

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.

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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.