator, and gear-box where applicable and perform alignments as required per manufacturer's installation and technical requirements. Alignments will be recorded as part of the commissioning documentation.
  - d. Remove dust covers from air intake and generator ventilators.
  - e. Inspect gas trains and gas train for piping connections and wiring terminations.
  - f. Drain factory installed lube oil and install new lube oil prior to startup of engines.
  - g. Assist owners' contractor with pressurization of bladder tanks, installation of coolant, and venting of coolant system. Inspect owner furnished coolant to ensure compliance with GEJ requirements. Document as part of the commissioning documentation.
  - h. Check and lock out breakers in the Module Interface panel and Diane panels. Provide 8D lead acid batteries, cables and install for each engine.
  - i. Inspect installation of the radiator, cooling pumps, piping, control valves, and fan control panels.
  - j. Check installation of fire, smoke, and emergency stop alarms.
  - k. Inspect installation of communication and data cables to/from Modular Interface to Diane panel.
  - l. Check interface cable connections to GEJ scope of supply.
  - m. Inspect owner contractor completed wiring terminations to GEJ Modular Interface and Diane panel.
  - n. Verify that owner's contractor has completed all phase rotation checks and inspections.
  - o. Inspection of NES-WES provided auxiliary systems.
  - p. Complete a final "Installation Checklist" and note any variances or exceptions.
  
6. NES-WES and GEJ technicians will perform the following typical Startup-Commissioning services. Startup-Commissioning documents will be completed during this process and left on site. A typical Startup-Commissioning process is as follows:
  - a. Day One:
    - i. Check interface cable connection to GE Jenbacher scope of supply
    - ii. Switch on electrical power to auxiliaries and 24 V electrical power supply
    - iii. Initial start-up of Jenbacher control equipment, load software
    - iv. Pre-heating of engine jacket water system
  
  - b. Day Two-Three
    - i. Adjustment of gas train and opening of fuel gas supply to the engine
    - ii. Check control functions to peripheral systems
    - iii. Initial start of engine and check engine control functions in idling speed
    - iv. Check synchronization conditions and prepare for first switch to electric mains
  
  - c. Day Four-Five
    - i. Carry out all tests and checks according to project specific "Test Plan for Start-up"
    - ii. Carry out electrical protective measurements
  
  - d. Day Six-Seven
    - i. Initial synchronization of generator set to electric mains
    - ii. Check control functions at unit parallel operation to mains
    - iii. Increase engine load step-by-step to full load
    - iv. Adjust engine to contractual plant performance settings
  
  - e. Day Eight
    - i. Check and document exhaust gas emission values
    - ii. Final adjustments to equipment and performance tests.
  
  - f. Day Nine
    - i. Eight hour test run in normal working conditions
  
  - g. Day Ten
    - i. Equipment hand over to customer
    - ii. Completion of a NES-WES and GEJ "Report on Transfer of Equipment" to implement commercial service and commencement of warranty period.

## INSTALLATION CHECKLIST

<b>Project:</b>	_____				
<b>Site Address:</b>	_____				
<b>City:</b>	_____				<b>State:</b> _____
<b>Contact(s):</b>	_____				<b>Phone:</b> _____
	_____				<b>Phone:</b> _____
<b>Equipment Model:</b>	_____	<b>J Number</b>	_____	<b># Units:</b>	_____
<b>GE Engine Nos.</b>	1. _____	2. _____	3. _____	4. _____	5. _____
<b>Gen. Serial Nos.</b>	1. _____	2. _____	3. _____	4. _____	5. _____
<b>Turbocharger Nos.</b>	1. _____	2. _____	3. _____	4. _____	5. _____
<b>Compressor Nos.</b>	1. _____	2. _____	3. _____	4. _____	5. _____
<b>NES Project Number:</b>	_____		<b>NES RO #:</b>	_____	

The following tasks must be completed with all inspections performed per manufacturers recommendations and requirements. All components installed not in compliance with manufacturers recommendations and requirements must be noted with a description of installation, field sketches, and digital photographs as may be required.

Any component not associated with the plant must be crossed off and noted as non-applicable.

### 1. Mechanical/Hydraulic Part

#### 1.1 Fuel gas

	YES	NO
a. Fuel gas piping-Is it completed?	<input type="checkbox"/>	<input type="checkbox"/>
b. Pipe sizes-Is it installed according to the hydraulic schematic?	<input type="checkbox"/>	<input type="checkbox"/>
c. Is the piping installed to the engine from the GEJ Gas train?	<input type="checkbox"/>	<input type="checkbox"/>
• Is the piping with welded connections?		
• Is the piping with threaded connections?		
d. Is there a gas filter installed?	<input type="checkbox"/>	<input type="checkbox"/>
• GEJ filter?	<input type="checkbox"/>	<input type="checkbox"/>
• Is there a gas strainer on the inlet piping to the GEJ gas train?	<input type="checkbox"/>	<input type="checkbox"/>
• If so, provide details _____		
• Is the maximum distance from GEJ gas train to gas mixer =< 2 meters?	<input type="checkbox"/>	<input type="checkbox"/>
e. Is there a flexible connector between the GEJ gas train and engine?	<input type="checkbox"/>	<input type="checkbox"/>
f. Is the <b>inside</b> of the piping <b>after</b> the GEJ gas train:		
• Cleaned?	<input type="checkbox"/>	<input type="checkbox"/>
• Pickled?	<input type="checkbox"/>	<input type="checkbox"/>
• Painted?	<input type="checkbox"/>	<input type="checkbox"/>

*A Division of Penn Detroit Diesel Allison*

**SALES • RENTALS • PARTS • SERVICE**

<b>PHILADELPHIA</b> 8330 State Road Philadelphia, PA 19136 215-335-5010 Fax: 215-335-2163	<b>PITTSBURGH</b> 11 Progress Avenue Cranberry Twp., PA 16066 724-742-0022 Fax: 724-742-0040	<b>SYRACUSE</b> 7044 Interstate Island Rd Syracuse, NY 13209 315-451-3838 Fax: 315-461-8662	<b>BUFFALO</b> 350 Bailey Avenue Buffalo, NY 14210 716-822-0051 Fax: 716-826-1544	<b>BOSTON</b> 65B Mathewson Drive Weymouth, MA 02189 781-340-9640 Fax: 781-340-9649
---	--	---	---	---

- g. Are vent lines installed to vent to the outside of the building?
- h. Is fuel gas...?
  - Available?
  - Condensate free?
- i. Is gas pressure before the gas train according to hydraulic schematic?
- j. Is there a pre-chamber gas compressor?
- k. Is the pre-chamber gas compressor completely installed...?
  - Mechanically
  - Electrically?
  - All piping completed?
- l. Are there methane (CH4) sensors installed at the site?
  - Are they mounted near the gas train?
  - Have they been calibrated?
- 1. Verify that the gas train stop valve is closed PRIOR to any pressure testing on the line.

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**1.2 Exhaust gas**

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| a. Exhaust gas piping-Is it completed to the engine?                           | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Is the exhaust piping completed to the outside of the building?             | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Is the exhaust piping designed to prevent water ingress to the engine?      | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Is the exhaust flexible connection to the engine installed?                 | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Is the exhaust flexible connection aligned properly and free of any weight? | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Are the exhaust pipes properly supported?                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Is there any weight or thrust forces on the turbocharger?                   | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Is there an exhaust purge fan?  | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Are exhaust pipe sizes according to hydraulic schematic?                    | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Are condensate pipes separately piped?                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Is there a condensate water trap and drain pipe?                            | <input type="checkbox"/> | <input type="checkbox"/> |
| l. Are the exhaust pipes insulated?  | <input type="checkbox"/> | <input type="checkbox"/> |
| m. Are there exhaust heat-heat exchangers?                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| n. Is the exhaust heat-heat exchanger insulated?                               | <input type="checkbox"/> | <input type="checkbox"/> |
| o. If a steam system are there pressure relief valves?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| p. If there is a steam system, please refer to separate checklist.             | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>1.3 Heating water loops</b>	Applicable <input type="checkbox"/>	Non-Applicable <input type="checkbox"/>
--------------------------------	-------------------------------------	---

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| a. Is there a cooling tower?   | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Are GEJ plate and frame heat exchangers used?   | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Are non-GEJ, customer furnished plate and frame heat exchangers used?<br>If so provide details: _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Are process plate and frame heat exchangers installed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Is all heat recovery piping completed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Are the following components installed and connected....  |                          |                          |
| • Regulators?  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Valves?  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Pumps?   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Strainers?   | <input type="checkbox"/> | <input type="checkbox"/> |

Provide details on all installed auxiliary, non-GEJ provided heat recovery loop devices.

Description	Manufacturer	Part Number	Purpose

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- |   |                          |                          |
|---|--------------------------|--------------------------|
| g. Are flexible connections installed between piping and the engine?        | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Are the heat recovery and engine coolant pipes properly supported?       | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Is there any weight or thrust forces on the water pump?                  | <input type="checkbox"/> | <input type="checkbox"/> |
| j. What is the distance of the water pump to the engine? _____              |                          |                          |
| k. Are there shutoff valves in the heat recovery piping?                    | <input type="checkbox"/> | <input type="checkbox"/> |
| l. Are the heat recovery pipes insulated?                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| m. Are all water loops and piping filled with mixture meeting GEJ TI specs? | <input type="checkbox"/> | <input type="checkbox"/> |
| n. Has the heat recovery system been purged of air?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| o. Is the water quality per GEJ T.I. requirements?                          | <input type="checkbox"/> | <input type="checkbox"/> |
| p. Are any water softeners or additives being used?                         | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

1.4 Emergency coolers (radiators etc.)	Applicable	Non-Applicable
	<input type="checkbox"/>	<input type="checkbox"/>
	YES	NO
a. Is there a cooling tower?	<input type="checkbox"/>	<input type="checkbox"/>
b. Is there a heat dump radiator?	<input type="checkbox"/>	<input type="checkbox"/>
c. Is there a fan control panel?	<input type="checkbox"/>	<input type="checkbox"/>
d. Is there a fan control panel PLC to be programmed?	<input type="checkbox"/>	<input type="checkbox"/>
If so provide details: _____		
e. Is the fan control panel wiring terminated to auxiliary contacts?	<input type="checkbox"/>	<input type="checkbox"/>
f. Are radiator fan motors terminated to auxiliary contacts?	<input type="checkbox"/>	<input type="checkbox"/>
g. Is all radiator piping completed?	<input type="checkbox"/>	<input type="checkbox"/>
h. Are the following components installed and connected....		
• Regulators?	<input type="checkbox"/>	<input type="checkbox"/>
• Valves?	<input type="checkbox"/>	<input type="checkbox"/>
• Pumps?	<input type="checkbox"/>	<input type="checkbox"/>
• Strainers?	<input type="checkbox"/>	<input type="checkbox"/>

Provide details on all installed auxiliary, non-GEJ provided cooling system devices.

Description	Manufacturer	Part Number	Purpose
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- i. Are flexible connections installed between piping and the engine?
- j. Are the engine coolant pipes properly supported?
- k. Is there any weight or thrust forces on the water pump?
- l. What is the distance of the water pump to the engine? \_\_\_\_\_
- m. Are there shutoff valves in the coolant piping to the radiator or tower?
- n. Are all water loops and piping filled?
- o. Has the cooling system been purged of air?
- p. Is the water quality per GEJ T.I. requirements?
- q. Is antifreeze installed in the engine cooling system?  
  - Type and manufacturer of anti-freeze? \_\_\_\_\_
  - Freeze protection level? \_\_\_\_\_
  - Percentage concentration? \_\_\_\_\_
- r. Are any water softeners or additives being used?

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>1.5</b>	<b>Low Temp. (2<sup>nd</sup> stage) Intercoolers</b>	<b>Applicable</b> <input type="checkbox"/>	<b>Non-Applicable</b> <input type="checkbox"/>
------------	--	--	--

- |   | YES                      | NO                       |
|---|--------------------------|--------------------------|
| a. Are non-GEJ, customer furnished plate and frame heat exchangers used?              | <input type="checkbox"/> | <input type="checkbox"/> |
| b. If so provide details: _____   |                          |                          |
| c. Is all low temperature piping completed?   | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Are the following components installed and connected....                           |                          |                          |
| • Regulators?   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Valves?   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Pumps?  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Strainers?  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Bladder tanks?  | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Is the 3-way thermostatic valve installed in the line correctly, per the GEJ P&ID? | <input type="checkbox"/> | <input type="checkbox"/> |

Provide details on all installed auxiliary, non-GEJ provided cooling system devices.

Description	Manufacturer	Part Number	Purpose
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



- f. Are flexible connections installed between piping and the engine?
- g. Are the pipes properly supported?
- h. Are there shutoff valves in the piping?
- i. Are all water loops and piping filled, with mixture meeting GEJ TI specs?
- j. Has the cooling system been purged of air?
- k. Is the water quality per GEJ T.I. requirements?

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**1.6 Jacket Water Loop**

- |   | YES                      | NO                       |
|---|--------------------------|--------------------------|
| a. Are all water loops and piping filled?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Has the cooling system been purged of air?                     | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Are coolant bladder tanks installed?                           | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Is the water quality per GEJ T.I. requirements?                | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Is antifreeze installed in the engine cooling system?          | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Type and manufacturer of anti-freeze? _____                    |                          |                          |
| g. Freeze protection level? _____                                 |                          |                          |
| h. Percentage concentration? _____                                |                          |                          |
| i. Does antifreeze or mixture meet GEJ TI specifications          | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Are any water softeners or additives being used?               | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Are the jacket water heaters properly terminated electrically? | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**1.7 Fresh Oil supply (day tank)**

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| a. Is the tank installed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Where is the tank installed relative to the engine?<br>_____<br>_____ |                          |                          |

**NOTE: Day tank installation height is a minimum 1 meter; maximum 3 meters.**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| c. Does the tank meet the minimum height requirements of GEJ P&ID? | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Is all piping completed?  |                          |                          |
| • Is the piping with welded connections?                           | <input type="checkbox"/> | <input type="checkbox"/> |
| • Is the piping with threaded connections?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| • Is there a lube oil strainer between the tank and the engine?    | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Is there a flexible connector between the tank and the engine?  | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Is the <b>inside</b> of the piping <b>after</b> the tank:       |                          |                          |

- a. Cleaned?
- b. Pickled?
- c. Painted?
- g. Has the system been purged of air?
- h. Is the lube oil per GEJ T.I. requirements?
- i. Is lube oil installed in the engine?
- j. Type and manufacturer of lube oil? \_\_\_\_\_
- k. Are electrical connections properly terminated?

**Comments** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**1.8 Ventilation System**

- |   | <b>YES</b>               | <b>NO</b>                |
|---|--------------------------|--------------------------|
| a. Are inlet louvers installed?   | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Are there inlet air filters and screens?   | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Are inlet louvers wired?   | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Are inlet fans installed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Are inlet fans wired?  | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Where is the inlet louver and fan installed relative to the engine? There is a GEJ Technical Instruction for this. |                          |                          |
| _____   |                          |                          |
| g. Are outlet louvers installed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Are outlet louvers wired?  | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Are exhaust fans installed?  | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Are exhaust fans wired?  | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Where are the outlet louvers and exhaust fans installed relative to the engine?                                    |                          |                          |
| _____   |                          |                          |
| _____   |                          |                          |
| l. Is the intake air drawn across the back of the engine-generator set?   | <input type="checkbox"/> | <input type="checkbox"/> |
| m. Is the engine room pressurized or is intake air ducted directly to the engine air inlet?                           |                          |                          |
| _____   |                          |                          |
| n. Are electrical connections properly terminated?  | <input type="checkbox"/> | <input type="checkbox"/> |

**Comments** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**1.9 Foundations**

- |  | <b>YES</b>               | <b>NO</b>                |
|--|--------------------------|--------------------------|
| a. Are the foundation and equipment pad per GEJ TI requirements? | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Type construction:  |                          |                          |
| • Spread footing?  | <input type="checkbox"/> | <input type="checkbox"/> |

- Piers?
- Material?

Dimensions: \_\_\_\_\_

c. Has the engine been placed on sylomer strips per the GEJ Installation Manual?

**Comments** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Specify Any Concerns or Variances from Mechanical Installation Requirements or Best Practices**

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2. Electrical Part**

<b>2.1 Power Cables</b>	
-------------------------	--

YES NO

- a. Are power cables completed and terminated properly?  YES  NO
- b. Cable type and size. Describe:  
 \_\_\_\_\_  
 \_\_\_\_\_
- c. Is the cable termination per GEJ TI requirements?  YES  NO

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2.2 Control Systems, Control and Measuring Cables**

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| a. Is the DiANE control panel within 100 meters of the generator set?  | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Where is the DiANE control panel located? _____                     |                          |                          |
| c. Are control and measuring cables completed and terminated properly? | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Are current transformers installed and sized correctly?             | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Cable type and size. Describe:<br>_____<br>_____                    |                          |                          |
| f. Is the cable termination per GEJ TI requirements?                   | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Is there Internet access available?                                 | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2.3 Auxiliaries**

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| a. Are control and measuring cables completed and terminated properly? | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Cable type and size. Describe:<br>_____<br>_____                    |                          |                          |
| c. Is the cable termination per GEJ TI requirements?                   | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2.4 Interface Cables (to customer system)**

YES NO

- a. Are control and measuring cables completed and terminated properly?
- b. Cable type and size. Describe:  


---



---
- c. Is the cable termination per GEJ TI requirements?

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2.5 Starter and Control Batteries**

- |   | YES                      | NO                       |
|---|--------------------------|--------------------------|
| a. Are engine starting batteries installed and terminated properly?     | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Is the starting battery charger properly terminated and functioning? | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Cable type and size. Describe:<br><hr/>                              |                          |                          |
| d. Are control batteries installed and charged?                         | <input type="checkbox"/> | <input type="checkbox"/> |

Comments \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**3. Overall System**

- |  | YES  | NO   |
|--|--|--|
| a. Are auxiliary electrical circuits completed and ready to be switched on?  | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| b. Are external gas supply systems such as compressors, regulators, dryers, dehumidifiers, and gas cleaning systems installed and operable?<br>Is the plant gas supply ready to switch on? | <input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/> |
| c. Is the utility interconnection completed?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| d. Are utility interconnect permits in place?  | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| e. Are emissions permits in place?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| f. Is there auxiliary switchgear required for island operation?  | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| g. Is load for island operation available?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| h. Is load shed capability in place?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| i. Are all heating and cooling circuits ready for operation?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| j. Is there a city water supply available to fill all water circuits?  | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| k. Are electrical control, interconnect, and power circuits ready for operation?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| l. Is relay testing required before parallel operation?  | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| m. Have coordination studies been completed?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| n. Is it possible to continuously utilize electric power produced?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |
| o. Is it possible to continuously utilize thermal output produced?   | <input type="checkbox"/>                             | <input type="checkbox"/>                             |

- p. Are the engines, generators, and engine room clean of debris and construction materials? Is the engine space room brush clean?
- q. Describe generator and utility interconnect circuit breakers:

Description	Manufacturer	Part Number	Purpose
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**Comments** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Specify Any Concerns or Variances from Electrical Installation Requirements or Best Practices**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Date Started:** \_\_\_\_\_ **Date Completed:** \_\_\_\_\_

**Northeast Energy Systems** **Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Customer:** \_\_\_\_\_ **Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

# NES / WES Energy Systems

## TRAINING PROTOCOL

Purpose: To provide an outline of the material and training topics to be covered during operational and maintenance training of operator personnel.

### DAY 1

1. Review of submittal book information
- 1.1 Review all data sheets, catalog cuts, drawings and specifications in the submittal book ( 1 hour )
- 1.2 Review and instruction on using GEJ and associated equipment electrical wiring diagrams ( 2 hours )
- 1.3 Review of the GEJ P&ID drawing and trace out system ( 1 hour )
- 1.4 Review of radiator components
  - 1.41 Review of Radiator Maintenance Manual, ( 0.5 hours )
  - 1.42 Review of control system, drawings ( 0.5 hours )
  - 1.43 Review of changing set points and parameters on Watlow temperature controller ( 0.5 hours )
- 1.5 Review of Technical Parameters and Controls
  - 1.5.1 Review of *DiANE XT* Parameters ( 1.5 hours )
  - 1.5.2 Review of Radiator and Fan Control Panel Parameters ( 0.5 hours )

### DAY 2

2. Review of GEJ Maintenance Manual
- 2.1 Review of Work Orders and Work Order Schedule ( 1 hour )
- 2.2 Starting and stopping of the equipment (Normal Operating Conditions) ( 1 hour )
- 2.3 Troubleshooting no start and hard start conditions ( 1 hour )
- 2.4 Manual vs Automatic Start Processes ( 0.5 hour )
- 2.5 Practical Application Review of Work Orders
  - 2.5.1 Valve lash, recession measurement, and recording of data in the log book. ( 3.5 hours )
  - 2.5.2 Ignition coil testing, spark plug gapping, cleaning, and recording of data in the log book. ( 2 hours )
  - 2.5.3 Lube oil sampling, oil changing, changing of oil filters, ( 2 hours )
  - 2.5.4 Gas and air filter changing ( 1 hours )
  - 2.5.5 Battery and battery charger maintenance ( 0.5 hour )
  - 2.5.6 Cooling system inspections, maintenance, sampling ( 0.5 hour )

### DAY 3

3. Review of GE parts manual
- 3.1 How to order parts ( 0.5 hour )
- 3.2 Parts in Electrical Wiring Drawings ( 0.5 hour )
- 3.3 Walk through of equipment to identify parts on the engine and scope of supply ( 1 hour )
4. Review of Description Book
- 4.1 Review of Technical Specification of Control ( 1 hour )
- 4.2 Review *Diane XT* Literature ( 1 hour )
- 4.3 Review of Alarms and Messages, Troubleshooting Guide ( 1 hour )
- 4.4 Troubleshooting ( 2 hours )
- 4.5 Review of Engine Diagrams ( 1 hour )
- 4.6 Review of GE Technical Instructions ( 1 hour )

### DAY 4

6. Practical Review of Wiring Schematics ( 2 hours )
7. Practical Training on *Diane XT* ( 2 hours )
8. Summation, question period ( 4 hours )