

DETAILED DESCRIPTION OF SERVICE LEVELS

Holt Power Systems, your Caterpillar® Dealer, provides maintenance to all makes and models of generator sets in accordance with the National Electric Code (NEC), the Life Safety Code, the National Fire Protection Association, and the Joint Commission. The following services will be provided in accordance with these specifications and Manufacturer's recommendations.

As a Preventive Maintenance Technician for Holt Power Systems it is mandatory that all findings be recorded throughout the inspection.

Scheduled Maintenance LEVEL 1 - Recommended Quarterly:

GENERAL

- Visual Inspection - Visual inspection of overall condition of unit to identify foreign objects, loose or broken fittings, guards, and components.
- Wipe off unit - Clean oil, coolant, fuel, and acid deposits. Police generator area.

COOLING SYSTEM

- Radiator/Heat Exchanger - Visual inspection for leaks, damage, and debris. Check louver operation.
- Coolant - Visual inspection for correct level and condition of coolant (rust, oil, and contaminants). Check coolant conditioner concentration and temperature protection. Check filler cap gasket and sealing surface. Replace filler cap as required at additional cost.
- Hoses and Connections - Visual inspection of all hoses for deterioration. Check tightness of connections.
- Fan Drive Pulley and Fan - Check for loose or worn pulleys. Check fan operation and clearance.
- Fan Belts - Inspect for wear or deterioration. Check tension and adjust as necessary.
- Jacket Water Heater - Inspect for proper operation. Record engine temperature prior to starting unit.
- Water Pump - Visual and operational inspection for leaks or unusual noises.

FUEL SYSTEM – LIQUID (DIESEL/GASOLINE)

- Fuel Tank - Visually inspect fuel tank system for leaks and fuel level (Natural gas and LP as well). Test day tank pump for proper operation.
- Water Trap/Separator - Drain water from fuel tank if possible or water separator if applicable.
- Fuel Lines and Connections - Inspect for leaks and check line brackets mounting (Natural gas and LP as well).
- Governor and Controls - Inspect governor oil level. Inspect controls and linkage for proper operation. Add oil as necessary.
- Fuel Filters (Primary/Secondary) - Inspect for damage, leaks, and proper operation.
- Fuel Pressure- Record if available.

AIR INDUCTION AND EXHAUST SYSTEM

- Air Filter Service Indicator - Record reading. Inspect for proper operation. Reset indicator.
- Air Filter - Inspect. Clean as necessary. Replace as required at additional cost.
- Air Inlet System - Inspect piping and air filter housing for damage, loose connections, and evidence of leaks. Clean air filter housing if air filter is cleaned or replaced. Check housing seals and gaskets.
- Turbocharger - Inspect for oil leakage, exhaust leakage, or unusual noises.
- Exhaust Manifold - Inspect for damage, loose or missing hardware, evidence of exhaust leakage, and wet-stacking. Provide load bank recommendation.
- Exhaust System - Inspect silencer and piping for damage, corrosion, or leakage. Check rain cap. Check supports for vibration damage and loose connections.

LUBE OIL SYSTEM

- Oil Level - Inspect for correct oil level. Visually inspect unit for leaks. Add as required at additional cost.
- Oil Pressure - Record oil pressure reading. Operational and visual inspection of prelube pump if applicable.
- Crankcase Breather - Inspect for proper operation. Check connections and inspect hose for deterioration. Visual inspection for excessive blowby.
- S.O.S. - Obtain oil sample for analysis.

STARTING SYSTEM

- Batteries - Inspect for damage or leakage, clean battery with acid neutralizer. Clean and tighten all battery cable connections. (Lead acid batteries only)
- Batteries (Specific Gravity) - Check electrolyte level and specific gravity. (Lead acid batteries only)
- Battery Charger - Inspect for proper operation, loose terminals, and deteriorated wiring. Record output.
- Starting Motor - Inspect electrical connections and wiring. For air starters, inspect oil jar and feeder operation. Perform operational check for abnormal engagement and cranking noises.
- Alternator - Inspect for proper operation, loose connections, and mounting hardware. Check belts, pulley, and voltage output. Record output if applicable.

ENGINE MONITORS AND SAFETY CONTROLS

- Safety Controls - Inspect for loose connections, wiring deterioration, and proper operation.
- Remote Annunciator and Alarms - Inspect and test all panel and system alarms for proper operation..

CONTROL PANEL

- Start Controls-Manual/Auto - Operational check for proper operation. Check automatic start: with customer approval.
- Voltmeter - Operational check for correct readings. Record readings.
- Ammeter - Operational check for correct readings if load is available. Record readings.
- Frequency Meter - Operational check for correct readings. Load and no load readings if load is available.

GENERATOR

- Verify anti-condensation heater operation if applicable. Record temperature.
- Vibration Isolators - Check for proper adjustment and condition.
- Check reduction gearbox oil level if applicable.

Scheduled Maintenance LEVEL 2 (Includes All Service Level 1 Inspections. As Well As The Following) - Recommended Annually:

FUEL SYSTEM

- Fuel Filter - Replace. Inspect for proper sealing and operation.

LUBE OIL SYSTEM

- Oil and Filters - Change. Inspect all gaskets and seals.
- Crankcase Breather - Inspect and clean as required. Replace if applicable at additional cost.

COOLING SYSTEM

- Lube fan drive bearing as required.

GENERATOR

- Generator Rear Bearing - Lubricate if applicable per manufacturer specification.
- Change reduction gearbox oil – if applicable.

CONTROL PANEL

- Circuit Breakers - Inspect for free movement and tight connections, if accessible.

Scheduled Maintenance LEVEL 3 (includes All Services Previously Listed Under Level 1 And Level 2, As Well As The Following)-Recommended Every Three (3) Years:

COOLING SYSTEM

- Coolant - Drain and replace coolant. (Coolant flush as required at additional cost.)
- Thermostats - Replace
- Fan Belts - Replace
- Hoses - Replace all cooling system hoses including jacket water heater hoses.

STARTING SYSTEM

- Batteries – Replace (Lead Acid ONLY)
- Alternator – Verify pulley alignment if applicable.

GENERATOR

- Visually inspect exciter, Permanent Magnet (PMG) if applicable, and rotating rectifiers.

AIR INDUCTION AND EXHAUST SYSTEM

- Air Filter - Replace.

OTHER SERVICES (Available From Your Caterpillar® Dealer)

TRANSFER SWITCH PREVENTIVE MAINTENANCE - Recommended Annually (Two Level Options)

Level 1 (Energized Switch):

INTERIOR WIRING COMPONENTS

- Perform visual inspection of all wiring and connections for signs of tracking, overheating, and insulation deterioration.
- Check all time delay settings and adjust to the customer's specifications. Record settings.
- Check all common and ground wires. Measure and record resistance to ground readings.
- Check for proper automatic transfer operation and sequencing of time control relays: **with customer approval only.**

ENCLOSURE

- Wipe down.
- Clean interior of enclosure and remove accumulated dust and/or dirt.
- Check door closure, locking bar, and mechanism for proper operation.

MISCELLANEOUS

- Record findings of the inspection. Record corrective action taken.
- Report unsafe conditions.
- Report recommendations for replacement of major components.

Level 2 (De-Energized Switch) All of the above plus:

- Check condition of main and arcing contacts and auxiliary contacts.
- Check manual switches for free movement and contact continuity.
- Check lug connections and mounting insulator bolts.
- Check and tighten all control circuit wiring terminals.
- Megger test for grounds or leakage.
- Test all phase and voltage sensitive relays as required.
- Lubricate per manufacturers specifications.
- Perform relative infrared heat scan on all contacts.

LOAD BANK TESTING - Required Annually For Most Applications (SEE NFPA 110 & NFPA 99)

In addition to your scheduled Preventive Maintenance services, we also recommend having a 1.5 hour Load Bank Test performed annually, in conjunction with your P.M. service. This test will help prevent a condition known as "wet stacking", which is the presence of carbon particles, unburned fuel, acids, and condensed water in the exhaust system, which accumulates due to incomplete combustion caused by low combustion temperatures. The presence of continual black smoke during operation is an indication that wet stacking is occurring.

NFPA 110 (2016) Chapter 8 states the following regarding Load Bank Testing (this also applies to NFPA 99 for Healthcare Facilities, pertinent information is underlined):

8.4 Operational Inspection and Testing.

- 8.4.1*** EPSS's, including all appurtenant components, shall be inspected weekly and shall be exercised under load at least monthly.

Exception: If the generator set is being used for standby power or for peak load shaving, such use shall be recorded and shall be permitted to be substituted for scheduled operations and testing of the generator set, provided the appropriate data are recorded.

- 8.4.2*** Diesel generator sets in service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:

- (a) Under operating temperature conditions or at not less than 30% of the EPS nameplate rating.
- (b) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer.

The date and time of day for required testing shall be decided by the owner, based on facility operations.

8.4.2.3 Diesel-powered EPS installations that do not meet the requirements of 8.4.2 shall be exercised monthly with the available EPSS load and exercised annually (8.4.2.3) with supplemental loads at not less than 50% of the name-plate rating for 30 continuous minutes and not less than 75% of nameplate rating for 1 continuous hour for a total test duration of 1.5 continuous hours.

In summary, the engine needs to be exercised at monthly intervals. This must be done at the manufacturer's recommended operating temperature, which can only be achieved by running it under recommended load (usually 30% to 50% of the generator's designed capacity). If this is not possible due to the inability to transfer adequate building loads to the generator, a Load Bank Test will be required to satisfy the supplemental load requirement.

Holt Power Systems offers the 3 year test for Level 1 EPSS as specified in 8.4.9* and 8.4.9.7. as well: Not less than 30% of the EPS nameplate rating for 3 continuous hours and not less than 75% of the EPS nameplate rating for 1 continuous hour for a total test duration of not less than 4 continuous hours.

INSULATION (MEGOHMETER) TESTING – Recommended Annually

Test main stator, main rotor, exciter stator, and exciter rotor. Record data: Report current issues and trend data as reference for potential issues.

FUEL ANALYSIS - Recommended Annually

Fuel analysis will include but is not limited to testing in accordance with ASTM D 975 requirements.

SWITCHGEAR PREVENTIVE MAINTENANCE - Recommended Annually:

- Individualized quote based on Switchgear type and customer scope.

UPS PREVENTIVE MAINTENANCE - Recommended Annually:

- Individualized quote based on UPS type and customer scope.

FLYWHEEL UPS PREVENTIVE MAINTENANCE - Recommended Quarterly:

- Individualized quote based on customer scope.