



## **Maintenance & Service**

*In Accordance with CSA Standard*

*CSA-C282 "Emergency electrical power supply for buildings"*

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## **About Us**

Ronnie's Generator Service Ltd. in Ontario ensures your backup power generator is ready when you need it. We work on a variety of emergency generators between 20kW and 3200 kW. We offer Kohler® warranty repairs, maintenance contracts and 24/7 emergency repairs. We provide residential, commercial, and industrial generator servicing in Ontario.

We are proud to be a sister company to Paramount Power Systems Ltd., an authorized Kohler® power systems retailer. Visit the Paramount Power Systems website to see our projects and products.

At Ronnie's Generator Service Ltd., we pride ourselves on our competence to provide our customers with 100% satisfaction every time. Our competitive pricing and customer-centric approach have given us the ability to go about the most complicated jobs with success. Our skilled workmen have the required training and experience to fix all kinds of faults efficiently and expeditiously.

We adopt a thorough approach to all kinds of repair jobs. Our professionals carry out a thorough inspection of your generator set. Maintenance, service, and repairs are used using the required tools and equipment to ensure that the work is completed with perfection.

Ronnie's Generator Service Ltd. is a family-owned and -operated business that was established in 1978. Ronnie moved from Italy to Canada in 1966. He worked for a Kohler distributor for ten years as both a foreman and a distributor of Kohler® products, Ronnie learned the ins and outs of how a generator works. He put his experience to good use, beginning his own business, Ronnie's Generator Service and Maintenance in 1978, doing service calls for repairs and maintenance. With an emphasis on honesty, Ronnie's business grew steadily, solely by word of mouth.

**What Service is required for my generator? See the excerpts below from C282 CSA standards.**

**11 Operation and maintenance program**

**11.1 General**

**11.1.1**

Operation and maintenance The emergency electrical power supply equipment shall be operated and maintained in accordance with the manufacturer's recommendations and instruction manuals and the requirements of Clauses 11.1.2 to 11.5

**11.1.2 Inspection, testing, and maintenance**

A permanent log of the inspection, testing, and maintenance of the emergency electrical power supply system shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions and cover at least the items specified in Tables 2 to 6.

This log shall be kept on site and shall include

- a) the date on which an inspection, testing, and maintenance exercise was carried out;
- b) the name(s) of the person(s) who performed the inspection, testing, and maintenance;
- c) notes on any unsatisfactory conditions observed or discovered and the steps taken to correct such conditions;
- d) copies of the design and installation performance test certificates.

**11.2 Instructions and tools**

**11.2.1 Manual of operating and maintenance instructions**

**11.2.1.1**

At least two copies of a manual containing mechanical and electrical drawings and instructions for the operation and maintenance of the emergency generator equipment shall be provided. The manual shall cover all of the elements affecting the reliable operation of the emergency electrical power supply, including the engine generator set and associated accessories, the generator control panel, the protective devices, and the transfer switch(es).

*note: Ronnie's maintains a large library of manuals for our technicians as needed.*

**11.2.1.3**

One copy of the manual shall be kept in the safe custody of the person responsible for overall control of the operation and maintenance program.

**11.2.1.4**

Copies of the manual to be used by the operating and maintenance staff shall be kept in a location convenient for staff use.

### **11.2.2**

Tools Any special tools and gauges needed for routine maintenance shall be kept in a secure location accessible to the operating and maintenance staff when necessary. Note: A possible suitable location is the area where the engine generator set is installed.

*note: Ronnie's maintains inventory of required tools for our services*

### **11.3 Annual test**

The emergency generator set shall be subjected annually to a 2 h full load test (see Table 5) at the maximum site design load in accordance with Clauses 10.3.2 to 10.3.4. In parallel generator set installations, each generator may be load tested individually if synchronization and load sharing is demonstrated. All inspection covers shall be opened or removed, as necessary, to provide access to all electrical connections during this test. An automated system shall be provided to ensure that the generator will not be overloaded in the event of a normal supply failure while performing the test.

### **11.4 Periodic operational tests**

#### **11.4.1 All facilities**

The emergency electrical power supply system shall be completely tested as specified in Table 3 at least once a month in all facilities.

#### **11.4.2 Health care facilities**

##### **11.4.2.1**

Where a generator set is required for emergency power supply to essential electrical systems in conformance with CSA Z32, it shall be tested in accordance with Tables 2 and 3 at least once a week. Note: This requirement does not apply to the transfer switches in an HCF.

##### **11.4.2.2**

Where a health care facility has multiple transfer switches, the testing of the generator set shall be conducted so that each transfer switch, with an engine start contact connected to the generator(s), is used to start the generator(s) at least bi-annually.

### **11.5 Maintenance**

#### **11.5.1 General**

The emergency electrical power supply shall be maintained as specified in the manufacturer's manual of operating and maintenance instructions, provided that the manual covers at least the items specified in Tables 2 to 6. The owner's representative shall ensure that competent persons perform the maintenance work.

### **11.5.2 Frequency of procedures**

The minimum frequency of inspection, testing, and maintenance procedures shall be as specified in Tables 2 to 6. Additional requirements may be specified by manufacturers, operators, or authorities having jurisdiction and shall be permanently recorded in the manual of operating and maintenance instructions and the log.

### **11.5.3 Records**

A permanent log of the maintenance work (including inspections and tests) shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions (see Clause 11.5.1). The permanent log shall be kept on site and shall include at least the following:

- a) the date on which the work was done;
- b) a note of parts replaced;
- c) a note of any unsatisfactory condition discovered, and the steps taken to correct it; Committee Member's Copy Only. Distribution Prohibited. CSA C282:19 Emergency electrical power supply for buildings
- d) the name of the person who performed the work; and
- e) a note verifying that any switches or controls that were deactivated for safety purposes during maintenance have been restored to their intended operating condition. Note: A permanent logbook meeting all of the requirements of this Standard is available from CSA (C282 Logbook).

### **11.5.4 Safety**

#### **11.5.4.1**

If a maintenance procedure involves a risk of injury because of moving parts or energized electrical parts, steps shall be taken before the work is begun to deactivate all automatic and manual control devices for the parts with which contact will be made.

#### **11.5.4.2**

Signs shall be installed on the equipment at the entrance to the enclosure and on the door to the room housing the equipment stating that the equipment is automatically controlled and could start at any time.

### **11.5.5 Visual inspection of fuel (clear and bright test)**

#### **11.5.5.1 General**

All fuel supplied to the emergency generator set shall be clean and clear and bright as specified in Clause 11.5.5.4. Immediately upon completion of the annual fuel oil inventory maintenance specified in Table 5, the fuel oil shall be tested to verify that it is clear and bright. If the fuel fails the test, the tank shall be flushed to remove built-up sludge and impurities.

Notes: 1) The purpose of this test is to detect possible water or solid contaminants in diesel fuel by visual inspection. The test method is based on ASTM D4176.

2) See also Clause B.12 for commentary on fuel types and quality.

#### **11.5.5.2 Description**

The fuel shall be placed in a transparent bottle or container (see Clause 11.5.5.3) and examined to determine whether it is clear and bright. Samples for the clear and bright test shall be obtained from the bottoms of the storage and auxiliary supply tanks.

#### **11.5.5.3**

Equipment A dry, capped, clear glass bottle or container capable of holding 250 to 1000 mL of liquid shall be used. The bottle or container shall have a clear, undistorted bottom and be thoroughly washed before the test.

#### **11.5.5.4 Procedure**

The following procedure shall be followed:

- a) Wash the fuel sample bottle or container before gathering each sample.
- b) Let the sample settle for 1 min to remove air bubbles.
- c) Observe the sample against a light background for a clear and bright condition. Swirl the bottle or container to create a vortex (free water and solids tend to collect beneath the vortex).

#### **11.5.5.5 Interpretation of test results**

The samples shall be clear and bright. The visual clarity shall be recorded as clear and bright or not clear and bright. It shall be recorded whether particulate matter or water was seen at the bottom of the vortex. Note: The term “clear and bright” has no relation to the natural fuel oil colour. Fuel oil colour varies from water white, to straw colour, to amber, depending on the processing and/or crude source. Clear and bright fuel has no floating or suspended matter. Brightness is a quality independent of the sample colour and refers to the lack of suspended or free water in the sample. Bright fuel tends to sparkle.

## **Weekly inspection, test, and maintenance requirements**

### **1. Consumables:**

- a) Inspect auxiliary supply tank fuel level (gas pressure) and main tank level (gas pressure) (if applicable). There shall be a minimum supply of 2 h (see Clause 7.3.1).
- b) Inspect lubricating oil level.
- c) Inspect engine coolant level.
- d) Inspect engine, generator, fuel tank(s), and cooling systems for leakage.
- e) Inspect for proper operation of fuel transfer pump (if applicable).
- f) Inspect fuel filter for contamination if filter is equipped with a transparent bowl.

### **2. Starter system:**

- a) Inspect electric starter for cleanliness, mounting, and terminal security.
- b) Air starter:
  - i) Inspect air tanks for pressure.*
  - ii) Inspect valves for leakage.*
  - iii) Test auxiliary engine and compressor for proper operation.*
  - iv) Bleed off any condensation.*

### **3. Batteries and charging equipment:**

- a) Inspect electrical connections for tightness and evidence of corrosion.
- b) Inspect battery for cleanliness and dryness between terminals.
- c) Inspect charger electrical connections for cleanliness and tightness.

### **4. Engine:**

- a) Test lubricant and/or coolant heaters for proper operation.
- b) Inspect governor control linkages and oil level (if applicable).
- c) Inspect fuel pump oil sump (if applicable).
- d) Inspect fan belts for correct tension and wear.

### **5. Control panel:**

- a) Inspect control panel covers for security. b) Test annunciator lamps to confirm that they are operational.
- c) Inspect control panel settings (ensure that the unit is ready for automatic start-up).
- d) Test remote visual and audible trouble signals at the building fire alarm panel.

### **6. Inspect air control louvre settings to ensure proper operation.**

### **7. Test emergency lighting unit(s).**

### **8. Verify whether room temperature is above 10 °C.**

### **9. Inspect generator and transfer switch room(s) for cleanliness and accessibility to all components of the emergency system.**

### **10. Correct all defects found during inspections and tests.**

### **11. Record all inspections, tests, and corrective actions in the log.**

## **Monthly (weekly in health care facilities) inspection, test, and maintenance requirements**

**1. Complete all items specified in Table 2.**

**2. Test and verify the entire system as follows:**

- a) Simulate a failure of the normal electrical supply to the building.
- b) Verify that the battery charger current output increases while cranking.
- c) Operate the system under at least 40% of the rated load for 60 min.
- d) Operate all automatic transfer switches under load.
- e) Inspect brush operation for sparking, if applicable.
- f) Inspect for bearing seal leakage.
- g) Inspect for correct operation of all auxiliary equipment, e.g., radiator shutter control, coolant pumps, fuel transfer pumps, oil coolers, and engine room ventilation system(s).
- h) Record the readings for all instruments in the log (see Clause 11.5.3) and verify that they are normal.
- i) Drain the exhaust system condensate trap.

**3. Inspect block heater hoses and wires.**

**4. Batteries and charging equipment:**

- a) Inspect all battery cells for correct electrolyte fill level (applicable to vented or flooded lead-acid batteries only). As a safer alternative, perform a battery conductance test using a conductance tester. Record test results in the log book for trending purposes.
- b) Test all battery cells for correct electrolyte-specific gravity (applicable to vented or flooded lead-acid batteries only). This inspection may be omitted if the conductance test in Item a) is performed.

**5. Correct all defects found during inspections and tests.**

**6. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).**

**7. Inspect all electrical components to ensure proper function.**

### **Semi-annual inspection, test, and maintenance requirements**

- 1. Complete all items specified in Tables 2 and 3.**
- 2. Inspect and clean engine crankcase breathers**
- 3. Inspect and clean all engine linkages.**
- 4. Lubricate the engine governor and ventilation system.**
- 5. Test protective devices for proper operation**
- 6. Before start-up, perform two full cranking cycles (as specified in Clauses 10.4.1 and 10.4.2). Near the end of each cycle (and while still cranking), measure and record the lowest indicated battery voltage. If the measured voltage is less than 80% of the battery's rated voltage, replace the battery. Alternatively, perform a battery load test using a suitable load tester.**
- 7. Inspect ventilation system belt(s).**
- 8. Correct all defects found during inspections and tests.**
- 9. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).**

## **Annual inspection, test, and maintenance requirements**

**1. Complete all items specified in Tables 2 to 4. For the load test (item 2. (c) in Table 3) increase the minimum load to 40% of the rated load for 60 minutes.**

**2. Control panel (see Clause B.29):**

- a) Open all inspection covers and inspect all electrical connections.
- b) Test breakers for proper operation.
- c) Clean insulators and bushings.
- d) Test voltage regulator for proper operation.
- e) Operate all moving parts to ensure that they move freely. f) Clean and dress contacts as necessary.
- g) Remove all dust.
- h) Check gauge calibration. Position to ensure valve rotates properly and that the audible alarm on generator control panel is activated.

**3. Engine:**

- a) Change engine lubrication oil and filters.
- b) Test strength of coolant and chemical protection level of coolant inhibitors.
- c) Change fuel filters, clean strainer(s), and verify that the fuel supply valve is open.
- d) Inspect the exhaust system. Check and record the back pressure of the exhaust system to ensure that it complies with the engine manufacturer's requirements and compare with previous readings.
- e) Clean and lubricate linkages.
- f) Inspect air filters.
- g) Inspect all mechanical connections.
- h) Inspect all electrical connections.
- i) Inspect all external surfaces of heat exchanger(s) and clean as necessary.
- j) Inspect all belts and hoses and replace if necessary. k) Test and inspect ignition system(s). Replace any defective components.
- l) Inspect coolant pump(s) for leaks and external wear [if belt driven, remove the belt(s) first].

**4. Diesel fuel storage tank(s):The fuel oil in any storage tank (and auxiliary supply tank, if used) shall be tested in accordance with Clause 11.5.5, and if the fuel oil fails the test, it shall be a) drained and refilled with fresh fuel in accordance with Article 6.5.1.5 of the National Fire Code of Canada; or b) full filtered to remove water, scale, bacteria, and oxidized gums/resins in order to minimize filter clogging and ensure diesel start-up (see Clause B.30 for commentary).Note: The bottom(s) of the tank(s) shall be also tested chemically for water. When the fuel is filtered, it shall be treated with a suitable conditioner and stabilizer to minimize degradation while in storage.**

**5. Generator:**

- a) Test surge suppressor and rotating rectifier on brushless machines.
- b) Grease bearings (replace old grease with new) (if applicable).
- c) Clean commutator and slip rings (if applicable).
- d) Clean rotor and stator windings using clean compressed air. e) Inspect coupling bolts and alignment.

- f) Inspect conduits for tightness.
- g) Inspect windings at rotor and stator slots.
- h) Inspect all electrical connections.

**6. Overcurrent protective devices:**

- a) Electrically isolate all overcurrent protective devices.
- b) Remove all dust.
- c) Test devices for proper operation.

**7. Transfer switches:**

- a) Isolate transfer switch, open all inspection covers, and inspect all electrical connections.
- b) Operate all moving parts to ensure that they move freely. c) Clean and dress contacts as required.
- d) Remove all dust.
- e) Clean and lubricate linkages.

**8. Infrared thermal imaging:**

- a) Perform infrared thermal imaging of the normal power supply (preferred) side of each transfer switch. Ensure that the normal power supply side of each transfer switch has been loaded to at least 40% of the circuit rating of the normal power supply feeder for at least 60 min and that the load does not drop below 40% during the imaging. Scan all electrical connections, contacts, and energized components.
- b) At the end of the 60 min load test (Item 2 c), Table 3), with the emergency power supply system (all components) still operating under at least 40% load, perform infrared thermal imaging of all components from the point where the load bank cables will be connected (for the 2 h full load test), through to and including the load side of each transfer switch. Scan all electrical connections, contacts, circuit breakers, and energized components.
- c) After at least 60 min of the emergency generator full load test (see Clause 11.3), with the emergency generator still operating under full load, conduct infrared thermal imaging of all components from the load terminals of each alternator through to the connection point for the load bank cables. Scan all electrical connections, contacts, circuit breakers, and energized components.
- d) Correct any components or connections that displayed unacceptably high temperatures or unacceptable differences in temperature between phases, during the tests in Items a), b), and c) above.
- e) Repeat the infrared thermal imaging for any components and connections that were serviced, repaired, or replaced following the scans performed in Items a), b), or c) above.

**9. Lubricate door locks and hinges (if necessary), especially those of outdoor enclosures.**

**10. Conduct a 2 h full load test (see Clause 11.3).**

**11. As needed, review and provide instruction on the technical requirements specified in Tables 2 to 4 with the person(s) responsible for carrying out the work.**

**12. Correct all defects found during inspections and tests.**

**13. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).**

## **Quinquennial (every 5 years) inspection, test, and maintenance requirements**

**1. Complete all items specified in Table 5.**

**2. Generator: Inspect insulation of generator windings. Use an insulation tester (megger). The resistance in megohms should be not less than If the resistance is less, dry out the insulation using the auxiliary heat process.**

**3. Engine:**

- a) Drain and flush the cooling system. Refill the system with new coolant.
- b) Clean radiator tubes and cooling fins.
- c) Replace thermostats.
- d) Inspect valve clearances and adjust as appropriate.

**4. Correct all defects found during inspections and tests. 5. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).**

## Offered Services

### 1- Weekly Visual Inspections (Fulfills Table 2 requirements of CSA Standard C282-15)

**-Perform and record every Week (Once in conjunction with the Monthly PM Service, Once with the Semi-Annual PM service, and Once with the Annual PM Service)**

- Inspect Fuel System (Gaseous or Diesel) for fuel leaks and adequate supply (2 Hours Minimum) including storage tank if equipped
- Confirm Operation of the Diesel Fuel Pump (if Equipped)
- Check the Engine Oil Lube level and evidence of leaks
- Check the Engine Cooling System for adequate coolant levels, evidence of leaks, and un-obstructed ventilation
- Check the Engine Starting System (All Batteries, Battery Charger, and Starters)
- Check the Generator Room Condition (Normal and Emergency Room Lighting, Temperature, and Overall Cleanliness)
- Check the Transfer Switch(es) Room Condition (Normal and Emergency Room Lighting, Temperature, and Overall Cleanliness)
- Check and Inspect the Engine Heaters, drive and fan belts, and engine hoses for operation and evidence of leaks
- Confirm the Generator Controller Status is Normal and in AUTO Mode
- Record Run Hours

### 2- Monthly Services/Inspections (Fulfills Table 3 requirements of CSA Standard C282-15)

**Perform and Record once every Month (Once in conjunction with the Semi-Annual PM Service and Once with the Annual PM Service)**

- All Services described in Weekly Inspections
- Confirmation the Battery Charger operates normally
- Inspection of the AC alternator
- Perform building load test for 60 Minutes to confirm generator, ventilation, and Automatic Transfer Switch(es) operate normally
- Check Exhaust system, Exhaust Pipe Insulation, and drain condensation.

Note: The C282 Code requires qualified trained technicians to perform the Monthly services to the emergency power generators utilized for life safety systems.

### 3- Semi-Annual PM Service (Fulfills Table 4 requirements of CSA Standard C282-15)

**Perform every 6 months (once in conjunction with the Annual PM Service)**

- Includes the Services described in the Monthly and Weekly Services.
- Check the Engine linkages, breathers, and governor operation and lubrication as needed
- Confirm the proper operation of protective devices
- Performance Test on all engine starting batteries

Note: The C282 Code requires qualified trained technicians to perform the Semi-Annual services to the emergency power generators utilized for life safety systems.

**4- Annual PM Service (Fulfills Table 5 requirements of CSA Standard C282-15)**

**Performed Annually, once every 12 Months**

- Includes the Services described in the Semi-Annual, Monthly, and Weekly Inspections
- Confirm operation of breaker(s), voltage regulator, and engine governor
- Change the engine oil, oil filters, fuel filters, and tank filters.
- Lubricate components as required
- Check condition of the diesel fuel
- Check control wiring and panels
- Complete a 2-Hour 100% full generator load capacity test with a resistive load bank
- Thermal survey of cable connections on breaker and transfer switches. Note: The C282 Code requires qualified trained technicians to perform the Annual services to the emergency power generators utilized for life safety systems.

**5- Quinquennial Service (Fulfills Table 6 requirements of CSA Standard C282-15)**

**Performed once every FIVE years**

- Inspect AC alternator windings and complete the winding resistance test (meggar)
  - Flush Coolant System and replenish the coolant with appropriate antifreeze
  - Replace the engine coolant thermostat(s)
  - Inspect engine valve clearance and adjust as required
  - Infrared Thermal Imaging assessment of generator breaker and ATS connections
- Note: The C282 Code requires qualified trained technicians to perform the Quinquennial services to the emergency power generators utilized for life safety systems.

**Request Quote for Service Contract**

Name: \_\_\_\_\_

Company Name: \_\_\_\_\_

E-Mail Address: \_\_\_\_\_ @ \_\_\_\_\_

Building Address: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Brand of Generator: \_\_\_\_\_

Size of Generator (kW): \_\_\_\_\_

Fuel type: \_\_\_\_\_

Please circle service you would like quoted;

Weekly	Monthly	Semi	Annually	Quintennial
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Date: \_\_\_\_\_

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

Need more time? Contact us at: [Service@Ronniesgenerator.com](mailto:Service@Ronniesgenerator.com) for inquiries on quotes and service.

*NOTICE: As you may already be aware, the CSA Standard "C282-15; Emergency Electrical Power Supply for Buildings" has very stringent 5 Year maintenance schedules and requirements for Life Safety generators. The quoted service **DOES NOT** cover all the maintenance requirements of the standard. Failing to abide by the standard is a liability risk to the equipment Owner if the emergency power system fails during a power outage. Contact Al Ruffolo to enquire about our 5 Year Preventative Maintenance Program which covers all the C282 maintenance requirements.*

