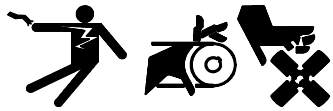
INSTALLATION INSTRUCTIONS

Original Issue Date: **5/99**
Model: **450–2000 kW (Detroit Diesel Series 2000 and 4000 Engines)**
Market: **Industrial**
Subject: **Reactive Droop Compensator Kits PA-361726–30 and PA-361726–30-SD, PA-365290–95 and PA-365290–95-SD**

Use the reactive droop compensator kit to distribute the load evenly when paralleling two generator sets. Have a qualified electrician or technician install the reactive droop compensator kit. Observe the following safety precautions while installing the kit.

kW	Alternator Model	Kit No.
450	5M4160, 5M4162	PA-365290, PA-365290-SD
	5M4270, 5M4272	PA-365291, PA-365291-SD
	5M4024, 5M4027, 5M4028	PA-365295, PA-365295-SD
500	5M4162, 5M4164	PA-365290, PA-365290-SD
	5M4270, 5M4272	PA-365291, PA-365291-SD
	5M4204, 5M4027, 5M4028, 5M4030, 5M4032	PA-365295, PA-365295-SD
600	5M4272, 5M4276	PA-365290, PA-365290-SD
	5M4164	PA-365292, PA-365292-SD
	5M4028, 5M4030, 5M4032	PA-365293, PA-365293-SD
750	5M4276, 5M4278	PA-365290, PA-365290-SD
	5M4038, 5M4166	PA-365292, PA-365292-SD
	5M4032, 5M4034, 5M4036	PA-365293, PA-365293-SD
800	5M4278	PA-365290, PA-365290-SD
	5M4034, 5M4036	PA-365293, PA-365293-SD
	5M4166, 5M4038	PA-365295, PA-365295-SD
900	5M4044, 7M4046	PA-361728, PA-361728-SD
	5M4280	PA-365292, PA-365292-SD
	5M4036	PA-365293, PA-365293-SD
	5M4168, 5M4038	PA-365295, PA-365295-SD
1000	7M4170	PA-361726, PA-361726-SD
	5M4044, 7M4046, 7M4282, 7M4284	PA-361728, PA-361728-SD
1250	7M4046, 7M4048, 7M4050, 7M4025, 7M4172, 7M4174	PA-361726 PA-361726-SD
	7M4288	PA-361728 PA-361728-SD
	7M4366, 7M4368	PA-361729 PA-361729-SD
1500	7M4050, 7M4052, 7M4174, 7M4176	PA-361726 PA-361726-SD
	7M4290	PA-361728 PA-361728-SD
	7M4368, 7M4370	PA-361730 PA-361730-SD
1750	7M4292	PA-361726 PA-361726-SD
	7M4052, 7M4054, 7M4058, 7M4176	PA-361727 PA-361727-SD
	7M4370, 7M4374	PA-361730 PA-361730-SD
2000	7M4292	PA-361726 PA-361726-SD
	7M4054, 7M4058, 7M4176	PA-361727 PA-361727-SD
	7M4374	PA-361730 PA-361730-SD

⚠ 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.

⚠ DANGER

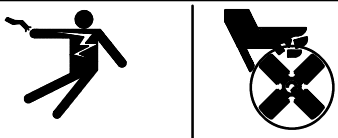
Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

(600 volt and above)

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing the equipment.

⚠ WARNING



Hazardous voltage. Moving rotor.

Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Installation

1. Place the generator set master switch in the OFF position.
2. Disconnect the power to the battery charger, if equipped.
3. Disconnect the generator set engine starting battery(ies), negative (-) lead first.
4. Remove the junction box upper rear panel. See Figure 1, Figure 2 or Figure 3.
5. Disconnect the required generator load lead(s) for installation of the droop current transformer (CT). See Figure 1 for the droop CT installation location on 380-600V generator sets, Figure 2 for 208-600V generator sets and Figure 3 for 3300 and 4160V generator sets.

NOTE

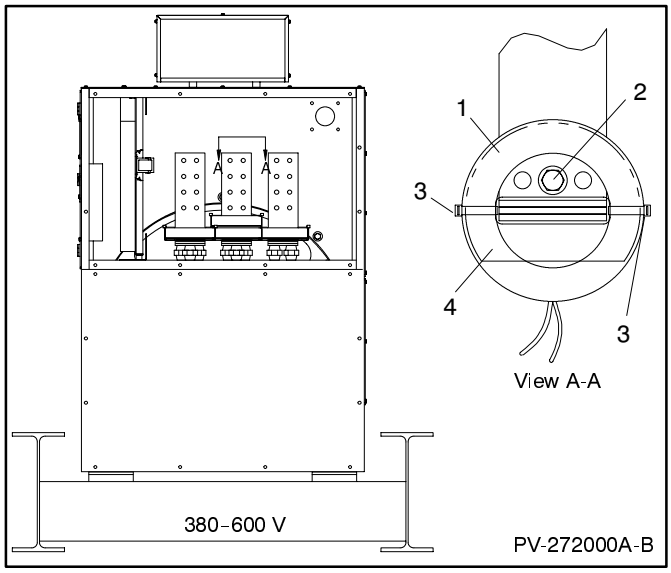
Position the dot or HI side of the CT toward the generator.

6. **380-600 V**. Install the droop CT on the center bus bar. If the generator set is equipped with CTs, place the CT support (361506) between the existing CT and the droop CT. If the generator set is not equipped with CTs, secure the CT support (361506) to the bus bar with the bolt (X-129-19) and 1/2-in. plain washer against the CT support. See Figure 1. Secure the droop CT to the CT support with cable ties (X-468-4).

   208-600 V. If the generator set is equipped with CTs, secure the droop CT to the CT support with cable ties (X-468-4). If the generator set is not equipped with CTs, secure the CT supports (365620 and 365621) to the junction box base with bolts (X-129-17), nuts ()X-6210-12), and washers (X-25-26). See Figure 2. Secure the droop CT to the CT support with cable ties (X-468-4).

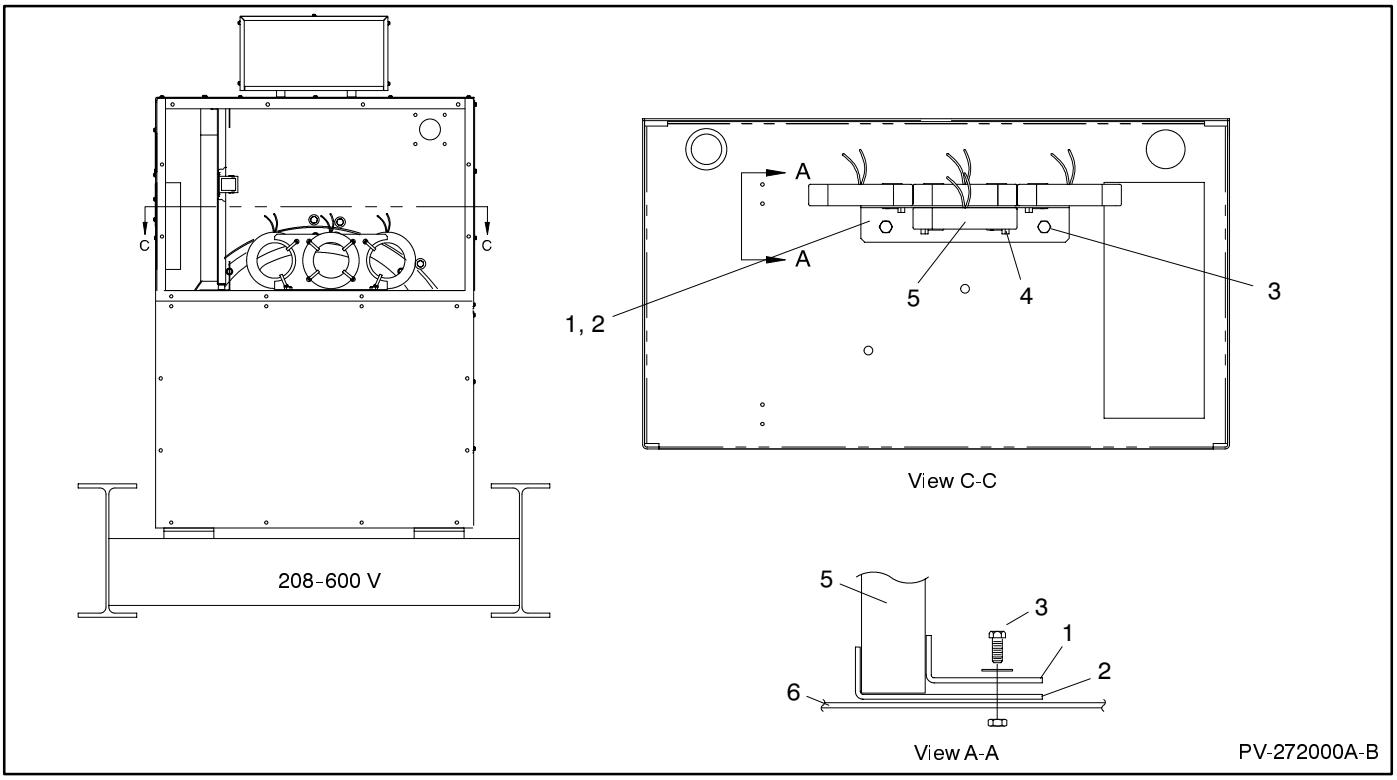
   3300 and 4160 V. If the generator set is equipped with CTs, secure the droop CT to the CT support (361853) with cable ties (X-468-4). If the generator set is not equipped with CTs, secure the CT support (361853) to to the junction box with bolts (X-6238-11) and spiralock nuts (X-6210-9). See Figure 3. Secure the droop CT to the CT support with cable ties (X-468-4).

7. Reconnect the generator load lead(s) that were disconnected for the droop CT installation. See Figure 4.
8. Connect the droop CT leads 115 and 116 to the voltage regulator. See Figure 5 for the wiring connections to a local-mounted voltage regulator. See Figure 6 for the wiring connections to a remote-mounted voltage regulator.
9. Reinstall the junction box upper rear panel.
10. Check that the generator master switch is in the OFF position.
11. Reconnect the generator set engine starting battery, negative (–) lead last.
12. Reconnect the power to the battery charger, if equipped.



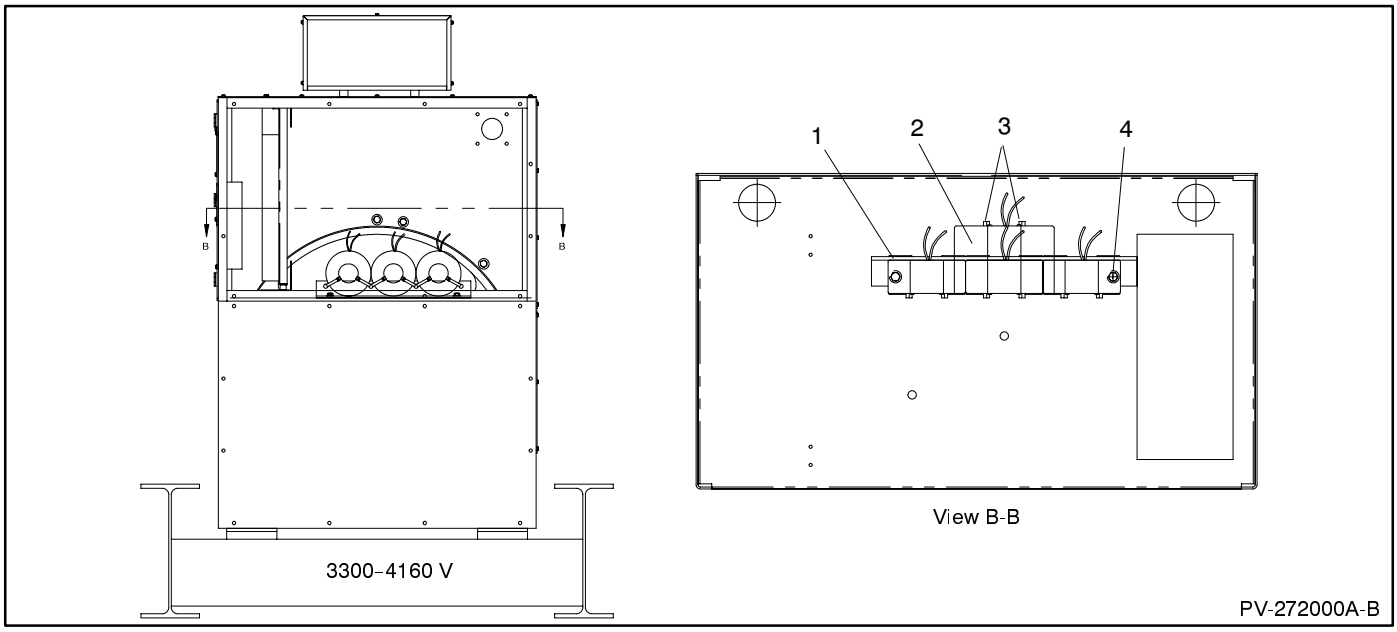
1. Current transformer
2. Bolt, 1/2-13 x 1.5 in. (X-129-19), and 1/2 in. plain washer
3. Cable tie, 4.0 in. (X-468-4)
4. CT support (361506)

Figure 1. 380–600 V CT Installation



1. CT support top (365620)
2. CT support bottom (365621)
3. Bolt, (X-129-17), nut (X-6210-12), and washer (X-25-26)
4. Cable tie, 4.0 in. (X-468-4)
5. Current transformer
6. Junction box base

Figure 2. 208–600 V CT Installation



1. CT support (361853)
2. Current transformer
3. Cable tie, 4.0 in. (X-468-4)
4. Bolt, 1/2-13 x 1.5 in. (X-129-19)

Figure 3. 3300–4160 V CT Installation

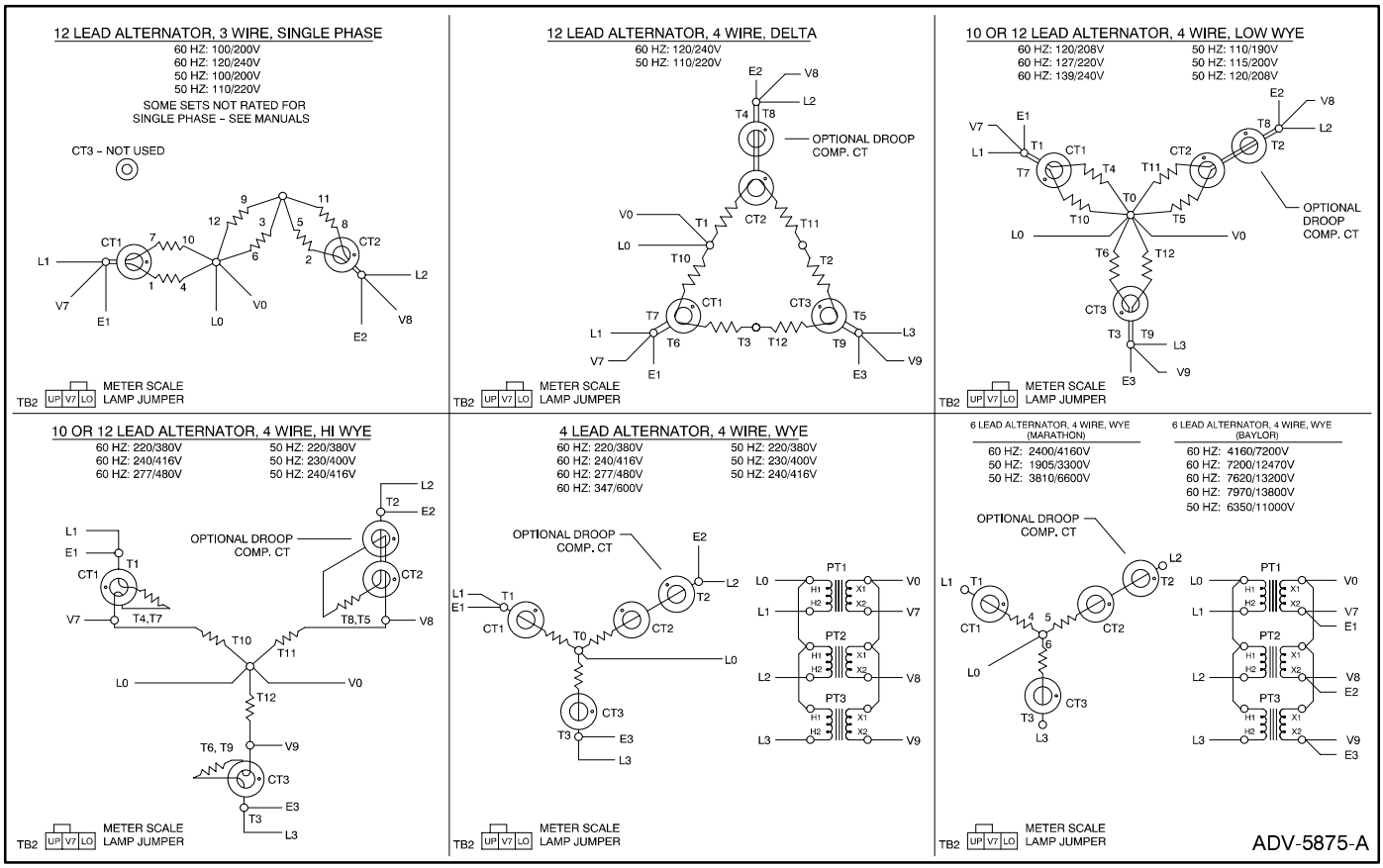


Figure 4. Reconnection Diagrams

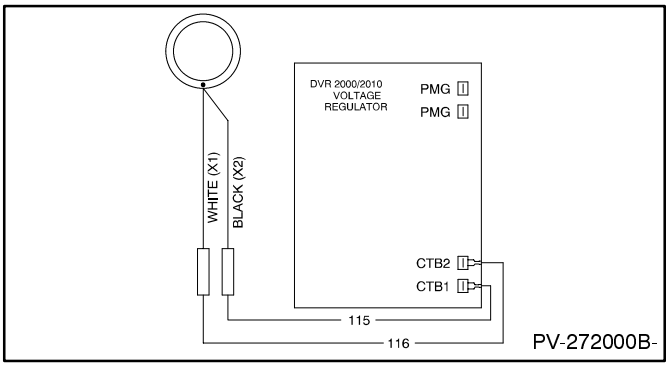


Figure 5. Local Mounted Voltage Regulator CT Connections

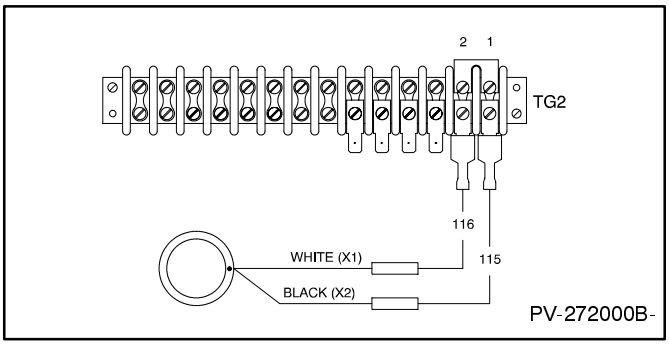


Figure 6. Remote Mounted Voltage Regulator CT Connections

Testing

Use the following procedure to test and adjust the reactive droop. Read the entire procedure before beginning the test.

1. With the droop adjustment set at minimum, record the RPM and voltage at quarter-load steps to full load on generator set #1. Repeat step 1 for generator set #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 that the frequency is within 0.1 Hz for each generator set.
3. Use the following procedure to check the droop compensation of each generator set.
   a. With generator set #1 operating at the rated speed and voltage, apply a lagging power factor load. Preferably this load should be one-half to full load, and it must be inductive. Resistance loads cannot be used.
   b. Observe the voltmeter on generator set #1 with the droop adjustment set at minimum. As the droop adjustment is increased, the voltmeter should show a decrease in voltage. If a larger voltage is obtained when the droop adjustment is increased, shut down the system and reverse the direction of the generator load line through the current transformer, or reverse the current transformer leads. Recheck the droop.
   c. Set the droop adjustment at a value that is approximately 4% of the rated voltage at full load. For example, the voltage droops (decreases) 19.2 volts on a 480 volt system at full load or 9.6 volts at one-half load. To determine voltage droop at other than full load use the following formula:

      Rated Voltage $\times$ 0.04 $\times$ Actual Load

NOTE

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

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   d. Repeat steps a, b, and c for generator set #2 and be certain the amount of voltage droop is equal at the same lead point as on generator set #1.
   e. Upon completion of this procedure, the two generator sets share reactive currents proportionately.
4. In addition to steps 1 through 3 use the following procedure to check that the generator sets share the reactive load.
   a. Parallel the two generator sets at one-half to full load. Check the wattmeters to determine that each generator set is carrying an equal kW load or a load proportional to its capacity. If the loads are incorrect, adjust and recheck the governor throttle control.
   b. With the load balanced, check the ammeters to verify that equal current is being produced or the current is proportional to the capacity. If the currents are incorrect, adjust the droop adjustment to reduce the current of the generator set that has the highest reading. The current should be reduced to an equal division or be proportional.
   c. Performing steps a and b results in the adjustment of the governors to balance load and the droop adjustment has been adjusted to balance current.

NOTE

Voltage must droop on lagging power factor loads (inductive loads). A little change in voltage is acceptable on unity power factor loads (resistance loads).

Reactive Droop Compensator Kits

Parts List					
	Kits: PA-361726, PA-361726-SD, PA-361727, PA-361727-SD, PA-361728, PA-361728-SD		Unique Parts		
Qty.	Description	Common Parts	PA-361726 PA-361726-SD	PA-361727 PA-361727-SD	PA-361728 PA-361728-SD
1	Lead, 115	T115-1635-5704			
1	Lead, 116	T116-1637-5704			
1	Bolt, 1/2-13 x 1.5 in.	X-129-19			
2	Tie, cable, 4 in.	X-468-4			
1	Transformer, current		297675	297676	291548
1	Support, CT	361506			

Reactive Droop Compensator Kits

Parts List				
	Kits: PA-361729, PA-361729-SD, PA-361730, PA-361730-SD		Unique Parts	
Qty.	Description	Common Parts	PA-361729 PA-361729-SD	PA-361730 PA-361730-SD
1	Lead, 115	T115-1635-5704		
1	Lead, 116	T116-1637-5704		
4	Washer, plain	X-25-37		
2	Tie, cable, 4 in.	X-468-4		
2	Nut, spiralock, 3/8-16	X-6210-9		
2	Screw, h.c., 3/8-16 x 1.0 in.	X-6238-11		
1	Transformer, current		233951	233952
1	Support, CT	361853		