

INSTALLATION INSTRUCTIONS

Original Issue Date: 11/93

Model: 20-300 kW

Market: Industrial and Marine

Subject: Reactive Droop Compensator Kits

Introduction

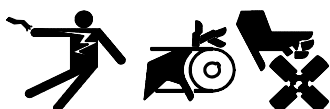
| Kit No. | kW |
|--------------------------|---------|
| PA-256496 & PA-256496-SD | 20-30 |
| PA-256497 & PA-256497-SD | 31-40 |
| PA-256498 & PA-256498-SD | 41-65 |
| PA-256499 & PA-256499-SD | 66-110 |
| PA-256500 & PA-256500-SD | 111-175 |
| PA-256505 & PA-256505-SD | 176-270 |
| PA-256506 & PA-256506-SD | 271-300 |

The reactive droop compensator is used to distribute the load evenly when two generator sets are used in parallel. A qualified electrician or technician should install these kits.

Safety Precautions

Observe the following safety precautions while installing the kit.

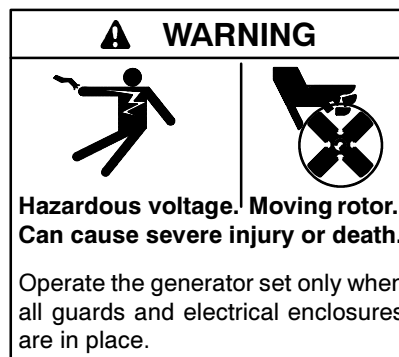
WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.



Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocuting is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Installation Procedure

1. Place the generator set master switch in the OFF position.
2. Disconnect power to the battery charger, if equipped.
3. Disconnect the generator set engine starting battery(ies), negative (-) lead first.
4. Drill mounting holes in the junction box as shown in Figure 1.
5. Install rheostat (X-467-4) through the mounting hole and align the tab with the smaller hole. Install nameplate (283869), lock washer, and nut. Attach the knob. See Figure 1 and Figure 3.

Note: The lock washer, nut, and knob are supplied with the rheostat.

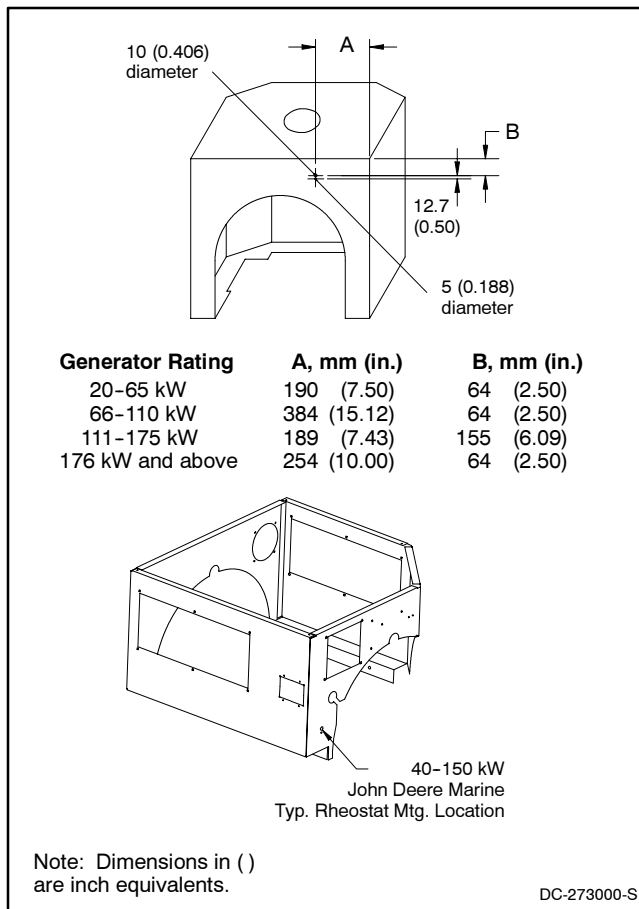


Figure 1 Drilling Instructions

6. Install the stator leads through the reactive droop compensator current transformer according to the application as shown in Figure 2.

Note: The dot or the HI mark on the current transformer must be toward the generator set.

Note: Generator sets up to 240 volts require one turn of the output leads through the current transformer. Generator sets above 240 volts require two turns of the output leads through the current transformer.

7. Attach lead (LW-1603-1313) to the center position of the rheostat with one screw (X-51-5), plain washer (X-25-48), and whiz nut (X-6210-4). See Figure 3.
8. Disconnect the V8 connection between the voltage regulator and the stator. Connect lead (LW-1606-400) to the voltage regulator V8 (white) lead.

9. Combine lead (LW-1606-400) and the black current transformer lead with ring terminal (X-283-11).
10. Attach the lead assembly from step 9 and lead (LW-1603-1313) from the rheostat's center position to the rheostat as shown in Figure 3 with one screw (X-51-5), plain washer (X-25-48), and whiz nut (X-6210-4).
11. Connect lead (LW-1636-400) to the V8 (black) lead from the stator. Combine the other end of lead (LW-1636-400) to the white (X1) current transformer lead with ring terminal (X-283-11).
12. Attach the lead assembly from step 11 to the remaining rheostat terminal with one screw (X-51-5), plain washer (X-25-48), and whiz nut (X-6210-4).

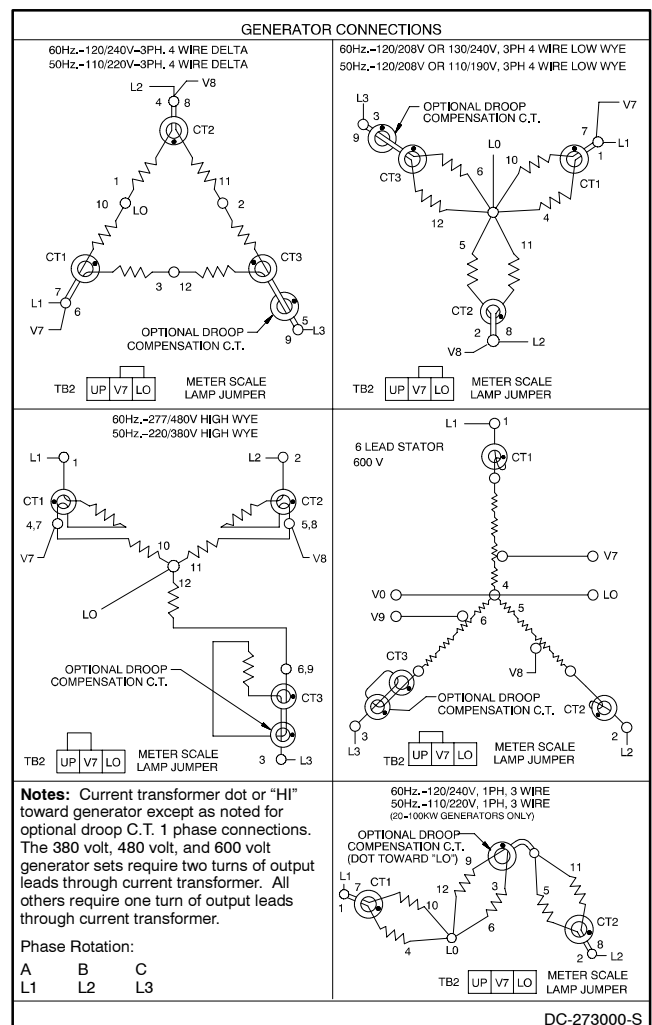


Figure 2 Generator Set Connections

Test Procedure

To test and adjust the reactive droop compensator, proceed as follows. Read the entire procedure before beginning.

1. With the reactive droop rheostat set at minimum (full counterclockwise position), record the rpm or frequency and voltage at 1/4 load steps to full load on unit #1. Repeat Step 1 for unit #2.
2. Compare the readings and make final adjustments so that the voltage is within 1 volt at each load step and the speed is within 3 rpm or the frequency is within 0.1 Hz for each unit. Adjust the voltage using the local or remote voltage adjusting potentiometer. Adjust the speed at the governor or at the remote speed adjusting potentiometer.
3. Check the droop compensation on each unit as follows:
 - a. With unit #1 operating at the correct speed and voltage, apply a lagging power factor load. This load should preferably be 1/2 to full load and must be inductive, as resistance loads cannot be used.
 - b. Observe the voltmeter on unit #1 with the reactive droop rheostat set at minimum. As the rheostat is turned clockwise, the voltmeter should show a decrease in voltage. If a larger voltage is obtained when the reactive droop rheostat is turned clockwise, shut down the system and reverse the direction of the generator load line through the current transformer, or reverse the transformer leads. Recheck the droop.
 - c. Adjust the reactive droop rheostat to a value at approximately 4% below rated voltage at full load. As an example, the voltage will droop (decrease) 19.2 volts on a 480-volt system at full load or 9.6 volts at 1/2 load. To determine voltage droop at other than full load, use the following formula:

$$\begin{aligned} \text{Note: } & \text{Rated Voltage} \times 0.04 \times \text{Actual Load} \\ & \text{(expressed as a percent of full load)} \\ & = \text{Voltage Droop} \end{aligned}$$

Note: With full load 0.8 power factor, a droop of 3-5% should be adequate for paralleling.

- d. Repeat Steps 3 a., b., and c. for unit #2 and be certain the amount of voltage droop is equal at the same load point as on unit #1.
 - e. With this procedure, the two units will share reactive currents proportionately.
4. In addition to Steps 1-3, it is desirable to use the following procedure to check that the units are sharing the reactive load correctly.
 - a. Parallel the units at 1/2 to full load. Check the wattmeters to determine that each unit is carrying equal kW load or a load proportional to its capacity. If the loads are incorrect, adjust and recheck the governor throttle control to correctly balance loading. Engine speed will determine load sharing ability.

Note: Use wattmeters, not ammeters, to verify load balance.

- b. With the load balanced, check the ammeters to see that equal current is being produced or the current is proportional according to capacity of each generator set. If the currents are incorrect, adjust the reactive droop rheostat to reduce the current of the unit(s) that has the highest reading. Adjust the rheostat to increase current on the unit(s) with the lower reading. Continue making minor adjustments until each unit supplies current proportional to its capacity as a proportion of the total system capacity.
- c. As a result of performing Steps 4 a. and b., the governors have been adjusted to balance the load and the reactive droop rheostat has been adjusted to balance the current. These settings would be optimum for parallel operation.

Note: The voltage must droop on lagging power factor loads (inductive loads). A little change in voltage is acceptable on unity power factor loads (resistive loads).

LOCALLY MOUNTED DROOP COMPENSATOR KIT

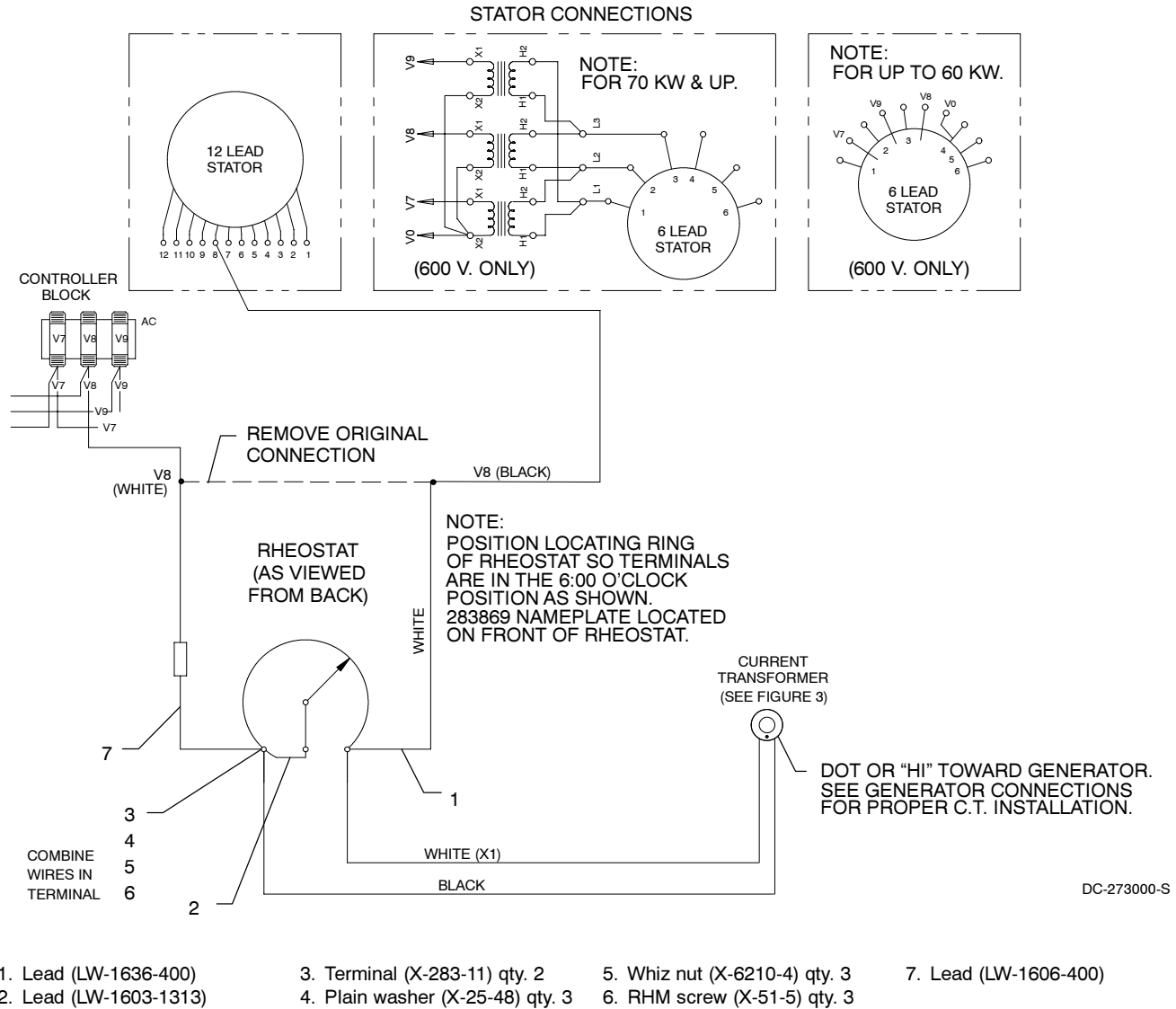


Figure 3 Wiring Diagram

Kits: PA-256496, PA-256496-SD, PA-256497, PA-256497-SD, PA-256498, PA-256498-SD, PA-256499, PA-256499-SD, PA-256500, PA-256500-SD, PA-256505, PA-256505-SD, PA-256506, and PA-256506-SD

| Qty. | Part Number | Description |
|-------|--------------|--|
| 1 | LW-1603-1313 | Lead |
| 1 | LW-1606-400 | Lead |
| 1 | LW-1636-400 | Lead |
| 3 | X-25-48 | Washer, 4.78 x 11.13 x 1.24 mm (0.188 x 0.438 x 0.049 in.) |
| 2 | X-283-11 | Terminal, ring |
| 1 | X-467-4 | Rheostat, 16 ohm, 2.5 amp |
| 3 | X-51-5 | Screw, RHM, 8-32 x 11.13 mm (0.438 in.) |
| 3 | X-6210-4 | Nut, 8-32 whiz |
| 6 ft. | — | Wire, 16-gauge white |
| 1 | 283869 | Nameplate |
| 1 | 233951 | Transformer, current, ratio 300:5 (kits PA-256496 and PA-256496-SD) |
| 1 | 233952 | Transformer, current, ratio 400:5 (kits PA-256497 and PA-256497-SD) |
| 1 | 233953 | Transformer, current, ratio 600:5 (kits PA-256498 and PA-256498-SD) |
| 1 | 233954 | Transformer, current, ratio 1000:5 (kits PA-256499 and PA-256499-SD) |
| 1 | 233957 | Transformer, current, ratio 1600:5 (kits PA-256500 and PA-256500-SD) |
| 1 | 233955 | Transformer, current, ratio 2500:5 (kits PA-256505 and PA-256505-SD) |
| 1 | 297676 | Transformer, current, ratio 4000:5 (kits PA-256506 and PA-256506-SD) |