

# Operation Manual

Standby Generator Sets



## **Models:**

Fast Response™ II  
Generators  
(John Deere— and  
Detroit Diesel—powered)

**KOHLER**<sup>®</sup>  
POWER SYSTEMS

# Table of Contents

SUBJECT	PAGE	SUBJECT	PAGE
<b>Section 1. Introduction</b> .....	1-1	Resetting Emergency Stop	
Service Assistance .....	1-1	Switches .....	3-15
Safety Precautions and Warning		Fault Shutdowns .....	3-17
Decals .....	1-2	Controller Resetting Procedure	3-18
Safety Precautions .....	1-2	Manual Controller Operation .....	3-19
Warning Decals .....	1-7	Features .....	3-20
<b>Section 2. Fast Response II</b>		Starting .....	3-20
<b>Concepts</b> .....	2-1	Stopping .....	3-21
General .....	2-1	Fault Shutdowns .....	3-21
System .....	2-1	<b>Section 4. Accessories</b> .....	4-1
Short Circuit Performance .....	2-2	Remote Annunciator	
<b>Section 3. Operation</b> .....	3-1	(Decision Monitor) .....	4-1
Prestart Checklist .....	3-1	Audio Visual (AV) Alarm Kit .....	4-2
Dec-3 16-Light Controller (Level 1)		Isolated Alarm Dry Contact Kit ...	4-3
Operation .....	3-2	Safeguard Breaker .....	4-4
Features .....	3-3	Line Circuit Breaker .....	4-4
Starting .....	3-6	Common Fault Relay Kit .....	4-5
Local Starting .....	3-6	One Relay Dry Contact Kit .....	4-5
Auto Starting .....	3-6	Overvoltage Kit .....	4-6
Stopping .....	3-6	Run Relay Kit .....	4-6
Normal Stopping .....	3-6	Emergency Stop Kit .....	4-7
Emergency Stopping .....	3-7	Controller Connection Kit .....	4-7
Resetting Emergency Stop		Fast Check Diagnostic Tester .....	4-8
Switches .....	3-7	Accessory Connection .....	4-9
Fault Shutdowns .....	3-9	<b>Section 5. Troubleshooting</b> .....	5-1
Controller Resetting Procedure .	3-10	<b>Section 6. Generator Reconnection</b> . . .	6-1
Dec-3 6-Light Controller (Level 2)		<b>Section 7. Generator Service</b> .....	7-1
Operation .....	3-11	<b>Section 8. Wiring Diagrams</b> .....	8-1
Features .....	3-12		
Starting .....	3-14		
Local Starting .....	3-14		
Auto Starting .....	3-14		
Stopping .....	3-15		
Normal Stopping .....	3-15		
Emergency Stopping .....	3-15		

# Section 1. Introduction

This manual covers the general operation of Kohler Fast Response II generators equipped with the Dec-3 (6 or 16-Light) Controller or the Manual Controller. Prior to operating the generator set, **READ THIS MANUAL**. Carefully follow the operating procedures and

observe all safety precautions to ensure proper generator operation and to avoid serious bodily injury. Information on servicing and troubleshooting the generator is available separately.

## Service Assistance

Contact your Kohler Generator Distributor to obtain additional servicing information for particular models. Look in the Yellow Pages listing under Generators-Electric. To obtain

complete engine and generator service literature, supply your distributor with the Model, Specification, and Serial numbers from the generator nameplate.

# Safety Precautions and Warning Decals

## Safety Precautions

A Generator Set, like any other electro-mechanical device can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best way to prevent accidents is to be aware of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a Generator Set follow. Keep these in mind. This manual contains several types of safety precautions which are explained below.

### DANGER

Danger is used to indicate the presence of a hazard which *will* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

### WARNING

Warning is used to indicate the presence of a hazard which *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

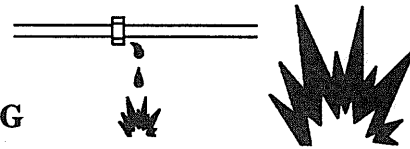
### CAUTION

Caution is used to indicate the presence of a hazard which *will* or *can* cause *minor* personal injury or property damage if the warning is ignored.

### NOTE

Note is used to notify people of installation, operation, or maintenance information which is important but not hazard-related.

### WARNING




All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels. Store fuel in a well-ventilated area away from spark producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition—don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Additional precautions must be taken when using the following fuels:

**Gasoline** – Store gasoline only in approved red containers clearly marked GASOLINE. Do not store gasoline in any occupied building.

**Propane (LP)** – Adequate ventilation is mandatory. Propane is heavier than air; install gas detectors low in room. Inspect detectors often.

**Natural Gas** – Adequate ventilation is mandatory. Natural gas rises; install gas detectors high in room. Inspect detectors often.

### WARNING



Storing gasoline and other volatile fuels in day or sub-base fuel tanks can cause an explosion. Store only diesel fuel in day or sub-base fuel tanks.

**⚠ CAUTION**



**Hazardous noise can cause loss of hearing.** Never operate generator without adequate hearing protection or muffler. Never operate generator with faulty exhaust system.

**⚠ WARNING**



**Carbon monoxide can cause death, severe nausea or fainting.** Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate in any area where exhaust gas could accumulate and seep back inside an occupied building. Avoid breathing exhaust fumes when working on or near the generator set. Carbon monoxide is particularly dangerous in that it is an odorless, colorless, tasteless, nonirritating gas. Be aware that it can cause death if inhaled for even a short period of time. The exhaust system must be leakproof and routinely inspected.

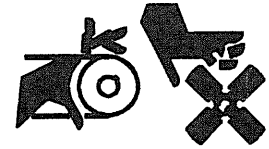
**⚠ CAUTION**



**Diesel fumes can rapidly destroy copper tubing in diesel exhaust systems.**

Do not use copper tubing in diesel exhaust systems. Exhaust sulphur will cause rapid deterioration and this could result in exhaust/water leakage.

**⚠ WARNING**



**Exposed moving parts can cause severe injury.** Keep hands, feet, hair, and clothing away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set.

**⚠ WARNING**



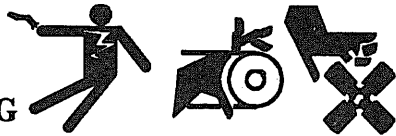
**Hot coolant can cause severe burns.** Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

**⚠ WARNING**



**Hot exhaust components may ignite nearby combustible materials.** Keep exhaust piping away from fuel lines, fuel tank, and combustible materials. A double-sleeved thimble (shield) must always be installed where exhaust piping passes through a combustible wall or roof.

**⚠ WARNING**



**Accidental starting can cause death or serious personal injury.** Turn Generator Master Switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by automatic transfer switch or remote start/stop switch unless these precautions are followed.

**⚠ CAUTION**



**Electrical shock may occur if battery charger is not properly installed.** Connect battery charger to a grounded, metal, permanent wiring system. As an alternative, run an equipment-grounding conductor with circuit conductors and connect to equipment-grounding terminal or lead on battery charger. Battery charger installation should be performed as prescribed in equipment manual and must comply with all local codes and ordinances.

**⚠ WARNING**



**Hazardous voltage can cause severe personal injury.** When testing or servicing generator set and there is the presence of hazardous voltage, carefully follow instructions in the equipment manual.

**⚠ WARNING**



**Hazardous voltage can cause death or severe injury.** Disconnect set from load by opening line circuit breaker or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. If high voltage is transferred to load during test, personal injury and equipment damage may result. **THE GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER!**

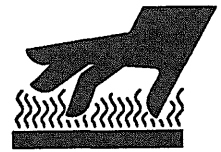
**Hazardous voltage can cause death or severe injury.** Perform electrical service only as prescribed in equipment manual. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions. Wiring should be inspected at the interval recommended in the service schedule — replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and that wherever electricity is present, there is the hazard of electrocution.

**⚠ WARNING**



**Hazardous voltage can cause death or severe injury.** Service day tank ECM (Electrical Control Module) as prescribed in equipment manual. Before servicing, disconnect power to day tank. When day tank ECM "OFF" push button is engaged the unit is disabled. However, 120 VAC power is still present within the ECM as indicated by the "POWER ON" light. Be sure that generator and day tank are properly grounded. Do not operate when standing in water, on wet ground, or when your hands are wet.

**⚠ CAUTION**



**Hot parts can cause personal injury.** Avoid touching generator field or exciter armature. Generator field and exciter armature will get hot if shorted.

**Hot parts can cause personal injury.** Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

**⚠ WARNING**



**Hazardous "backfeed" voltage can cause death or severe injury.** Install a transfer switch in standby power installations to prevent connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause serious injury or death to utility personnel working on transmission lines.

**⚠ WARNING**



**Battery gases can cause an explosion.** Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is being charged. Avoid contacting terminals with tools, etc. to prevent burns and to prevent sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Never connect negative (-) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together or sparks could ignite battery gases or fuel vapors. Any compartment containing batteries must be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting battery connections. When disconnecting battery, remove negative lead first and reconnect it last.

**⚠ CAUTION**



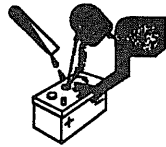
**Short circuits can cause equipment damage.** Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

**⚠ WARNING**



**A sudden backfire can cause serious burns.** Do not operate with air cleaner removed.

**⚠ WARNING**



Sulfuric acid in batteries can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If battery electrolyte is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In the case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous spattering of electrolyte.

**⚠ CAUTION**



**Rough handling can damage battery charger.** Do not operate charger if it has received a sharp blow, been dropped, or damaged in any way; have charger repaired as prescribed in equipment manual.

**⚠ WARNING**



**Charging unsuitable batteries can cause them to explode.** Charge only LEAD-ACID or NI-CAD batteries with battery charger.

**NOTE**

**Charging unsuitable batteries can damage charger.** Connect battery charger only to battery with the same DC voltage to prevent damage to charger circuitry.

**⚠ CAUTION**

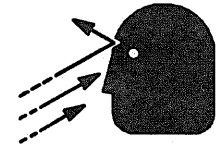


**Engine block heater can cause electrical shock.** Remove engine block heater plug from electrical outlet before working on block heater electrical connections.

**NOTE**

**Block heater will fail if not immersed in water.** Always unplug block heater(s) before draining coolant and fill engine block with coolant prior to plugging in block heater(s). Block heater element **MUST** be immersed in engine coolant before being energized.

**⚠ CAUTION**



**Flying projectiles can cause injury.** When making adjustments or servicing generator set, do not loosen crankshaft hardware or rotor thru-bolt. If rotating crankshaft manually, direction should be clockwise only. Turning crankshaft or rotor thru-bolt counterclockwise can loosen hardware and result in serious personal injury from hardware or pulley flying off engine while unit is running. Retorque all crankshaft and rotor hardware after servicing.



## Warning Decals

Warning decals are affixed to the generator set in prominent places to advise the operator or service technician of potentially hazardous situations. These decals are reproduced here to improve operator recognition and thereby increase decal effectiveness. For a further

explanation of decal warnings, reference preceding safety precautions. Before operating or servicing the generator set, be sure you understand the message of these decals. Replace decals if missing or damaged

GENERATOR CONNECTIONS			
<p><b>SINGLE PHASE</b> SOME SETS NOT RATED FOR SINGLE PHASE - SEE MANUALS</p> <p>CT3 - NOT USED</p> <p>80HZ-120/240 VOLT 50HZ-110/220 VOLT</p> <p>REMOVE V9 FROM TERMINAL STRIP AND TAPE.</p>	<p><b>3 PHASE DELTA</b></p> <p>110/220 VOLT 50HZ 120/240 VOLT 60 HZ</p>	<p><b>3 PHASE WYE</b></p> <p>190-208 VOLT 50 HZ 208-240 VOLT 60HZ</p>	<p><b>3 PHASE WYE</b></p> <p>380-416 VOLT 50 HZ 416-480 VOLT 60HZ</p>
<b>⚠ WARNING</b>			
	<p><b>Hazardous voltage.</b> Backfeed to utility system can cause electrocution or property damage.</p>	<p>When generator is used for standby power, use of automatic transfer switch is recommended to prevent inadvertent interconnection of standby and normal sources of supply.</p>	

<b>⚠ DANGER</b>	
<p><b>Hazardous voltage.</b> Will cause severe injury or death.</p>	<p><b>Moving rotor.</b> Will cause severe injury.</p>
<p>Do not operate generator set without all guards and electrical enclosures in place.</p> <p>Operate and service by trained personnel only. Refer to manual prior to installation, operation or service. Manuals available from Kohler Co. Kohler, Wisconsin 53044</p>	

<b>⚠ WARNING</b>	
<p><b>Rotating parts.</b> Can cause severe injury.</p> <p>Do not operate generator set without all guards, screens or covers in place.</p> <p style="text-align: right;">249808</p>	

<b>⚠ CAUTION</b>	
<p><b>Hot engine and exhaust system.</b> Can cause severe burns.</p> <p>Do not work on generator set until unit is allowed to cool.</p> <p style="text-align: right;">249809</p>	

<p><b>WARNING</b> THIS IS A POSITIVE TERMINAL ONLY. DO NOT ATTACH NEGATIVE LEAD !</p>
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280733

**! WARNING**



**Hazardous voltage.  
Backfeed to  
utility system  
can cause  
electrocution  
or property damage.**

When generator is used for standby power, use of automatic transfer switch is recommended to prevent inadvertent interconnection of standby and normal sources of supply.

258815

**! WARNING**



**EXPLOSION.**

**Battery spark can cause explosion and severe injury or death.**

Do not connect negative (-) battery cable to positive (+) connection terminal of starter solenoid.

Do not short battery terminals together.

See owners manual for instructions on handling battery cables to prevent sparks, prior to installation, operation or service.

Manuals available from Kohler Co.  
Kohler, Wisconsin 53044

273780

**! DANGER**



**Hazardous voltage.  
Will cause severe  
injury or death.**



**Moving rotor.  
Will cause severe  
injury.**

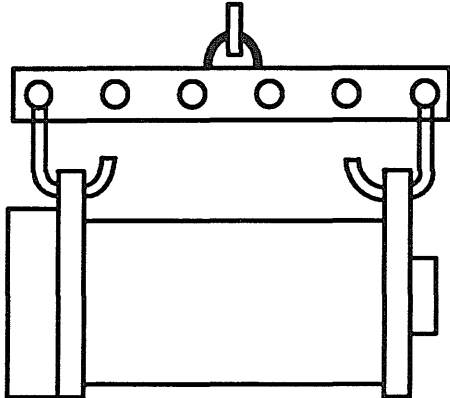
Do not operate generator set without all guards and electrical enclosures in place.

Operate and service by trained personnel only. Refer to manual prior to installation, operation or service. Manuals available from Kohler Co. Kohler, Wisconsin 53044

257438

**! WARNING**

DO NOT LIFT GENERATOR BY A SINGLE LIFTING EYE. PERSONAL INJURY OR EQUIPMENT DAMAGE MAY RESULT.



PREFERRED LIFTING METHOD  
ROTOR MUST BE SECURED IN GENERATOR WHILE LIFTING

**! WARNING**

DO NOT APPLY ANY FORCE TO GENERATOR FAN FOR LIFTING OR ROTATING GENERATOR ROTOR. DISREGARDING THESE INSTRUCTIONS MAY CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

257441

**! WARNING**

DO NOT LIFT COMPLETE GENERATOR SET BY MEANS OF LIFTING EYES.

257437

# Section 2. Fast Response II Concepts

## General

A Kohler Fast Response II set is a rotating-field generator and a smaller rotating

armature generator turned by a common shaft. The main, rotating field generator supplies current to load circuits while the rotating armature (exciter) generator supplies DC to excite the main generator's field.

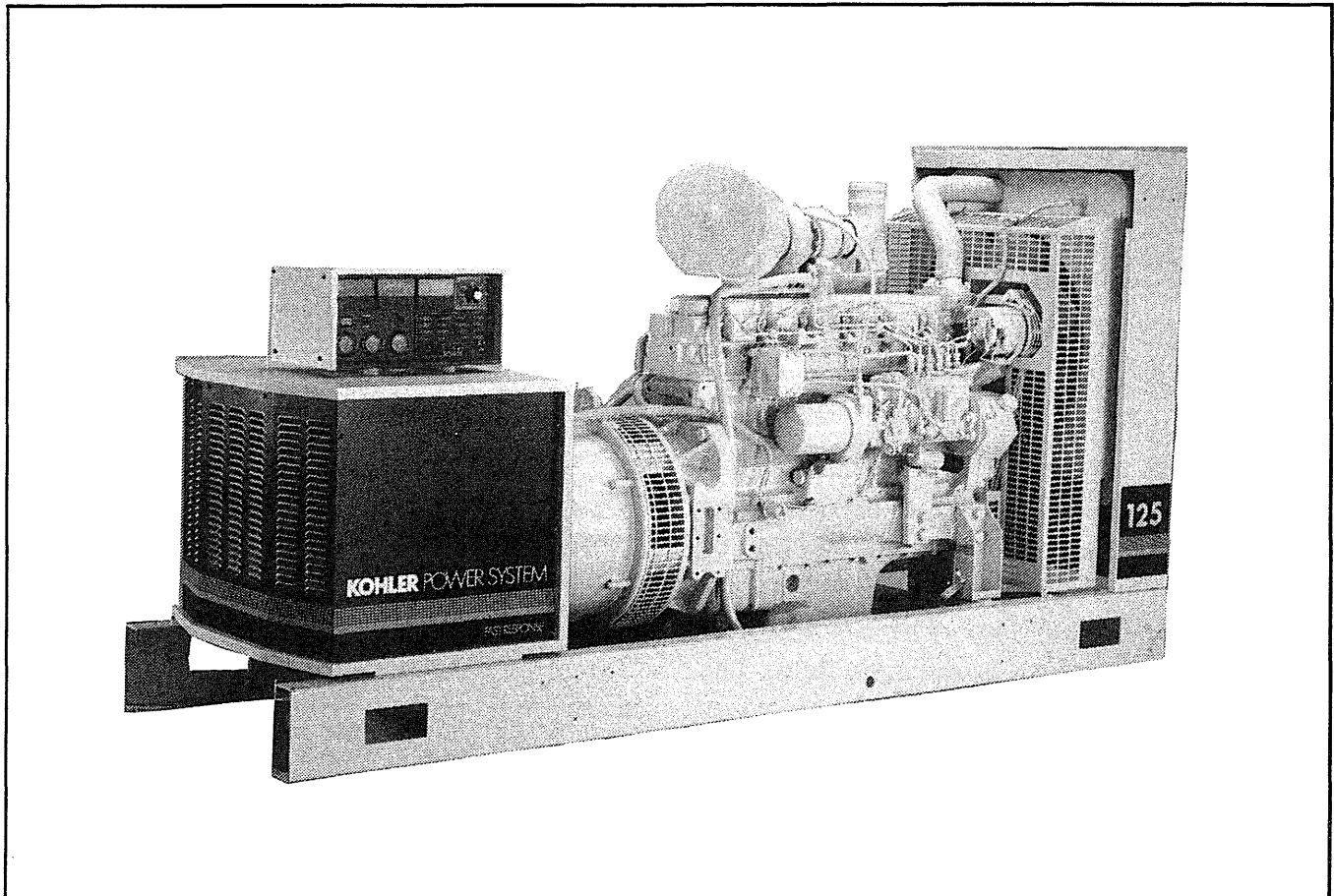


Figure 2-1. Kohler Fast Response II Generator Set

## System

The Fast Response II excitation system uses a permanent magnet exciter with an FR Activator (SCR Bridge) which controls the amount of DC current fed to the generator field. (Components of the FR Activator are divided between the photo transistor board and SCR assembly). This type of system uses a voltage regulator which signals the FR Activator through an optical coupling. The

voltage regulator monitors engine speed and generator output voltage to turn a stationary LED (light emitting diode) on or off, according to engine speed and output voltage. The LED is mounted on the end bracket opposite a photo transistor board which rotates on the shaft. The photo transistor picks up the signal from the LED and tells the SCR rotating bridge to turn on or off, depending on the need, as dictated by the voltage regulator. This controls the amount of current fed to the generator exciter field. This type generator has a voltage

recovery time several times faster than the conventional wound field brushless generator because it does not have the inductance of the exciter field to contend with. It also has better recovery characteristics than the static excited machine because it is not dependent upon the generator output voltage for excitation power. Possibly the greatest advantage of this type machine is its inherent ability to support short circuit current and allow system coordination for tripping downstream branch circuit breakers.

Fast Response II systems deliver proper exciter current to the main field within 0.05 seconds of a change in load demand.

## **Short Circuit Performance**

When a short circuit occurs in the load circuit (s) being served, output voltage drops to a low level until the short is removed. Amperage temporarily rises to 600–1000% of the generator's rated current. The FR activator sends full exciter power to the main field. The generator then sustains up to 300% of its rated amperage. Sustained high current will cause properly rated load circuit fuse/breakers to open or generator safeguard breaker to trip. The safeguard breaker will collapse the generator's main field if a sustained heavy overload or short circuit occurs.

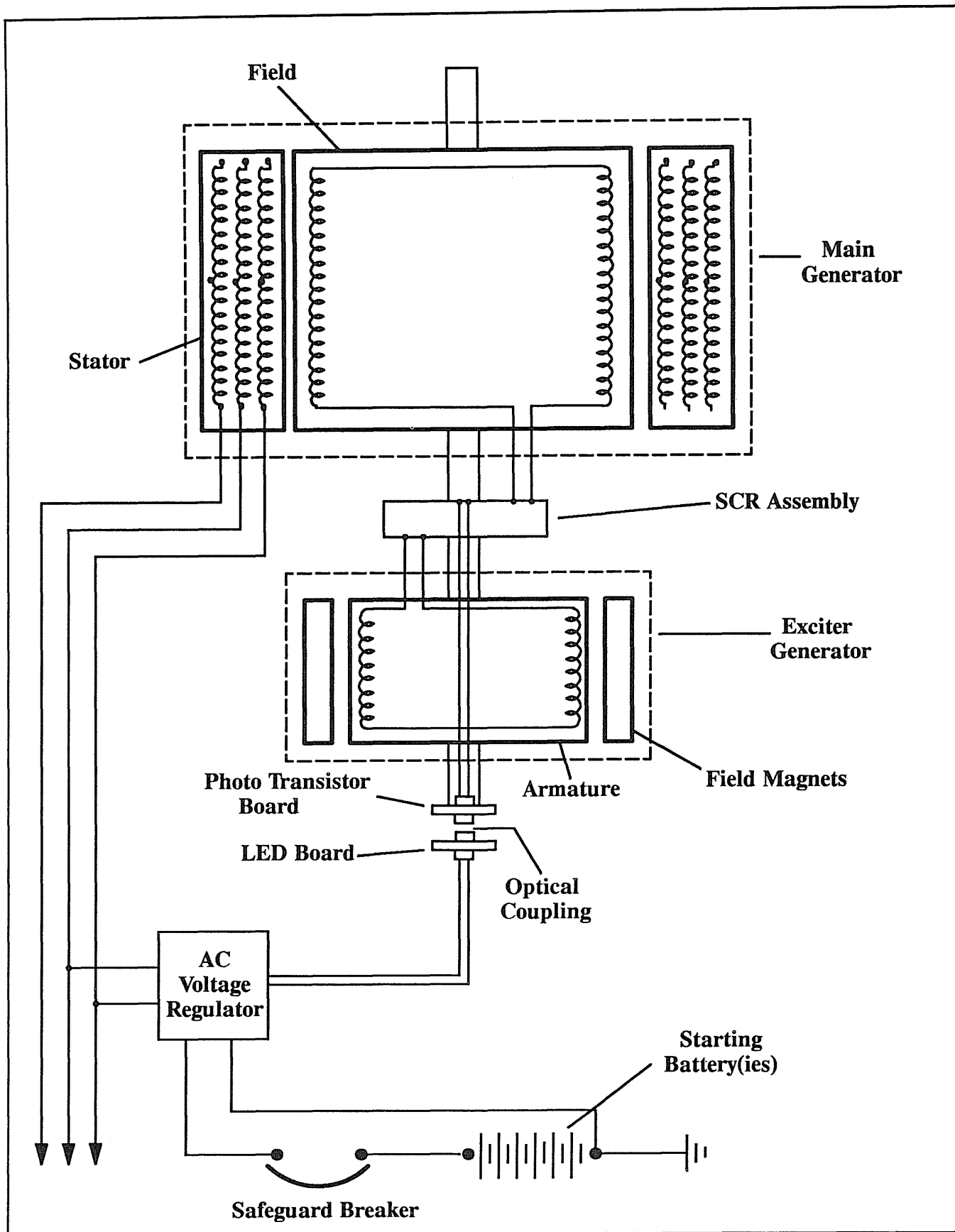


Figure 2-2. Fast Response II Schematic

# Section 3. Operation

## Prestart Checklist

The following items should be checked before each start-up of manually controlled generator sets and at regular intervals on sets equipped with automatic transfer switches. See your engine operation/maintenance manual for specific service procedures.

**OIL LEVEL:** Should be at or near FULL mark on dipstick — not over. Check oil level in governor (if applicable); oil should be at or near full level.

**FUEL LEVEL:** Make sure there is adequate supply; keep tanks full to allow operation for extended periods.

**BATTERY:** Check connections and level of battery electrolyte.

**AIR CLEANER:** Must be clean and properly installed to prevent unfiltered air from entering engine.

**DRIVE BELTS:** Make visual check of radiator fan, water pump, and battery charging alternator belt to make sure it is tight and in good condition.

**OPERATING AREA:** Make sure there are no obstructions that could block the flow of cooling air. Make sure area is clean. Rags, tools, or debris must not be left on or near the generator set.

**COOLANT LEVEL:** Maintain coolant level at approximately 3/4 to 1-1/2 in. (19 – 38 mm) below the radiator filler neck seat when the engine is cold. If the unit is equipped with a coolant recovery tank, level in tank should be

between 1/3 full (cold) and 2/3 full (hot). See "Safety Precautions" before filling radiator. A coolant solution of 50% ethylene glycol and 50% clean, softened water is recommended to inhibit rust/corrosion.

A coolant solution of 50% ethylene glycol will provide freezing protection to -34°F (-37°C) and overheating protection to 265°F (129°C). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause damage to engine and components. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Consult the engine manufacturer's operation manual for specific engine coolant specifications.

Do not add coolant to an engine that has overheated until engine has cooled. Adding coolant to an extremely hot engine can cause a cracked block or cylinder head.

### NOTE

Do not turn on block heater before filling cooling system. Before energizing block heater, run engine until warm and refill radiator to purge air from the system. Block heater failure will result if heater element is not immersed in water.

**EXHAUST SYSTEM:** Exhaust outlet must be clear; silencer and piping must be tight and in good condition.

**LAMP TEST:** Press the lamp test button (if equipped) to verify all controller lamps are operational.

# Dec-3 16-Light Controller (Level 1) Operation

The 16-Light Microprocessor Controller (level 1) is available in the standard model and

the oversize meterbox version (for installation of additional meters and gauges). For identification of 16-Light Controller components (standard and oversize meterbox) and an explanation of their function, refer to Figure 3-1 and the following descriptions.

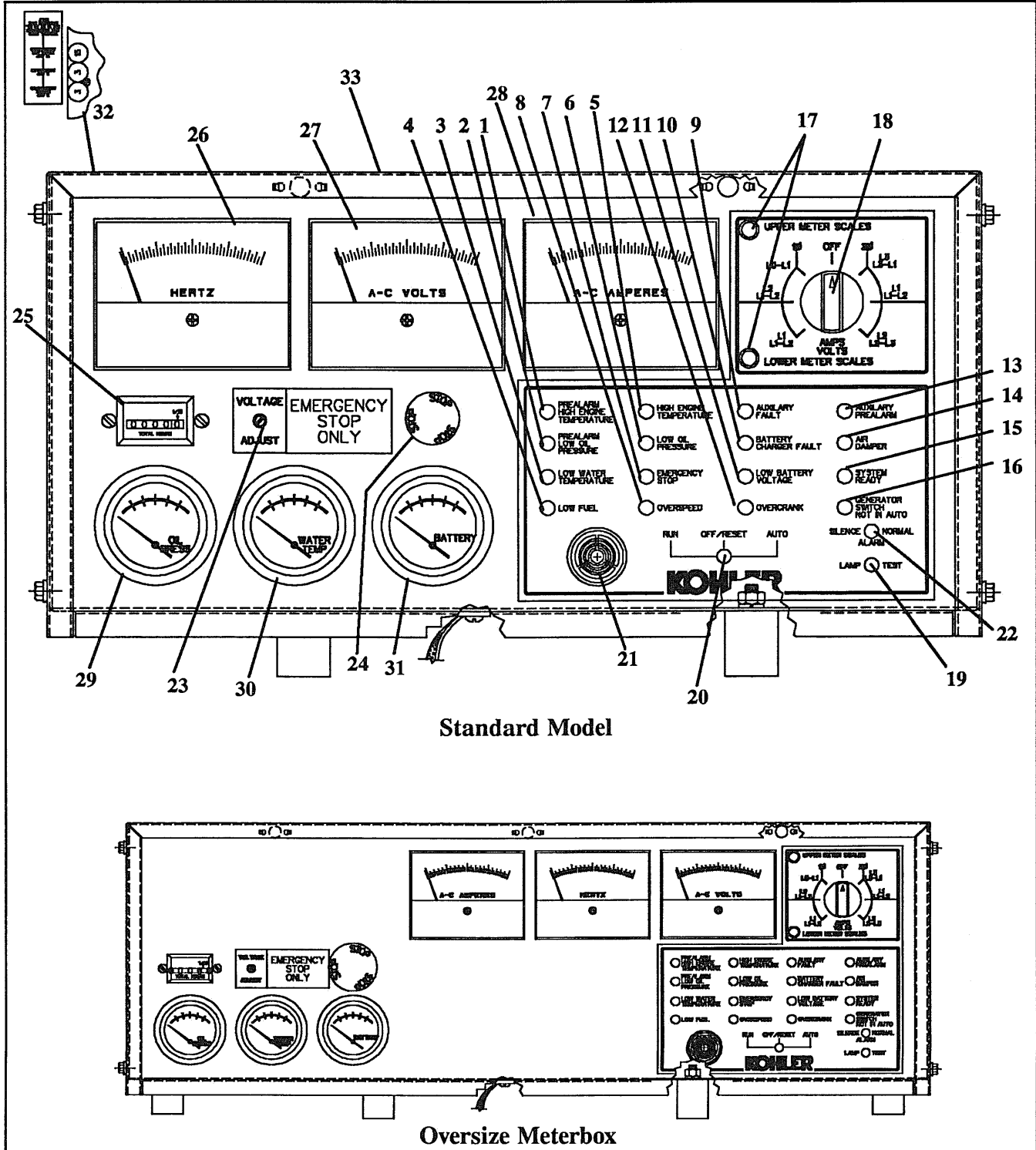


Figure 3-1. Dec-3 Microprocessor Controller (Standard and Oversize Meterbox Models)



## Features

1. **Pre-High Engine Temperature (if equipped)** -- lamp lights if engine coolant temperature approaches shutdown range.
2. **Pre-Low Oil Pressure (if equipped)** -- lamp lights if engine oil pressure approaches shutdown range.
3. **Low Water Temperature (if equipped)** -- lamp lights if water temperature approaches shutdown range.
4. **Low Fuel (if equipped)** -- lamp lights if fuel level in tank approaches empty.
5. **High Engine Temperature** -- lamp lights if engine has shut down due to high engine coolant temperature. Shutdown occurs 5 seconds after engine reaches temperature of approximately 225°F (107°C).
6. **Low Oil Pressure** -- lamp lights if set shuts down due to insufficient oil pressure. Shutdown occurs 5 seconds after fault; 5.5 to 10.5 psi (38–72 kPa) on diesel models and 11.5 to 18.5 psi (79–126 kPa) on gasoline models.
7. **Emergency Stop (if equipped)** -- lamp lights and engine stops if emergency stop is made (local or remote). NOTE: 200–300 kW sets are equipped with controller mounted emergency stop switch.
8. **Overspeed** -- lamp lights if set shuts down due to overspeed condition (governed frequency exceeds 70 Hz).
9. **Auxiliary** -- lamp flashes/lights under the following conditions:
  - auxiliary lamp will flash immediately if controller senses no AC output (except during first 10 seconds after start-up).
  - auxiliary lamp lights and engine stops 5 seconds after low coolant level fault (if equipped); inhibited during first 30 seconds after starting.
  - auxiliary lamp will flash if the battery is connected with Generator Master Switch in RUN or AUTO position.
  - auxiliary lamp lights and engine shuts down immediately if overvoltage condition arises (if overvoltage equipped).
  - auxiliary lamp lights if optional Emergency Stop Switch is reset with generator master switch in the AUTO or RUN position.
10. **Battery Charger Fault (if Battery Charger equipped)** -- lamp lights if battery charger malfunctions.
11. **Low Battery Volts (if Battery Charger equipped)** -- lamp lights if battery or charging voltage drops below preset level. Lamp will also light when the set is not running if under-voltage condition occurs due to battery or charger malfunction.

12. **Overcrank** — cranking stops and overcrank lamp will light if engine does not start after 45 seconds of continuous cranking or 75 seconds of cyclic cranking. See “Auto Starting.”

- cranking stops and overcrank lamp will light after 15 seconds if starter or engine will not turn (locked rotor).
- overcrank lamp will flash if speed sensor signal is absent longer than one second.

#### NOTE

The Dec-3 controller is equipped with an Automatic Restart function. The genset will attempt to restart if the engine speed drops below 13 Hz. Failure to correct the cause of the decreased engine speed will result in an overcrank condition.

13. **Auxiliary Prealarm** — activated by customer provided sensing devices.

14. **Air Damper (200–300 kW Sets Only)** — lamp lights after emergency stop or overspeed fault or overvoltage fault. Lamp indicates that engine air damper is closed; lamp remains lit until air damper is manually reset. See “Resetting Emergency Stop Switches” later in this section.

15. **System Ready** — lamp lights when generator master switch is in AUTO position and the system senses no faults.

16. **Generator Switch Not in Auto** — lamp lights when generator master switch is in RUN or OFF/RESET position.

17. **Scale Lamps (upper/lower)** — indicate AC voltmeter and/or ammeter scales to be read.

18. **Selector Switch** — selects generator output circuits to be measured. When switched to a position with three circuit lead labels, amperage is measured on the upper lead and voltage is measured between the lower two leads. AC ammeter and voltmeter will not register with switch in the OFF position.

19. **Lamp Test** — press to test the controller indicator lamps.

20. **Generator Master Switch** — dual function of controller reset and generator operation switch. Refer to “Testing, Starting, Stopping, and Resetting” following.

21. **Alarm Horn** — horn sounds if any fault or pre-alarm condition exists (except Emergency Stop, Battery Charger Fault, or Low Battery Volts). The Alarm Horn can only be silenced with the Generator Master Switch in the AUTO position. See “Resetting Procedure” following.

22. **Alarm Silence** — disconnects alarm during servicing (generator master switch must be in the AUTO position). Alarm Horn switches at all locations (controller, remote annunciator, or A/V alarm) must be restored to normal position after fault shutdown is corrected to avoid reactivating alarm horn. See “Resetting Procedure” section following.

23. **Voltage Adjustment** — used to fine-adjust generator output voltage.

24. **Emergency Stop (If equipped)** — press switch to instantly shut-down generator set in emergency situations. Reset switch after shutdown by rotating switch clockwise. THE EMERGENCY STOP SWITCH IS INTENDED FOR EMERGENCY SHUTDOWNS ONLY. Use the generator master switch to stop the set under normal circumstances.

25. **Hourmeter** — records generator set total operating hours for reference in scheduling maintenance.

26. **Frequency Meter** — measures frequency (Hz) of generator output voltage.

27. **AC Voltmeter** — measures voltage across output leads indicated.

28. **AC Ammeter** — measures amperage from output leads indicated by selector switch.

29. **Oil Pressure** — measures engine oil pressure.

30. **Water Temperature** — measures engine coolant temperature.

31. **DC Voltmeter** — measures voltage of starting battery(ies).

32. **Fuses** — located on controller circuit board adjacent to K3 relay.

- **3 Amp. Remote Annunciator (F1)** — protects remote annunciator circuit, A/V Alarm, and Isolated Alarm Kit (if equipped).
- **3-Amp Controller (F2)** — protects controller circuit board, speed sensor, and lamp circuit board.
- **15-Amp. Engine and Accessories (F3)** — protects engine/starting circuitry and accessories.

33. **Controller TB1 Terminal Strip (on Circuit Board)** — allows connection of generator accessories such as emergency stop switch, remote start/stop switch, audio-visual alarms, etc. Crank mode selection (cyclic or continuous) is also made on the TB1 terminal strip. Location of the TB1 terminal strip on the controller circuit board is shown in Figure 3-2. Refer to Section 4. "Accessories" for additional information on connecting accessories to the TB1 terminal strip.

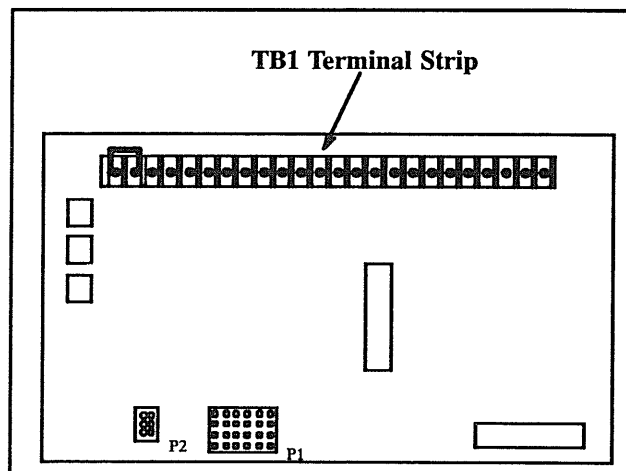


Figure 3-2. TB1 Terminal Strip on Controller circuit Board

## Starting

### "Local" Starting

To start the generator set at the controller, move the generator master switch to the RUN position.

#### NOTE

The Alarm Horn will sound and the NOT IN AUTO lamp will light whenever the generator master switch is not in the AUTO position.

#### NOTE

The Dec-3 controller is equipped with a transient Start/Stop function to avoid accidental cranking of the rotating engine. If the generator master switch is momentarily placed in the OFF/RESET position then quickly returned to RUN, the genset will slow to 249 rpm and re crank before returning to rated speed.

### "Auto" Starting

To allow start-up by automatic transfer switch or remote start-stop switch (connected to controller terminals 3 and 4) move the generator master switch to the AUTO position.

## NOTE

The Dec-3 Microprocessor Controller provides up to 45 seconds of continuous cranking or 75 seconds of cyclic cranking (crank 15 seconds, rest 15 seconds, crank 15 seconds, etc.) before overcrank shutdown. Cranking mode (cyclic or continuous) selection is made on the controller circuit board terminal strip. For cyclic cranking, leave circuit board terminal TB1-9 open. Continuous cranking is achieved by running a jumper between circuit board terminal TB1-2 (ground) and terminal TB1-9.

## Stopping

### "Normal" Stopping

1. Disconnect load from generator set and allow it to run without load for 5 minutes.

#### NOTE

Run the generator at no load for 5 minutes prior to stopping to insure adequate cooling of the set.

2. Move generator master switch to the OFF/RESET position. Engine will stop.

#### NOTE

If engine stop is signaled by a remote switch or Automatic Transfer Switch, the generator set will continue running during a 5 minute cool-down cycle.

## **”Emergency” Stopping**

Turn generator master switch to the OFF/RESET position or activate controller Emergency Stop switch (if equipped) or optional remote emergency stop for immediate shutdown. If either Emergency Stop switch is activated, the controller EMERGENCY STOP lamp will light and the unit will shut down. On 200–300 kW sets, both the AIR DAMPER and EMERGENCY STOP lamps will light if the emergency stop switch is activated.

### **NOTE**

The Emergency Stop Switch(s) are to be used for emergency shutdowns only. Use the generator master switch to stop the generator set under normal circumstances.

## **Resetting Emergency Stop Switches**

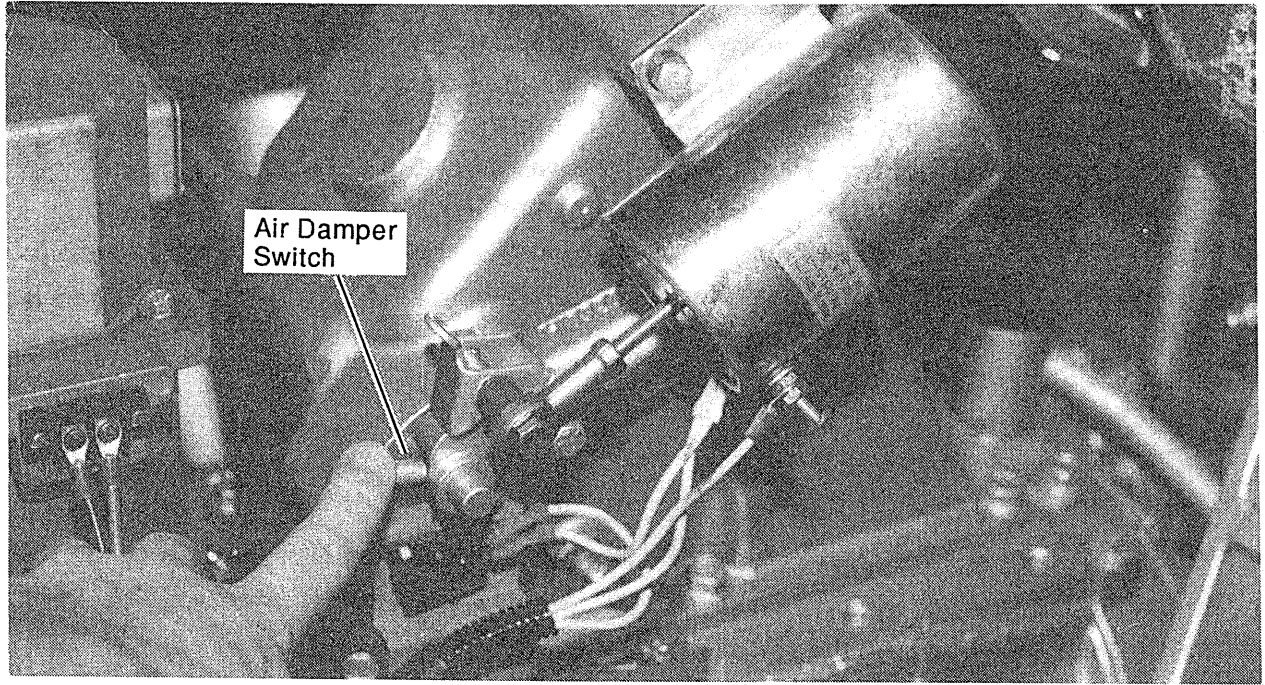
Use the following procedure to restart the generator set after shut-down by emergency stop switch (local or remote). Refer to ”Controller Resetting Procedure” later in this section to restart the generator set following a fault shutdown.

1. Investigate cause of emergency stop and correct problem(s).
2. If remote emergency stop switch was activated, reset switch by replacing glass face. If controller-mounted emergency stop switch was activated (if equipped), reset controller emergency stop switch by rotating switch clockwise until switch springs back to original position.

### **NOTE**

The controller AUXILIARY lamp will light if the generator master switch is in the RUN or AUTO position during the resetting procedure.

3. If controller AIR DAMPER light is on, reset air damper on engine by rotating air damper lever as shown in Figure 3-3. The AIR DAMPER light will go out.
4. Toggle generator master switch to OFF/RESET and then to RUN or AUTO to resume operation. The generator set will not crank until the resetting procedure is completed.



**Figure 3-3. Air Damper Lever (Typical) 200-300 kW Sets Only**

## **Fault Shut-downs**

The generator set will shut down automatically under the following fault conditions:

**OVERSPEED:** Unit shuts down immediately if governed frequency exceeds 70 Hz.

**OVERCRANK:** Shutdown occurs after 45 seconds of continuous cranking. Shutdown occurs after 75 seconds of cyclic cranking (crank 15 seconds, reset 15 seconds, crank 15 seconds, etc. for a total of 75 seconds). Shutdown occurs after 15 seconds if engine or starter will not turn (locked rotor).

**LOW OIL PRESSURE:** Shutdown occurs 5 seconds after fault; 5.5 to 10.5 psi (38–72 kPa) on diesel models; 11.5 to 18.5 psi (79–126 kPa) on gasoline models. Low Oil Pressure shutdown will not function during the first 30 seconds after start-up.

### **NOTE**

Low oil pressure shutdown will not protect against low oil level. Check for proper oil level at engine.

**HIGH ENGINE TEMPERATURE:** Shutdown occurs 5 seconds after fault (shutdown occurs at engine temperature of approximately 225°F, 107°C). High Engine Temperature shutdown will not function during first 30 seconds after start-up.

### **NOTE**

High temperature shutdown will not function if proper coolant level is not maintained.

**LOW COOLANT LEVEL:** Shutdown occurs 5 seconds after fault. Low Coolant Level shutdown will not function during the first 30 seconds after start-up.

### **NOTE**

Low Oil Pressure, High Engine Temperature, and Low Coolant Level Shutdowns will not function during the first 30 seconds after start-up.

**OVERVOLTAGE:** (if equipped) Unit will shut down after approximately one second of voltage 15% or more over nominal voltage. AUXILIARY lamp will light.

### **NOTE**

Sensitive equipment may suffer damage in less than one second of an overvoltage condition. On-line equipment requiring faster shutdowns should have its own overvoltage protection.

## **Controller Resetting Procedure (Following Fault Shutdown)**

Use the following procedure to restart the genset after a FAULT shutdown. Refer to "Resetting Emergency Stop Switches" earlier in this section to reset the generator after an EMERGENCY stop.

1. Move Controller alarm horn switch to the SILENCE position. If equipped, AV/annunciator alarm horn and lamp are activated. Move AV/annunciator alarm switch to SILENCE to stop alarm horn. AV/annunciator lamp stays lit.
2. Disconnect generator set from load with line circuit breaker or automatic transfer switch.
3. Correct cause of fault shutdown. See "Safety Precautions" section of this manual before proceeding.
4. Start generator set by moving the generator master switch to OFF/RESET and then to the RUN position. If equipped, AV/annunciator alarm horn sounds and lamp goes out.
5. Verify that cause of shutdown has been corrected by test operating generator set.
6. Reconnect generator to load via line circuit breaker or automatic transfer switch.
7. Move generator master switch to AUTO position for start-up by remote transfer switch or remote start/stop switch. If equipped, move AV/annunciator alarm switch to NORMAL.
8. Move controller alarm horn switch to the NORMAL position.

### **NOTE**

Controller alarm horn can only be silenced with controller master switch in AUTO position.



# Dec-3 6-Light Controller (Level 2) Operation

The 6-Light Microprocessor Controller (level 2) is available in the standard model and the

oversize meterbox version (for installation of additional meters and gauges). For identification of controller components (standard and oversize meterbox) and an explanation of their function, refer to Figure 3-4 and the following descriptions.

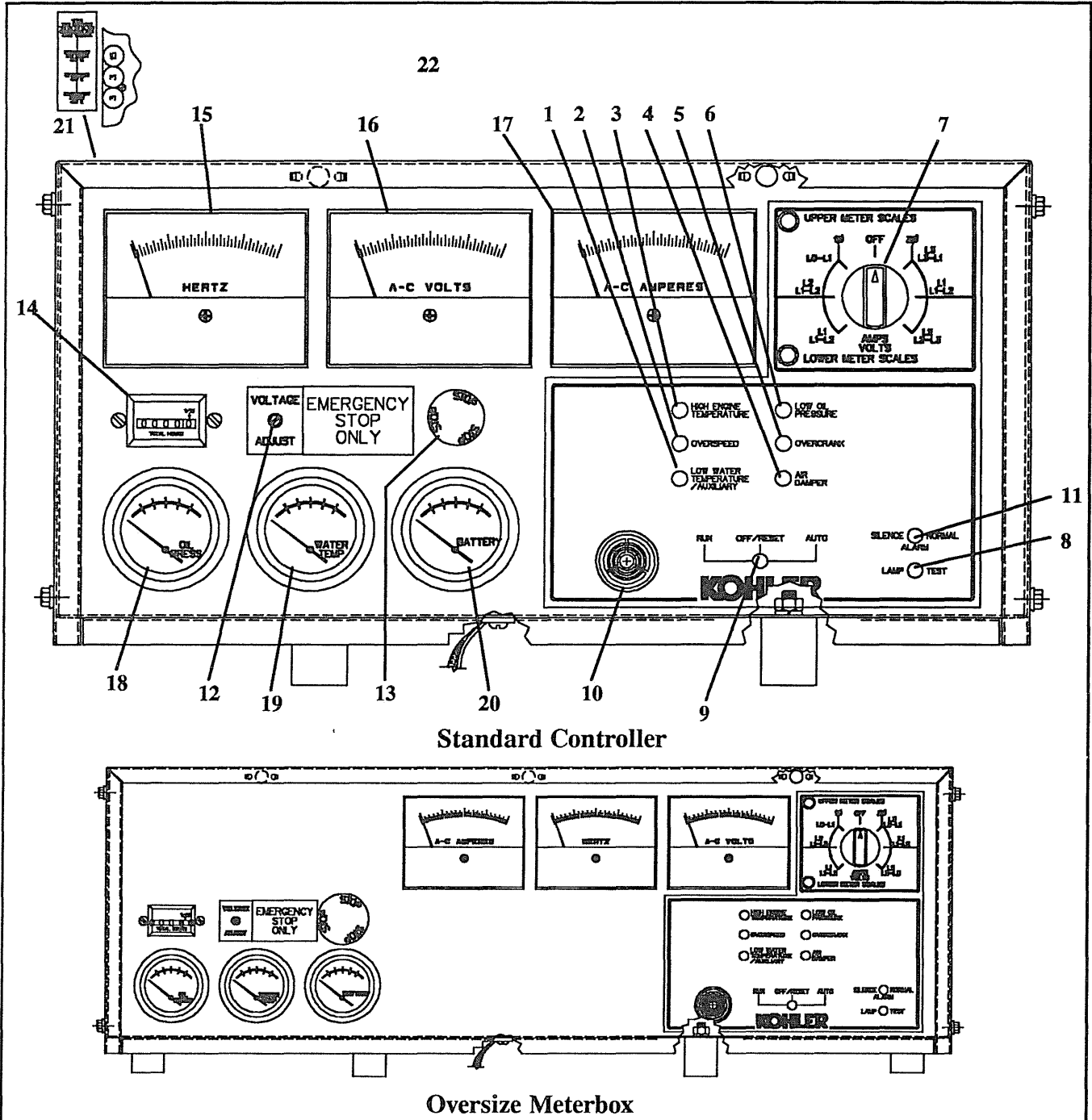


Figure 3-4. 6-Light Microprocessor Controller (Standard and Oversize Meterbox Models)

## Features

1. **Low Water Temperature/Auxiliary** — lamp flashes or lights under the following conditions:
  - lamp lights if engine water temperature is too low (if sensor equipped).
  - lamp will flash immediately if controller senses no AC output (except during first 10 seconds after start-up).
  - lamp lights and engine stops 5 seconds after high oil temperature or low coolant level fault (if equipped); inhibited during first 30 seconds after starting.
  - lamp will flash if the battery is connected with generator master switch in RUN or AUTO position.
  - lamp will flash due to low battery voltage to controller (low voltage reset or hardware reset of controller board internal timer).
  - lamp lights and engine shuts down immediately if overvoltage condition arises (if overvoltage equipped).
  - lamp lights and engine shuts down if activated by sensing devices connected to auxiliary immediate shutdown port (P1-17).
  - lamp lights if optional Emergency Stop Switch is activated.
  - lamp lights if optional Emergency Stop Switch is reset with generator master switch in the AUTO or RUN position.
2. **Overspeed** — lamp lights if set shuts down due to overspeed condition (governed frequency exceeds 70 Hz).
3. **High Engine Temperature** — lamp lights if engine has shut down due to high engine coolant temperature. Shutdown occurs 5 seconds after engine reaches temperature of approximately 225°F (107°C).
4. **Air Damper (200–300 kW Sets Only)** — lamp lights after emergency stop or overspeed fault or overvoltage fault. Lamp indicates that engine air damper is closed; lamp remains lit until air damper is manually reset. See "Resetting Emergency Stop Switches" later in this section.
5. **Overcrank** — cranking stops and overcrank lamp will light if engine does not start after 45 seconds of continuous cranking or 75 seconds of cyclic cranking. See "Auto Starting."
  - cranking stops and overcrank lamp will light after 15 seconds if starter or engine will not turn (locked rotor).
  - overcrank lamp will flash if speed sensor signal is absent longer than one second.

### NOTE

The 6-Light Controller is equipped with an Automatic Restart function. The genset will attempt to restart if the engine speed drops below 13 Hz. Failure to correct the cause of the decreased engine speed will result in an overcrank condition.

6. **Low Oil Pressure** -- lamp lights if set shuts down due to insufficient oil pressure. Shutdown occurs 5 seconds after fault; 5.5 to 10.5 psi (38–72 kPa) on diesel models and 11.5 to 18.5 psi (79–126 kPa) on gasoline models.
7. **Selector Switch** -- selects generator output circuits to be measured. When switched to a position with three circuit lead labels, amperage is measured on the upper lead and voltage is measured between the lower two leads. AC ammeter and voltmeter will not register with switch in the OFF position.
8. **Lamp Test** -- press to test the controller indicator lamps.
9. **Generator Master Switch** -- dual function of controller reset and generator operation switch. Refer to “Testing, Starting, Stopping, and Resetting” following.
10. **Alarm Horn** -- horn sounds if any fault or pre-alarm condition exists (except Emergency Stop, Battery Charger Fault, or Low Battery Volts). The Alarm Horn can only be silenced with the generator master switch in the AUTO position. See “Resetting Procedure” following.
11. **Alarm Silence** -- disconnects alarm during servicing (generator master switch must be in the AUTO position). Alarm Horn switches at all locations (controller, remote annunciator, or A/V alarm) must be restored to normal position after fault shutdown is corrected to avoid reactivating alarm horn. See “Resetting Procedure” section following.
12. **Voltage Adjustment** -- used to fine-adjust generator output voltage.
13. **Emergency Stop (If equipped)** -- press switch to instantly shut-down generator set in emergency situations. Reset switch after shutdown by rotating switch clockwise. **THE EMERGENCY STOP SWITCH IS INTENDED FOR EMERGENCY SHUTDOWNS ONLY.** Use the generator master switch to stop the set under normal circumstances.
14. **Hourmeter** -- records generator set total operating hours for reference in scheduling maintenance.
15. **Frequency Meter** -- measures frequency (Hz) of generator output voltage.
16. **AC Voltmeter** -- measures voltage across output leads indicated.
17. **AC Ammeter** -- measures amperage from output leads indicated by selector switch.
18. **Oil Pressure** -- measures engine oil pressure.
19. **Water Temperature** -- measures engine coolant temperature.
20. **DC Voltmeter** -- measures voltage of starting battery(ies).

21. **Fuses** -- located on controller circuit board adjacent to K3 relay.

- **3 Amp. Remote Annunciator (F1)** -- protects remote annunciator circuit, A/V Alarm, and Isolated Alarm Kit (if equipped).
- **3-Amp Controller (F2)** -- protects controller circuit board, speed sensor, and lamp circuit board.
- **15-Amp. Engine and Accessories (F3)** -- protects engine/starting circuitry and accessories.

22. **Controller TB1 Terminal Strip (on Circuit Board)** - allows connection of generator accessories such as emergency stop switch, remote start/stop switch, audio-visual alarms, etc. Crank mode selection (cyclic or continuous) is also made on the TB1 terminal strip. Location of the TB1 terminal strip on the controller circuit board is shown in Figure 3-5. Refer to Section 4. "Accessories" for additional information on connecting accessories to the TB1 terminal strip.

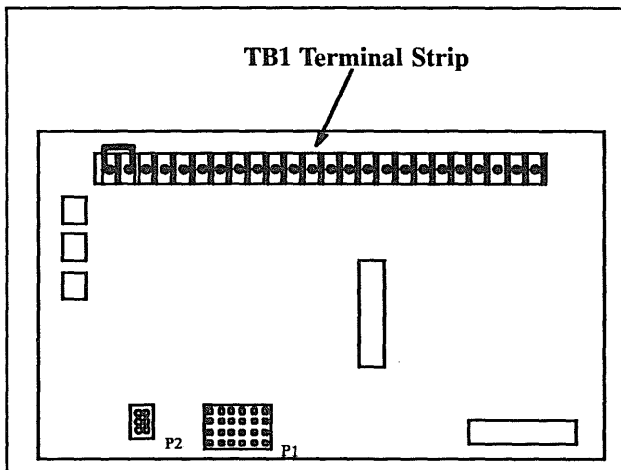


Figure 3-5. TB1 Terminal Strip on Controller circuit Board

## Starting

### "Local" Starting

To start the generator set at the controller, move the generator master switch to the RUN position.

#### NOTE

The 6-Light Controller is equipped with a transient Start/Stop function to avoid accidental cranking of the rotating engine. If the generator master switch is momentarily placed in the OFF/RESET position then quickly returned to RUN, the genset will slow to 249 rpm and recrank before returning to rated speed.

### "Auto" Starting

To allow start-up by automatic transfer switch or remote start-stop switch (connected to controller terminals 3 and 4) move the generator master switch to the AUTO position.

#### NOTE

The 6-Light Microprocessor Controller provides up to 45 seconds of continuous cranking or 75 seconds of cyclic cranking (crank 15 seconds, rest 15 seconds, crank 15 seconds, etc.) before overcrank shutdown. Cranking mode (cyclic or continuous) selection is made on the controller circuit board terminal strip. For cyclic cranking, leave circuit board terminal TB1-9 open. Continuous cranking is achieved by running a jumper between circuit board terminal TB1-2 (ground) and terminal TB1-9.

## Stopping

### ”Normal” Stopping

1. Disconnect load from generator set and allow it to run without load for 5 minutes.

#### NOTE

Run the generator at no load for 5 minutes prior to stopping to insure adequate cooling of the set.

2. Move generator master switch to the OFF/RESET position. Engine will stop.

#### NOTE

If engine stop is signaled by a remote switch or Automatic Transfer Switch, the generator set will continue running during a 5 minute cool-down cycle.

### ”Emergency” Stopping

Turn generator master switch to the OFF/RESET position or activate controller Emergency Stop switch (if equipped) or optional remote emergency stop for immediate shutdown. If either Emergency Stop switch is activated, the controller LOW WATER TEMPERATURE/AUXILIARY lamp will light and the unit will shut down. On 200–300 kW sets, both the AIR DAMPER and LOW WATER TEMP./AUXILIARY lamps will light if the emergency stop switch is activated.

#### NOTE

The Emergency Stop Switch(s) are to be used for emergency shutdowns only. Use the generator master switch to stop the generator set under normal circumstances.

## Resetting Emergency Stop Switches

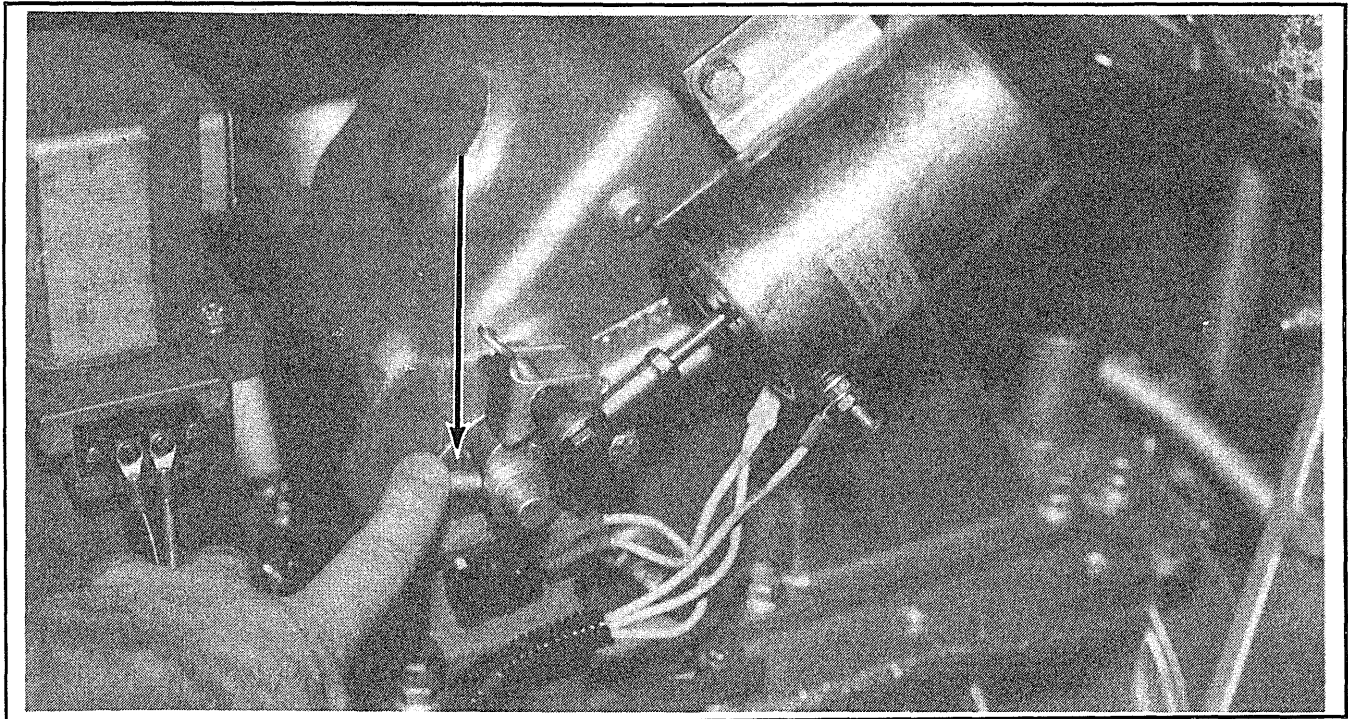
Use the following procedure to restart the generator set after shut-down by emergency stop switch (local or remote). Refer to ”Controller Resetting Procedure” later in this section to restart the generator set following a fault shutdown.

1. Investigate cause of emergency stop and correct problem(s).
2. If remote emergency stop switch was activated, reset switch by replacing glass face. If controller-mounted emergency stop switch was activated (if equipped), reset controller emergency stop switch by rotating switch clockwise until switch springs back to original position.

#### NOTE

The controller LOW WATER TEMPERATURE/AUXILIARY lamp will light if the Controller Master Switch is in the RUN or AUTO position during the resetting procedure.

3. If controller AIR DAMPER light is on, reset air damper on engine by rotating air damper lever as shown in Figure 3–6. The AIR DAMPER light will go out.
4. Toggle generator master switch to OFF/RESET and then to RUN or AUTO to resume operation. The generator set will not crank until the resetting procedure is completed.



**Figure 3-6. Air Damper Lever (Typical) 200-300 kW Sets Only**

## **Fault Shut-downs**

The generator set will shut down automatically under the following fault conditions:

**OVERSPEED:** Unit shuts down immediately if governed frequency exceeds 70 Hz.

**LOW OIL PRESSURE:** Shutdown occurs 5 seconds after fault; 5.5 to 10.5 psi (38–72 kPa) on diesel models; 11.5 to 18.5 psi (79–126 kPa) on gasoline models. Low Oil Pressure shutdown will not function during the first 30 seconds after start-up.

### **NOTE**

Low oil pressure shutdown will not protect against low oil level. Check for proper oil level at engine.

**OVERCRANK:** Shutdown occurs after 45 seconds of continuous cranking. Shutdown occurs after 75 seconds of cyclic cranking (crank 15 seconds, reset 15 seconds, crank 15 seconds, etc. for a total of 75 seconds). Shutdown occurs after 15 seconds if engine or starter will not turn (locked rotor).

**HIGH ENGINE TEMPERATURE:** Shutdown occurs 5 seconds after fault (shutdown occurs at engine temperature of approximately 225°F, 107°C). High Engine Temperature shutdown will not function during first 30 seconds after start-up.

### **NOTE**

High temperature shutdown will not function if proper coolant level is not maintained.

**LOW COOLANT LEVEL:** Shutdown occurs 5 seconds after fault. Low Coolant Level shutdown will not function during the first 30 seconds after start-up.

### **NOTE**

Low Oil Pressure, High Engine Temperature, and Low Coolant Level Shutdowns will not function during the first 30 seconds after start-up.

**OVERVOLTAGE:** (if equipped) Unit will shut down after approximately one second of voltage 15% or more over nominal voltage. **LOW WATER TEMP./AUXILIARY** lamp will light.

### **NOTE**

Sensitive equipment may suffer damage in less than one second of an overvoltage condition. On-line equipment requiring faster shutdowns should have its own overvoltage protection.

## **Controller Resetting Procedure (Following Fault Shutdown)**

Use the following procedure to restart the genset after a FAULT shutdown. Refer to "Resetting Emergency Stop Switches" earlier in this section to reset the generator after an EMERGENCY stop.

1. Move Controller alarm horn switch to the SILENCE position. If equipped, AV/annunciator alarm horn and lamp are activated. Move AV/annunciator alarm switch to SILENCE to stop alarm horn. AV/annunciator lamp stays lit.
2. Disconnect generator set from load with line circuit breaker or automatic transfer switch.
3. Correct cause of fault shutdown. See "Safety Precautions" section of this manual before proceeding.
4. Start generator set by moving the generator master switch to OFF/RESET and then to the RUN position. If equipped, AV/annunciator alarm horn sounds and lamp goes out.
5. Verify that cause of shutdown has been corrected by test operating generator set.
6. Reconnect generator to load via line circuit breaker or automatic transfer switch.
7. Move generator master switch to AUTO position for start-up by remote transfer switch or remote start/stop switch. If equipped, move AV/annunciator alarm switch to NORMAL.
8. Move controller alarm horn switch to the NORMAL position.

### **NOTE**

Controller alarm horn can only be silenced with controller master switch in AUTO position.



# Manual Controller Operation

The Manual Controller is designed for prime power applications and is used on 20 -

180ROZJ diesel generators. For identification of Manual Controller components and an explanation of their function, refer to Figure 3-7 and the following descriptions.

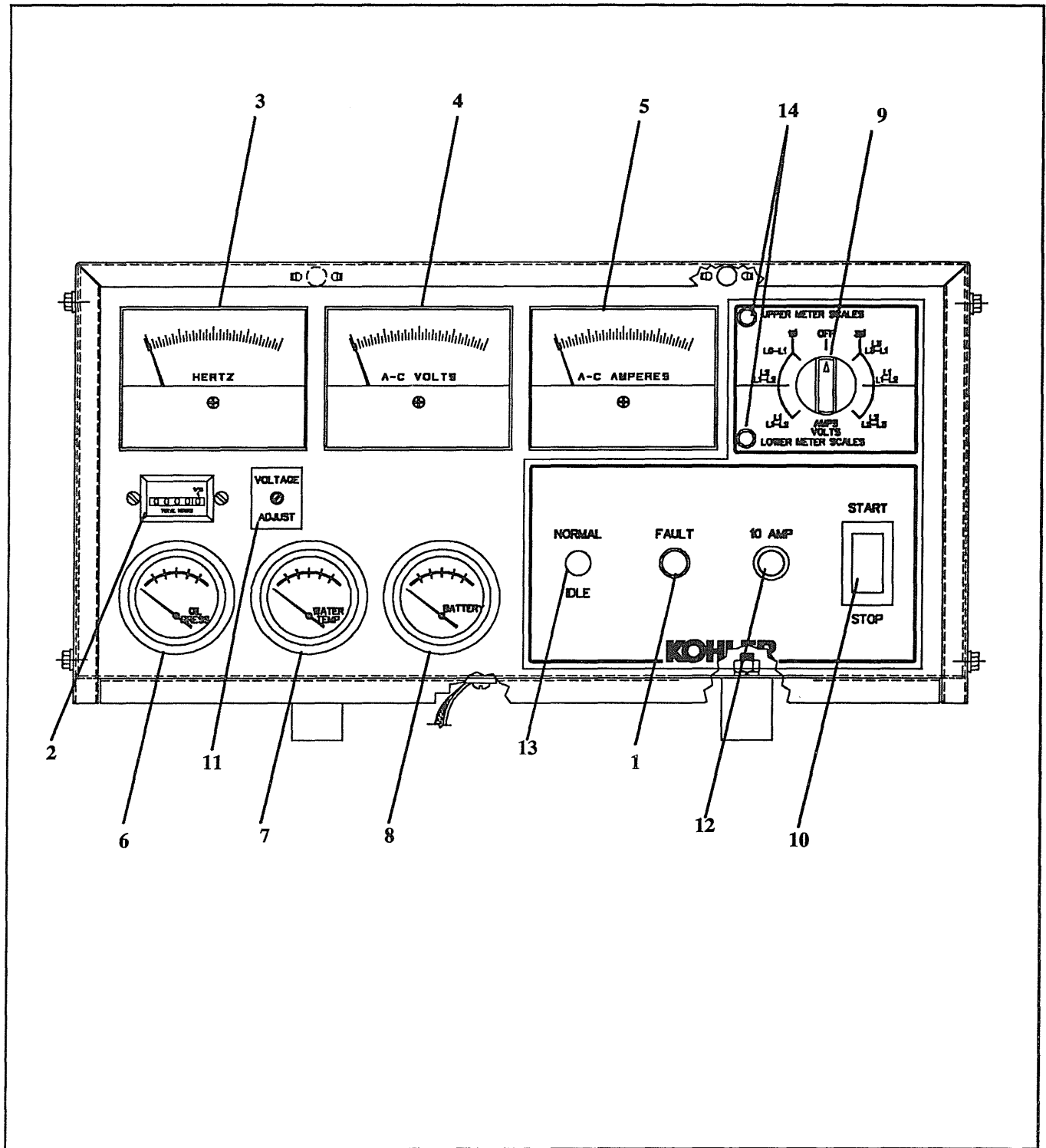


Figure 3-7. Manual Controller

## Features

1. **Fault Lamp** — lamp lights during engine shutdown if engine has shut down due to high engine temperature, low oil pressure, low water level or overspeed faults. See "Fault Shutdowns" following for additional shutdown information.
2. **Hourmeter** — records generator set total operating hours for reference in scheduling maintenance.
3. **Frequency Meter** — measures frequency (Hz) of generator output voltage.
4. **AC Voltmeter** — measures voltage across output leads indicated by selector switch.
5. **AC Ammeter** — measures amperage from output leads indicated by selector switch.
6. **Oil Pressure** — measures engine oil pressure.
7. **Water Temperature** — measures engine coolant temperature.
8. **DC Voltmeter** — measures voltage of starting battery(ies).
9. **Selector Switch** — selects generator output circuits to be measured. When switched to a position with three circuit lead labels, amperage is measured on the upper lead and voltage is measured between the lower two leads. AC ammeter and voltmeter will not register with switch in the OFF position.
10. **Start/Stop Switch** — used to start and stop generator set. Refer to "Start/Stop

Procedure" following.

11. **Voltage Adjustment** — used to fine-adjust generator output voltage.
12. **10 Amp. Fuse** — protects controller circuitry from short circuits and overloads.
13. **Governor Control Switch (if equipped)** — changes engine governed speed from "normal" (1800 rpm at 60 Hz) to "idle" (speed determined by customer) for increased fuel efficiency during periods of no-load operation.
14. **Scale Lamps (upper/lower)** — indicate AC voltmeter and/or ammeter scales to be read.

## Starting

Hold controller or remote Start/Stop switch in "Start" position until the engine starts. Normally the engine will start within 2 seconds. However, if the engine fails to start after cranking for 5 seconds, release the switch. Wait for the engine to come to a complete stop before attempting restart.

### NOTE

Do not crank engine continuously for more than 10 seconds at a time. A 60-second cool-down period must be allowed between cranking attempts if the engine does not start. If the engine does not start after three attempts, contact an Authorized Service Dealer for repair.

## Stopping

1. Disconnect load from generator set and allow it to run without load for 5 minutes.

### NOTE

Run the generator at no load for 5 minutes prior to stopping to insure adequate cooling of the set.

2. Press controller or remote Start/Stop switch to the "Stop" position. The generator set shuts down.

## Fault Shut-downs

The generator set will shut down automatically under the following fault conditions and cannot be restarted until the fault condition has been corrected. The shutdown switches will automatically reset when the problem is corrected or the generator set cools (if overheating was the problem).

**OVERSPEED:** Unit shuts down immediately if governed frequency exceeds 70 Hz (2100 rpm) on 50 and 60 Hz models.

**LOW OIL PRESSURE:** Shutdown occurs after engine oil pressure drops to 5.5 – 10.5 psi (38–72 kPa). Low Oil Pressure shutdown will not function during the first 5 seconds after start-up.

### NOTE

Low oil pressure shutdown will not protect against low oil level. Check for proper oil level at engine.

**HIGH ENGINE TEMPERATURE:** Shutdown occurs after fault (shutdown occurs at engine temperature of approximately 225°F, 107°C). High Engine Temperature will not function during first 5 seconds after start-up.

### NOTE

High temperature shutdown will not function if proper coolant level is not maintained.

**LOW COOLANT LEVEL:** Shutdown occurs 5 seconds after coolant level sensor detects no coolant. Low Coolant Level shutdown will not function during first 5 seconds after start-up.

### NOTE

Low Oil Pressure, High Engine Temperature,, and Low Coolant Level Shutdowns will not function during the first 5 seconds after start-up.

## Section 4. Accessories

### Remote Annunciator Kit (Decision Monitor) \*

A remote annunciator allows convenient monitoring of the set's condition from a location remote from the generator. See Figure 4-1. Decision Monitors include alarm

horn, alarm silence switch, lamp test, and the same lamp indicators as the Dec-3 microcomputer controller, plus the following:

**Line Power** — lamp lights when commercial utility power is in use.

**Generator Power** — lamp lights when generator power is in use.

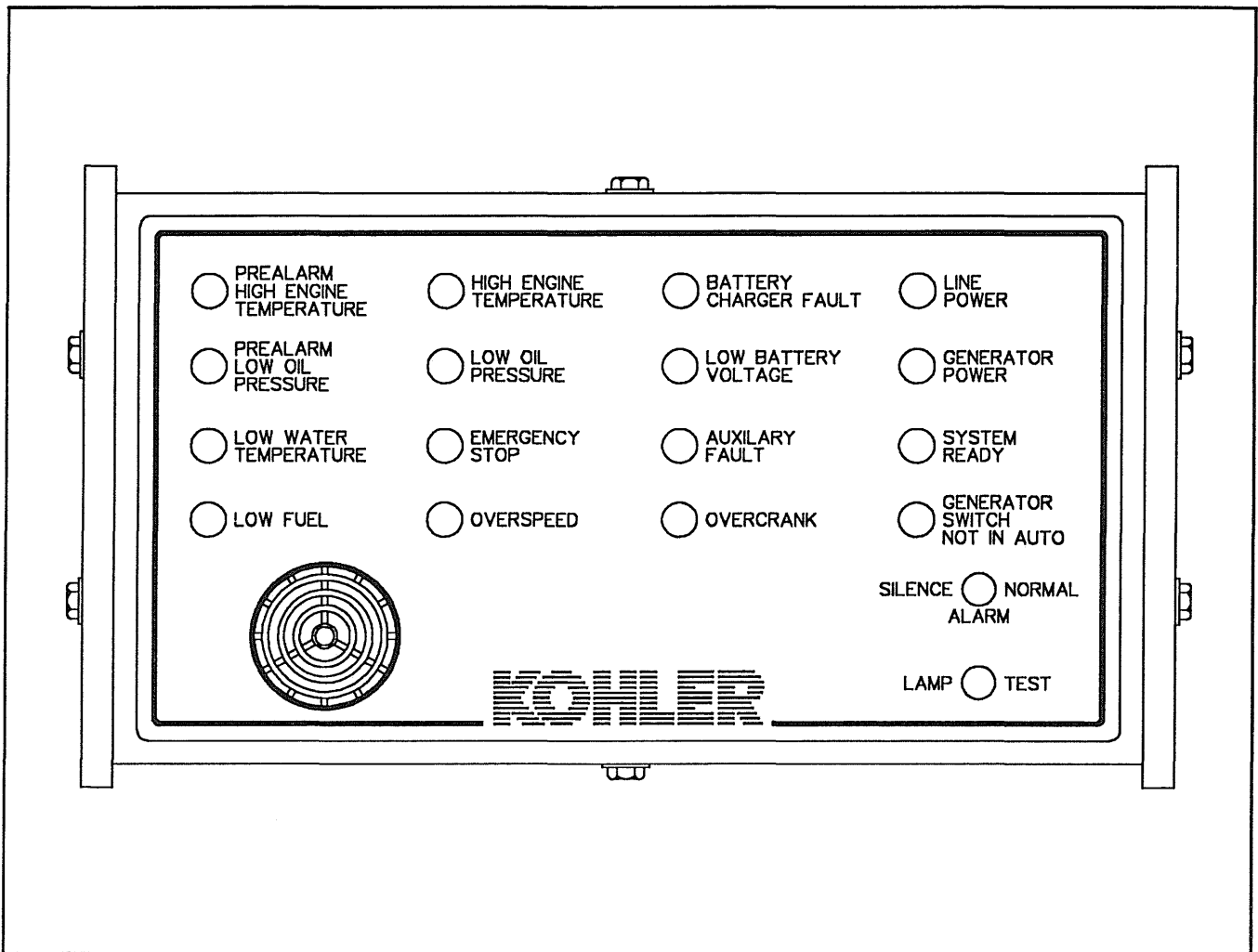


Figure 4-1. Remote Annunciator

\* Used with Dec-3 Controllers Only.

## Audio-Visual (AV) Alarm \*

An AV alarm warns the operator of fault shutdowns and pre-alarm conditions (except battery charger fault and low battery voltage) from a location remote from the generator. AV alarms include alarm horn, alarm silence

switch, and common fault lamp. See Figure 4-2.

### NOTE

Any combination of remote annunciators and/or AV alarms totaling three may be connected to the generator controller.

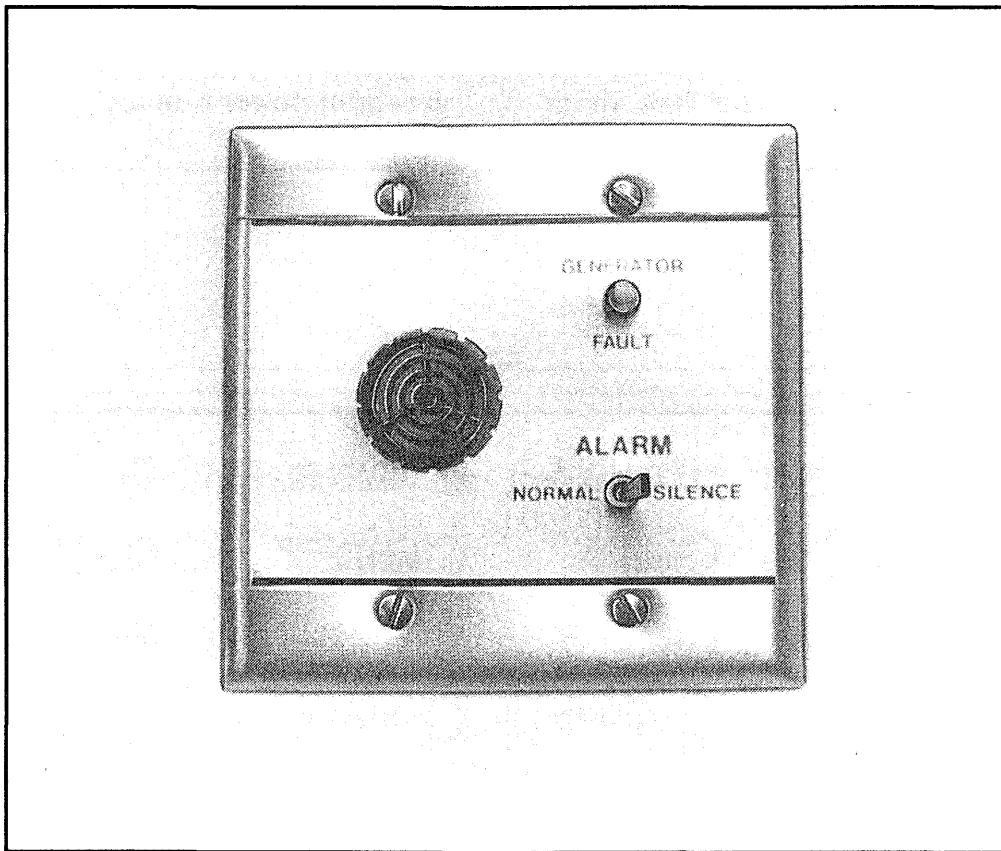


Figure 4-2. Audio-Visual Alarm

\* Used with Dec-3 Controllers Only.

# Isolated Alarm Dry Contact Kit \*

Isolated alarm contact kits allow monitoring of the standby system and/or the ability to activate accessories such as derangement panels. The kit includes ten sets of relay contacts for connection of customer provided devices to desired generator functions. Warning devices (lamps, audible alarms) and other accessories are typically connected to controller outputs listed. A total of three isolated alarm contact kits may be connected to the controller. An internal view of the contact kit is shown in Figure 4-3.

- Typical Contact Kit Output Connections:**
- Overspeed
  - Overcrank
  - High Engine Temperature
  - Low Oil Pressure
  - Low Water Temperature
  - Auxiliary Fault
  - Air Damper (if equipped – Detroit–Diesel sets only)
  - Pre–Alarm High Engine Temperature
  - Pre–Alarm Low Oil Pressure
  - Emergency Stop

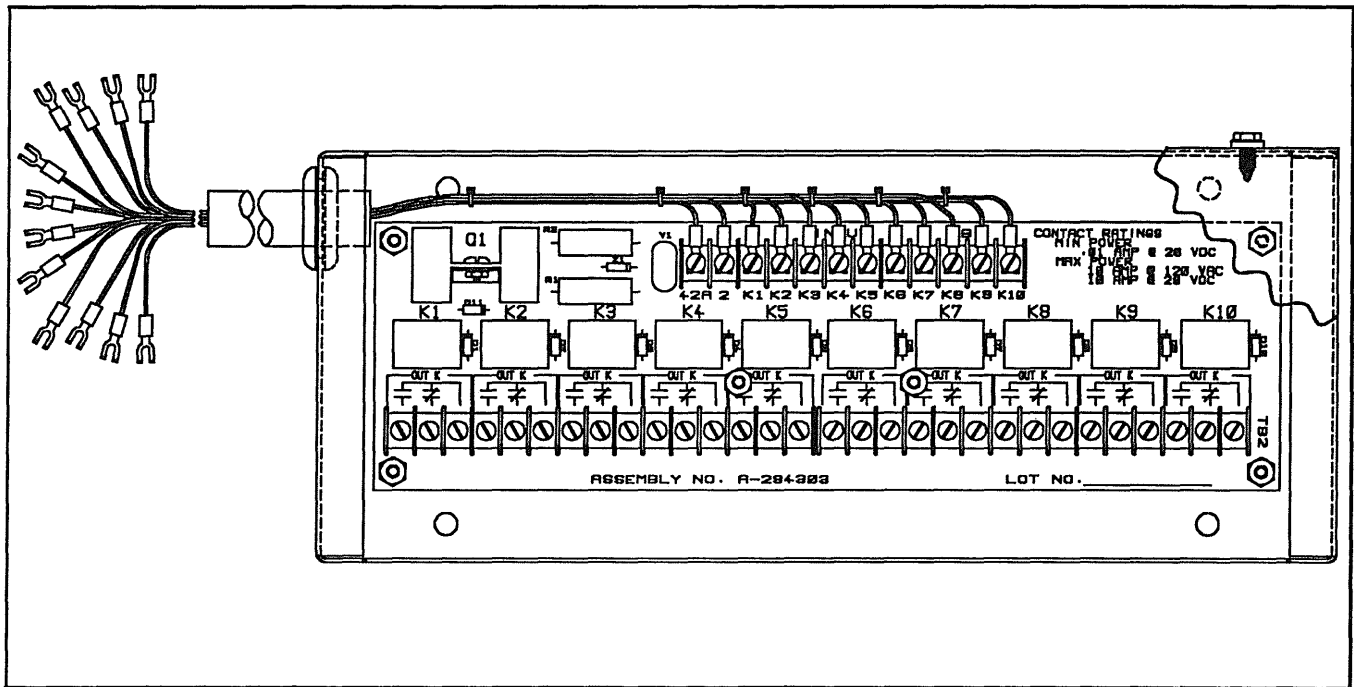


Figure 4-3. Isolated Alarm Dry Contact Kit

\* Used with Dec-3 Controllers Only.

## Safeguard Breaker

The safeguard breaker senses output current on each generator phase and will shut off the AC voltage regulator in the event of a sustained overload or short circuit. It is not a line circuit breaker and will NOT disconnect the generator from the load. See Figure 4-4.

### WARNING



**Hazardous voltage can cause death or severe injury.** Disconnect set from load by opening line circuit breaker or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. If high voltage is transferred to load during test, personal injury and equipment damage may result. The GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER!

## Line Circuit Breaker

The line circuit breaker interrupts generator output in the event of an overload or short circuit. It should be opened manually to disconnect the generator from the load when servicing the generator set. See Figure 4-5.

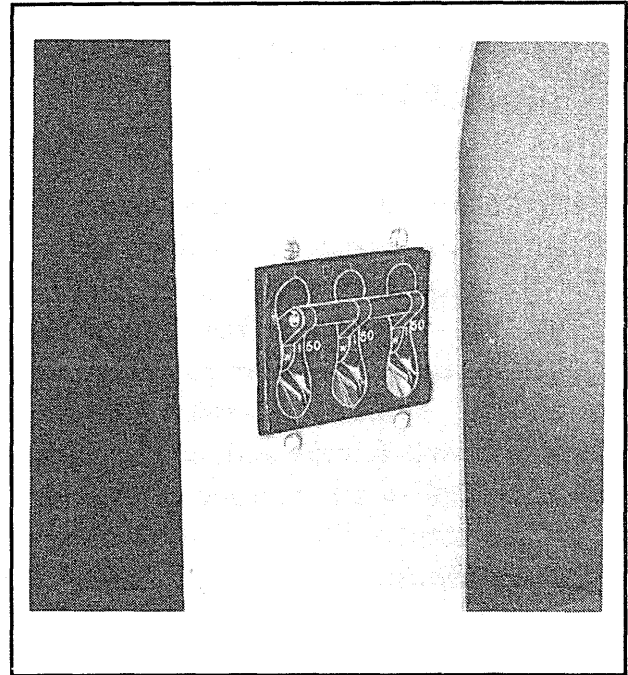


Figure 4-4. Safeguard Breaker

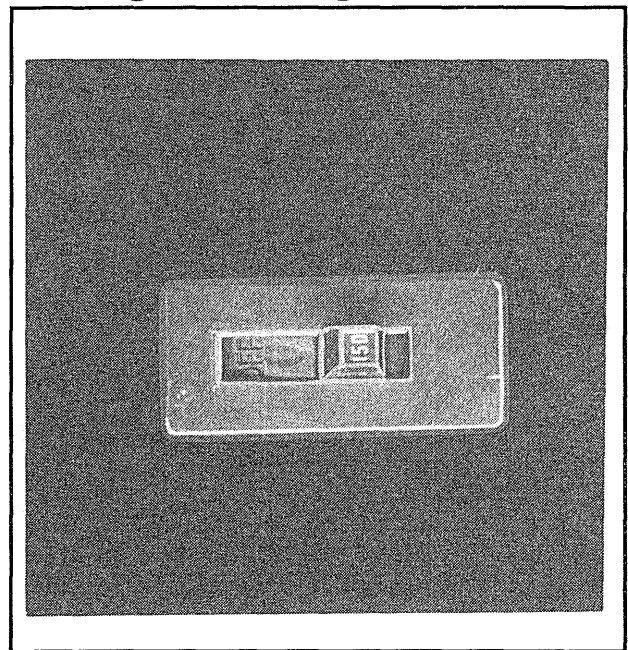


Figure 4-5. Line Circuit Breaker

\* Used with Dec-3 Controllers Only.

## Common Fault Relay Kit \*

The common fault relay kit uses one set of relay contacts to trigger customer provided warning devices if a fault condition occurs. A wiring harness included with the kit links the relay kit with the controller terminal strip or controller connection kit. Reference the accessory wiring diagram for proper connection of relay kit wiring harness. Although the common fault alarm can be connected to any controller fault output (on TB1 terminal strip), the kit is typically used to signal the following fault conditions:

- Emergency Stop
- Auxiliary
- Overspeed
- Low Oil Pressure
- High Engine Temperature

## One Relay Dry Contact Kit \*

The one relay dry contact kit uses one set of contacts to trigger customer provided warning devices if a fault condition occurs. While any controller fault output (from TB1 terminal strip) can be connected to the one relay kit, this accessory is typically used to signal an overspeed condition. The one relay dry contact kit is shown in Figure 4-6.

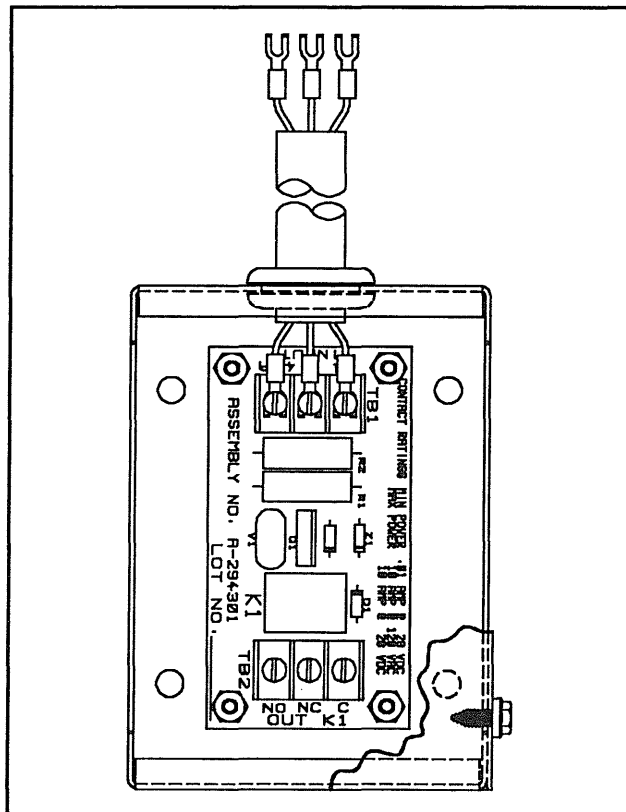


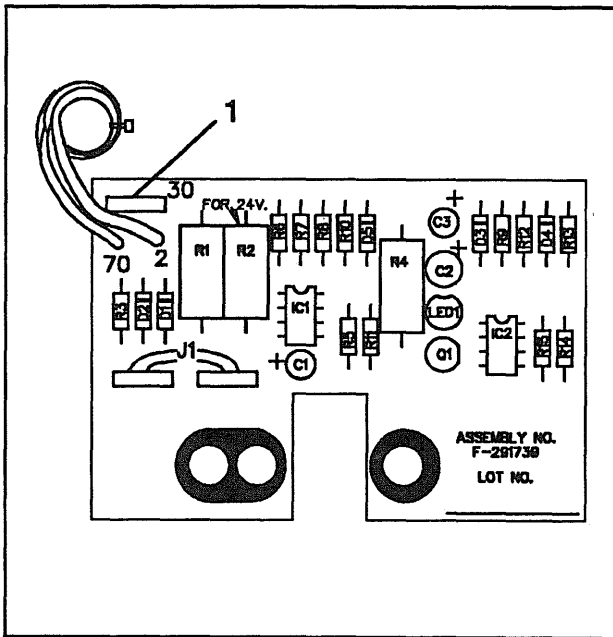
Figure 4-6. One Relay Dry Contact Kit

\* Used with Dec-3 Controllers Only.



## Overvoltage Kit \*

The overvoltage circuit will cause immediate engine shutdown when it is triggered by a DC signal from an overvoltage shutdown option. The generator set will automatically shut down if output voltage is 15% above nominal voltage longer than one second. The overvoltage option connects to wire 30 in the controller. See Figure 4-7.



1. Connects to Controller Wire 30

Figure 4-7. Overvoltage Circuit Board

## Run Relay Kit

The run relay kit is energized only when the generator set is running. The three sets of contacts in the kit are typically used to control air intake and/or radiator louvers. However, alarms and other signalling devices can also be connected to the contacts. Refer to the accessory wiring diagram in Section 5 for proper connection of the run relay kit.

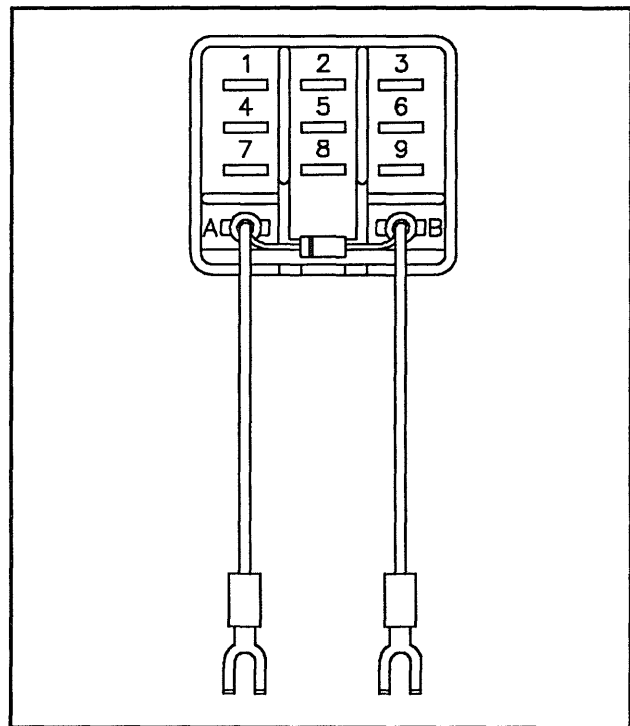


Figure 4-8. Run Relay kit

\* Used with Dec-3 Controllers Only.

## Remote Emergency Stop Kit

\*

The emergency stop kit allows immediate shutdown of the set from a station remote from the generator (Figure 4-9). If the emergency stop switch is activated, the EMERGENCY STOP lamp lights and the unit shuts down. The generator cannot be restarted until the emergency stop switch is reset (by replacing glass face) and the controller is reset by placing Generator Master Switch in the OFF/RESET position. On later models using Detroit Diesel engines, the engine air damper switch must also be reset. See Section 2. "Resetting Emergency Stop Switches".

## Controller Connection Kit

The controller connection kit allows easy connection of controller accessories without accessing the controller terminal strip. The kit uses a 65 in. (165 cm) wiring harness to link the controller TB1 terminal strip with a remote terminal strip. With the exception of terminals TB1-1, 1A, and 56, the remote terminal strip is identical to that of the controller. All accessories (except the emergency stop kit)

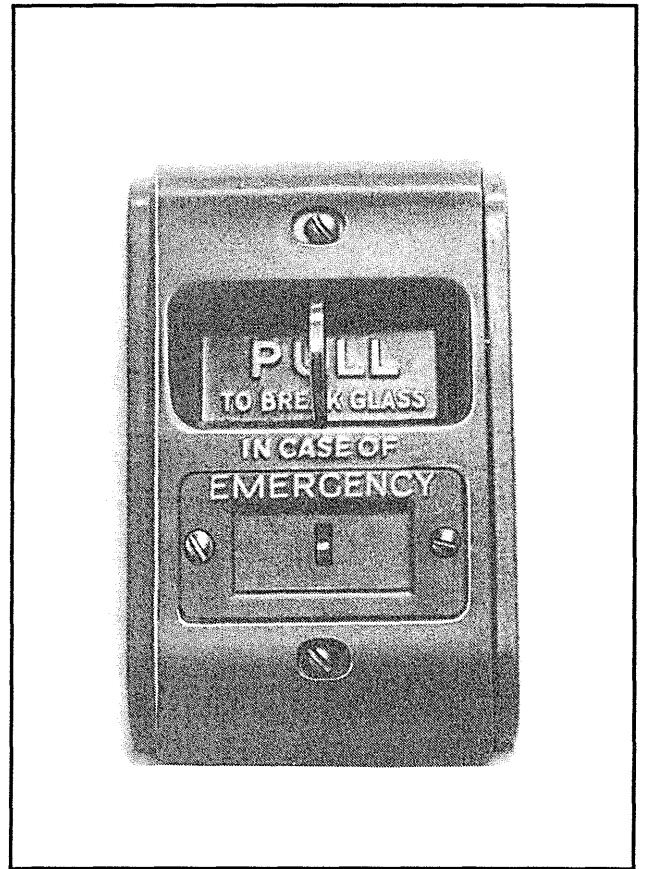


Figure 4-9. Emergency Stop Kit

can be connected to the connection kit terminal strip.

\* Used with Dec-3 Controllers Only.

## Fast Check Diagnostic Tester

\*

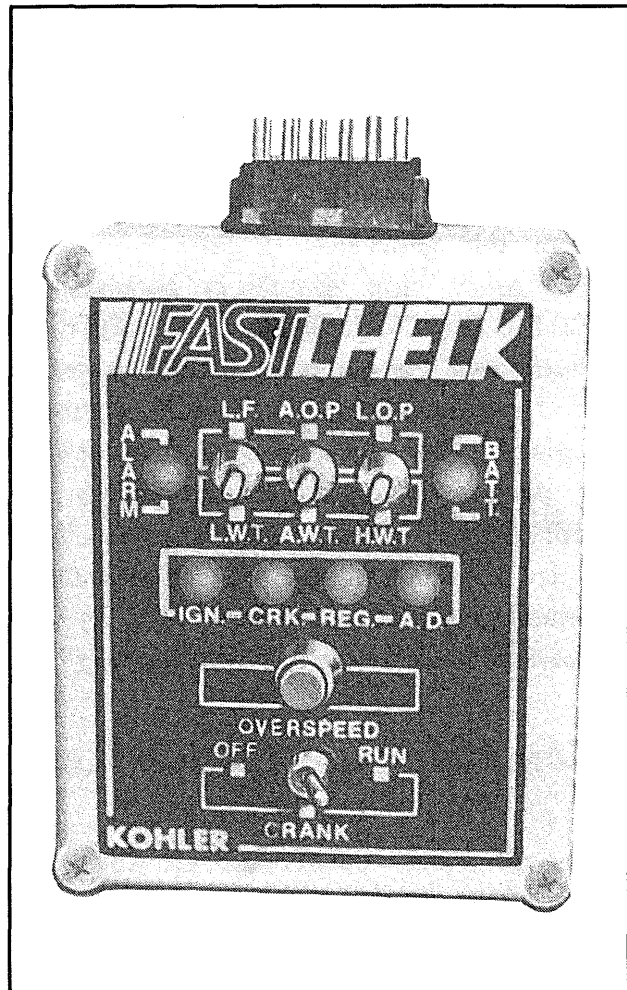
The Fast Check Diagnostic Tester simulates engine operation to identify faults in the controller and engine circuitry. Use the Fast Check when troubleshooting start-up problems or to test and troubleshoot the controller when removed from the generator. Tests are performed without starting the generator set. Functions performed by the Fast Check are listed below; refer to Figure 4-10 to identify LED's and switches.

**LED's on the Fast Check indicate the energizing of the following circuits:**

- Engine Ignition
- Engine Crank
- AC Voltage Regulator
- Engine Anti-Dieseling
- Battery Connection (correct polarity)
- Engine Malfunction Alarm and/or Alarm Shutdown

**Switches on the Fast Check simulate:**

- Engine Cranking
- Engine Running
- Engine Overspeed
- Low Fuel
- Low Engine Coolant Temperature
- Anticipatory Low Engine Oil Pressure
- Anticipatory High Engine Coolant Temperature
- Low Engine Oil Pressure
- High Engine Coolant Temperature



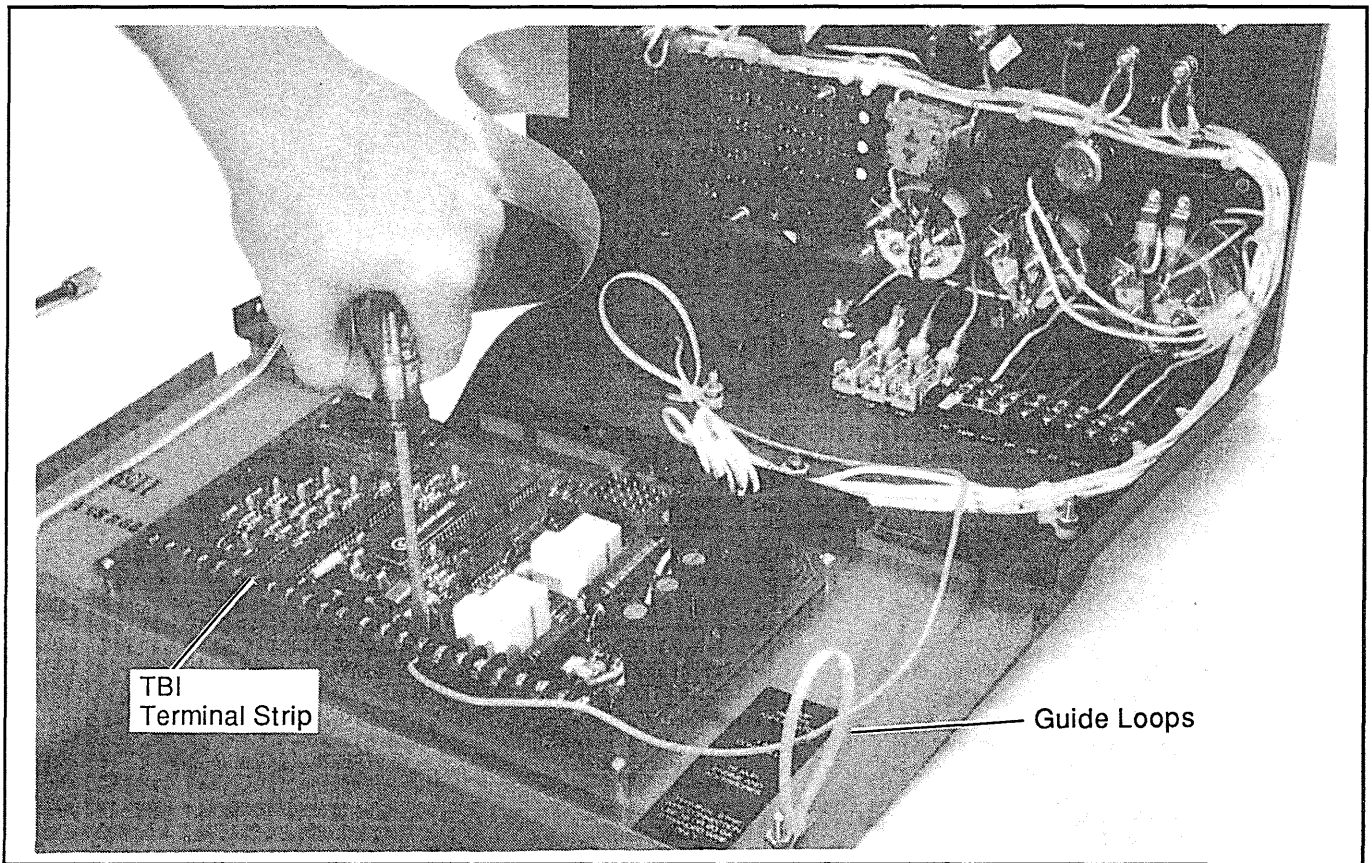
**Figure 4-10. Fast Check Diagnostic Tester**

\* Used with Dec-3 Controllers Only.

## Accessory Connection \*

The Dec-3 controller circuit board is equipped with a terminal strip (TB1) for easy connection of generator set accessories. Alarms, battery chargers, remote switches, and other accessories can be direct-connected to the controller circuit board using 18 or 20 gauge stranded wire. (A controller connection kit may also be connected to the controller terminal strip to eliminate the need to open the controller to connect accessories.) See "Controller Connection Kit" earlier in this section.

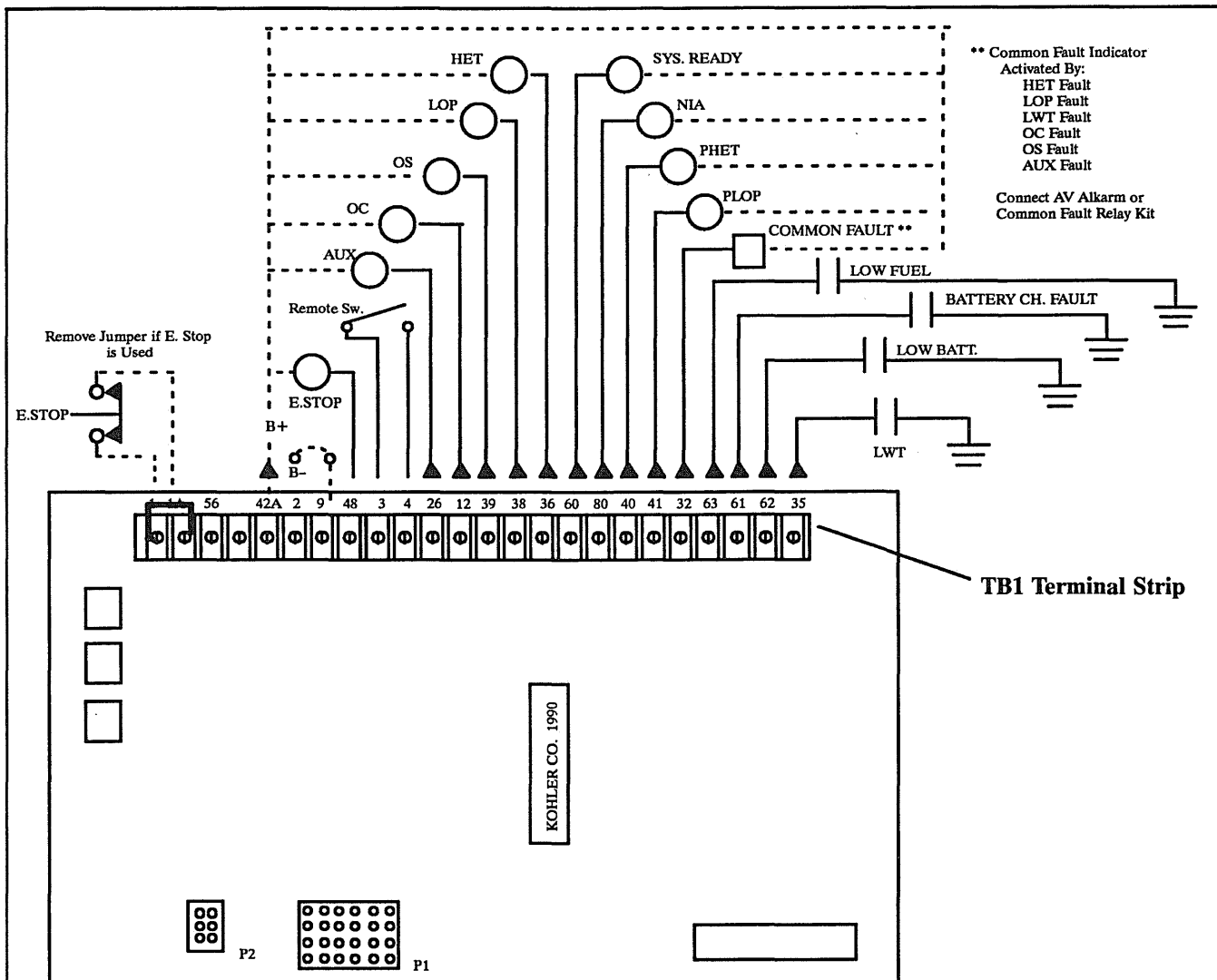
To connect accessories to the controller TB1 terminal strip, lower the controller circuit board panel until it is lying flat. Route accessory leads through the controller port and guide loops to the circuit board terminal strip. See Figure 4-11. The controller circuit board panel must be lying flat to ensure adequate slack in accessory leads and/or harnesses. For specific information on accessory connections, refer to Figure 4-12, the accessory wiring diagram (Section 8) and the instruction sheet accompanying each kit.



1. TB1 Terminal Strip 2. Guide Loops

Figure 4-11. Connecting Accessory Leads

\* Used with Dec-3 Controllers Only.



**CIRCUIT BOARD TERMINAL IDENTIFICATION (TB1)**

- 1 - Ground - Emergency Stop Relay (K4) - Connect Emergency Stop Across Terminals TB1-1 and 1A.
- 1A - Emergency Stop Relay (K4) Coil; Negative - Connect Emergency Stop Across Terminals TB1-1 and 1A.
- 56 - Not Used
- Not Used
- 42A - Battery Voltage (Fuse #1 Protected) - Accessory Power Supply; Customer May also Provide Separate Accessory Power Source
- 2 - Ground Terminal
- 9 - Crank Mode Selection (open - cyclic crank; ground - continuous crank) Connect TB1-2 to TB1-9 for Continuous Cranking; Leave TB1-9 open for cyclic cranking. See Section 3, Starting.
- 48 - Emergency Stop Indicator \*
- 3 - Remote Start Ground - Connect Remote Start Switch to TB1-3 and TB1-4
- 4 - Remote Start - Connect Remote Start Switch to TB1-3 and TB1-4
- 26 - Auxiliary Indicator \*
- 12 - Overcrank Indicator \*
- 39 - Overspeed Indicator \*
- 38 - Low Oil Pressure Indicator \*
- 36 - High Engine Temperature Indicator \*
- 60 - System Ready Indicator \*
- 80 - Not In Auto Indicator \*
- 40 - Prealarm High Engine Temperature Indicator \*
- 41 - Prealarm Low Oil Pressure Indicator \*
- 32 - Common Fault/Prealarm Line - AV Alarm or Common Fault Relay Activated by HET, LOP, LWT, OC, OS, and AUX Faults
- 63 - Low Fuel - Connect Fuel Level Sensor to TB1-63 to Activate Fault Lamp (If Used)
- 61 - Battery Charger Fault - Connect Battery Charger to TB1-61 to Activate Fault Lamp (If Used)
- 62 - Low Battery Volts - Connect Battery Charger to TB1-62 to Activate Fault Lamp (If Used)
- 35 - Low Water Temperature - Connect LWT Sensor (Prealarm Kit) to TB1-35 to Activate LWT or LWT/AUX Lamp

\* Indicators may be customer supplied lamps and/or alarms or Kohler AV Alarms, Annunciators, Dry Contact Kits, etc.

**Figure 4-12. Controller TB1 Terminal Strip Connection**

\* Used with Dec-3 Controllers Only.

# Section 5. Troubleshooting

When troubles occur, do not overlook simple causes which might seem too obvious to be considered. A starting problem, for example, could be attributed to an empty fuel tank. As a general aid to diagnosing common problems,

refer to the Troubleshooting Table following. If the trouble cannot be corrected through routine servicing, contact an Authorized Service Center for assistance.

Problem	Possible Cause	Corrective Action
Unit will not crank	Weak or dead battery  Reversed or poor battery connections  Fuse blown in controller  Emergency Stop Switch activated (local or remote)  Fault shutdown  Generator Master Switch in OFF position (attempting start-up from remote switch; Dec-3 controllers only)	Recharge or replace; check charger operation  Check connections  Replace fuse  Reset controller and Emergency Stop Switch (remote) and air damper (200-300 kW sets only)  Correct fault and reset controller *  Move Master Switch to AUTO position
Unit cranks but will not start	Improper fuel  No fuel	Replace fuel  Replenish fuel supply; check fuel control circuit
No AC output	Line Circuit Breaker or Safeguard Breaker in the OFF position (if equipped)  Generator problem such as defective voltage regulator or other internal fault	Return to the ON position  Contact Authorized Service Center
Low output or excessive drop in voltage	Unit overloaded  Engine speed too low  Faulty voltage rheostat or voltage regulator	Reduce load  Contact Authorized Service Center  Contact Authorized Service Center

\* not applicable to generator sets equipped with manual controller

Problem	Possible Cause	Corrective Action
Unit stops suddenly	Low oil pressure shutdown	Check oil level (if low, check for leaks)
	High temperature shutdown	Check for cooling air restrictions or poor belt tension
	Low coolant level shutdown (if equipped)	Check coolant level (if low, check for leaks); see "Safety Precautions" Section
	Out of fuel	Replenish fuel supply
	Overcrank shutdown *	Reset -- if overcrank fault reoccurs, contact Authorized Service Center
	Fuse blown in controller	Replace fuse -- if fuse blows again, contact Authorized Service Center
	Engine malfunction	Contact Authorized Service Center
	Overspeed shutdown	Reset -- if unit overspeeds again, contact Authorized Service Center
	High oil temperature shutdown	Check oil level and type. If shutdown reoccurs, contact Authorized Service Center
	Overvoltage shutdown (if equipped)	Contact Authorized Service Center
Generator Master Switch in OFF/RESET position *	Move switch to proper position (RUN or AUTO)	
Emergency Stop Switch activated (local or remote) *	Check reason for emergency shutdown; Reset switch	

\* not applicable to generator sets equipped with manual controller

# Section 6. Generator Reconnection

The stator leads of the generator may be reconnected if a different output phase or voltage is desired. Refer to the following procedure and the connection schematics

below. Follow all safety precautions at the front of this manual and in the text during this procedure.

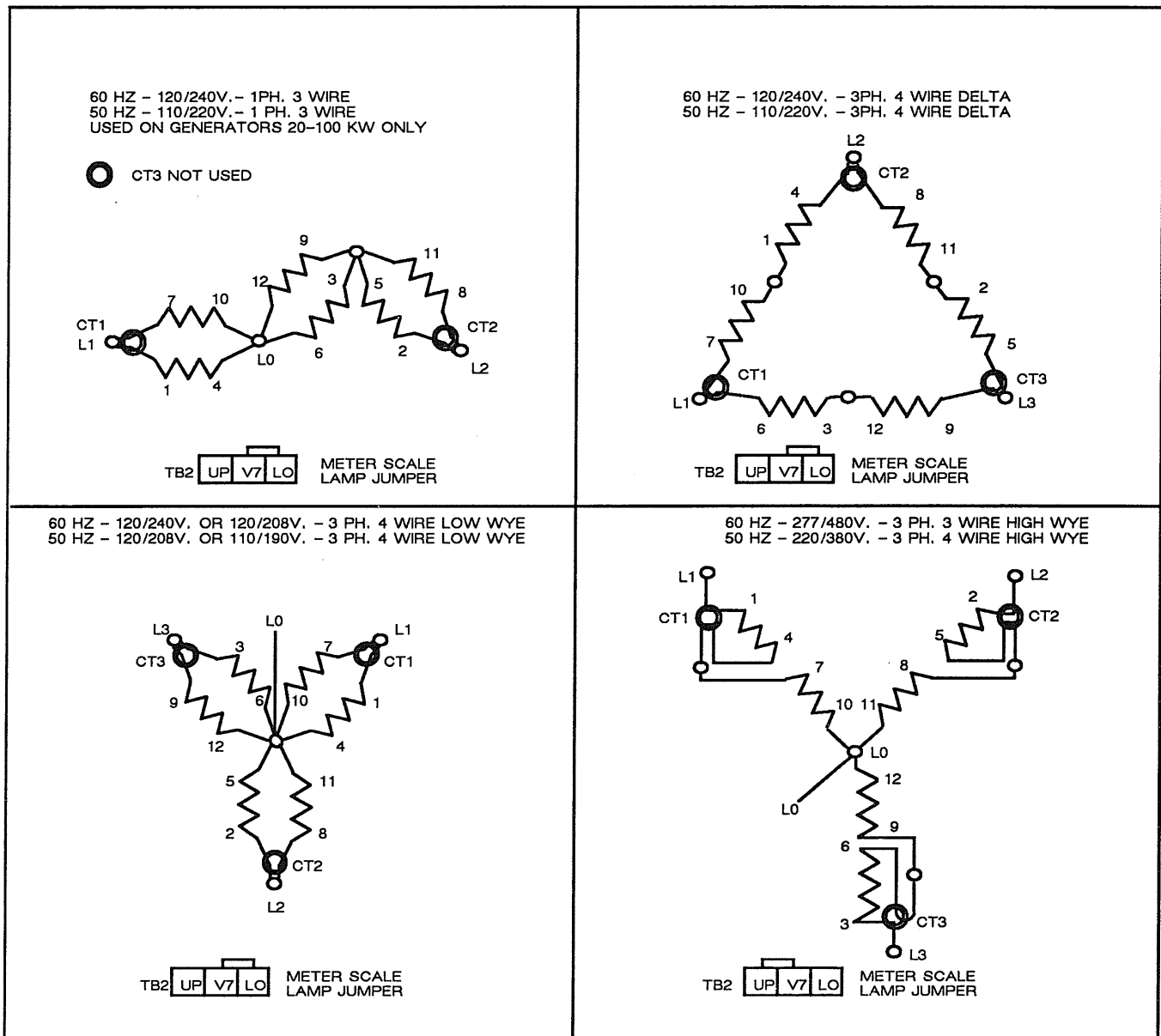


Figure 6-1. Generator Reconnection



## Reconnection Procedure

### NOTE

1. Move controller master switch to OFF/RESET position (Dec-3 Controllers) or START/STOP switch to STOP position (Manual Controller).



**Hazardous voltage can cause death or severe injury.** Disconnect set from load by opening line circuit breaker or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. If high voltage is transferred to load during test, personal injury and equipment damage may result. The **GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER!**

2. Disconnect engine starting battery, negative (-) lead first. Disconnect power to battery charger (if equipped).
3. Select desired voltage connection from Figure 6-1. Route leads through current transformers and connect according to the diagram for desired phase and voltage.

### NOTE

Current transformers CT1, CT2, and CT3 should be positioned with "dot" or "HI" mark toward generator set. Current transformers will only be used on generator sets equipped with metered controllers and/or Safeguard Breakers.

### NOTE

**EQUIPMENT DAMAGE!** Be sure that line circuit breakers, transfer switch and any other accessories using line voltage are properly sized for the voltage selected.

See the generator service manual for information on changing generator frequency.

4. If controller is equipped with meters, remove controller cover and reposition meter scale lamp jumper (see Figure 6-2), if necessary, to match meter scale lamps with desired voltage (as shown in Figure 6-1).
5. If the generator is equipped with the overvoltage kit, the J1 jumper must be in place on the overvoltage circuit board if the generator is connected for 139/240 or 277/480 Volts (3-phase, 4-wire, 60 Hz). For all other voltages, remove the J1 jumper from the overvoltage circuit board. See Figure 6-3 for J1 jumper location on overvoltage circuit board.

### WARNING



**Hazardous voltage can cause death or severe injury.** Perform electrical service only as prescribed in equipment manual. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and that wherever electricity is present, there is the hazard of electrocution.

6. If the controller is equipped with meters, turn the phase selector switch to the L1-L2 position (1-Phase or 3-Phase depending on generator connection). If the controller is not equipped with meters, connect a voltmeter across leads L1 and L2.

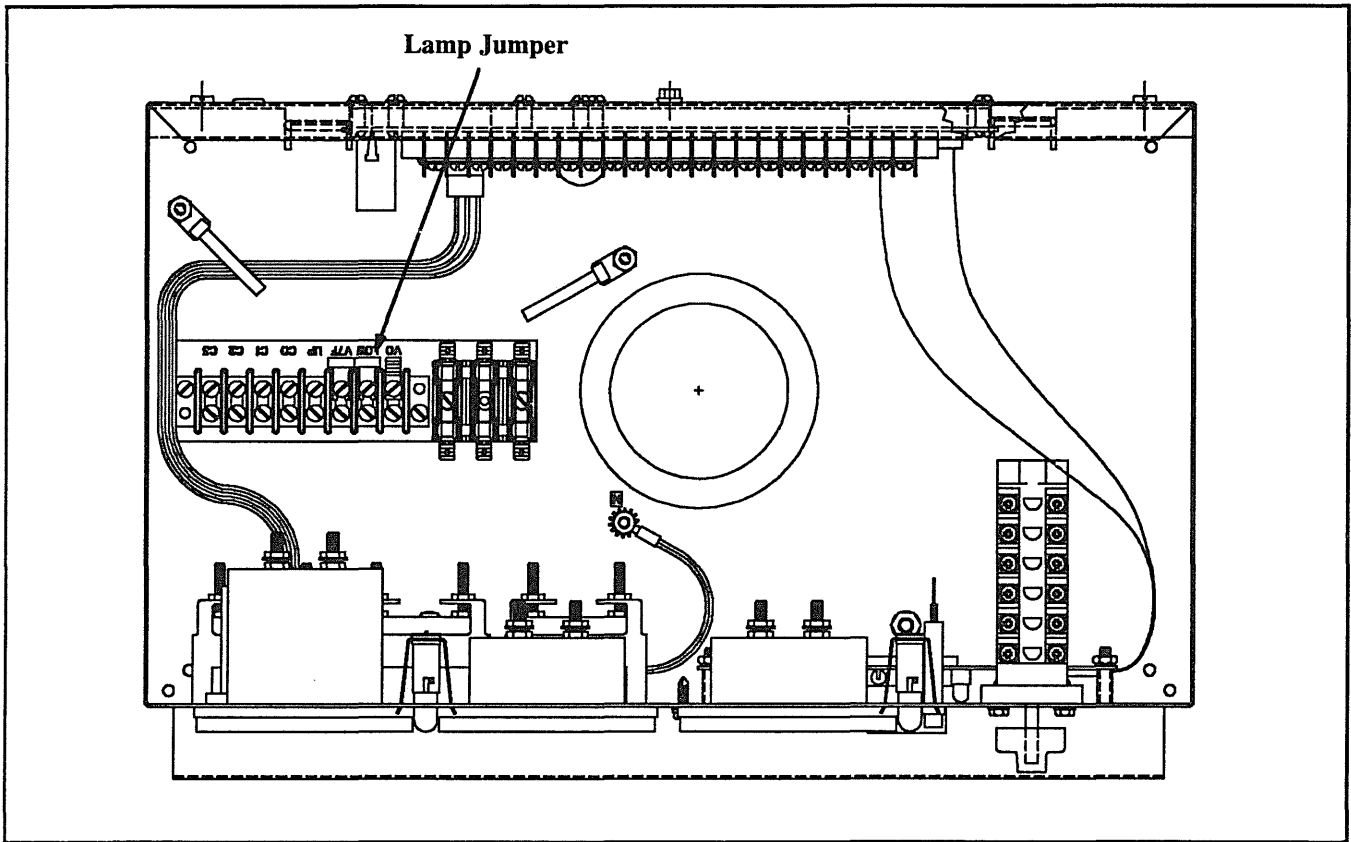


Figure 6-2. Meter Scale Lamp Jumper - Typical

7. Reconnect starting battery, negative lead last. Move generator master switch to the RUN position (Dec-3 Controllers) or press START switch (Manual Controller) to start the generator set. Check voltmeter for proper voltage. Adjust voltage, if necessary, with the Voltage Adjustment on the controller front panel. See Figure 6-4.

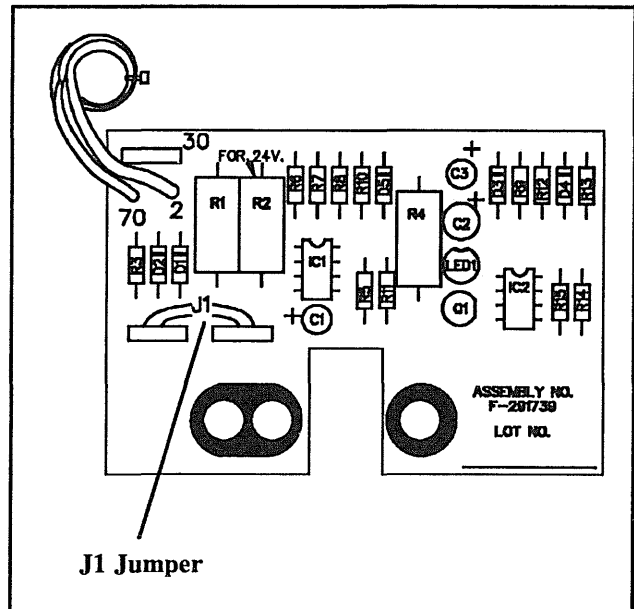


Figure 6-3. Overvoltage Circuit Board

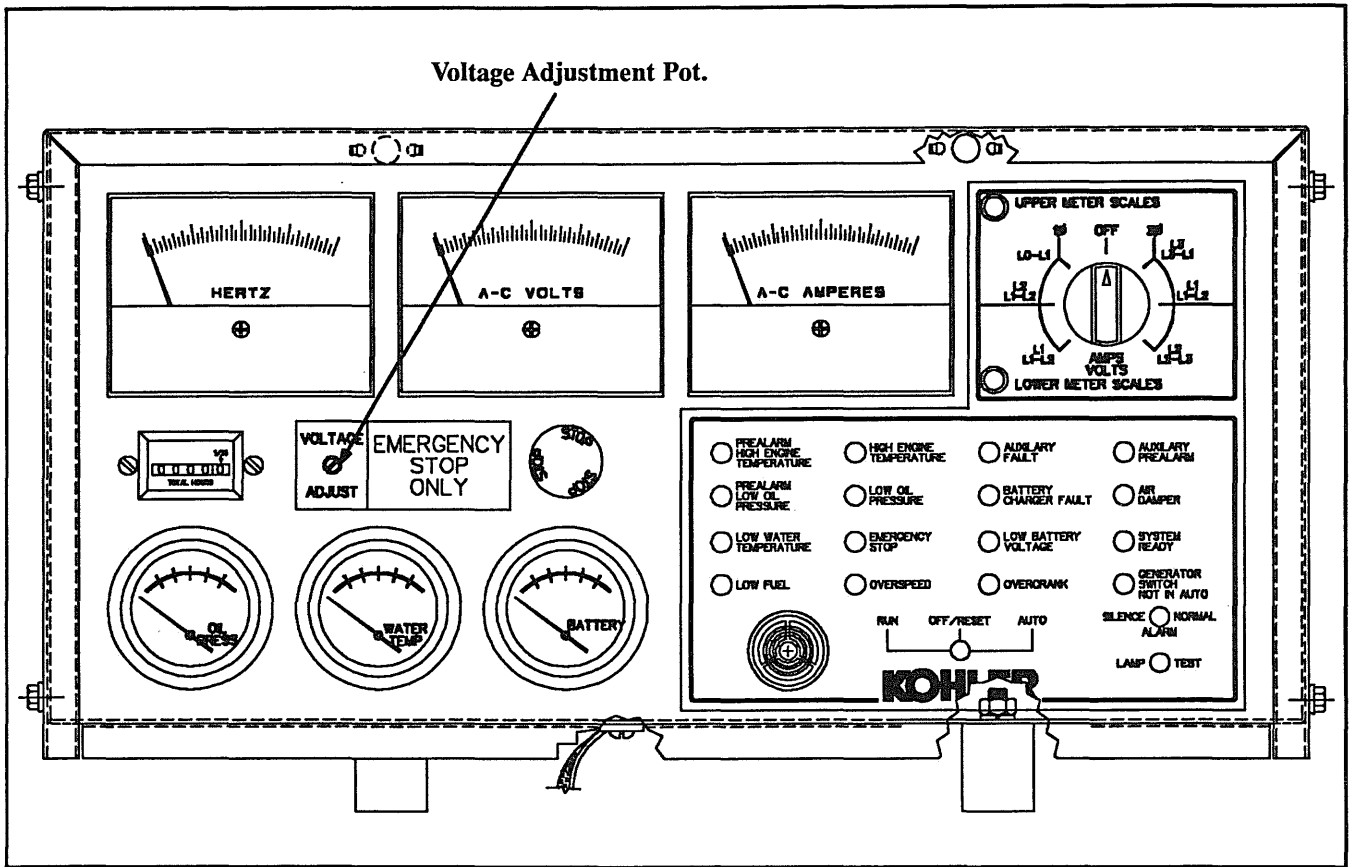


Figure 6-4. Voltage Adjustment - Typical

## Section 7. Generator Service

Under normal conditions, generator service will not be required on a regular basis. If operating under extremely dusty and dirty conditions, use DRY compressed air to blow dust out of the generator. Do this with the generator running and direct the stream of air through openings in the generator end bracket.

The end bracket bearing should be replaced every 10,000 hours of operation in standby and prime power applications. Service more frequently if bearing inspection indicates excessive rotor end play or bearing damage

from corrosion or heat build-up. The tolerance ring must be replaced if the end bracket is removed. The end bracket bearing is sealed and requires no additional lubrication. All generator service must be performed by an authorized service dealer.

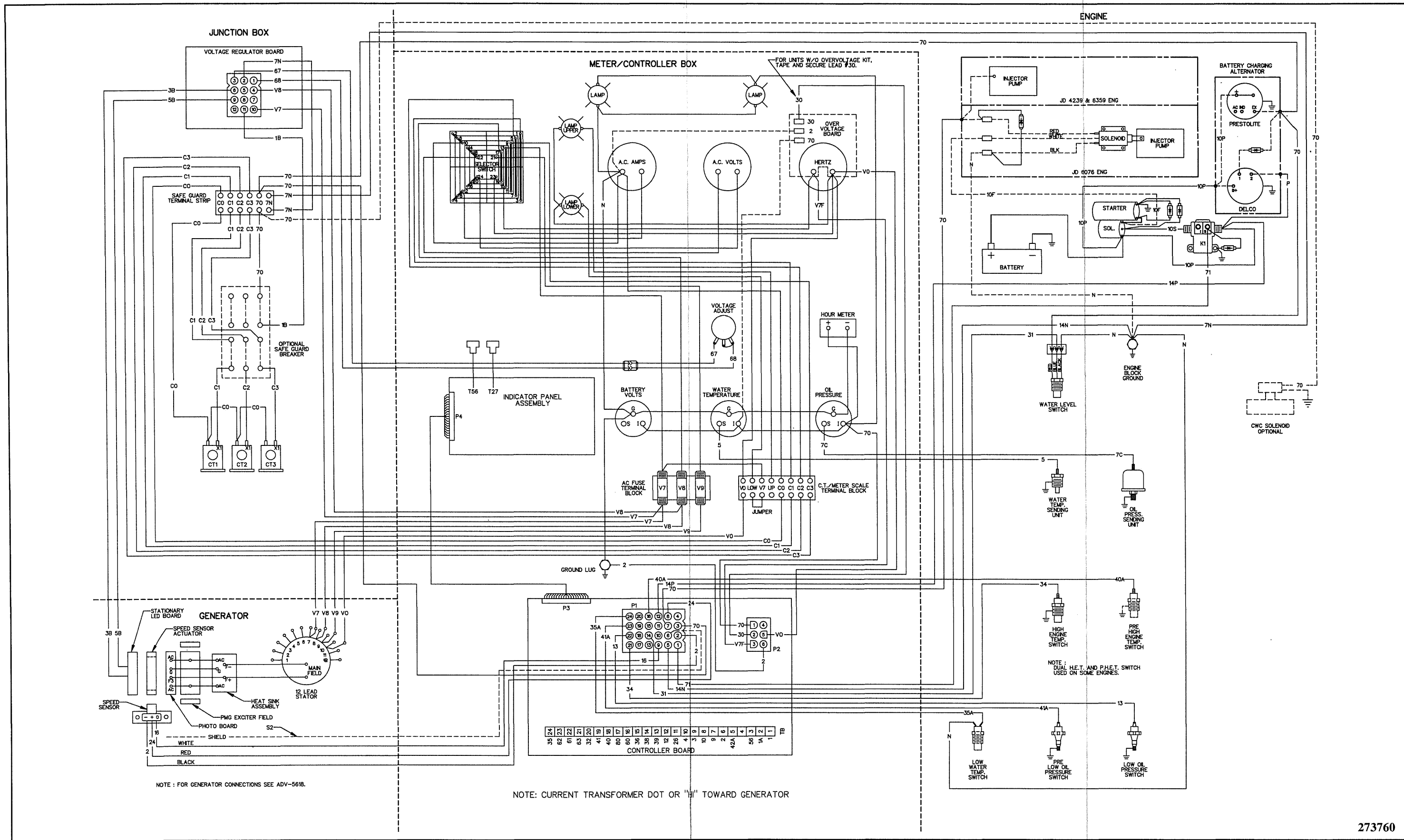
Generator engine service should be performed at the intervals specified by the engine manufacturer in the engine service literature. Contact your Kohler Generator Distributor to obtain service literature for specific models.

# Section 8. Wiring Diagrams

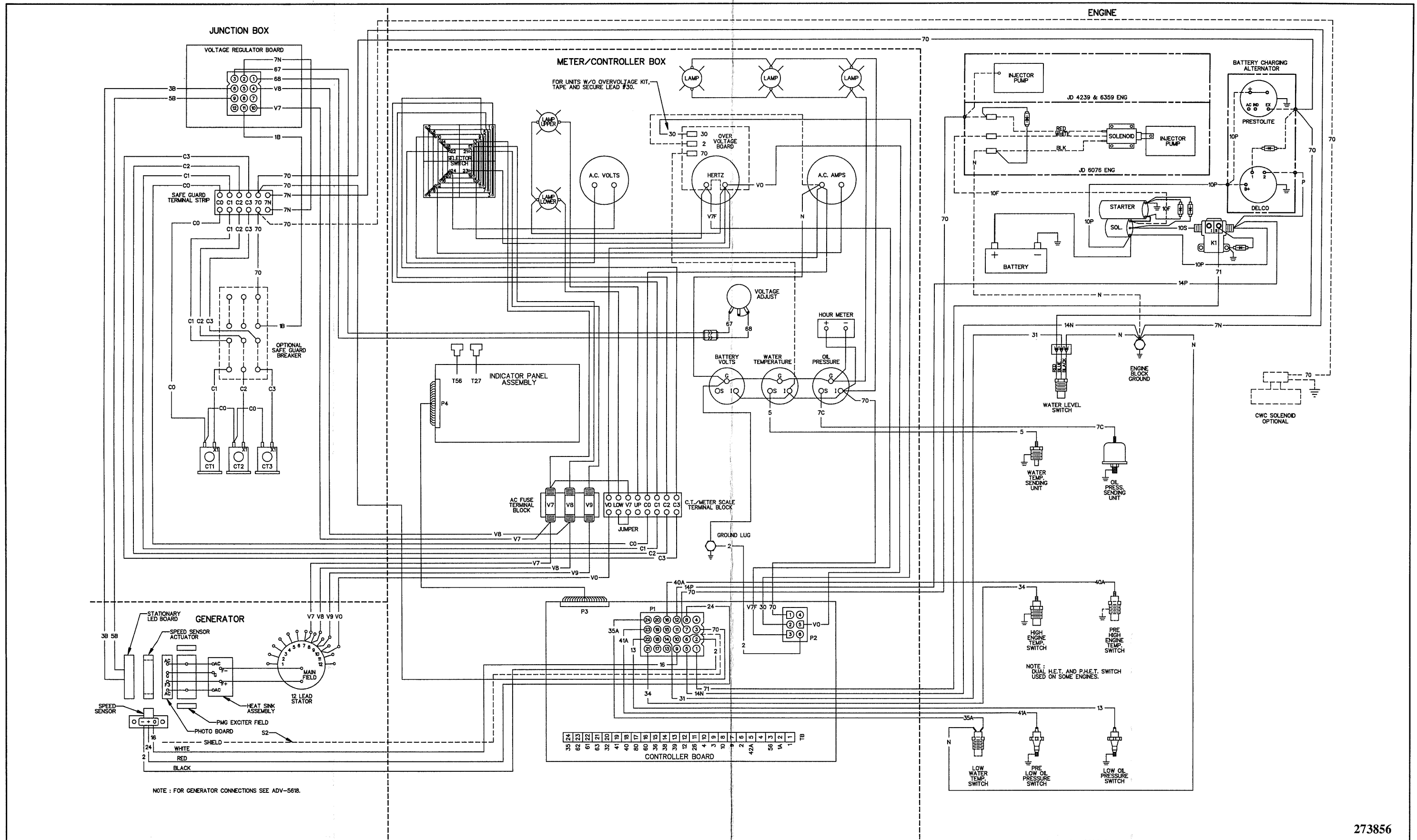
## (Engine/Generator/Controller Interconnection)

<b>Description</b>	<b>PAGE</b>
John Deere Engines, Diesel, 1-Phase/3-Phase, 6 or 16-Light Dec-3 Controller (Standard) .....	8-3
John Deere Engines, Diesel, 1-Phase/3-Phase, 6 or 16-Light Dec-3 Controller (Oversize) .....	8-4
John Deere Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Standard) .....	8-5
John Deere Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Oversize) .....	8-6
John Deere Engines, Diesel, 1-Phase/3-Phase, Manual Controller .....	8-7
Detroit Diesel Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Standard) .....	8-8
Detroit Diesel Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Oversize) .....	8-9
6 or 16-Light Dec-3 Controller Accessory Connection .....	8-10

## Notes



John Deere Engines, Diesel, 1-Phase/3-Phase, 6 or 16-Light Dec-3 Controller (Standard)

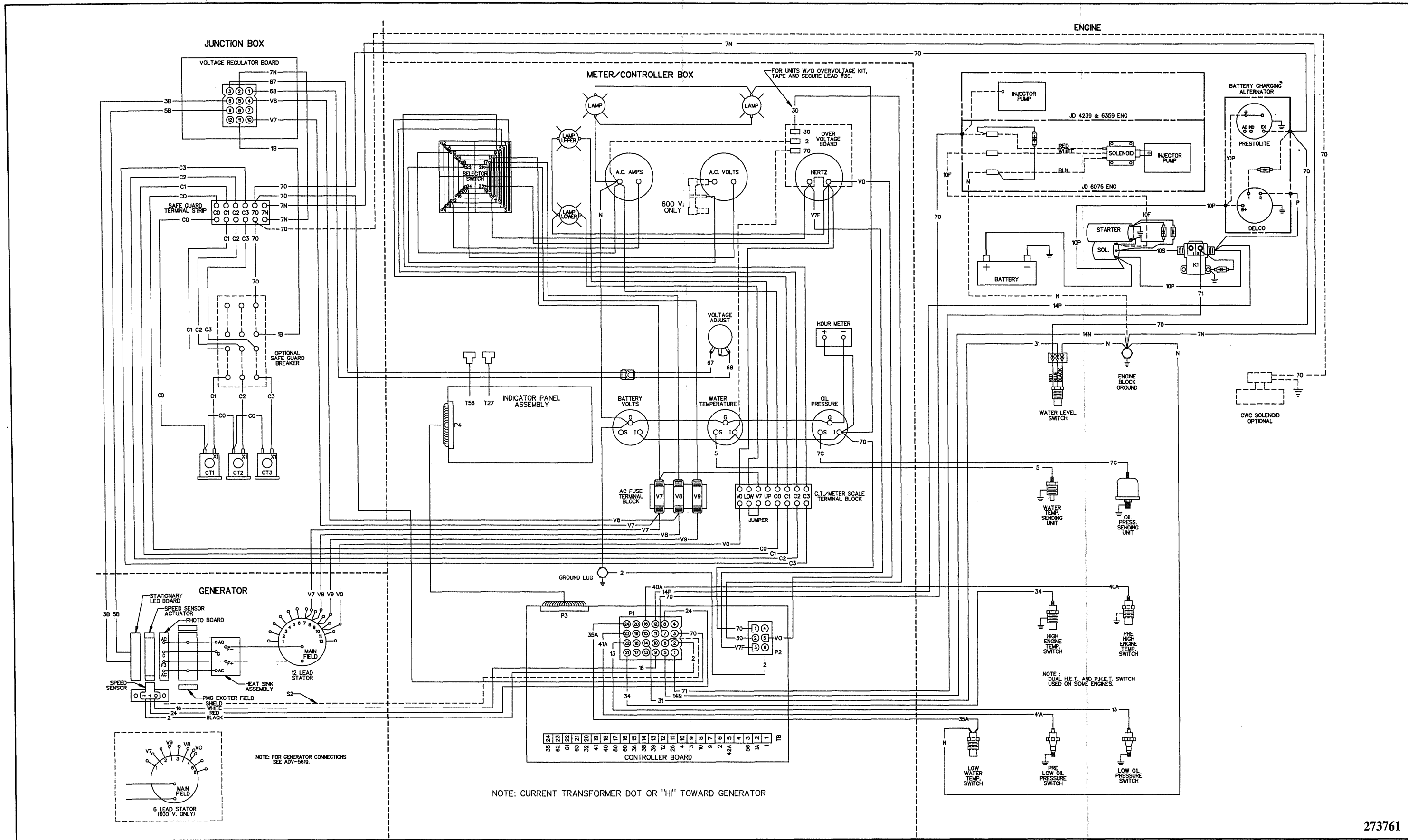


NOTE : FOR GENERATOR CONNECTIONS SEE ADV-5618.

NOTE : DUAL H.E.T. AND P.H.E.T. SWITCH USED ON SOME ENGINES.

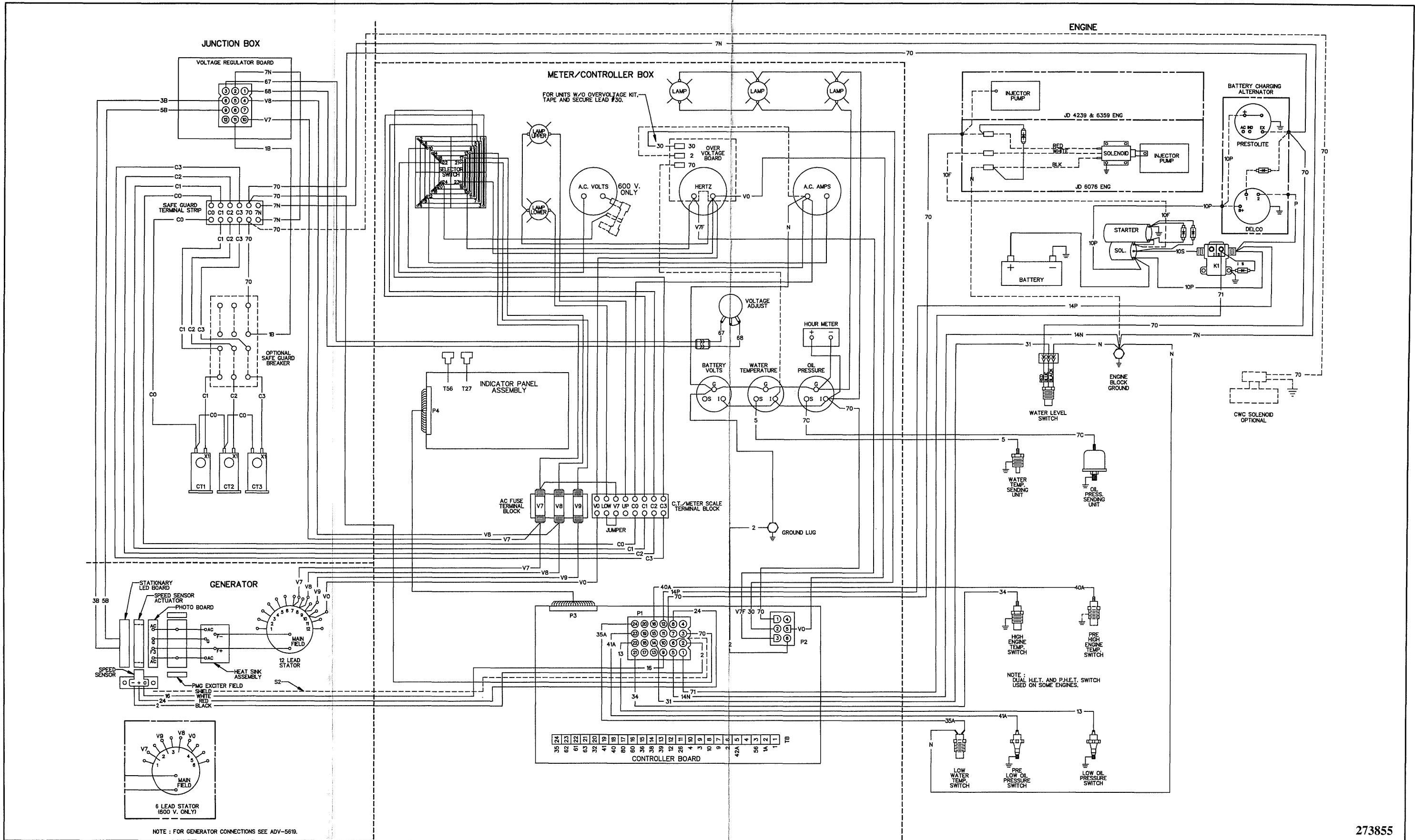
John Deere Engines, Diesel, 1-Phase/3-Phase, 6 or 16-Light Dec-3 Controller (Oversize)





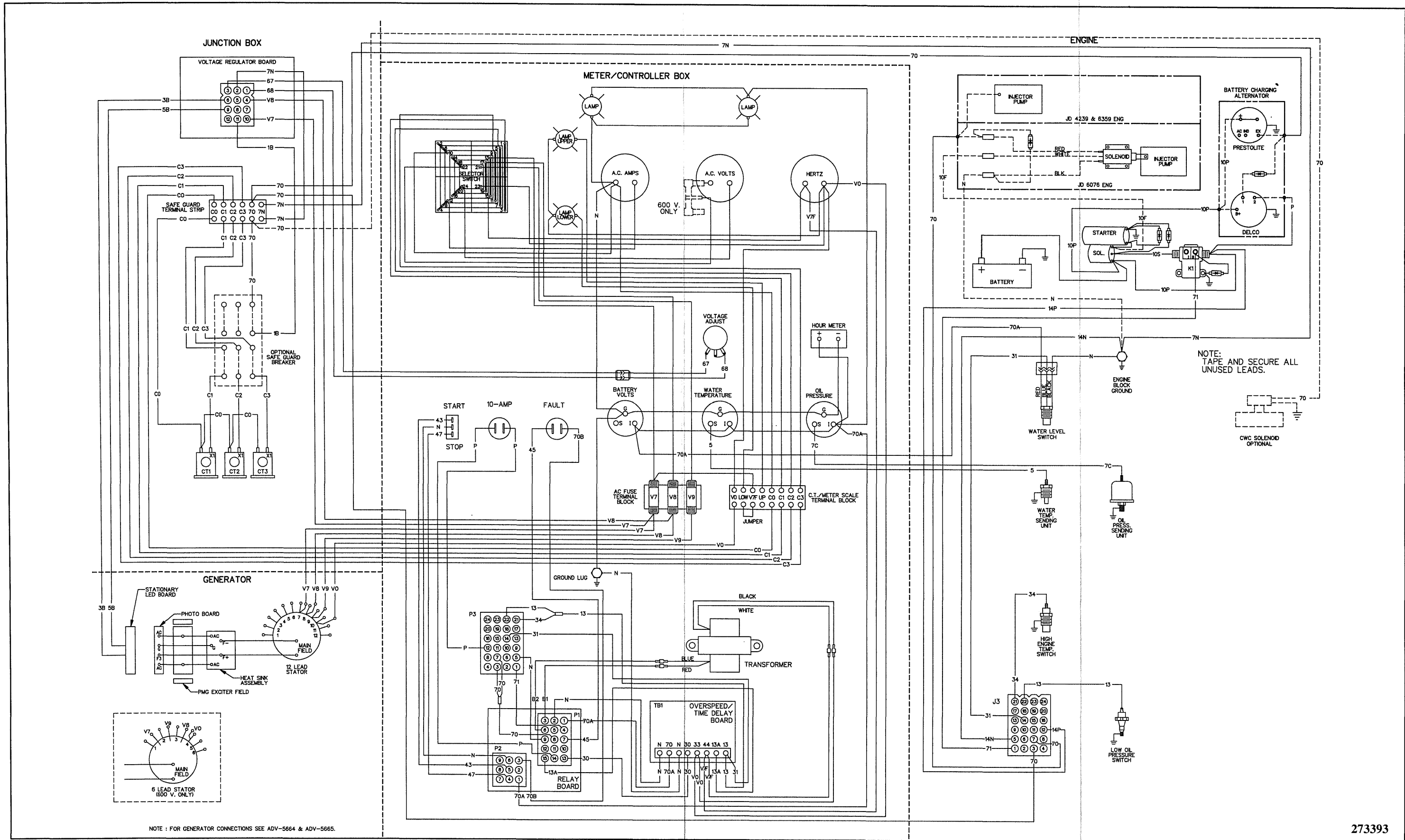
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John Deere Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Standard)



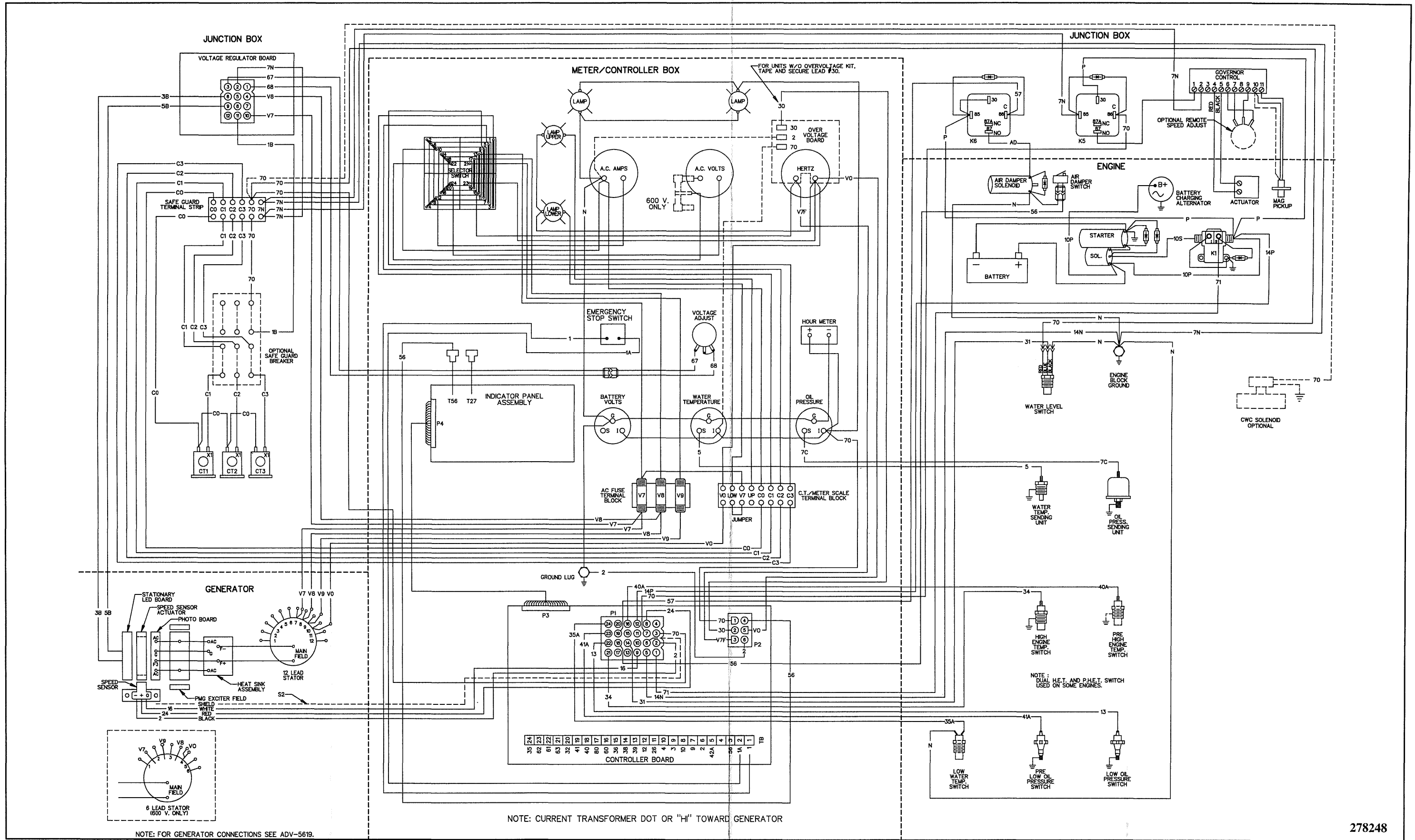
273855

John Deere Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Oversize)



John Deere Engines, Diesel, 1-Phase/3-Phase, Manual Controller

273393



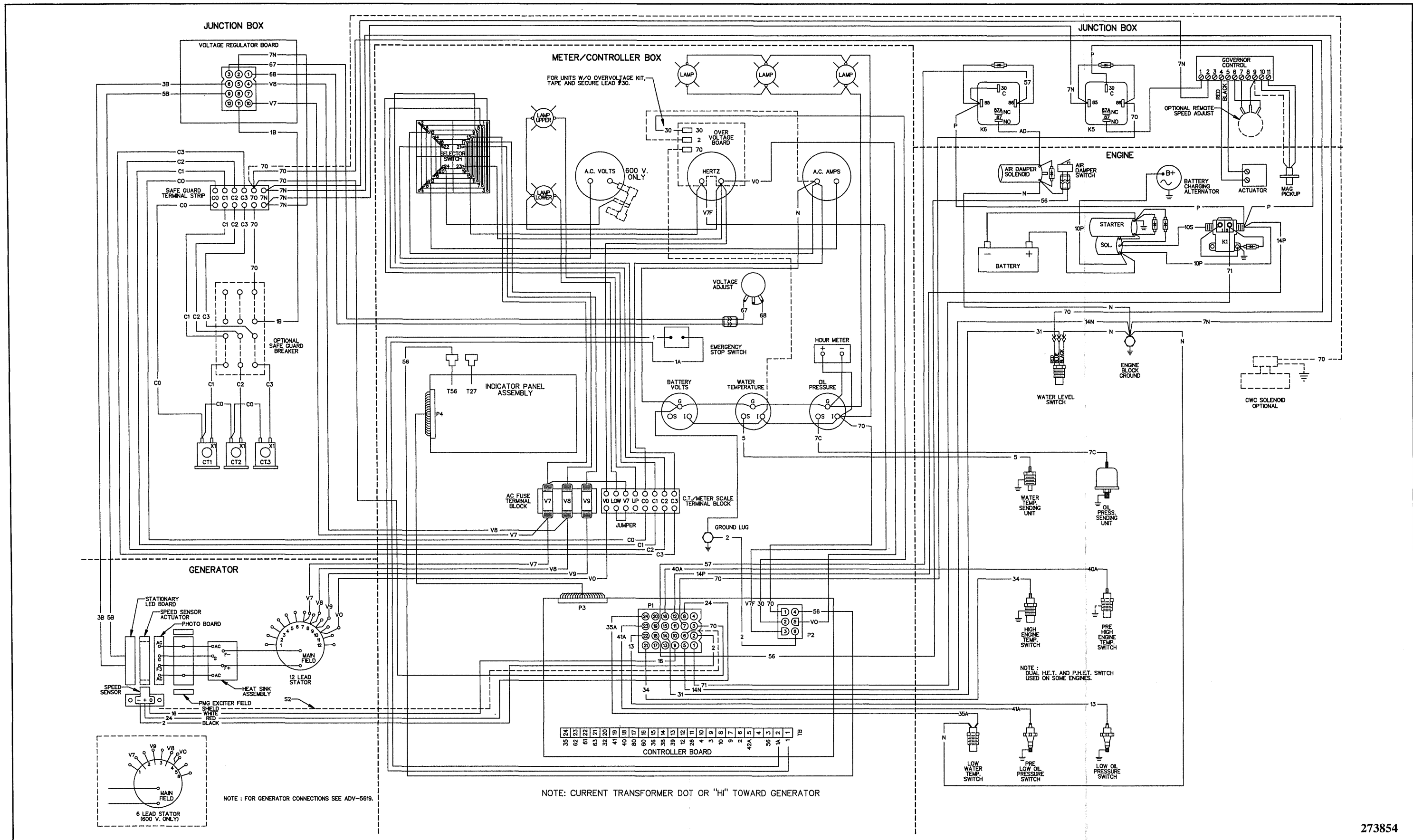
NOTE: FOR GENERATOR CONNECTIONS SEE ADV-5619.

NOTE: CURRENT TRANSFORMER DOT OR "HI" TOWARD GENERATOR

NOTE: DUAL H.E.T. AND P.H.E.T. SWITCH USED ON SOME ENGINES.

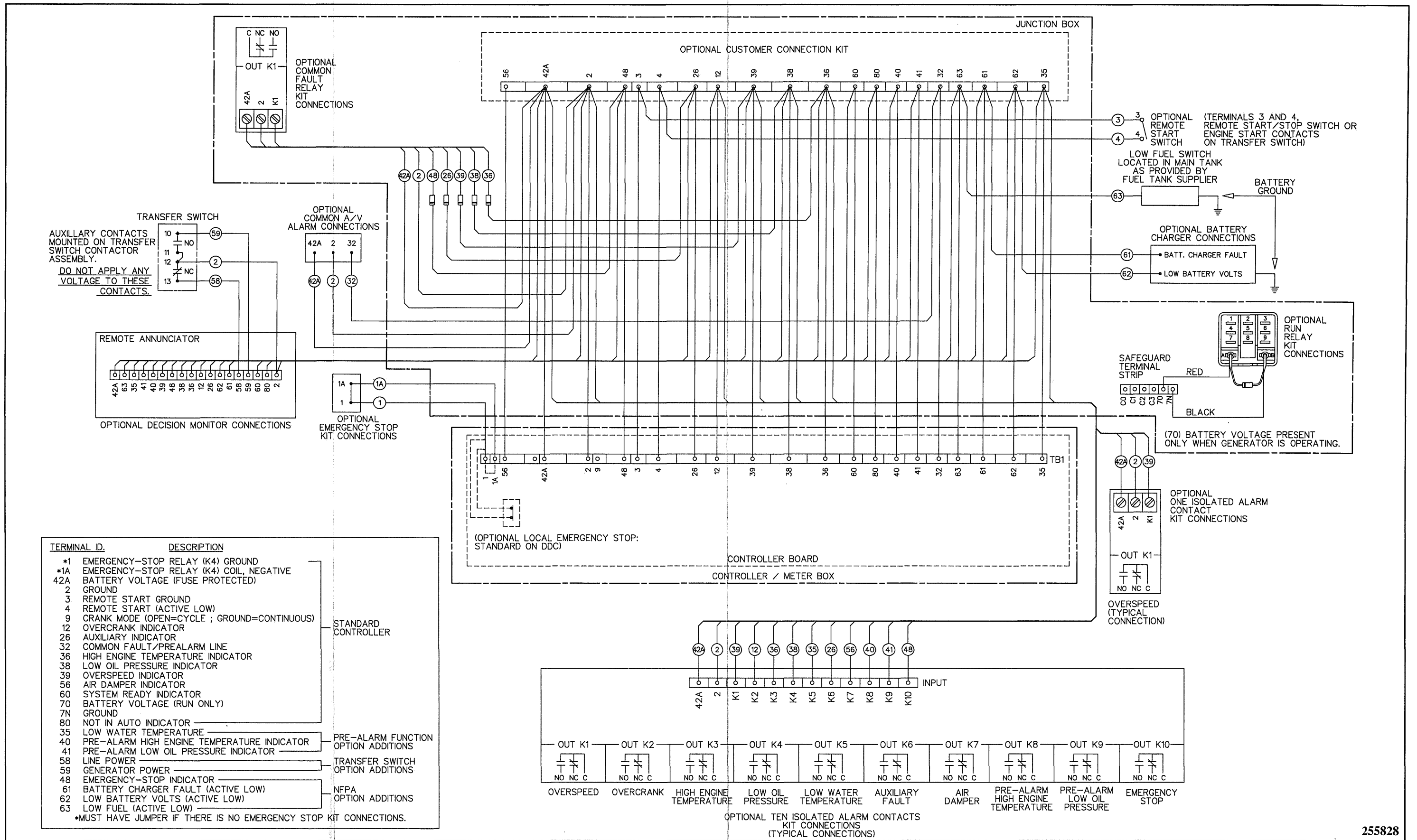
278248

Detroit Diesel Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Standard)



273854

Detroit Diesel Engines, Diesel, 3-Phase & 600 Volt, 6 or 16-Light Dec-3 Controller (Oversize)



6 or 16-Light Dec-3 Controller Accessory Connection

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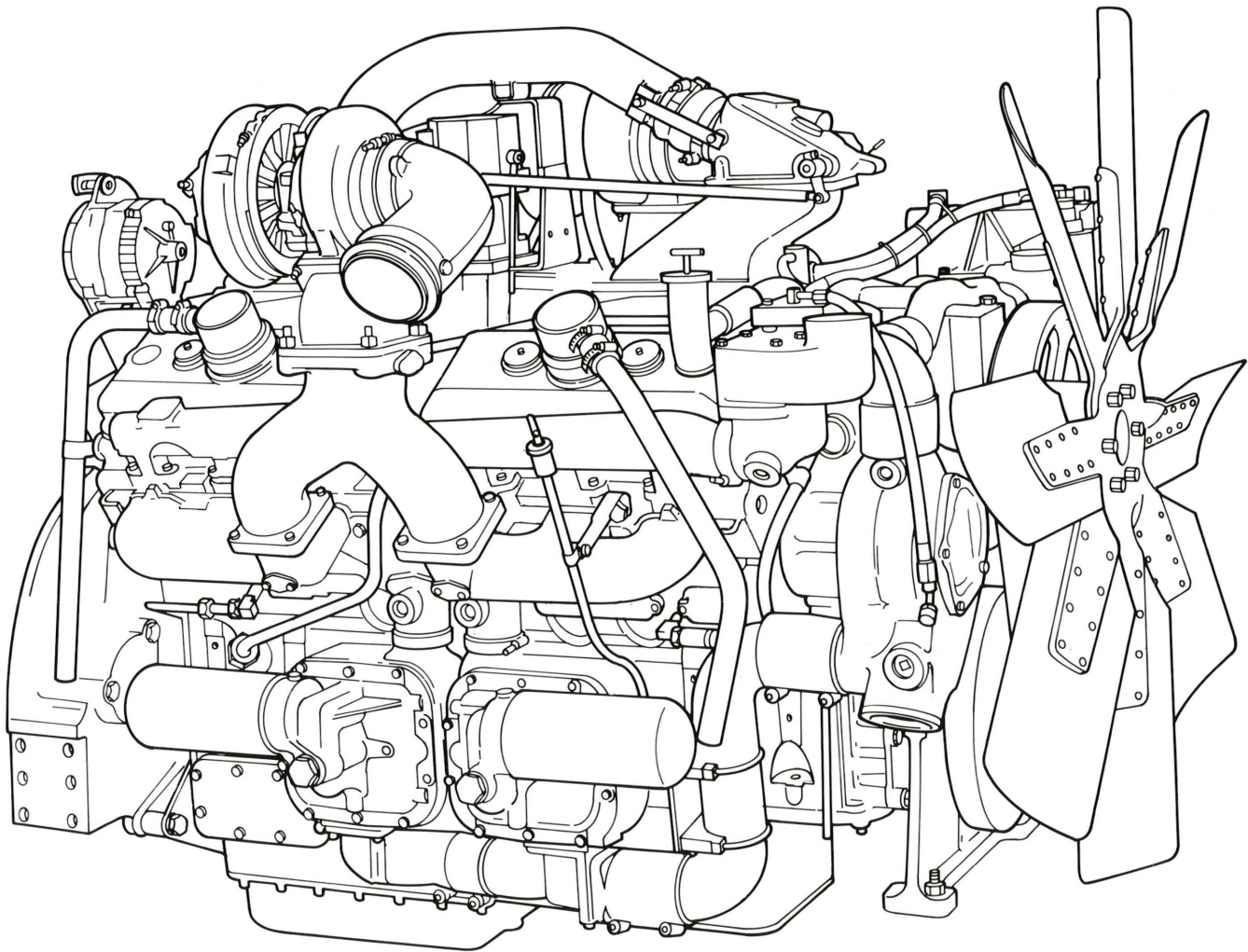
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# DETROIT DIESEL

## Generator Set Power



### *Engine Operator's Guide*



## To The Operator

Safety, based on technical skill and years of experience, has been carefully built into your Detroit Diesel Generator Set engine. Time, money, and effort have been invested to make your engine a safe product. The dividend you realize from this investment is your personal safety.

Remember, however, that power-driven equipment is only as safe as the person operating the controls. You are urged, as the operator of this diesel engine, to keep fingers and clothing away from the revolving belts, drive shafts, etc. on the engine installation.

Throughout this guide **CAUTIONS** regarding personal safety and **NOTICES** regarding engine performance or service life will appear. To avoid personal injury and insure long engine service life, always heed these instructions.

This guide contains instructions on the safe operation and preventive maintenance of your Detroit Diesel generator set engine. Maintenance instructions cover routine engine services such as lube oil and filter changes in enough detail to permit self-servicing, if desired.

The operator should become familiar with the contents of this manual before operating the engine or carrying out maintenance procedures.

Whenever possible, it will pay to rely on an *authorized Detroit Diesel service* outlet for all your service needs from maintenance to major parts replacement. *Authorized service outlets* worldwide stock factory original parts and have the specialized equipment and experienced, trained personnel to provide prompt preventive maintenance and skilled engine repairs.

The information and specifications in this publication are based on the information in effect at the time of approval for printing. Contact an *authorized Detroit Diesel service outlet* for information on the latest revision. The right is reserved to make changes at any time without obligation.

### WARRANTY

This applicable engine warranty is contained in the booklet entitled "Warranty Information on Detroit Diesel Generator Set Engines," available from authorized Detroit Diesel service outlets.

**Keep this Operators Guide with the Generator Set at all times. It contains important operating, maintenance, and safety instructions.**

### PROTECT YOUR INVESTMENT

Detroit Diesel Corporation stands behind all of the power systems products we supply. To ensure that your Detroit Diesel warranty coverage is in force for the entire period for which it is eligible, confirm that the equipment supplier has properly completed and submitted the warranty registration form (DDC # 6SA340) and retain your copy for your records. Your equipment may not be covered for the full period for which it qualifies unless the warranty has been properly registered with Detroit Diesel Corporation.

**Any questions should be directed to the local Detroit Diesel Distributor or nearest regional office (see back cover).**

## Table of Contents

<b>Subject</b>	<b>Page</b>
ENGINE MODEL, SERIAL NUMBER, OPTION GROUP DESIGNATION .....	2
Option Labels .....	2
GENERATOR SET INSTALLATION FACTORS .....	8
Ventilation .....	8
Engine Exhaust .....	10
Exhaust Silencing .....	12
Sound-Attenuation .....	13
Engine Cooling .....	14
ENGINE SYSTEMS .....	17
Fuel System .....	17
Lubrication System .....	17
Air System .....	17
Cooling System .....	17
General Cooling System Design Criteria .....	17
Electrical System .....	20
Governing System .....	20
Exhaust System .....	20
LUBRICATION AND PREVENTIVE MAINTENANCE INTERVALS .....	21
OPERATING INSTRUCTIONS .....	33
Preparations for Starting the Engine the First Time .....	33
Starting the Engine .....	34
Running the Engine .....	35
Stopping the Engine .....	35
"HOW TO" SECTION .....	36
How to Select Lubricating Oil .....	36
When to Change Oil .....	37
How to Replace the Lube Oil Filter .....	37
How to Select Fuel Oil .....	39
How to Replace the Fuel Filter and Strainer .....	40
Engine Out of Fuel—How to Restart .....	41
How to Select Coolant .....	41
How to Drain and Flush the Cooling System .....	44
When to Service the Dry Type Air Cleaner .....	44
SERVICE PUBLICATIONS .....	47
CUSTOMER ASSISTANCE .....	48

# 1. ENGINE MODEL, SERIAL NUMBER, OPTION GROUP DESIGNATION

The engine serial number and model number are stamped on the cylinder block in the following locations (as viewed from the flywheel end):


Inline 71	Left side, upper front corner
6V, 8V-92, 12V-71	Right side, upper front corner
12V, 16V-92 16V-71	Right side, upper rear corner
12V, 16V-149	Right side of front block, on rocker cover rail


## Option Labels

Computerized paper laminate engine option labels are attached to the valve rocker covers. These labels contain the engine serial number and model number and, in addition, list any optional equipment used on the engine. Labels also include required tune-up information (injector timing, valve lash, maximum, no-load RPM, etc.).

With any order for parts, the engine model and serial number must be given. If a type number is shown on the option label covering the equipment required, this number should also be included on the parts order. For example, if a thermostat is required for an 8V-92, the MPC group # (see following pages) is 5.2000B. The type number taken from the option label is 0380. Refer to the proper parts catalog under section 5.2000B, find type 0380 and pick necessary parts and quantities.

Generator sets usually carry their own name plates. The model and serial number information on these plates is useful when ordering parts for these assemblies.

SERIAL #	TYPE #	DESCRIPTION	
0193 WAT MANIFOLD	0141 WAT BY PASS	0380 THERMOSTAT	 L11246
0423 EXH MFLD	0177 FUEL PUMP	0184 INJ 9225	
0634 BLOWER	1208 TURBOCHARGER	0338 FUEL FILTER	
1725 FUEL LINES	0840 AIR INLT HSG	0872 SHUT OFF	
0117 INJECTOR CONT	0013 GOVERNOR ELEC	0648 ENGINE MOUNTS	
0196 VALVE MECH	0357 ROCKER COVER	0125 OIL FIL CAP	
0727 VENT SYSTEM	1918 BATT CHRGR GEN	0366 STARTING MTR	
UNIT 08VF148413 S.O.7A20476 MODEL 80837405 SPEC A 279548			

0211 ENG LIFT BKT	0741 F/W HOUSING	THIS ENGINE DESIGNED TO OPERATE AT 0540 HP AT 01800 RPM INJ. TIMING 1.490 VALVE LASH .016 STARTING AID .000 THRTDLY/FMOD .000 MAX RPM NL 01800 STD GT RET CAM	 L11246
0711 VIB DAMPER	0952 FLYWHEEL		
0396 CONN ROD/PSTN	0169 OIL PAN		
NONE OIL PAN DRAIN	0186 OIL PUMP		
0028 OIL PRESS REG	0203 OIL DIST		
0125 OIL COOLER	1039 DIPSTICK		
0382 OIL FILTER	0794 VENT SYSTEM		
1732 FAN MOUNTS	0396 C/S PULLEY		
0231 C/S PUL BELT	0181 WATER PUMP		
UNIT 08VF148413 S.O. 7A20476 MODEL 80837405 SPEC A 279548			

Typical 8V-92 Option Labels

0071 ENG LIFT BKT	0719 F/W HOUSING	THIS ENGINE DESIGNED TO OPERATE AT 0630 HP AT 01800 RPM INJ. TIMING 1.460 VALVE LASH .016 STARTING AID .000 THRTDLY/FMOD .000 MAX RPM NL 01800 STD GT STD CAM
0154 VIB DAMPER	1122 FLYWHEEL	
0293 CONN ROD/PSTN	0218 OIL PAN	
0395 OIL PAN DRAIN	0149 OIL PUMP	
0505 OIL DIST	0246 OIL COOLER	
0215 DIPSTICK	0372 OIL FILTER	
0659 VENT SYSTEM	0050 C S COVER	
0044 BAL WT COVER	1384 FAN	
0394 C/S PULLEY	0209 C/S PUL BELT	



L11246

UNIT 12VA085706 S.O. 7A21190 MODEL 71237305 SPEC

0141 WAT BY PASS	0092 THERMOSTAT	0244 EXH MFLD
0177 FUEL PUMP	0064 INJ M95	0451 BLOWER
0409 TURBOCHARGER	0758 FUEL FILTER	1233 FUEL LINES
0785 AIR INLT HSG	1071 SHUTOFF	0601 OVER SPD GOV
0118 INJECTOR CONT	0016 GOVERNOR ELEC	0340 ENGINE MOUNTS
0380 ROCKER COVER	0125 OIL FIL CAP	0727 VENT SYSTEM
0186 STARTING MTR	0393 EXH MFLD CONN	



L11246

UNIT 12VA085706 S.O. 7A21190 MODEL 71237305 SPEC

*Typical 12V-71 Option Labels*

0214 AIR BOX DRAIN	0140 ENG LIFT BKT	THIS ENGINE DESIGNED TO OPERATE AT HP AT 01800 RPM INJ. TIMING VALVE LASH STARTING AID THRTDLY/FMOD MAX RPM NL 01800 STD GT & STD CAM
0764 F/W HOUSING	0165 VIB DAMPER	
1076 FLYWHEEL	0397 CONN ROD/PSTN	
0758 OIL PAN	0123 OIL PUMP	
0491 OIL DIST	0093 OIL FIL TUBE	
1246 OIL COOLER	1019 DIPSTICK	
0465 OIL FILTER	0777 VENT SYSTEM	
0140 C/S COVER	0448 C/S PULLEY	
0189 WATER PUMP	0145 WAT PUMP CVR	



L11231

UNIT 16E0011015 S.O. 7A23990 MODEL 91637416 SPEC ES 17102

0398 THERMOSTAT	0122 WAT OTLT ELBO	0604 EXH MFLD
0317 INJECTOR	0114 TURBOCHARGER	0061 FUEL MFLD CON
0837 FUEL FILTER	1538 FUEL LINES	0822 AIR INLT HSG
0865 SHUTOFF	0262 INJECTOR CONT	0019 GOVERNOR ELEC
0562 ENGINE MOUNTS	0776 CAM/GR TRAIN	0451 ROCKER COVER
0773 VENT SYSTEM	2204 BATT CHR G EN	0290 STARTING MOTOR
0447 TACH DRIVE	0171 C/S COVER	



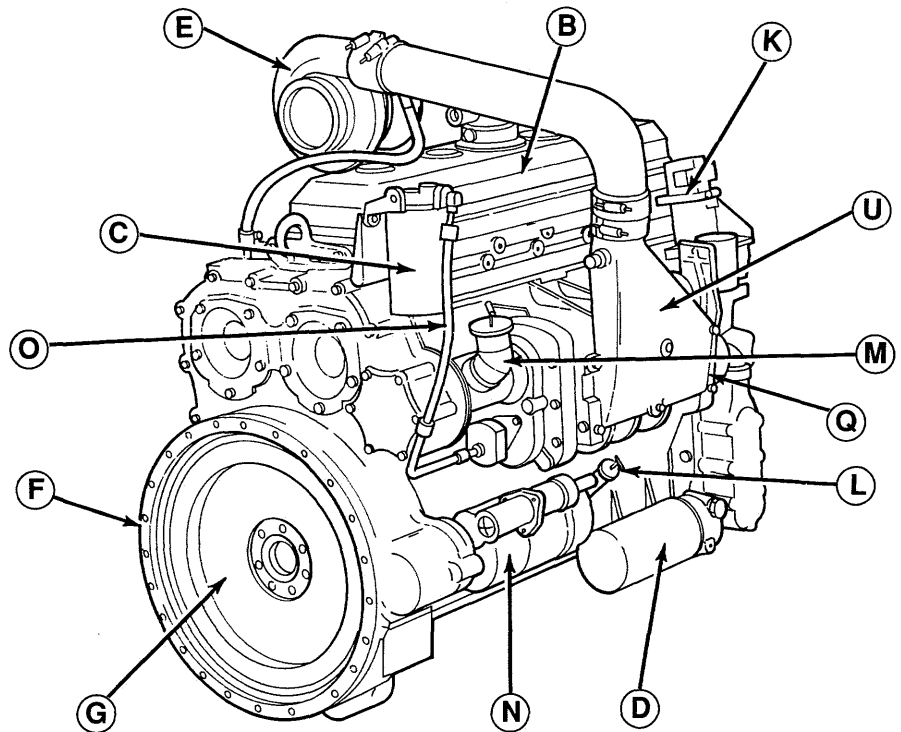
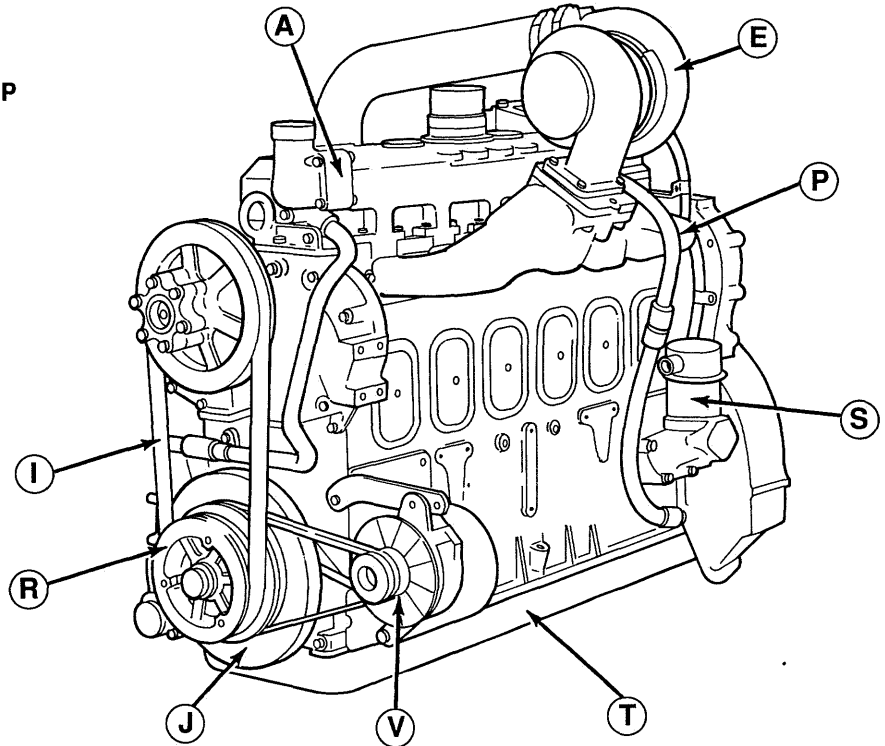
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UNIT 16E0011015 S.O. 7A23990 MODEL 91637416 SPEC ES 17102

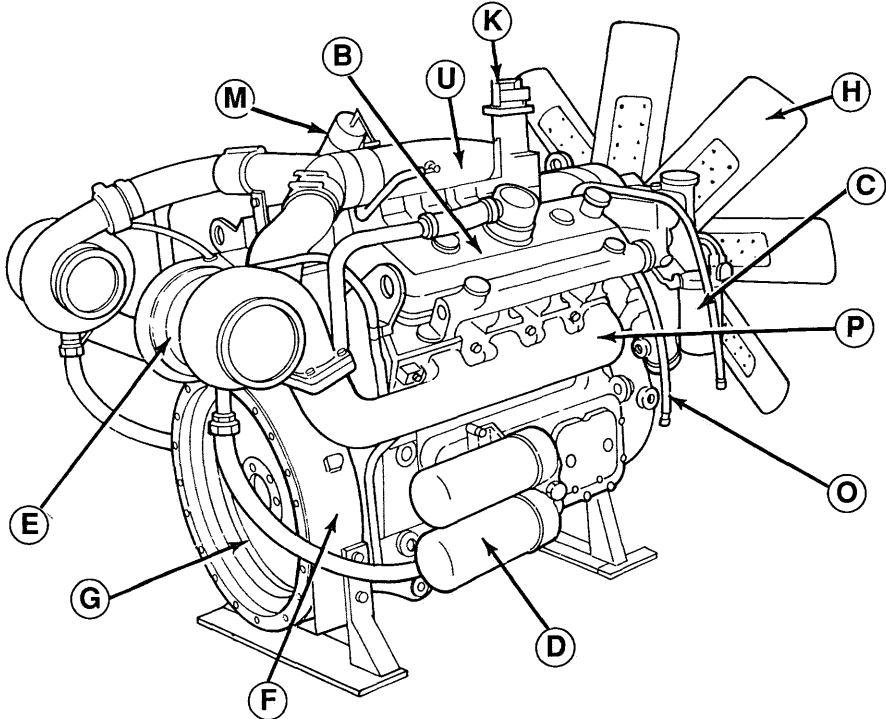
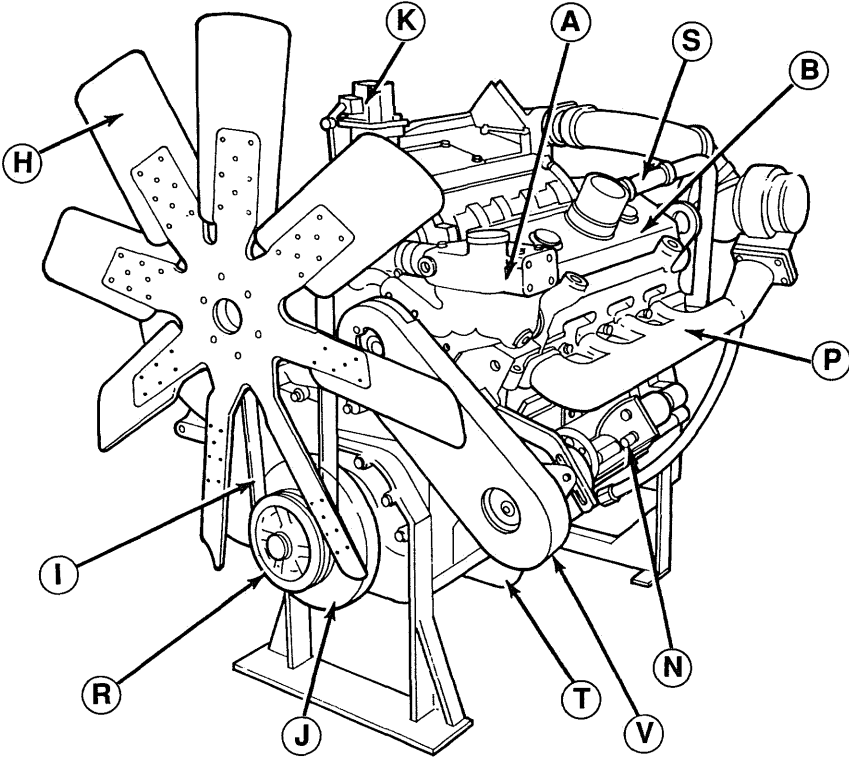
*Typical 16V-149 Option Labels*

## Series 71 (Inline 4/Inline 6)

ITEM	DESCRIPTION	MPC GROUP
A	Thermostat	5.2000B
B	Injector	2.1000A
C	Fuel Filter	2.3000A
D	Oil Filter	4.2000A
E	Turbocharger	3.5000A
F	F/W Housing	1.5000A
G	Flywheel	1.4000A
H	Fan	5.4000A
I	Fan Belt	1.3000D
J	Vibration Damper	1.3000B
K	Governor	2.6000B
L	Oil Dipstick	4.6000A
M	Oil Filler Tube	4.5000A
N	Starter Motor	7.3000A
O	Fuel Lines	2.5000A
P	Exhaust Manifold	6.1000A
Q	Air Box Drain	1.1000A
R	C/S Pulley	1.3000C
S	Breather System	4.8000A
T	Oil Pan	4.7000A
U	Air Inlet Housing	3.3000A
V	Battery Charging Alternator	7.1000A

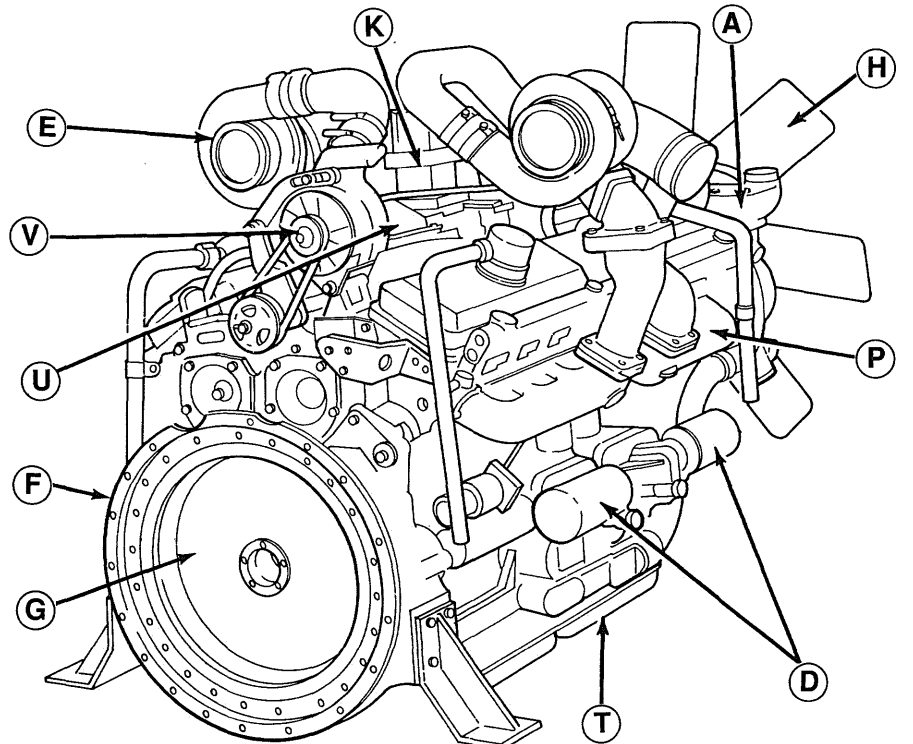
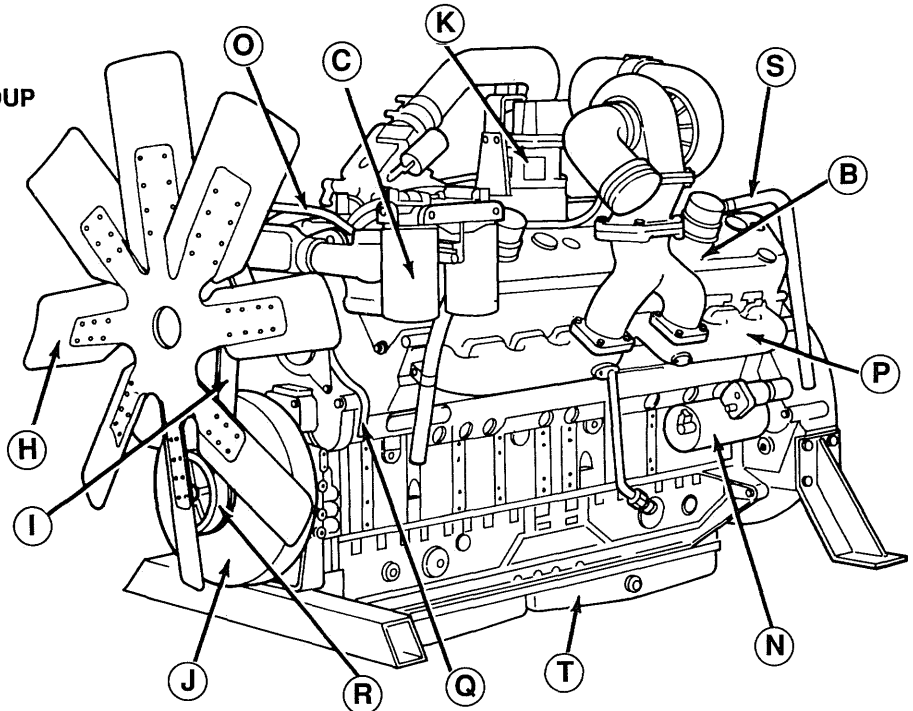


**Series 92 (6V/8V)**

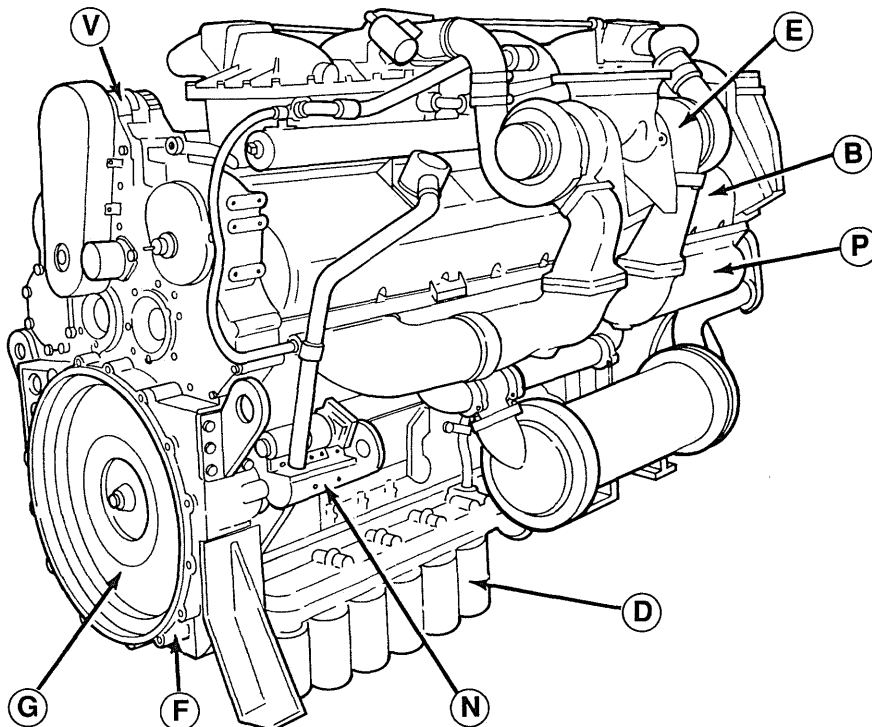
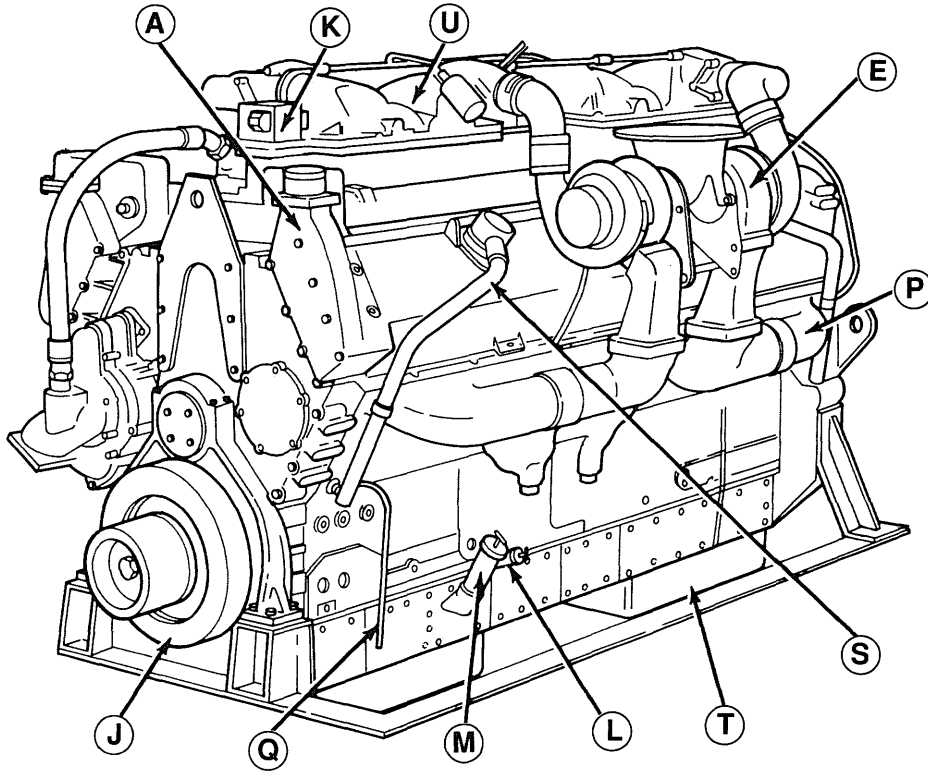


## Series 92 (12V/16V)

ITEM	DESCRIPTION	MPC GROUP
A	Thermostat	5.2000B
B	Injector	2.1000A
C	Fuel Filter	2.3000A
D	Oil Filter	4.2000A
E	Turbocharger	3.5000A
F	F/W Housing	1.5000A
G	Flywheel	1.4000A
H	Fan	5.4000A
I	Fan Belt	1.3000D
J	Vibration Damper	1.3000B
K	Governor	2.6000B
L	Oil Dipstick	4.6000A
M	Oil Filler Tube	4.5000A
N	Starter Motor	7.3000A
O	Fuel Lines	2.5000A
P	Exhaust Manifold	6.1000A
Q	Air Box Drain	1.1000A
R	C/S Pulley	1.3000C
S	Breather System	4.8000A
T	Oil Pan	4.7000A
U	Air Inlet Housing	3.3000A
V	Battery Charging Alternator	7.1000A



### Series 149 (12V/16V)





## 2. GENERATOR SET INSTALLATION FACTORS

### Ventilation

Any internal combustion engine requires a liberal supply of cool, clean air for combustion. If the air entering the engine intake is too warm or too thin, the engine may not produce its rated power. Operation of the engine and generator radiates heat into the room and raises the temperature of the room air. Therefore ventilation of the generator room is necessary to limit room temperature rise and to make clean, cool intake air available to the engine. When the engine is cooled by a set-mounted radiator, the radiator fan must move great quantities of air through the radiator core. There must be enough temperature difference between the air and the water in the radiator to cool the water sufficiently before it recirculates through the engine. The generator set supplier can provide the maximum air temperature limit for which the cooling system is designed. The air temperature at the radiator inlet depends on the temperature rise of air flowing through the room from the inlet ventilator. By drawing air into the room and expelling it outdoors through a discharge duct, the radiator fan helps to maintain room temperature in the desirable range.

In providing ventilation, the objective is to maintain the room air at a temperature that is cool enough for efficient operation and full available power, but not be so cold in winter that engine starting is difficult.

### Circulation

Good ventilation requires adequate flow into and out of the room and free circulation within the room. The room should be of sufficient size to allow free circulation of air so that temperatures are equalized and there are not pockets of stagnant air. The generator set should be located so that the engine intake draws air from the cooler part of the room. If there are two or more electric sets, avoid locating them so that air heated by the radiator of one set flows toward the engine intake or radiator fan of an adjacent set. A typical arrangement for adequate air circulation and ventilation is shown in Figure 1.

### Ventilators

To bring in fresh air, there *should be* an inlet ventilator opening to the outside or at least an opening to another part of the building through which the required amount of air can enter. In smaller rooms, ducting may be used to bring air to the room or directly to the engine's air intake. In addition, an exit ventilator opening should be located on the opposite outside wall, preferably high up, to exhaust warm air. If the exit air ventilator is located in a lower position, sufficient air flow may be generated by convection. Otherwise, a fan must be installed in the exit ventilator.

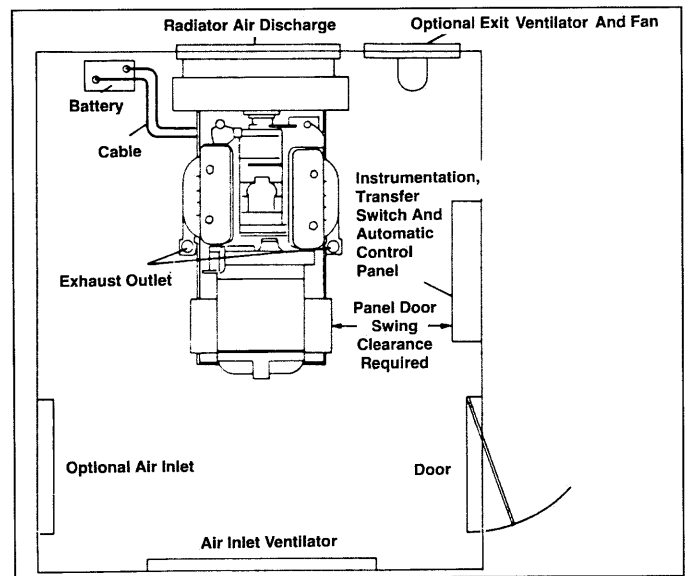


Figure 1. Typical arrangement for adequate air circulation and ventilation

Both the inlet and exit ventilators *should have* louvers for weather protection. These may be fixed but preferably should be movable in cold climates. For automatic-starting electric sets, if the louvers are movable, they should be automatically operated and those on the air inlet ventilator should be programmed to open immediately upon starting the engine. Inlet louvers must be large enough to allow the intake air flow needed for satisfactory engine performance.

The louvers and fan in the exit ventilator may be thermostatically controlled so that the fan operates as needed and louver position is varied in response to room temperature. If the electric set is equipped

with a set-mounted radiator and there is a discharge duct for radiator air, most or all of the air required for room cooling is drawn into the room and discharged outdoors by the radiator fan. In this case the exit ventilator will be quite small (if required at all), and the exit ventilator fan probably will operate to exhaust a portion of the air flow outdoors only when the electric set is operating at high load or when outdoor temperature is high.

The signal for controlling the exit ventilator louvers and fan normally comes from a temperature sensor on a wall of the generator room. If temperatures at the engine are close to specified limits for engine intake or radiator inlet the sensor may be located at one of these points. An economical alternative is to measure temperatures with the electric set operating at maximum load and set the wall thermostat low enough to assure cool air at the engine intake and radiator fan inlet.

### Inlet Ventilator Size

Before calculating the inlet ventilator size, it is necessary to calculate the air flow required to limit the room temperature rise due to radiation when the electric set is operating at its rated load. Total heat radiated by the complete electric set, including the exhaust system in the room, should be taken into account.

Engine and generator heat radiation for engines and generators, when operating at standby rated power, are shown on engine specification sheets. Exhaust system radiation depends on the length of pipe within the room, the type of insulation used, and whether the silencer is located within the room or outside. It may be possible to insulate the exhaust piping and silencer so that heat radiation from this source may be neglected in calculating air flow required for room cooling. Calculate the required air flow using the total heat radiation and any temperature rise that may be accommodated without exceeding temperature limits at the radiator inlet or engine intake. Compare the calculated room ventilation air flow with the total of engine combustion air flow and radiator air flow discharged from the room. The larger flow is the required inlet ventilator air flow.

After determining the required air flow into the room, calculate the size of inlet ventilator opening to be installed in the outside wall. The inlet ventilator

must be large enough so that the flow restriction at a selected air velocity will not generally exceed 0.2 in. H<sub>2</sub>O including the restriction of a screen and louver that may be used in the ventilator. The inlet air flow restriction must be very low, since this restriction adds to the radiator fan loss and to the engine combustion air inlet depression.

Screens, filters and louvers in the ventilators will tend to increase the air flow restriction, therefore the inlet air velocity may have to be reduced by increasing the area of the ventilator. Restriction values of air filters, screens and louvers should be obtained from manufacturers of these items.

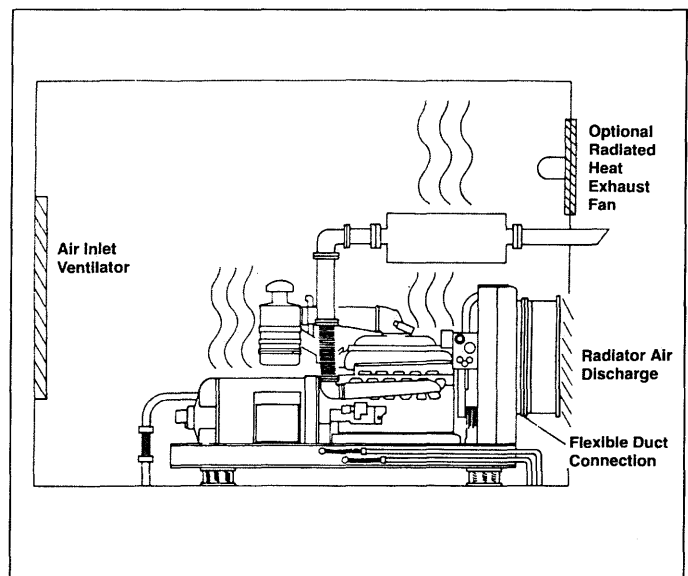


Figure 2. Heat radiation to room

### Exit Ventilator Size

If the engine is cooled by a heat exchanger or remote radiator, the exit ventilator must be large enough to exhaust all of the air flowing through the room except the relatively small amount that enters the engine intake. If the engine is cooled by a set-mounted radiator that discharges air outdoors through a duct, the exit ventilator size is based on that portion of the air flow required for room cooling which exceeds the total of radiator air flow plus combustion air flow. Exit ventilator should be sized to limit the restriction to radiator air flow to no more than 0.3 inches H<sub>2</sub>O.

In some cases the total of radiator and combustion air flow will exceed the air flow required for room cooling—so, no exit ventilator is needed.

## Engine Exhaust

Engine exhaust must be directed to the outside through a properly designed exhaust system that does not create excessive back pressure on the engine. A suitable exhaust silencer should be connected into the exhaust piping, either inside or outside the building. Exhaust system components located within the engine room should be insulated to reduce heat radiation. The outer end of the pipe should have an elbow or U shape and should be equipped with a rain cap to prevent rain or snow from entering the exhaust system. If the building is equipped with smoke detection system, the exhaust outlet should be positioned so it cannot set off the smoke detection alarm.

**CAUTION: Engine exhaust contains elements which may be harmful to persons or property. Exhaust stacks must be properly routed to an outdoor area in compliance with applicable laws and regulations. Keep engine exhaust away from building air inlets.**

### Exhaust Piping

For both installation economy and operating efficiency, engine location should make the exhaust piping as short as possible with minimum bends and restrictions. Usually the exhaust pipe extends through an outside wall of the building and continues up the outside of the wall to the roof. There should be a collar in the wall opening to absorb vibration and an expansion joint in the pipe to compensate for lengthwise thermal expansion or contraction. Another method is to connect the exhaust pipe into a flue or stack (provided local laws permit), thus eliminating the tail pipe that would otherwise run up to the roof. There should be an expansion joint in the pipe and a collar in the stack wall, and inside the stack, the end of the exhaust pipe should be directed upward. Directing the engine exhaust pipe upward avoids reflection of exhaust pulsations from the stack wall back into the exhaust pipe. Such pulsations may affect exhaust back pressure.

When the exhaust is connected into a flue or stack the silencer may be mounted inside the building so the exhaust gas passes through the silencer and then into the stack. The silencer may also be mounted vertically inside the stack. When mounted

vertically inside the stack the silencer need not be insulated but the stack may have to be larger to avoid air flow restriction. In rare cases, connecting into a stack may make it possible to eliminate the silencer since exhaust pulsations might be sufficiently dissipated in a large stack to exit far enough above ground level to be less bothersome.

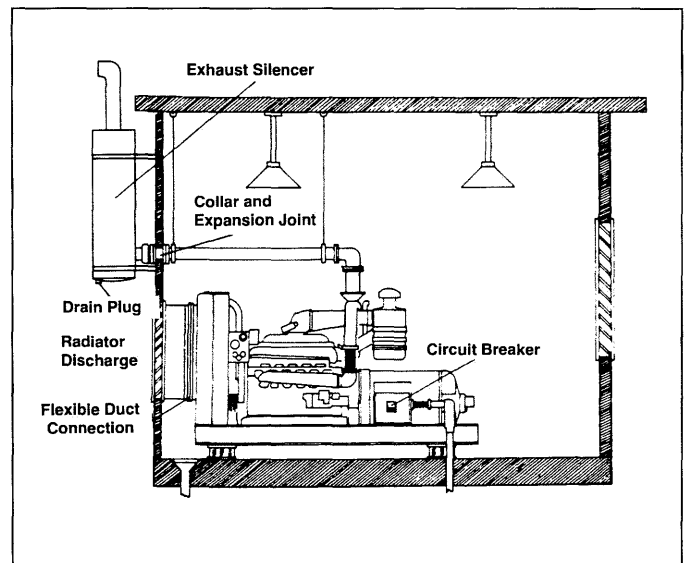


Figure 3. Typical installation outside vertically mounted exhaust

It is not recommended that the engine exhaust share a flue with a furnace or other equipment since there is a possibility that back pressure caused by one will adversely affect operation of the other. In multi-engine installations, do not connect engine exhaust systems together because exhaust gases from an operating engine can migrate back through a non-operating engine and cause severe damage.

The exhaust can be directed into a special stack that also serves as the outlet for radiator discharge air and may be should-insulated. The radiator discharge air enters below the exhaust gas inlet so that the rising radiator air mixes with the exhaust gas. The silencer may be located within the stack, or in the room with its tail pipe extending into the stack, and then upward. Air guide vanes should be installed in the stack to turn radiator discharge air vertically.

## Exhaust Pipe Flexible Section

A flexible connection between the manifold and the exhaust piping system should be used to prevent transmitting engine vibration to the piping and building, and to isolate the engine and piping from forces due to thermal expansion, motion or weight of piping. A well-designed flex section will permit operation with  $\pm 1/2$ -inch permanent displacement in any direction of either end of the section without damage. Not only must the section have the flexibility to compensate for a nominal amount of permanent mismatch between piping and manifold, but it must also yield readily to intermittent motion of the electric set on its spring isolators in response to load changes. The flexible connection should be specified with the electric set.

## Exhaust Pipe Insulation

No exposed parts of the exhaust system should be near wood or other inflammable material. Exhaust piping inside the building should be covered with suitable insulation materials to protect personnel and to reduce room temperature. A sufficient layer of suitable insulating material surrounding the piping and silencer may virtually eliminate heat radiation to the room from the exhaust system. An additional benefit of the insulation is that it provides should attenuation to reduce noise in the room.

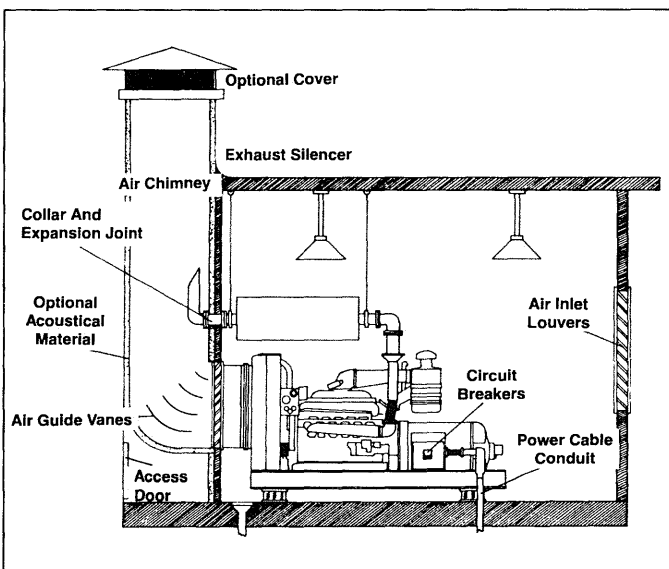


Figure 4. Horizontally mounted exhaust silencer

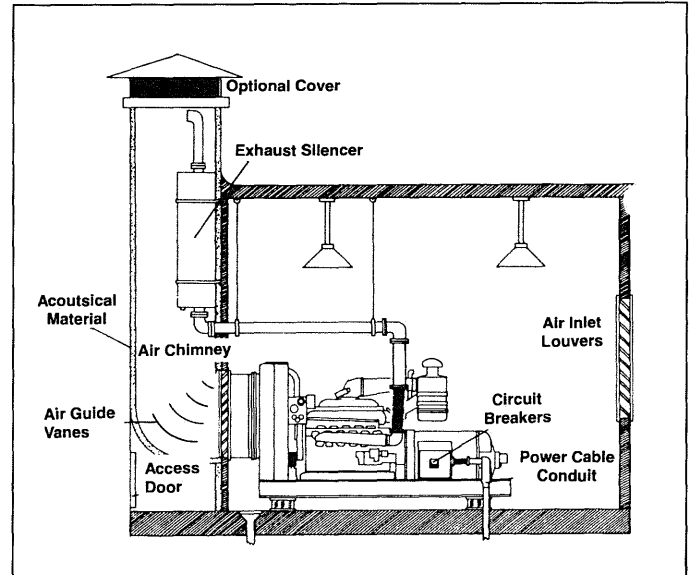


Figure 5. Vertically Mounted Exhaust Silencer

## Minimizing Exhaust Flow Restriction

Free flow of exhaust gases through the pipe is essential to minimize exhaust back pressure. Excessive exhaust back pressure seriously affects engine horsepower output, durability, and fuel consumption. By resisting the discharge of gases from the cylinder it causes poor combustion and higher operating temperatures. The major design factors that may cause high back pressure include:

- Exhaust pipe diameter too small
- Exhaust pipe too long
- Too many sharp bends in exhaust system
- Exhaust silencer restriction too high
- Standing pressure waves (at certain critical lengths).

Excessive restriction in the exhaust system can be avoided by proper design and construction. The effect of pipe diameter, length and the restriction of any bends in the system can be calculated to make sure your exhaust system is adequate without excessive back pressure. The longer the pipe, and the more bends it contains, the larger the diameter required to avoid excessive flow restriction and back pressure. The back pressure should be calculated during the installation planning stage to make certain it will be within the recommended limits for the engine.

When installing a generator set measure the exhaust pipe length from installation layout drawing. Take exhaust flow data and back pressure limits from the generator set engine specification sheet. Allowing for restrictions of the exhaust silencer and any elbows in the pipe, calculate the minimum pipe diameter so that the total system restriction will not exceed the recommended exhaust back pressure limit. Refer to Figure 6 for typical measurement procedure.

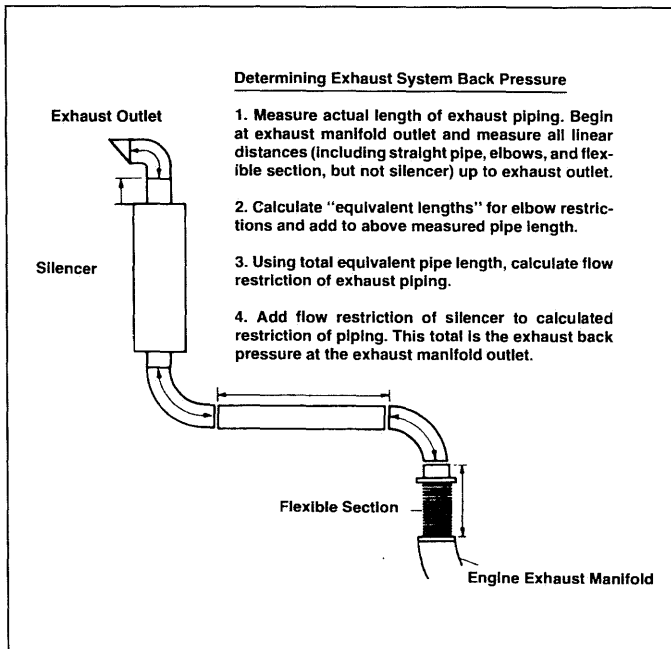


Figure 6. Measuring exhaust pipe length to determine exhaust back pressure

Allowance should be made for deterioration and scale accumulation that may increase restriction over a period of time.

Elbow restriction is most conveniently handled by calculating an equivalent length of straight pipe for each elbow and adding it to the total length of pipe. For a 90 degree elbow the equivalent length of straight pipe can be calculated as follows:

$$L = 2.50 \times D$$

where

L = equivalent of straight pipe, fit  
D = diameter of pipe, inches

The following formulas are used to calculate the back pressure of an exhaust system:

$$P = \frac{CLRQ^2}{D^5}$$

Where:

- P = back pressure in inches of mercury
- C = .00059 for engine airflow\* of 100 to 400 cfm  
= .00056 for engine airflow\* of 400 to 700 cfm  
= .00049 for engine airflow\* of 700 to 2000 cfm  
= .00044 for engine airflow\* of 2000 to 5400 cfm
- L = length of exhaust pipe in feet
- R = exhaust density in pounds per cubic foot
- Q = exhaust gas flow in cubic feet per minute\*\*
- D = inside diameter of exhaust pipe in inches
- R =  $\frac{41.1}{\text{Exhaust temperature } ^\circ\text{F} + 460^\circ}$

\*Engine airflow is combustion air requirement from engine specification sheet

\*\*Available from engine specification sheet

These formulas assume that the exhaust pipe is clean commercial steel or wrought iron. The back pressure is dependent on the surface finish of the piping and an increase in the pipe roughness will increase the back pressure. The constant 41.1 is based on the weight of combustion air and fuel burned at rated load and SAE conditions. See engine specification sheet for exhaust gas temperature and air flow.

## Exhaust Silencing

Excessive noise is objectionable in most locations. Since a large part of the electric set noise is produced in the engine's pulsating exhaust this noise can be reduced to an acceptable level by using an exhaust silencer. The required degree of silencing depends on the location and may be regulated by law. For example, the noise of an engine is objectionable in a hospital area but generally is not as objectionable in an isolated pumping station.

**CAUTION: Excessive noise has been known to adversely affect hearing ability. Use proper ear protection when in the vicinity of the generator set. Note: The set could start at any time, so protection should be worn at all times.**

## Exhaust Silencer Selection

The silencer reduces noise in the exhaust system by dissipating energy in chambers and baffle tubes and by eliminating wave reflection that causes resonance. The silencer is selected according to the degree of silencing required by the site conditions and regulations. The size of silencer and exhaust piping should hold exhaust back pressure within limits recommended by the engine manufacturer.

Silencers are rated according to their degree of silencing “low degree” or “commercial,” “moderate” or “semi-critical,” and “high degree” or “critical.”

- Low-Degree or Commercial Silencing—Suitable for industrial areas where background noise level is relatively high or for remote areas where partly muffled noise is permissible.
- Moderate-Degree of Semi-Critical Silencing—Suitable for localities where moderately effective silencing is required, such as semi-residential areas where a moderate background noise is always present.
- High-Degree or Critical Silencing—Provides maximum silencing for residential, hospital, school, hotel, store, apartment building and other areas where background noise level is low and generator set noise must be kept to a minimum.
- Cost is lowest for commercial silencers and highest for high-degree silencers. The high-degree type is most often required for generator set applications.

Silencers are normally available in two configurations:

Silencers with end inlet and end outlet

Silencers with side inlet and end outlet

This choice provides flexibility of installation, such as horizontal or vertical, above engine, on outside wall, etc. The side-inlet type permits 90 degree change of direction without using an elbow. Both silencer configurations should contain drain fittings in locations that assure the silencer can be drained in whatever attitude it is installed.

The silencer may be located close to the engine, with exhaust piping leading to the outside; or it may be located outdoors on the wall or roof. Locating the silencer close to the engine affords best overall noise attenuation because of minimum piping.

Servicing and draining the silencer is likely to be more convenient when it is located indoors, however, mounting the silencer outside has the advantage that it may not need to be insulated. The job of insulating piping within the room is simpler when the silencer is outside, and the insulation can aid noise attenuation.

Regardless of where it is mounted, the silencer must be adequately supported so its weight is not applied to the engine’s exhaust manifold or turbocharger. The silencer must fit into the space available without requiring extra bends in the exhaust piping as these could cause high exhaust back pressure.

Silencers or exhaust piping within reach of personnel should be protected by guards or insulation. Indoors, it is preferable to insulate the silencer and piping because the insulation not only protects personnel, it also reduces exhaust system noise. Silencers mounted horizontally should be set at a slight angle with a drain fitting at the lowest point to allow the disposal of any accumulated moisture.

## Sound-Attenuation

If noise level must be limited, it should be specified in terms of maximum allowable free-air dbA at certain points one meter away from the electric set, when tested under conditions as defined in the Engine Manufacturers Association Procedure for Engine Sound Measurement. Then the power room installation must be designed to hold actual noise inside or outside the room to an acceptable level. Don’t attempt to make this noise level unnecessarily low, because the means of achieving it may be too costly.

Use of resilient mounts for the generator set plus normal techniques for controlling exhaust, intake and radiator fan noise, should reduce noise to an acceptable level for many installations. If the remaining noise level is still too high, acoustic treatment of either the room or the electric set is necessary. Sound barriers can be erected around the set, or the walls of the generator room can be sound-insulated, or the electric set can be enclosed in a specially developed sound-insulated hood.

When it is desirable to protect operating personnel from direct exposure to electric set noise, the instruments and control station may be located in a separate sound-insulated control room.

Noise transmitted outside the building by the engine exhaust and radiator discharge can be reduced by having them discharge into a stack lined with noninflammable acoustic material. A lined canopy above the stack reflects noise back into the stack and keeps out rain and snow.

## Engine Cooling

A diesel engine is cooled by circulating a liquid coolant through the oil cooler and through passages in the engine block and head. Hot coolant emerging from the engine is cooled, then recirculated through the engine. Cooling devices are commonly coolant-to-air (radiator) or coolant-to-raw water (heat exchanger) types.

In the most common electric set installation, the engine coolant is cooled in a set-mounted radiator with air blown through the radiator core by an engine driven fan. Some installations use a remotely mounted radiator cooled by an electric motor-driven fan. Where there is a continuously available supply of clean, cool raw water, a heat exchanger may be used instead of a radiator. The engine coolant circulates through the heat exchanger and is cooled by the raw water supply.

An important advantage of a radiator cooling system is that it is self-contained. If a storm or accident disrupted the utility power source it might also disrupt the water supply and disable any electric set whose supply of raw water depended upon a utility.

Whether the radiator is mounted on the electric set or mounted remotely, accessibility for servicing the cooling system is important. For proper maintenance, the radiator fill cap, the cooling system drain cocks, and the fan belt tension adjustment must all be accessible to the operator.

### Set-Mounted Radiator

A set-mounted radiator is mounted on the electric set base in front of the engine. An engine-driven fan blows air through the radiator core, cooling the liquid engine coolant flowing through the radiator. A typical set mounted radiator system is illustrated in Figure 7.

Set-mounted radiators are of two types. One type is used with the cooling fan mounted on the engine. The fan is belt-driven by the crankshaft pulley in a two point drive. The fan support bracket, fan spindle

and drive pulley in order to maintain proper belt tension. The fan blades project into the radiator shroud which has sufficient tip clearance for belt tension adjustment.

The other type of set-mounted radiator consists of an assembly of radiator, fan, drive pulley and adjustable idler pulley to maintain belt tension. The fan is mounted with its center fixed in a venturi shroud with very close tip clearance for high-efficiency performance. The fan drive pulley, idler pulley and engine crankshaft pulley are precisely aligned and connected in a three-point drive by the belts. This second type of set-mounted radiator is usually much quieter and more efficient than the first type. However, it is usually more expensive.

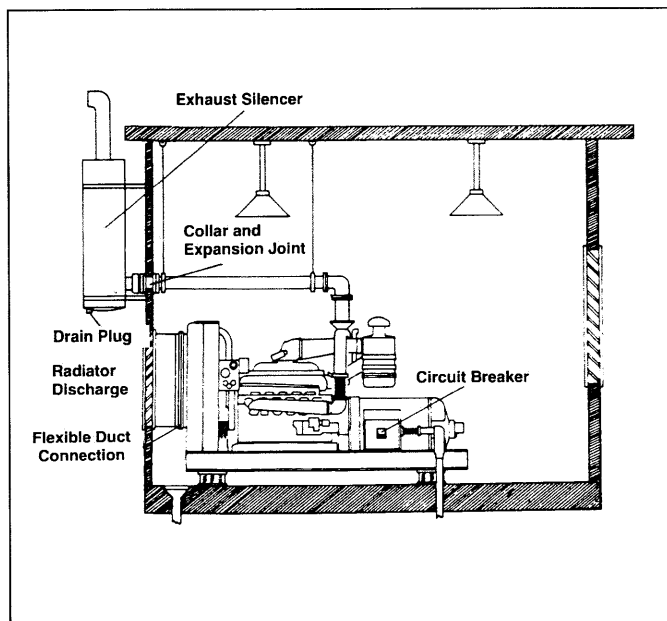


Figure 7. Typical set-mounted radiator

The proper radiator and fan combination will be provided by your Detroit Diesel Distributor and furnished with the generator set. Air requirements for cooling a particular Detroit Diesel Engine are given in the specification sheet. The radiator cooling air must be relatively clean to avoid clogging the radiator core. Adequate filtration of air flowing into the room should assure relatively clean air. However, if the air at the site normally contains a high concentration of dirt, lint, sawdust, or other matter, the use of a remote radiator, located in a cleaner environment, may alleviate a core clogging problem.

The discharge air from a set mounted radiator should flow *directly* outdoors through a duct that connects the radiator to an opening in an outside wall. The engine should be located as close to the outside wall as possible to keep the ducting short. If the ducting is too long, it may be more economical to use a remote radiator. The total air flow restriction downstream of the radiator should not exceed 0.3 in. H<sub>2</sub>O.

When the set mounted radiator is to be connected to a discharge duct, a duct adapter should be specified for the radiator. A duct adapter is simply a framework around the air discharge side of the radiator core area whose edges are perpendicular to the frontal plane of the radiator. The adapter may contain a series of holes to facilitate attaching one end of a flexible duct section to the front of the radiator. A length of flexible duct material (rubber or suitable fabric) between the radiator and the fixed discharge duct is required to isolate vibration and provide freedom of motion between the electric set and the fixed duct.

**NOTICE:** The discharge air must not be permitted to recirculate through the radiator. Hot discharge air provides no cooling ability when directed through the radiator.

### **Remote Radiator**

A remote radiator with electric motor-driven fan can be installed in any convenient location away from the electric set. The fan may be driven by a thermostatically controlled motor which will only draw power from the electric set when required to cool the engine.

A well-designed remote radiator has many useful features and advantages that provide greater flexibility of electric set installations in buildings. For example, remote radiators might eliminate the need for radiator air ducts through the engine room wall and a more efficient venture shroud and fan can provide substantial reduction in horsepower required for engine cooling.

A remote radiator, located outdoors where there is less air flow restriction and air cooler than engine room air, may result in higher efficiency by allowing use of a smaller size radiator.

Remote radiators must be connected to the engine

cooling system by coolant piping, including flexible sections between engine and piping. The higher cost of a remote radiator may be substantially offset by its higher efficiency and by the deduction of fan, mounting parts, belts and crankshaft pulley from the engine.

### **Remote Radiator/Hot Well System**

In order to reduce the static head on the engine coolant system or to reduce the cost of antifreeze in a large system, a remote radiator mounted on the roof or another elevated location may be isolated from the engine by a hot well or mixing tank. The hot well is divided by a baffle into a hot side and a cold side. The baffle is perforated to permit enough flow between the two sides so that circulation through the radiator can be maintained and overflow avoided during engine warm-up when the engine thermostat shuts off flow to the hot side of the well.

The engine water pump draws coolant from the cold side and returns it from the engine to the hot side. A separate pump circulates coolant from the hot side of the hot well through the remote radiator and returns it to the cold side. See Figure 8.

When the engine is not operating, coolant drains from the remote radiator into the hot well, located inside the building, and thus avoids freezing in winter. The hot well or another isolation method must be used if the static head exceeds 50 feet. The hot-well tank must have sufficient capacity to store all of the coolant which drains back when the engine is not operating.



### Remote Radiator/Heat Exchanger System

Another type of remote radiator system employs a heat exchanger at the engine in place of the hot well. In this application the heat exchanger functions as an intermediate heat exchanger to isolate the

engine coolant system from the high static head of the remote radiator coolant. The engine pump circulates engine coolant through the engine and the element of the heat exchanger. A separate pump circulates radiator coolant between the remote radiator and the heat exchanger tank.

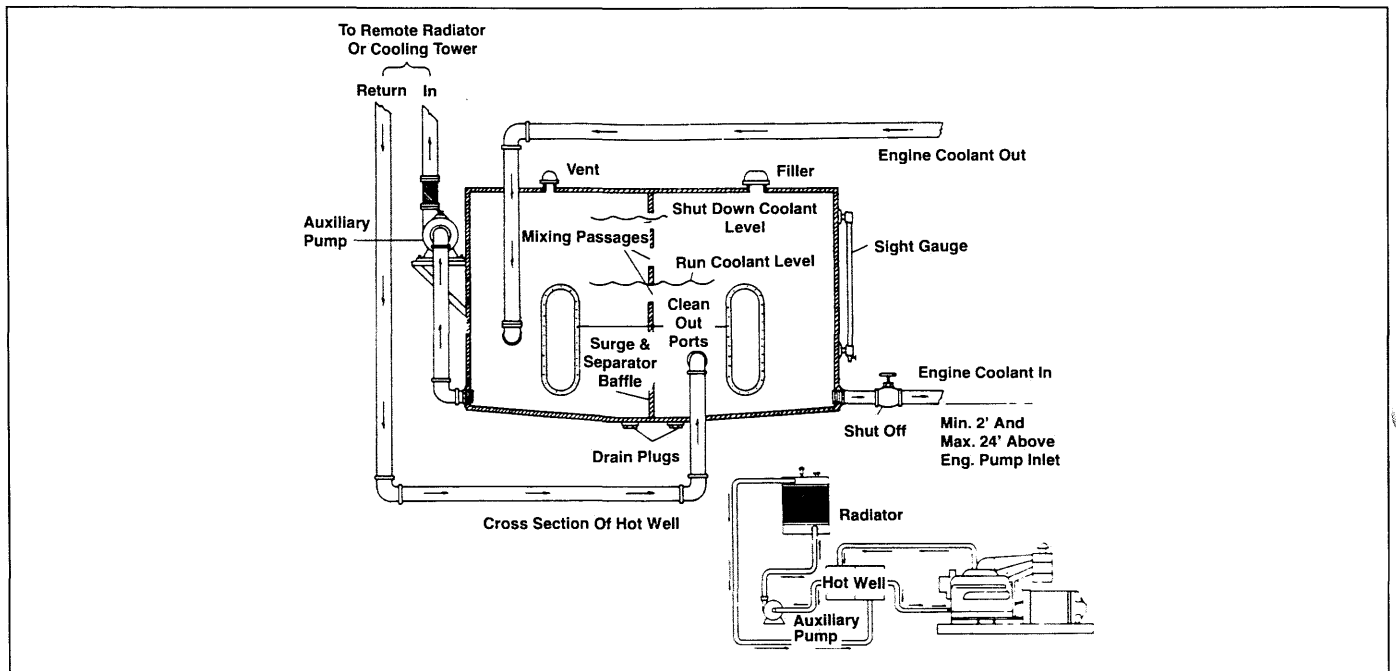


Figure 8. Typical remote radiator/hot well system

## 3. ENGINE SYSTEMS

### Fuel System

The fuel system consists of the fuel injectors, fuel pipes, fuel manifolds (integral with the cylinder head on Series 71 and 92 engines, external on Series 149 engines), fuel pump, fuel strainer, fuel filter, and the necessary connecting fuel lines.

A fuel/water separator and filter are used in the fuel system to remove impurities from the fuel. The filter (marked "S" for secondary filter) removes the smaller particles.

### Lubrication System

The lubricating oil system consists of an oil pump, oil cooler, full flow oil filter(s), bypass valves at the oil cooler and filter(s), and pressure regulator valves at the lube oil pump and in the cylinder block main oil gallery.

### Air System

In the air system used on Detroit Diesel engines, outside air drawn into the engine passes through the air filter and is pulled into the turbocharger, where it is compressed. It then moves through the blower, where it is further compressed. An intercooler before the blower or an aftercooler after the blower may be used to further increase the density of the charge. The air then flows into the cylinders, where it mixes with atomized fuel from the injectors.

Dry type air cleaners should be used on turbocharged Detroit Diesel engines. For optimum protection of the engine from dust and other airborne contaminants, service these air cleaners when the maximum allowable air restriction has been reached, or annually.

### Cooling System

Radiator or heat exchanger/raw water pump cooling systems are used on Detroit Diesel generator set engines. Each system has a centrifugal type fresh water pump to circulate coolant within the engine. Each system also incorporates thermostats to maintain normal engine operating temperature.

### General Cooling System Design Criteria

It is important for the operator to understand that many factors must be considered when designing the overall cooling system. In order to meet minimum standards the following guidelines are presented for radiator (air to coolant) cooled applications.

**Heat Sources**—Total heat rejected to the coolant must be determined to properly size the radiator and fan arrangement so sufficient heat can be dissipated. This allows the thermostat(s) to control the coolant temperature at an optimum operating level. The cooling system must be able to control maximum engine coolant temperature regardless of the mode of operation.

Factors or components that will raise the temperature of the radiator inlet air or increase restriction to air flow must also be considered when selecting a radiator and fan:

- Engine radiated heat (blower fans)
- Generator radiated heat
- Exhaust system radiated heat
- Recirculated radiator discharge air
- Generator set room configuration

**Engine Operating Temperatures**—As a general rule the engine coolant-out temperature under normal operating conditions, will range from 10°F below to 15°F above the start to open temperature of the thermostat(s). The temperature differential between the engine coolant in and out is typically 10°F (5.5°C) at maximum engine speed and load. Maximum allowable engine coolant-out temperature is 210°F (200°F for Series 149 engines). This limit is necessary to control oil temperatures.

The engine coolant temperature rise and radiator coolant temperature drop values will be different whenever the engine and radiator flow rates are not the same or when auxiliary coolers are placed between the engine and the radiator.

**Environmental and Operating Conditions**—Both environmental and operating modes of the installation must be considered when designing the cooling system. Additional reserve capacity and special selection of components may be required for operation in the following cases:

- Extreme hot or cold ambient temperatures
- High altitude
- Arid, damp, dusty, oily windy conditions
- Long term idle, full load operation
- Long term storage or standby operation
- Indoor/outdoor operation
- Serviceability limitations
- Infrequent maintenance intervals
- Severe shock or vibration

When engine performance is reduced due to external conditions, the heat rejected to the coolant

generally increases. Engine performance is adversely affected by:

- High air inlet restriction
- High exhaust back pressure
- Elevated air inlet temperature
- Altitude

Operation in extremely cold ambients, at light loads, and/or during idling will require conservation of heat energy. Coolant temperatures must be maintained near the thermostat opening value to control engine oil at a satisfactory temperature level for good engine performance and reliability.

The cooling system ability to dissipate heat to the atmosphere is poorer with increased altitude operation because air density is less. This increases the cooling index (ATW) by 2°F (1.1°C) per 1000 feet (305m).

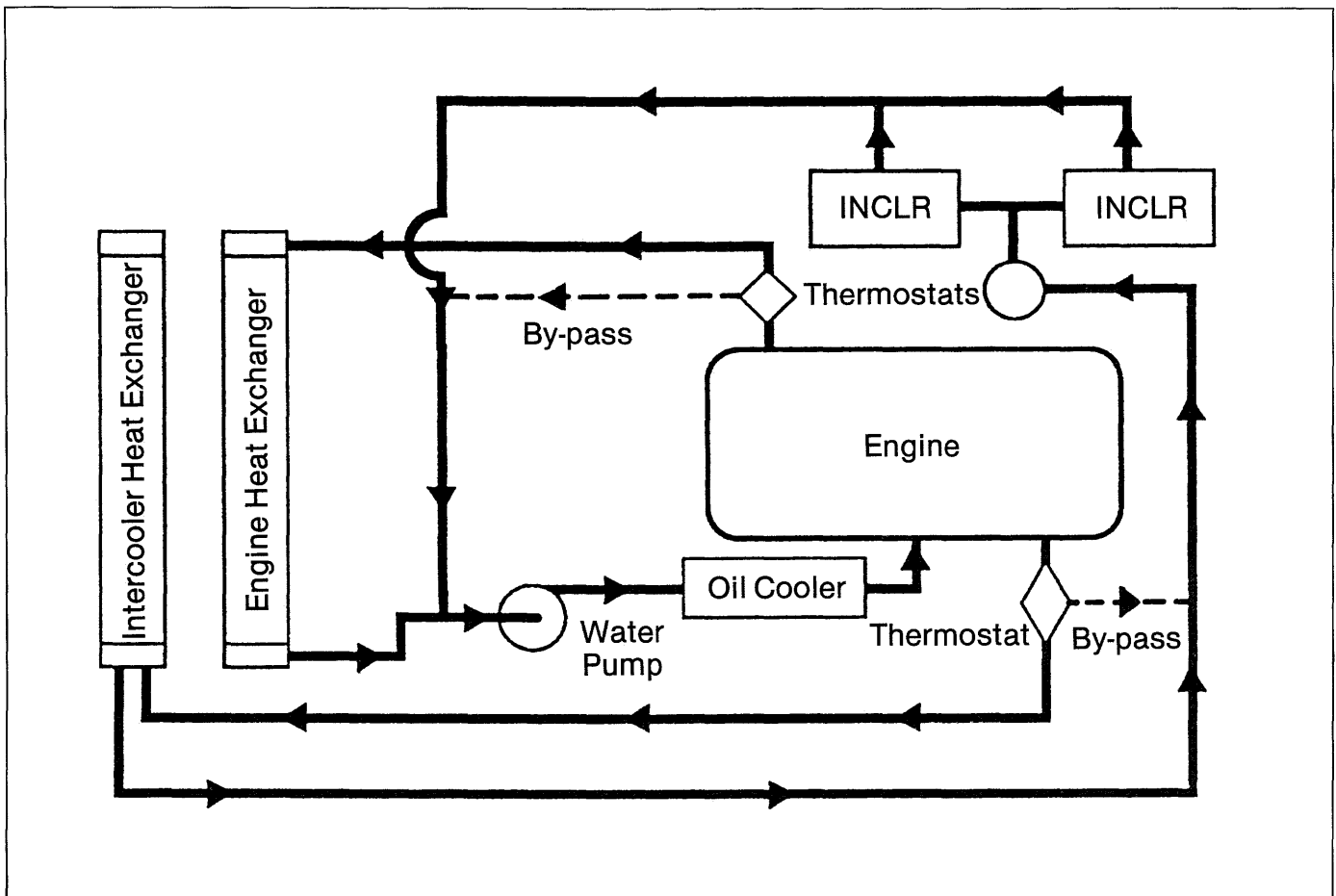


Figure 9. Integrated Liquid Charge Cooling Design Schematic

**System Coolant Capacity**—Total cooling system coolant capacity must be known in order to provide adequate expansion volume to the deaeration tank. The total capacity must include the basic engine, radiator, heater circuit, plumbing, etc. A minimum 6% expansion volume (Figure 9) must be provided in the deaeration tank along with a 2% deaeration volume and sufficient reserve volume to meet drawdown capacity.

A combined minimum 8% expansion and deaeration volume must be provided in a coolant recovery bottle whenever used with the cooling system.

Basic engine coolant capacity is shown in the "Specifications" chart on page 46.

**Integrated Liquid Charge Cooling (ILCC)**—The ILCC cooling system (Figure 9) is required for the higher horsepower Series 149 engines. This system utilizes a single engine water pump and separate radiators to cool engine and intercooler coolant. Radiator manufacturers refer to the system as two circuit, split flow, separate circuit cooling, advance charge cooling, etc. Improved fuel economy and engine life are benefits of this system. Approximately 15% of the total water pump flow is diverted from the left side front cylinder block to a separate radiator. This radiator can experience water pressure up to 40 psig. Air box temperature is sensed to control the amount of coolant flow to this radiator. This radiator gives a large coolant temperature drop and the cooled coolant is routed directly to the intercoolers for improved charge air cooling.

Two fan clutch control switches are required when using an on/off or thematic fan. One switch must sense the intercooler radiator coolant out temperature and cause the fan to engage at  $125^{\circ}\text{F} \pm 5^{\circ}\text{F}$  ( $52^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ). The other switch must sense engine coolant out temperature (before thermostats) and engage fan  $1^{\circ}\text{F}$  ( $5.6^{\circ}\text{C}$ ) after thermostat start to open temperature.

**Jacket Water After Cooling (JWAC)**—In JWAC V-92 models, coolant circulates from the water pump through the oil cooler, to the cylinder block where approximately 10% is shunted to the aftercooler and returned to the left-bank thermostat housing. In in-line 71 JWAC models, the coolant circulation is from the cylinder block through the aftercooler and to the cylinder head.

Inlet air is compressed by the turbocharger and directed to the blower. After passing through the blower, the air travels through the aftercooler. "Air in" is cooled from over  $300^{\circ}\text{F}$  ( $148^{\circ}\text{C}$ ) to approximately  $200^{\circ}\text{F}$  ( $93.3^{\circ}\text{C}$ ) at  $85^{\circ}\text{F}$  ( $29.4^{\circ}\text{C}$ ) ambient temperature under full-load conditions. The cool, dense air then travels from the aftercooler into the air box and cylinders for combustion. Other aspects of the JWAC in-line 71 and Series 92 cooling systems are identical to the standard non-aftercooled engines.

**Jacket Water Heaters**—are used to keep coolant temperatures high enough to prevent excessive smoke on start up. These units are often mounted on the base frame of the generator set.

## Electrical System

The electrical system generally consists of a starting motor, starting switch, battery-charging alternator, storage batteries, and the necessary wiring.

## Governing System

Speed governors automatically control the fuel input to Detroit Diesel engines so as to maintain a given speed such as 1800 RPM or 1500 RPM. The governing of speed becomes more difficult as we try to govern more precisely and quickly as required for generator set applications.

Mechanical governors contain a speed sensing element (ball arms or fly weights) and a desired speed element (the speeder spring), and compare the two through the pilot valve position.

The electronic governor uses a speed sensor consisting of a magnetic pickup, mounted on the flywheel housing or the cam gear cover. As the gear teeth pass by the end of the magnetic sensor, an AC sine wave is generated. The frequency of the signal is proportional to engine speed. The AC signal is rectified (changed to DC). The actual speed signal is a DC voltage, the amplitude of which is proportional to desired speed. The electronic governor's actuator then meters the proper amount of fuel to maintain the desired speed. A mechanical, hydraulic, electric or electronic governor may be installed on the engine.

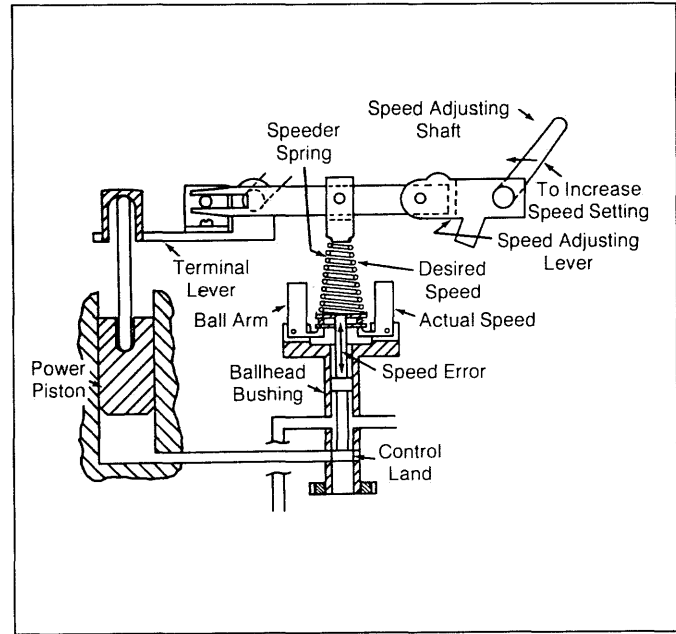


Figure 11. Schematic for Typical Mechanical Governor

## Exhaust System

Hot exhaust gas flowing from the exhaust manifold(s) into the exhaust riser(s) is used to drive the turbocharger(s). Exhaust gases are then vented to atmosphere. See Section 2 for more detailed information on engine exhaust systems.

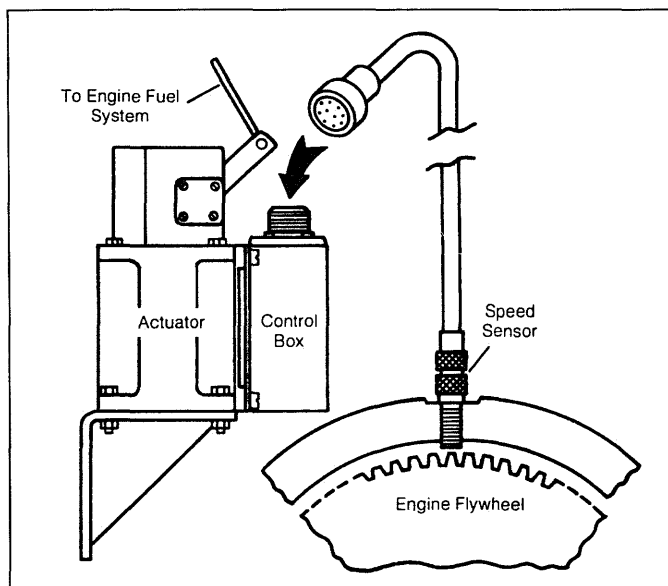


Figure 10. Schematic for Typical Electronic Governor

## 4. LUBRICATION AND PREVENTIVE MAINTENANCE INTERVALS

The following is intended as a guide for establishing preventive maintenance intervals. The recommendations given should be followed as closely as possible to obtain long life and optimum performance from Detroit Diesel engines. Intervals indicated on the chart are time (hours) of actual operation.

The intervals shown apply only to the maintenance functions described. These functions should be coordinated with other regularly scheduled maintenance.

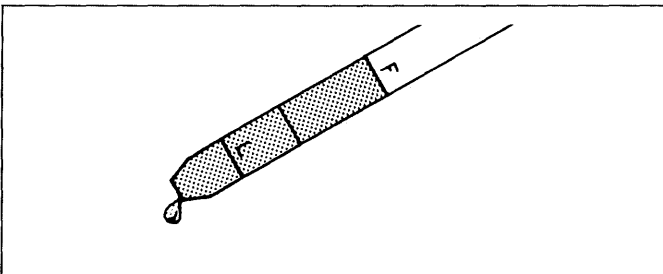
The "monthly" instructions are as required by NFPA code and are recommended by Detroit Diesel Corporation. The "daily" instructions are for prime power generator sets. They do not apply to a new engine or one that has not been operated for a considerable period of time. For new or stored engines, refer to the appropriate engine service manual. Follow instructions given under **Preparations for Starting the Engine the First Time** (Section 5).

**Refer to pages 31-32 for detailed preventive maintenance recommendations.**

Preventive maintenance other than the "daily" check should be performed by *authorized Detroit Diesel service outlets*. DDC outlets have the trained personnel and special tools to properly perform these services.

### Item 1 - Lubricating Oil

Check the oil level, monthly for standby or daily for prime power generator sets, with the engine stopped. If necessary, add sufficient oil to raise the



Check oil level with engine stopped

level to the proper mark on the dipstick. All diesel engines are designed to use some oil, so the periodic addition of oil is normal.

**NOTICE:** If the oil level is constantly above normal and excess lube oil has not been added to the crankcase, consult with an *authorized Detroit Diesel service outlet* for the cause. Fuel or coolant dilution of lube oil can result in serious engine damage.

For lubricating oil change intervals, refer to "When to Change Oil" in the **How To** section of this guide. Before adding lube oil, refer to "How to Select Lubricating Oil" in the **How To** section.

### Item 2 - Lubricating Oil Filter

Lubricating oil filters should be changed whenever the engine oil is changed. Before changing filters, refer to "How to Replace the Lube Oil Filter" in the How To section of this guide. Refer to "Specifications" (page 45) for required filter part number.

### Item 3 - Oil Pressure

Under normal operation, oil pressure is noted each time the engine is started as well as during load test. Check and record pressure every 700 hours for Series 71 and 92 engines or every 250 hours for Series 149 engines.

### Item 4 - Fuel/Water Separator, Filter

Drain water from fuel/water separator daily or as required. Primary and secondary fuel filters should be replaced according to PM chart on pages 31-32, or annually, whichever comes first (or sooner if plugging is indicated). Only those filters shown on page 45 should be used. Before changing filters, refer to "How to Replace the Fuel Filter and Strainer" in the **How To** section of this guide. The addition of aftermarket supplemental filtration systems may be used provided they do not replace the factory installed system nor reduce oil volumes or fuel pressures delivered to the engine.

## Item 5 - Fuel and Fuel Tank

Before adding fuel, refer to "How To Select Fuel Oil" in the **How To** section of this guide.

Keep the fuel tank filled to reduce condensation. Condensation formed in a partially filled tank promotes the growth of microorganisms that can clog fuel filters and restrict fuel flow. To prevent microbe growth add a biocide to the fuel tank or primary fuel supply. Follow manufacturer's usage, handling, and safety recommendations.

Water accumulation can be controlled by installing a fuel/water separator. Drain accumulated water as necessary. Water can also be controlled by mixing isopropyl alcohol into the fuel oil at a ratio of one pint (0.5 liter) per 125 gallons (473 liters) fuel (or 0.10% by volume).

**NOTICE:** A galvanized steel tank should *never* be used for fuel storage, because the fuel oil reacts chemically with the zinc coating to form powdery flakes which can quickly clog the fuel filters and damage the fuel pump and injectors.

## Item 6 - Fuel Lines, Flexible Hoses

**Pre-Start Inspection.** Check hoses as part of the pre-start inspection. Examine hoses for leaks, and check all fittings, clamps, and ties carefully. Make sure that hoses are not resting on or touching shafts, couplings, heated surfaces including exhaust manifolds, any sharp edges, or other obviously hazardous areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as required.

Investigate leaks immediately to determine if fittings have loosened or cracked or if hoses have ruptured or worn through. Take corrective action immediately. Leaks are potentially detrimental to machine operation and will result in added expense caused by the need to replace lost fluids.

**CAUTION:** Personal injury and/or property damage may result from fire due to the leakage of flammable fluids such as fuel or lube oil.

**Service Life.** A hose has a finite service life. With this in mind, all hoses should be thoroughly inspected at least every 500 operating hours (1,000 hours for fire-resistant fuel and lubricating oil hoses) and/or annually. Look for cover damage and/or indications of twisted, worn, crimped, brittle, cracked, or leaking lines. Hoses with their outer cover worn through or damaged metal reinforcement should be considered unfit for further service.

All hoses in and out of machinery should be replaced during major overhaul and/or after a maximum of five years of service. Fire resistant fuel and lube oil hose assemblies do not require automatic replacement after five years service or at major overhaul.

## Item 7 - Turbocharger, Exhaust Connections

Visually inspect the mountings, intake and exhaust ducting and connections for leaks daily. Check the oil inlet and outlet lines for leaks or restrictions to oil flow. Check for unusual noise or vibration and, if excessive, stop the engine and do not operate until the cause is determined.

The exhaust manifold retaining nuts, exhaust flange clamp, and other manifold connections should also be checked for leakage and tightened, if necessary.

Check heat-insulating exhaust system, turbocharger, and turbocharger riser blankets for damage daily. Torn, matted, crushed, oil-soaked, or otherwise damaged insulation blankets **must** be replaced immediately.

**CAUTION:** A special screen assembly is installed over the compressor inlet housings of all blower-mounted and front center-mounted turbochargers used on V-53, V-71, and Series 92 engines. The screen assembly protects the service technician from the exposed turbocharger compressor wheel when the engine must be operated with the air inlet piping removed.

*The screen assembly, if applicable, forms a permanent part of the compressor inlet housing and must not be removed. Removing the screen assembly will*

result in a potential safety hazard created by the exposed rotating compressor wheel. Removing the screen assembly will also damage the assembly and the aluminum compressor housing. A damaged screen assembly or housing cannot be reused.

## **Item 8 - Battery**

**CAUTION: To avoid possible personal injury and/or engine damage from accidental engine startup, always disconnect the battery before servicing the electrical system. To avoid alternator damage when removing battery connections, disconnect the negative (-) terminal first. Reconnect the negative terminal last.**

Check the hydrometer "eye" of maintenance-free batteries for charge.

If lead-acid or low maintenance batteries are used, check the specific gravity of each cell every 150 hours. Check more frequently in warm weather due to the more rapid loss of water through evaporation. Maintain the electrolyte level according to the battery manufacturer's recommendations, but do not overfill. Overfilling can cause poor performance or early failure.

Keep the terminal side of the battery clean. When necessary, wash with a solution of baking soda and water. Rinse with fresh water. Do not allow the soda solution to enter the cells.

Inspect the cables, clamps, and hold-down brackets regularly. Clean and reapply a light coating of petroleum jelly when needed. Have corroded or damaged parts replaced. Keep batteries fully charged. Replace any battery that fails to hold a charge.

Periodically check battery connections for corrosion and tightness. If necessary, remove connections and wire brush any corrosion from terminals and cable ends. Replace damaged wiring.

## **Item 9 - Battery Charging Alternator**

Every 700 hours for Series 71 and 92 or 250 hours for Series 149 engines, terminals should be checked for corrosion and loose connections and wiring inspected for damaged or frayed insulation. Have wiring repaired or replaced as required.

Precautions must be taken when working on or around the alternator. The diodes and transistors in the alternator circuit are very sensitive and can be easily destroyed.

1. Avoid grounding the output terminal. Grounding an alternator's output wire or terminal (which is always *hot*, regardless of whether or not the engine is running) and accidentally reversing the battery polarity will result in equipment damage.
2. Do not reverse battery connections. This can also cause damage.
3. Never disconnect the battery while the alternator is operating. Disconnecting the battery can result in damage to the alternator diodes. In marine applications which have two sets of batteries, switching from one set to the other while the engine is running will momentarily disconnect the batteries. *This can result in equipment damage.*
4. If a booster battery is to be used, batteries must be connected correctly (negative to negative, positive to positive) to avoid equipment damage.
5. Never use a fast charger with the batteries connected or as a booster for battery output.

## **Item 10 - Air Cleaners**

A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine. This, in turn, can result in high operating temperatures, increased fuel consumption, inefficient engine operation, and engine malfunction or damage.



Dry type air cleaner elements (if used) should be replaced with new elements after one year of service or when the restriction indicator or manometer shows that the *maximum allowable air intake restriction* has been reached, whichever comes first. Check restriction indicator daily for prime power applications and monthly or at load test for standby applications.

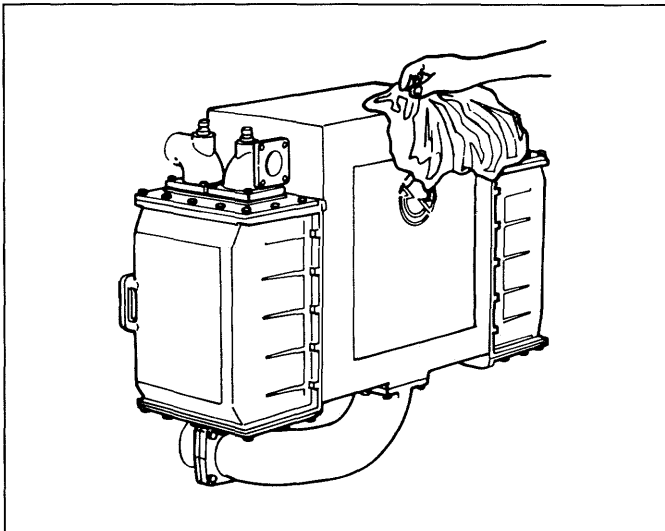
If reusable elements are used, the maximum element service life is still one year. Cleaning, drying, and inspection before reuse must be done per the manufacturer's recommendations.

Inspect the entire air system for leaks. Look especially for torn air inlet piping or boots and loose or damaged clamps. Have worn or damaged parts repaired or replaced, as required. Retighten any loose connections.

## Item 11 - Drive Belts

Drive belt tension should be checked daily for prime power applications and monthly for standby applications, and adjusted every 300 hours for Series 71 and 92 engines or every 250 hours for Series 149 engines. Inspect belts for splits, cracks and glazing. Replace as required.

## Item 12 - Cooling System/Radiator



Remove radiator or heat exchanger pressure control cap with caution.

**CAUTION:** Do not remove the pressure control cap from the heat exchanger or radiator or attempt to drain the coolant until the engine has cooled. Once the engine has cooled, use extreme caution when removing the cap. The sudden release of pressure from a heated cooling system can result in a loss of coolant and possible personal injury (scalding, eye injury, etc.) from the hot liquid.

Check the coolant level and maintain it near the bottom of the filler neck on the radiator or heat exchanger tank when cold. On some installations this is done by checking an overflow bottle or sight glass. Add coolant as necessary, but *do not overfill*. Before adding coolant, refer to "How to Select Coolant" in the **How To** section of this guide.

Make a visual check in accordance with the PM schedule on pages 31-32.

**Precharge and Maintenance Elements.** Spin-on coolant elements containing Detroit Diesel Selected Product supplemental inhibitors are used on all engines. These elements maintain proper inhibitor levels in the engine cooling system.

Engines are factory-equipped with a dual element head and *precharge* coolant elements. These elements charge the cooling system with Detroit Diesel Selected Product supplemental inhibitors at initial fill of the cooling system with coolant. After 250 engine hours of operation, the *precharge* elements **must** be removed and replaced with *maintenance* elements which will recharge the cooling system to the proper inhibitor level.

Maintenance elements must be replaced every 250 engine hours of operation to maintain proper inhibitor levels.

Precharge elements must be installed any time the cooling system has been drained and refilled with new coolant.

Refer to "Specifications" (page 46) for required precharge and maintenance element part numbers.

**NOTICE:** If freeze protection is not required and if ethylene glycol is not used, a second dosage of the precharge element must be used after the first 8 hours of engine operation. Regular maintenance elements should be used thereafter.

**Coolant Drain Interval.** *Detroit Diesel recommends replacing coolant with permanent type antifreeze annually. However, a cooling system properly maintained and protected with Detroit Diesel Selected Product supplemental inhibitors can be operated up to two years or 4000 hours, whichever comes first. At this interval, the coolant **must** be drained and the cooling system cleaned thoroughly. The cooling system should then be replenished with an ethylene glycol-base antifreeze/water solution in the required concentration and the required Detroit Diesel Selected Product precharge elements should be installed on the dual element head. In extremely hot environments, clean, soft, properly inhibited water may be used in place of antifreeze. After 250 engine hours or operation, the precharge elements should be removed and replaced with Detroit Diesel Selected Product maintenance elements.*

**Cooling System Hoses.** All cooling system hoses should be inspected at least every 500-600 hours for signs of deterioration and replaced, if necessary.

**Coolant Strainer.** Series 149 engines equipped with tube and shell oil coolers use coolant strainers to filter contaminants from the fresh water cooling system. Strainer baskets should be removed and cleaned annually.

**Radiator.** Inspect the outside of the radiator core every 500 hours and, if necessary, clean it with a quality grease solvent such as mineral spirits and dry it with compressed air.

**CAUTION:** To avoid personal injury, wear adequate eye protection and do not exceed 40 psi (276 kPa) air pressure.

**Do not use fuel oil, kerosene, or gasoline.** Clean the radiator more frequently if the engine is operated in extremely dusty or dirty areas.

### **Item 13 - Thermostats and Seals**

Thermostats should be removed and checked at 6000 hours for Series 71 and 92 engines, 5000 hours for Series 149 engines, and, if serviceable, reinstalled with new seals. Thermostats and seals should be *replaced* at overhaul.

### **Item 14 - Water Pump**

The water pump drain hole on Series 149 engines should be inspected for plugging every 500 hours and cleaned out, if necessary. The water pump seal **must** be replaced every 5000 hours. *Authorized Detroit Diesel service outlets* are properly equipped to perform these services.

### **Item 15 - Fan Hubs**

The bearings in the fan hub assembly should be replaced with new bearings at major engine overhaul. The hub assembly should be packed with Texaco Premium RB grease or an equivalent lithium-base multi-purpose grease before installing.

### **Item 16 - Emergency Shutdown**

With the engine running at idle speed, the operation of the emergency shutdown should be checked at least once a year or every 500 hours of engine operation, whichever comes first. If the valve fails to shut down the engine, it **must** be readjusted to provide positive shutdown. *Authorized Detroit Diesel service outlets* are properly equipped to perform this service. The valve should be reset in the *open* position after the check has been made.

**NOTICE:** Do not use the emergency shutdown for normal or routine engine stopping. Failure to observe this precaution can result in serious blower seal damage.

### **Item 17 - Crankcase Breather, Pressure**

The integral crankcase breather assembly should be removed and the steel mesh pad cleaned in fuel oil every 1,000 hours.

Some engines may use an additional crankcase breather collection device. If so equipped, the drain should be checked every oil change period. Remove the oil reservoir and *replace* the filter element and gasket annually, or every 500 hours, whichever comes first.

These service intervals may be reduced depending on the severity of service.

The externally mounted crankcase breather assembly should be removed and the steel mesh pad cleaned in fuel oil every 1,000 hours. The cleaning period may be reduced or lengthened depending on severity of service.

Crankcase pressure should be checked and recorded every 1,000 hours. If an additional crankcase breather collection device is used, the crankcase pressure should be recorded with the unit attached and removed.

### **Item 18 - Crankcase Pressure Monitor**

The crankcase pressure monitor should be checked for proper operation every 1000 hours for Series 71 and 92 engines, or every 250 hours for Series 149 engines. As well as at every engine oil change.

### **Item 19 - Air Box Drain Tube**

Air flow from the air box drain tubes and check valves should be checked every 1000 hours with the engine running. If tubes or valves are clogged they should be removed, cleaned, and reinstalled. They should be cleaned periodically, even though a clogged condition is not apparent.

If the engine is equipped with an air box tank, drain the sediment periodically.

### **Item 20 - Engine Tune-up/Fuel Injectors**

Series 149 engines **must** be tuned-up every 5,000 hours. **Tune-up must include replacement of injectors.** There is no scheduled tune-up interval for other Detroit Diesel engines. As long as engine performance is satisfactory, no tune-up should be needed.

Minor adjustments in the valve and injector operating mechanism, governor, etc. may be required periodically to compensate for normal wear on parts.

### **Item 21 - Blower Bypass Valve**

The blower bypass valve should be removed, cleaned in solvent (if necessary), and inspected every or 3000 hours for Series 71 and 92 engines or 5000 hours for Series 149 engines. The valve should be checked for free operation and for scoring on the piston, piston guide, or sleeve assembly. Have repaired or replaced, as necessary.

### **Item 22 - Tachometer Drive**

The tachometer drive (if fitted) should be lubricated every 300 hours for Series 71 and 92 engines or 250 hours for Series 149 engines at the grease fitting. Use an all-purpose grease (No. 2 grade).

### **Item 23 - Governor**

***For Barber Colman electronic governors the following connection and calibration procedures apply to the DYNA 8000 series governors:***

#### **Connection**

1. With the remote speed potentiometer connected it will provide approximately a  $\pm 5\%$  adjustable speed range.
2. For wide speed range applications, connect the wiper of the remote speed potentiometer to terminal 8 and use a value for resistor "R" that will provide the proper adjustable speed range.
3. When using an ILS unit, the remote speed potentiometer may be left connected to the controller as shown.
4. When an ILS unit is used, connect 3-wire shielded cable to terminals 6, 7 and 8. Connect drain shield wire to terminal 10 at the controller only. Other end of drain shield wire is to be cut off and taped.

#### **Calibration and Adjustments**

1. See reference guide before making any adjustments of the potentiometers, DROOP, I, GAIN and speed.
2. Power OFF — engine not operating

**3.** Initial potentiometer settings:

**3.1** Set the I adjustment one division from zero and the GAIN at the third division from zero.

**3.2** For isochronous operation, set DROOP counterclockwise to minimum position.

**3.3** For DROOP operation, set DROOP potentiometer clockwise to obtain desired amount of DROOP from no-load to full load. Turning potentiometer clockwise increases DROOP.

**NOTICE:** If the full 35° rotation of the actuator shaft is used and the linkage adjusted to use only the active fuel range, the maximum obtainable DROOP would be approximately 12% at full load.

**3.4** See step 5.3 for setting switches S1 and S2.

**4.** If a remote speed potentiometer is used, set it to midrange. If the remote speed potentiometer is connected to terminals 6, 7 and 9, a resistor "R" in the wiper is not needed. This will provide approximately a ±5% adjustable speed range.

**5.** Start the engine.

**5.1** Adjust the controller speed potentiometer until the engine is operating at the desired engine RPM. Clockwise increases engine RPM.

**5.2** If the governor system is unstable, slightly reduce the I and GAIN settings.

**NOTICE:** Except for the speed adjustment, the potentiometers have internal stops at the 0 and 100% positions.

**6.** With the engine unloaded, finalize the settings, I and GAIN adjustments as follows:

**6.1** Turn the GAIN adjustment clockwise slowly until the actuator lever oscillates. (This will be a faster oscillation than was observed when the I was adjusted.) Reduce the GAIN adjustment slowly counterclockwise until the lever is stable. Upset the lever by hand. If the lever oscillates 3 to 5 diminishing oscillations and stops, the setting is correct.

If system performance to load changes is satisfactory, omit step 6.2

**6.2** Reduce the GAIN setting counterclockwise one division. Next, turn the I adjustment fully clockwise while observing the actuator lever. If the lever does not become unstable, upset it by

hand. When the lever slowly oscillates, turn the adjustment counterclockwise slowly until the lever is stable. Upset the lever again; it should oscillate 3 to 5 times and then become stable for optimum response.

**NOTICE:** Use the settings of step 6.1 or step 6.2, whichever provides the best performance.

**6.3** Unit is now calibrated.

**For Woodward electronic governors:**

**INSTALLATION CHECKS**

**Checks For All Applications**

The following steps check only the speed control and actuator. They must work correctly before paralleling the generator. Since most faults appear when the prime mover is first run, this step by step approach eliminates most problems before they occur.

If a Load Sensor is used, temporarily remove the wires at speed control terminals 11 and 12 and temporarily jumper terminals 11 to 12. The generator must not be paralleled during these tests. If a Ramp Generator is used, then also temporarily remove the wire at speed control terminal 10 that goes to the ramp generator. Leave the idle-rated switch wiring connected. Perform the checks in the order indicated. Terminal numbers in this section refer to the speed control.

**1.** Check that all electrical connections are correctly made and terminal screws are tight; the magnetic pickup is properly installed and the jam nut is tight; the actuator and linkage are securely fastened. If start-fuel limit is present turn the adjustment fully clockwise during these tests.

**2.** Do not start the prime mover now. Turn on governor power. If the fuse or breaker opens as soon as power is applied, the battery polarity (terminals 14 and 15) is probably reversed. The actuator shaft can jump when power is turned on but must quickly come back to the minimum fuel position. Check the battery voltage at terminal 1(+), and 2(-). It must be from 10 to 16 Vdc for models 1712/512 EPG control and from 20 to 32 Vdc for models 1724/524.

3. Disconnect any wiring or jumper on terminal 7. Measure voltage from 2(-) to 7(+). The voltage must be  $7.2 \pm 1$  volt. If voltage is correct, then reinstall the wiring to terminal 7.

4. If idle speed is desired, connect a 50 Kohm potentiometer or fixed resistor to terminals 9 and 10 as shown in the typical wiring diagram. To calculate the value of a fixed resistor:

$$R = 17 \text{ Kilohm} \left( \frac{\text{Rated Speed}}{\text{Idle Speed}} - 1 \right)$$

5. Put the idle-rated switch in the rated position or jumper terminal 9 and 10. Measure the voltage from terminal 7(+) to 2(-). Put the idle-rated switch in the idle position or remove the jumper. The voltage must increase. If it does not increase, check the speed trim pot, if used, and idle-rated switch wiring.

6. If a signal generator with an isolated output is available the failsafe and actuator travel can be checked. Rated and idle speeds can be preset. If a signal generator is not available skip to step 7.

Turn governor power off. Remove the magnetic pickup wires from terminals 5 and 6. Connect the signal generator to terminals 5 and 6. Set the output between 2 and 10 Vrms. The waveform can be sine, square, or triangular. Calculate the MPU frequency for idle and rated speeds.

#### 6.1 CHECK FAILSAFE AND ACTUATOR TRAVEL

Set the signal generator frequency to about half idle speed. Set the idle-rated switch to rated. Turn the signal generator and governor power on. The linkage must be at the maximum fuel position. Except for Detroit Diesel engines verify linkage travel is limited by the prime mover fuel control, not by the actuator stop. Turn the signal generator off and remove the connections at terminals 5 and 6. The linkage should move to the minimum fuel position. Verify linkage travel is limited by the prime mover's fuel control, not by the actuator stop.

#### 6.2 PRESET RATED SPEED

Set the signal generator for MPU frequency at rated speed and connect it to terminals 5 and 6. Put the idle-rated switch in the rated position. Set the speed trim pot, if connected, to mid position. Observe the linkage position.

— *If the linkage is at the maximum fuel position:*  
Slowly turn the rated speed pot ccw until the linkage just begins to move to the minimum fuel position.

— *If the linkage is at the minimum fuel position:*  
Slowly turn the rated speed pot cw until the linkage just begins to move to the maximum fuel position.

Continue to very slowly adjust the rated speed pot in the appropriate direction, trying to stop the linkage between the minimum and maximum fuel stops. Because it is not possible to stop the motion, cease adjusting when the linkage moves slowly. The rated speed reference is now set very close to desired speed. A slight adjustment when the engine is running will achieve the exact speed.

#### 6.3 PRESET IDLE SPEED

Preset idle speed only after presetting rated speed. Set the signal generator for MPU frequency at idle speed. Put the idle-rated switch in the idle position. Observe the linkage position.

— *If the linkage is at the maximum fuel position:*  
Slowly turn the idle speed pot ccw until the linkage just begins to move to the minimum fuel position.

— *If the linkage is at the minimum fuel position:*  
Slowly turn the idle speed pot cw until the linkage just begins to move to the maximum fuel position.

Continue to very slowly adjust the idle speed pot in the appropriate direction, trying to stop the linkage between the minimum and maximum fuel stops. Because it is not possible to stop the motion, cease adjusting when the linkage moves slowly. The idle speed reference is now set very close to desired speed. A slight adjustment when

the engine is running will achieve the exact speed.

7. If the idle and rated speed pots were not preset with a signal generator, set the rated speed pot fully ccw.
8. Remove the MPU wires from speed control terminals 5 and 6. Measure the resistance of the MPU at the wire ends. It should be between 100 and 300 ohms. Reconnect the MPU wires.
9. Set the idle-rated switch for rated speed. Turn governor power on.

**CAUTION: To protect against possible personal injury, loss of life, and/or property damage when starting the engine, turbine, or other type of prime mover, be prepared to make an emergency shutdown to protect against runaway or overspeed should the mechanical-hydraulic governor(s), or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.**

## 10. GAIN & STABILITY

Set the gain and stability pots to mid position. Connect an ac voltmeter to speed control terminals 5 and 6 to measure the MPU voltage. Start the prime mover and check the MPU voltage. It must be at least 1.5 Vrms while cranking.

- If the prime mover does not start check the linkage while cranking. If it is at the maximum fuel position the EPG is operating correctly. Check the fuel supply, ignition, etc.
- If the linkage is not at the maximum fuel position, cranking speed can be greater than the speed reference. Measure the resistance from speed control terminal 9 to 10. It must be a short circuit (0 ohms). If not, the idle-rated switch is in the idle position or the switch or wiring is defective. Place in rated position or repair. If the resistance is 0 ohms the rated speed reference can be lower than cranking speed. Turn the rated speed pot cw four turns and try to restart. Be prepared to quickly

adjust rated speed ccw to minimize overspeed if the prime mover starts. If it still doesn't start turn the rated speed pot fully ccw to minimize overspeed when it does start.

When the prime mover starts, slowly turn the gain pot back and forth to observe high and low frequency oscillation. Eliminate oscillation by slowly turning the gain pot for the stable region between high and low frequency oscillation. If the oscillation does not stop at the high-low crossover, turn the stability pot slightly ccw and slowly readjust the gain pot. Continue adjusting the stability pot slightly ccw followed by readjusting gain until the prime mover runs at a steady speed.

### 10.1 SET TRANSIENT RESPONSE

By turning gain slightly cw and stability slightly ccw, or vice-versa, it is possible to maintain stable speed and vary transient response. Increasing the gain and decreasing the stability causes shorter settling times at the expense of ringing. The use of chart recorder makes it easier to observe transient response.

Check response after each adjustment by momentarily changing speed. Repeat the following tuning procedure until the prime mover responds as desired. Note that settings with high gain and low stability can result in stable operation at normal temperatures and oscillation when the prime mover is cold.

- To decrease settling time turn the gain pot cw. Turn the stability pot ccw as required to eliminate oscillation and obtain desired response.
- To decrease ringing turn the stability gain pot cw. Turn the gain pot ccw as required to eliminate oscillation and obtain desired response.

— Check response by applying and removing load, manually hitting the linkage, or quickly switching to idle speed and back to rated.

#### **11. SETTING SPEED REFERENCES**

The prime mover should not be oscillating. Make sure the idle-rated switch is in the rated speed position. Adjust the rated speed pot for exactly rated speed. Set the idle-rated switch for idle speed. Adjust the idle speed pot for desired idle speed. Set the idle-rated switch back to rated.

#### **Item 24 - Engine and Generator Mounts**

Engine and generator mounting bolts and the condition of the mounting pads should be checked every 1,000 hours or annually (whichever comes first) and tightened or repaired, as required.

#### **Item 25 - Load Test**

The generator set should be started and exercised under load on a monthly basis (per NFPA recommendations).

When exercising the generator set, load should be at least 35% of nameplate rating. Operate the generator at that load or higher until coolant temperature becomes stable. This will evaporate any moisture that may have condensed in the crankcase and prevent wet-stacking.

If no load is available to put on the engine, Detroit Diesel recommends starting the engine for a period of time that would allow verification of oil pressure. When oil pressure stability is confirmed shut the engine down.

## SERIES 71 AND 92 GENERATOR DRIVE ENGINE MAINTENANCE CHART

ITEM	Prime, Daily	Standby, Monthly	HOURS						
			3	5	7	1	2	3	6
			0	0	0	0	0	0	0
1. Lubricating Oil	I	I*	REPLACE @ 150 HOURS OR EVERY 6 MONTHS						
2. Lubricating Oil Filter									
3. Oil Pressure	I	I*			I				
4. Fuel Filters, Water Separator	I	I*	R						
5. Fuel & Fuel Tank		I			I				
6. Fuel Lines, Flexible Hoses	I				I			R	
7. Turbo, Exhaust Conns.	I				I				
8. Battery		I							
9. Batt Charging Alternator					I				
10. Air System, Cleaners	I	I			R				
11. Drive Belts	I	I	I					I	
12. Cooling System/Radiator	I	I*			I				
13. Thermostats and Seals									I
14. Water Pump									R
15. Fan Hub					I				
16. Emergency Shutdown				I					
17. Crankcase Breather				I		I			
18. Crankcase Press Monitor						I			
19. Air Box Drain Tube						I			
20. Engine Tune-up/Injector			AS REQUIRED						
21. Blower Bypass Valve								I	
22. Tachometer Drive			I						
23. Governor				I					
24. Engine/Generator Mounts					I				
25. LOAD TEST*		P							

I: Inspect R: Replace P: Perform

\*: Perform these items at time of Load Test, Load Test should be at least 35% of the unit's full rated output.



### SERIES 149 GENERATOR DRIVE ENGINE MAINTENANCE CHART

ITEM	Prime, Daily	Standby, Monthly	HOURS			
			250	500	1000	5000
1. Lubricating Oil	I	I*	REPLACE @ 250 HOURS OR EVERY 6 MONTHS			
2. Lubricating Oil Filter						
3. Oil Pressure	I	I*	I			
4. Fuel Filters, Water Separator	I	I*	R			
5. Fuel & Fuel Tank	I			I		
6. Fuel Lines, Flexible Hoses	I	I		I		
7. Turbo, Exhaust Conns.	I	I*	I			
8. Battery		I				
9. Battery Charging Alternator			I			
10. Air System, Cleaners	I	I		R		
11. Drive Belts	I		I			
12. Cooling System/Radiator	I	I*	P			R
13. Thermostats and Seals						R
14. Water Pump			I			R
15. Fan Hub						
16. Emergency Shutdown				I		
17. Crankcase Breather				I	I	
18. Crankcase Pressure Monitor			I			
19. Air Box Drain Tube					I	
20. Engine Tune-up/Fuel Injector						P/R
21. Blower Bypass Valve						I
22. Tachometer Drive			I			
23. Governor				I		
24. Engine/Generator Mounts					I	
25. LOAD TEST*		P				

I: Inspect R: Replace P: Perform

\*: Perform these items at time of Load Test, Load Test should be at least 35% of the unit's full rated output.

## 5. OPERATING INSTRUCTIONS

### Preparations for Starting the Engine the First Time

When preparing to start a new or newly overhauled engine or an engine which has been in storage, perform all of the operations listed below. Failure to follow these instructions may result in serious engine damage. Before a routine start, see "Daily" checks in the **Lubrication and Preventive Maintenance chart** (pages 31-32).

**NOTICE:** If the generator set or engine is to be stored or unused for a period greater than six months, contact your local authorized Detroit Diesel service outlet to have proper procedures for engine storage be completed.

**CAUTION:** Before working on or near the generator set remove loose items of clothing or jewelry that could get caught in a moving part of the engine and cause personal injury. Safety glasses and hearing protection must also be worn.

### Cooling System Checks

1. Make sure all the drain cocks in the cooling system are installed (drain cocks are often removed for shipping) and are closed tightly.
2. Open air bleed petcock if so equipped.
3. Remove radiator or heat exchanger fill cap and fill with an ethylene glycol-base antifreeze solution in the required concentration. In extremely hot environments, clean, soft, properly inhibited water may be used in the summer. For more detailed coolant recommendations, refer to **How to Select Coolant** (page 41). Keep the coolant level at the bottom of the filler neck to allow for expansion of the coolant. Add coolant until it stabilizes at the proper cold full level, usually the bottom of the filler neck extension or a sight glass indicator. If coolant recovery bottle is used, radiator surge tank must be completely filled and coolant added to proper level in the bottle.

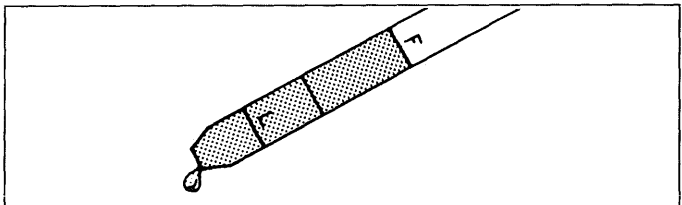
4. Close all petcocks, once solid coolant is being expelled.
5. Entrapped air must be purged after filling the cooling system. To do this, allow the engine to warm-up without the fill cap installed, adding coolant as required. Run engine until thermostats have opened in order to purge entrapped air again adding coolant as required.

Install the fill cap after entrapped air has been purged and proper coolant level established.

### Lubrication System Checks

The lubricating oil film on the rotating parts and bearings of a new or newly overhauled engine, or one which has been in storage for six months or more, may be insufficient when the engine is started for the first time. Insufficient lubrication at start-up can cause serious damage to engine components.

To insure an immediate flow of oil to all bearing surfaces at initial engine start-up, the engine lubrication system should be charged with a commercially available pressure pre-lubricator. If this is impractical, rocker covers should be removed and clean lubricating oil should be poured over the rocker arms. The oil should be the same weight and viscosity as that used in the crankcase. After pre-lubricating, add additional oil to bring the level to the proper mark on the dipstick. Refer to **How to Select Lubricating Oil** (page 36) for lubricant recommendation.



*Check lube oil level before starting*

### Fuel System Checks

Fill the tank with the recommended fuel. Keeping tanks full reduces water condensation and helps keep fuel cool, which is important to engine performance. Full tanks also reduce the chances for microbe (black slime) growth. Refer to **How to Select Fuel Oil** (page 39) for fuel recommendation.

Make sure fuel supply shutoff valves (if used) are open.

To insure prompt starting and even running, the fuel system must be primed if air has entered the fuel system. Priming is done by connecting a manual or electric priming pump to the secondary fuel filter. *Authorized Detroit Diesel service outlets* are properly equipped to perform this service.

Priming is not normally necessary if the filter elements are filled with fuel when installed and the manifolds in the head are not drained of fuel.

**NOTICE:** Prolonged use of the starting motor and engine fuel pump to prime the fuel system can result in damage to the starter, fuel pump, and injectors, and cause erratic engine operation due to the amount of air in the lines and filters from the supply tank to the cylinder head.

If the engine is equipped with a fuel/water separator, drain off any water that has accumulated. Water in fuel can seriously affect engine performance and may cause engine damage.

**NOTICE:** If the generator set or engine has been stored or unused for a period of six months or longer, contact your local authorized Detroit Diesel service outlet to check for properly operating fuel system and injectors prior to starting the engine.

### Other Checks

**NOTICE:** If the generator set or engine has not been used for a period of six months or longer, the air, fuel, and lube oil filters may need to be changed.

Check drive belts to make sure they are in good condition (not cracked, torn, worn, or glazed) and are properly adjusted.

Make sure cable connections to the storage battery are clean and tight and battery electrolyte level is normal.

Check turbocharger(s) for signs of oil, coolant, or exhaust leaks. Leaks should be corrected before starting the engine. Check engine mounting bolts for tightness. Retighten, if necessary.

## Starting the Engine

Before starting the engine the first time, perform the operations listed under **Preparations for Starting the Engine the First Time** (page 33).

If the engine has an emergency manual or automatic shutdown system, make sure the control is set in the *open* position before starting. The blower and turbocharger may be seriously damaged if the engine is cranked or run with the air shutdown in the *closed* position. On units with dual air shutdown housings, both shutdown valves must be in the *open* position before starting the engine.

### Initial Engine Start

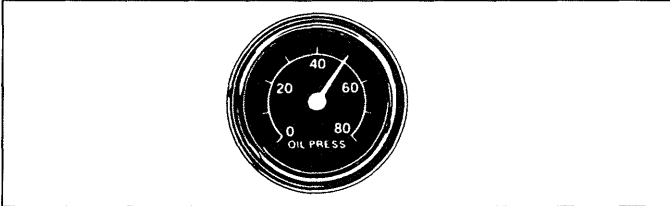
1. Press the starter switch firmly.
2. If the engine fails to start within 30 seconds, release the starter switch and allow the starting motor to cool at least two minutes before trying again. If the engine fails to start after four attempts, an inspection should be made to determine the cause.

**NOTICE:** To prevent starting motor damage do not press the starter switch again after the engine has started.

Starting tip: Some white smoke is normal at start-up when the engine is cold and will clear up shortly after the engine warms. However, if your experience excessive smoke at cold start-up, hold the governor in the "no fuel" position at the same time you press the starter button and crank the engine for a few seconds. Release the governor and continue to crank the engine until it starts (but not longer than 30 seconds). This will preheat the cylinders and reduce white smoke at start-up. Use of a jacket water heater with thermostat set at 120°F will also reduce white smoke.

**NOTICE:** Jacket water heaters are required by code on some standby generator set applications. Detroit Diesel strongly recommends their use to aid in starting standby equipment.

## Running the Engine



Check oil pressure gauge after starting

### Oil Pressure

Observe the oil pressure gauge immediately after starting the engine. If no oil pressure is indicated within 10 to 15 seconds, stop the engine and check the oil level gauge. If the oil level is OK, the engine lubrication system should be checked.

The *minimum* oil pressure should be at least 25 psi (172 kPa) at 1800 rpm. If pressure fails to fill within these guidelines, it should be checked with a manual gauge.

**CAUTION:** To avoid personal injury from the hot oil, do not operate Series 149 engine with rocker covers removed for any reason.

### Warm-up

For routine operational checks and load tests, run the engine at no load for about five (5) minutes allowing it to warm up. Then, apply a load equal to or greater than 35% of the nameplate rating. The unit should then be operated until temperatures stabilize.

### Inspection

While the engine is idling, look for coolant, fuel, or lubricating oil leaks. If any are found, shut down the engine immediately and have leaks repaired *after* the engine has cooled.

**Crankcase.** If the engine oil was replaced, stop the engine after normal operating temperature has been reached. Allow the oil to drain back into the crankcase for approximately twenty (20) minutes, and check the oil level. If necessary, add oil to bring the level to the proper mark on the dipstick. Use only the heavy-duty oils recommended in **How to Select Lubricating Oil** (page 36) in this guide.

**Turbocharger.** Make a visual inspection of the turbocharger for oil or exhaust leaks, excessive noise or vibration. Stop the engine immediately if a leak or unusual noise or vibration is noted. **Do not restart the engine until the cause of the concern has been investigated and corrected.** *Authorized Detroit Diesel service outlets* are properly equipped to perform this service.

### Avoid No Load Conditions

During long periods of no load operation the engine coolant temperature may fall below the normal operating range. The incomplete combustion of fuel in a cold engine will cause crankcase dilution, formation of lacquer or gummy deposits on the valves, pistons, and rings, and rapid accumulation of sludge in the engine. In order to maintain proper engine operating temperature, the generator set should be loaded at or above 35% of the nameplate rating.

## Stopping the Engine

### Normal stopping

Allow the engine to run at idle with no load for four (4) or five (5) minutes. This allows the engine to cool and permits the turbocharger(s) to slow down. After idling four or five minutes, shut down the engine.

### Emergency Stopping

The emergency shutdown should be used only when the engine does not respond to the normal stop engine procedure. To shut down the engine, simply activate the emergency control. This is an electrical switch or mechanical lever which is normally identified as such on the control panel.

**NOTICE:** Never use the emergency shutdown system, except in an emergency. Use of the emergency shutdown can cause lubricating oil to be sucked past the oil seals and into the blower housing and may also cause turbo-charger damage.

The air shutdown, located in the air inlet housing, must be reset by hand and the **"emergency stop"** knob pushed in before the engine is ready to start again. On engines with dual air shutdowns, be certain to activate both shutdowns simultaneously.

## 6. "HOW TO" SECTION

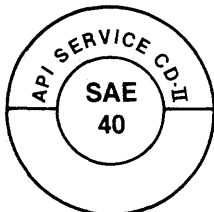
This section covers Detroit Diesel's recommendations on how to select lubricating oil, fuel oil, and coolant and includes basic engine maintenance procedures which can be performed by the operator.

### A. How to Select Lubricating Oil

#### Two-Cycle Engines - Series 71, 92, 149

##### Lubricant Recommendation

API Symbol:



SAE Viscosity Grade: 40  
API Classification: CD-II  
Military Spec.: Mil-L-2104E  
Sulfated Ash: less than 1.0%

The logo consists of a large outer circle with the text 'API SERVICE CD-II' around its perimeter. Inside this is a smaller circle containing the text 'SAE 40'.

**This is the only engine oil recommended for Detroit Diesel two-cycle engines.** Lubricants meeting these criteria have provided maximum engine life when used in conjunction with recommended oil drain and filter maintenance schedules.

Certain engine operating conditions may require exceptions to this recommendation. They are as follows:

1. In high load applications, the use of SAE 50 viscosity grade lubricants will provide additional protection in Series 149 engines.
2. For continuous high temperature operation (over 100°F ambient or 200°F coolant-out), or high load applications (certain marine, mine haul, and gen set applications), the use of an SAE grade 50 lubricant is recommended.

3. When the use of high sulfur fuel is unavoidable, lubricants with a Total Base Number exceeding 10 are recommended. Such a lubricant may have a sulfated ash content above 1.0% mass. High sulfur fuels require modification to oil drain intervals.

#### Synthetic Oils

Synthetic Oils are not recommended for use in Detroit Diesel Corporation generator set engines. Synthetics offer advantages in cold temperature pumpability and high temperature oxidation resistance. Neither of these characteristics provides benefit in a generator set application. Synthetic lubricants have not proven to provide operational or economic benefits over conventional petroleum based lubricants in Detroit Diesel two-cycle engines. Their use does not permit the extension of oil drain intervals.

#### Use of Supplemental Additives

Lubricants meeting the Detroit Diesel recommendations already contain a balanced additive treatment. The use of supplemental additives which are added to the lubricant by the customer are unnecessary and may be harmful. *Detroit Diesel does not review, approve, or recommend such products.*

#### Marine Lubricants, Railroad Diesel Lubricants

The petroleum industry markets specialty lubricants for use in diesel engines designed specifically for marine propulsion or railroad locomotive use. Typically these lubricants are high TBN (Total Base Number greater than 15) and low zinc-containing oils. These products have been used successfully in Series 149 engines in a variety of applications. They are particularly beneficial where the use of high sulfur (greater than 0.5%) fuel is unavoidable. Oil drain intervals may not be extended beyond those recommended for high sulfur use.

## **B. When to Change Oil**

### **Oil Drain Intervals**

During use, engine lubricating oil undergoes deterioration from combustion by-products and contamination. For this reason, regular oil drain intervals are necessary. These intervals however, may vary in length depending upon engine operation, fuel quality, and lubricant quality. The oil drain interval may be established on recommendations of the Detroit Diesel Oil Analysis Program until the most practical oil change interval has been determined. Under no circumstances, however, should the drain intervals in the chart be exceeded. All engine oil filters should be changed when the lube oil is changed.

Dispose of used lubricating oil, filter, and gasket in an environmentally approved manner according to state and/or federal (EPA) recommendations.

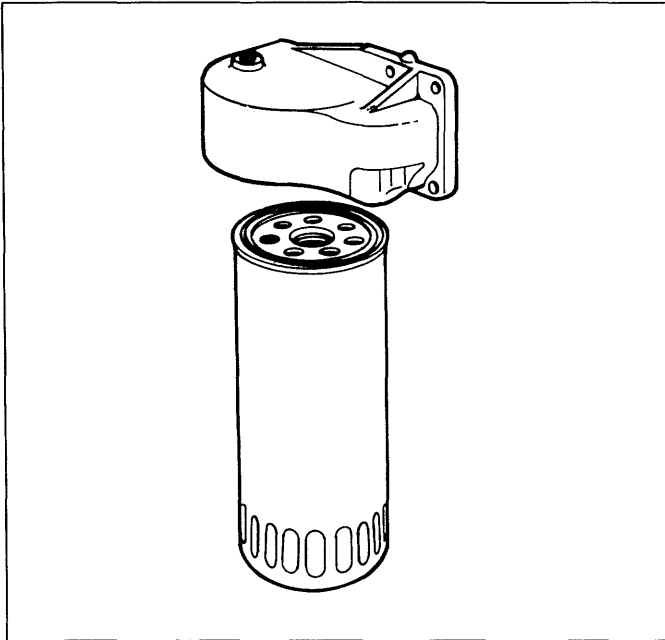
### **Oil Drain Intervals When Using High Sulfur Fuel**

When the continuous use of high sulfur fuel (greater than 0.5%) is unavoidable, lubricant selection and oil drain interval must be modified. A lubricant with a Total Base Number (TBN per ASTM D 2896) above 10 is recommended. It is likely that such a lubricant will also exhibit a sulfated ash above 1.0%. The proper oil drain interval must be determined by oil analysis when operating on high sulfur fuel. A reduction in TBN (D 2896) to one third of the initial value provides a general drain interval guideline.

## **C. How to Replace the Lube Oil Filter**

The *spin-on type* consists of a shell, element, and gasket unitized into a single cartridge and a filter cover which includes a threaded sleeve to accept the spin-on filter cartridge.

## Replace Spin-on Type Filter



Typical spin-on type oil filter assembly

1. Remove the spin-on filter cartridge using strap wrench tool J29917 (or equivalent) and a 1/2" drive socket wrench and extension.
2. Dispose of the used oil and filter in an environmentally approved manner according to state and/or federal (EPA) recommendations.
3. Clean the filter adaptor with a clean, lint-free cloth.
4. Lightly coat the filter gasket (seal) with clean engine oil or petroleum jelly.
5. Start the new filter on the adaptor and *tighten by hand* until the gasket touches the mounting adaptor head. Tighten an additional two-thirds turn.

**NOTICE:** Overtightening may distort or crack the filter adaptor.

6. Add oil as required to bring the level to the "full" mark on the dipstick.
7. Start and run the engine for a short period and check for leaks. After any leaks have been corrected, stop the engine long enough for oil from various parts of the engine to drain back to the crankcase (approximately 20 minutes). Add oil as required to bring the level to the proper mark on the dipstick.

**NOTICE:** If the oil level is constantly above normal and excess lube oil has not been added to the crankcase, consult with an *authorized Detroit Diesel service outlet* for the cause. Fuel or coolant dilution of lube oil can result in serious engine damage.

## D. How to Select Fuel Oil

**Quality.** Fuel quality is an important factor in obtaining satisfactory engine performance, long engine life, and acceptable exhaust emission levels. Detroit Diesel engines are designed to operate on most diesel fuels marketed today. In general, fuels meeting the properties of ASTM Designation D 975 (grades 1-D and 2-D) have provided satisfactory performance.

The ASTM 975 specifications, however, does not in itself adequately define the fuel characteristics needed for assurance of fuel quality. The properties listed in the fuel oil selection chart below have provided optimum engine performance.

Grade 2-D fuel is normally available. Grade 1-D fuel should not be used except in an emergency.

### Fuel Oil Selection Chart

General Fuel Classification	ASTM Test	No. 1 ASTM 1-D	No. 2 ASTM 2-D
Gravity, °API#	D 287	40 - 44	33 - 37
Flash Point Min. °F (°C)	D 93	100 (38)	125 (52)
Viscosity, Kinematic cST @ 100°F (40°C)	D 445	1.3 - 2.4	1.9 - 4.1
Cloud Point °F #	D 2500	See Note 1	See Note 1
Sulfur Content wt%, Max.	D 129	0.5	0.5
Carbon Residue on 10%, wt%, Max.	D 524	0.15	0.35
Accelerated Stability Total Insolubles mg/100 ml, Max. #	D 2274	1.5	1.5
Ash, wt%, Max.	D 482	0.01	0.01
Cetane Number, Min. +	D 613	45	45
Distillation Temperature, °F (°C) IBP, Typical # 10% Typical # 50% Typical # 90% + End Point #	D 86	350 (177) 385 (196) 425 (218) 500 (260) Max. 550 (288) Max.	375 (191) 430 (221) 510 (256) 625 (329) Max. 675 (357) Max.
Water & Sediment %, Max.	D 1796	0.05	0.05

# Not specified in ASTM D 975

+ Differs from ASTM D 975

Note 1: The cloud point should be 10°F (6°C) below the lowest expected fuel temperature to prevent clogging of fuel filters by crystals.



**Supplemental Fuel Additives.** Detroit Diesel engines operate satisfactorily on a wide range of diesel fuel without the addition of supplemental additives. Such additives increase operating costs without providing benefit. Detroit Diesel does not approve, review, or recommend fuel additives which are added by the operator.

**Fuel Contamination.** The most likely fuel contaminants are water and microbial growth (black "slime"). Generally, this type of contamination is the result of poor fuel handling practices. Black "slime" requires water in the tank to form and grow, so the best prevention is to keep water content to minimum in storage tanks.

Treating fuel which has microbial growth requires to use of a fuel additive and is *the only exception to the Detroit Diesel policy on supplemental additives*. Detroit Diesel *does* recommend the use of fuel additives such as Biobor JF, or equivalent, for treatment of microbial fuel contamination. Follow the manufacturers' instruction for use. If treating contaminated fuel, frequent fuel filter changes will be necessary until the fuel system is purged.

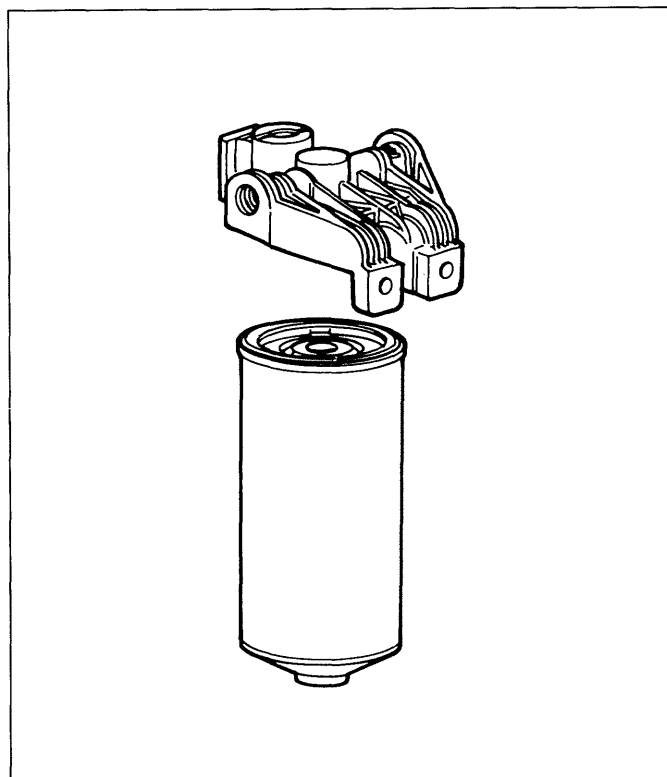
For more detailed information on the fuel selection, refer to "Lubricating Oil, Fuel Oil, and Filter Recommendations," form 7SE270, available from Detroit Diesel distributors.

**NOTICE:** Standard quality fuel should be used in Detroit Diesel engines. If the use of fuel that is less than pipeline Standard No. 2 diesel cannot be avoided, severe duty fuel filters should be used, see chart on page 45 for part numbers.

## E. How to Replace the Fuel Filter and Strainer

The *spin-on type* consists of a shell, element, and gasket unitized into a single cartridge and a strainer or filter cover which includes a threaded sleeve to accept the spin-on filter cartridge. A one-inch diameter, 12-point nut on the bottom of the cartridge is provided for removal and installation.

### Replace Spin-on Type Filter Element



Typical spin-on fuel filter assembly

1. With the engine shut down, place a suitable container under the strainer or filter and unscrew the cartridge. Dispose of the cartridge in an environmentally approved manner according to state and/or federal (EPA) recommendations.
2. Fill a new replacement cartridge above two-thirds full with clean fuel oil. Coat the seal gasket lightly with clean fuel oil.
3. Install the new cartridge and tighten it two-thirds of a turn beyond gasket contact.

**NOTICE:** Overtightening may distort or crack the filter adaptor.

4. Start the engine and check for leaks.

**NOTICE:** To improve starting, have replacement filters filled with fuel and ready to install immediately after used filters are removed. This will prevent possible fuel siphoning, which can cause fuel system aeration.

*If the engine fails to start after replacement of the fuel strainer and/or filter elements, the fuel system will require priming with tool J5956 (or equivalent). Authorized Detroit Diesel service outlets are properly equipped to perform this service.*

## F. Engine Out of Fuel— How to Restart

When an engine has run out of fuel, there is a definite procedure to follow when restarting it.

1. Fill the fuel tank with the recommended grade of fuel. If only partial filling is possible, add a minimum of 10 gallons (38 liters) of fuel to the tank. Add a minimum of 25 gallons (95 liters) when starting a Series 149 engine.
2. Remove the fuel strainer/water separator from its cover, fill it with fuel, and reinstall it.
3. Remove the fuel filter from its cover, fill with the fuel, and reinstall it.

**NOTICE:** To improve engine starting, have replacement elements filled with fuel and ready to install *immediately* after used elements are removed. This will prevent possible siphoning and fuel system aeration.

4. Start the engine, and check fuel filter and strainer for leaks.

**NOTICE:** Under no circumstances should the starting motor and fuel pump be used to prime the fuel filter and strainer. Prolonged use of the starting motor and fuel pump to prime the fuel system can result in damage to the starter, fuel pump, and injectors and cause erratic running of the engine due to the amount of air in the lines and filters.

## G. How to Select Coolant

Use an ethylene glycol antifreeze (low silicate formulation) that either meets the standard of the GM 6038-M formulation (GM 1899-M performance), or ASTM D 4985 requirements.

A 50% antifreeze/water solution is normally used as a factory fill. Concentrations over 67% are not recommended because of poor heat transfer capability, adverse freeze protection and possible silicate dropout. Concentrations below 30% offer little freeze, boilover or corrosion protection.

**Although some antifreezes contain inhibitor packages, all Series 149 engines require that Detroit Diesel Selected Product supplemental inhibitors be added to the cooling system after an initial fill and that they be maintained at proper concentration.**

Antifreeze solution should be used year-round to provide freeze and boil-over protection as well as a stable environment for seals and hoses.

**Only non-chromate inhibitors should be used with antifreeze solutions.**

Coolant and inhibitor concentration must be checked at each oil change (150 hours maximum). Adjust the concentration, if not at the proper protection level.

Mix antifreeze/water makeup solution at the proper concentration before adding to the cooling system. This should prevent over- or under-coolant concentration problems.

**Methyl alcohol-based antifreeze is not recommended for use in Detroit Diesel engines because of its effect on the non-metallic components of the cooling system and its low boiling point. Methoxy propanol-based antifreeze is also not recommended for Detroit Diesel engines because it is not compatible with fluoroelastomer seals found in the cooling system.**

Coolant properly maintained and protected with supplemental inhibitors can be operated up to two years, or 4000 hours, whichever comes first. At this interval the antifreeze **must** be drained, discarded in an appropriate manner, and the cooling system thoroughly cleaned.

Over a period of time normal maintenance dosages of supplemental coolant additives (SCA's) and ethylene glycol can result in the total dissolved solids being raised to a level that may cause the cooling system to lose some of its efficiency.

Inspect all components that make up the cooling system and make necessary repairs at this time. Refill the cooling system with a recommended ethylene glycol-base antifreeze and water solution at the required concentration (see graph, page 43). Add required Detroit Diesel Selected Product cooling system inhibitors. After filling, run engine until thermostat(s) open and top off radiator or heat exchanger recommended full level. Reinstall fill/pressure cap.

**NOTICE:** Do not use sealer additives in the cooling system. The presence of the gumming and gelling material in stop-leak additives could cause plugging in the cooling passages, which will adversely affect the cooling system.

### **Detroit Diesel Selected Product Inhibitor Systems**

Detroit Diesel Selected Product supplemental coolant inhibitors protect the metallic surfaces of the cooling system against corrosive attack.

- pH control chemicals are used to maintain an acid-free solution.
- Water-softening chemicals deter formation of mineral deposits.
- Cavitation suppression chemicals minimize the formation of vapor pockets, preventing erosion of cooling system surfaces.

**It is imperative that Detroit Diesel Selected Product supplemental inhibitor be added to Series 149 engines. A pre-charged dosage must be used at the initial coolant fill and the maintenance dosage used at each service interval.**

Refer to "Specifications" (page 46) for coolant filter precharge and maintenance elements.

All inhibitors become depleted through normal operation, and additional inhibitor must be added to the coolant as required to maintain original strength levels.

**Soluble oils and chromate inhibitors are not recommended for use in Detroit Diesel engine cooling systems.**

**NOTICE:** Overinhibiting with supplemental coolant additives or antifreeze solutions can cause additive dropout. Always follow the manufacturer's recommendations on usage and handling.

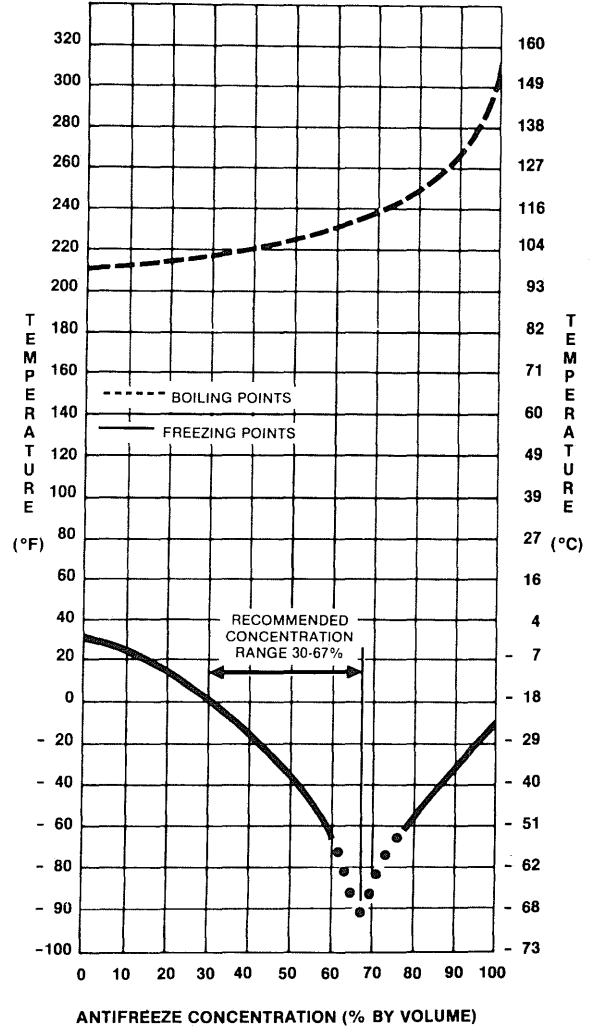
### Inhibitor Test Procedures

Test kits and test strips are commercially available to check engine coolant for nitrite concentration. Coolants must be tested at each oil change (150 hours maximum) to ensure that inhibitor levels are maintained within the ranges shown on the following chart.

**Use Nalco Chemical Company nitrite test kits (CO-318) to measure the nitrite concentration. Always follow the manufacturer's recommended test procedures. A factory coolant analysis program is also available through local Detroit Diesel distributors under part number 23508774.**

SELECTED PRODUCTS SUPPLEMENTAL COOLANT ADDITIVE VALUES WITH GM6038-M OR ASTM D 4985		
Detroit Diesel Selected Products System		
	Min. PPM	Max. PPM
Boron (B)	1000	1500
Nitrite (NO <sub>2</sub> )	800	2400
Nitrates (NO <sub>3</sub> )	1000	2000
Silicon (Si)	50	250
Phosphorous (P)	300	500
pH	8.5	10.5

**COOLANT FREEZING AND BOILING TEMPERATURES VS. ANTIFREEZE CONCENTRATION (SEA LEVEL)**



**NOTICE:** Failure to maintain inhibitors at proper levels can result in damage to the cooling system and its related components. Conversely, overinhibiting antifreeze solutions can cause "silicate dropout", which can plug oil cooler and intercooler cores and/or cause hot spots in the engine. Always follow supplier's recommendations on inhibitor usage and handling.

For more detailed coolant recommendations, refer to "Coolant for Detroit Diesel Engines," form 7SE298, available from authorized Detroit Diesel service outlets.

## H. How to Drain and Flush Cooling System

**CAUTION:** Do not remove the pressure control cap from the heat exchanger tank or radiator or attempt to drain the coolant until the engine has cooled. Once the engine has cooled, use extreme care when removing the cap. The sudden release of pressure from a heated cooling system can result in a loss of coolant and possible personal injury (scalding) from the hot liquid.

1. With the engine cool, drain the coolant from the engine and radiator/heat exchanger tank. Dispose of the solution in an environmentally responsible manner according to state and/or federal (EPA) recommendations.
2. Refill the cooling system with clean, soft water and a good radiator cleaning compound. If the engine is warm, fill slowly to prevent the rapid cooling and distortion of the metal castings.
3. Start the engine and operate it with no-load for fifteen minutes to circulate the solution thoroughly and allow the thermostats to open fully.
4. Stop the engine and allow it to cool.
5. With the engine cool, drain the cooling system completely.
6. Refill the cooling system with clean, soft water and operate it under no-load for fifteen minutes to circulate the water and allow the thermostats to open fully.
7. Stop the engine and allow it to cool.
8. With the engine cool, drain the cleaner residue from the cooling system.
9. Install new Detroit Diesel Selected Product supplemental inhibitor precharge elements in the dual element adaptor. Refill the cooling system with the proper mix of antifreeze and clean, soft water.

10. Entrapped air **must** be purged after filling the cooling system. To do this, allow the engine to warm-up without the fill cap installed. Add coolant as required, and install the pressure cap after the coolant level has stabilized at the bottom of the radiator or heat exchanger tank filler neck.

**NOTICE:** If the engine overheats and the coolant level is satisfactory, the cooling system may require cleaning with a descaling solvent and backflushing. *Authorized Detroit Diesel service outlets* are properly equipped to perform these services.

In addition to the cleaning procedure, other components of the cooling system should be checked periodically to keep the engine operating at peak efficiency:

**Hoses.** Cooling system hoses should be inspected and any hose that shows obvious signs of damage or feels abnormally soft or hard should be replaced. Damaged clamps should be replaced. All external leaks should be corrected as soon as detected.

**Coolant Strainer.** Series 149 engines equipped with tube and shell oil coolers and jacket water inter-coolers have coolant strainers which are used to strain contaminants (rust, scale, etc.) from the fresh water cooling system. Strainer baskets should be removed and cleaned annually.

## I. When to Service the Dry Type Air Cleaner

Most dry type air cleaner elements must be discarded and replaced with new elements when the *maximum allowable air cleaner restriction* has been reached, or annually. Some air cleaners are equipped with a restriction indicator which aids in determining the servicing interval.

Before attempting to clean or reuse dry type air cleaner elements, follow the manufacturer's recommendations on reuse and observe his prescribed cleaning, drying and inspection guidelines carefully. This information is available from the manufacturer or distributor of the elements. *Do not reuse damaged air cleaner elements.*

## SPECIFICATIONS

<b>LUBRICATING OIL FILTERS</b>			
<b>Filter Type</b>	<b>Detroit Diesel Part No.</b>	<b>AC Part No.</b>	<b>Micron Rating</b>
Full Flow	25013192	PF-911L	12

<b>FUEL FILTERS</b>				
<b>Filter Type</b>	<b>Usage</b>	<b>Detroit Diesel Part No.</b>	<b>AC Part No.</b>	<b>Micron Rating</b>
Primary	3/4-53 & 71	25014371	TP 936	25
	6/8V 71 & 92	25014274	TP 915	25
	12/16V 92 & 149	25014341	TP 948	25
Secondary	3/4 53 & 71	25010959	TP 928	8
	6/8 71 & 92	25014392	TP 916D	8
	12/16 92 & 149	25011026	TP 959	8
Secondary (severe duty)	3/4 53 & 71	25013273	TP 928L	3
	6/8 71 & 92	25013261	TP 916L	3
	12/16 92 & 149	25013535	TP 959L	3

## SPECIFICATIONS

### COOLANT FILTERS

Engine	Cooling System Capacity (Gal)	Detroit Diesel Precharge Element Part No.	Detroit Diesel Maintenance Element Part No.
6-71	14	23507189	23507545
12V-71	30-39	23508427	23508425
6V-71, 92	13-22	23507189	23507545
8V-71, 92	22-24	23508427	23508425
12V-92	40-50	23508428	23508426
16V-71, 92	47	23508428	23508426
8V-149	70	(2) 23508427	(2) 23508425
12V-149	109	(2) 23508428	(2) 23508426
16V-149	138	(2) 23508428	(2) 23507189

### ADDITIONAL COOLANT INHIBITOR TREATMENT PRODUCTS

Item	Size	Detroit Diesel Part No.
NALCOOL 2000* -Liquid	Pint (12 per case)	23507858
	Half Gallon (6 per case)	23507859
	5 Gallon	23507860
NALCOOL 3000* -Liquid	Pint (12 per case)	23507854
	Half Gallon (6 per case)	23507855
	5 Gallon	23507856
NALPREP 2001* -Liquid On-Line Cleaner	Half Gallon (6 per case)	23507862
	5 Gallon	23507863
NALCOOL 2015* Twin Pac- Dry Chemical	2 per case	23507867

\*NALCOOL, Nalco, and NALPREP are registered trademarks of the Nalco Chemical Company.

## 7. SERVICE PUBLICATIONS

Service manuals covering Detroit Diesel Series 71, 92 and 149 engines are listed below. Also shown are reference works which may be of interest to the owner/operator.

To purchase a copy of these publications, contact an authorized Detroit Diesel distributor. Check the Yellow Pages under "Engine, Diesel" or refer to the Worldwide Distributor and Dealer Directory (form 6SE280) for the distributor nearest you.

<u>Description</u>	<u>Form No.</u>
Generator Set Operator's Guide .....	6SE513
Worldwide Distributor/Dealer Directory .....	6SE280
Inline 71, Engine Service Manual .....	6SE164
V-71, Engine Service Manual .....	6SE193
Series 92, Engine Service Manual .....	6SE379
Series 149, Engine Service Manual .....	6SE313
Lube Oil, Fuel, Filter Recommendations .....	7SE270
Coolant Recommendations .....	7SE298
Warranty Registration Form .....	6SA340



## 8. CUSTOMER ASSISTANCE

The satisfaction and goodwill of the owners of Detroit Diesel engines are of primary concern to Detroit Diesel Corporation and its distributor/dealer organization.

As the owner of a Detroit Diesel Corporation product, you have a complete network of over 3,000 authorized service outlets in the U.S. and Canada, plus many outlets worldwide that are prepared and anxious to meet your parts and service needs:

- Service by trained personnel.
- Sales teams to help determine your power requirements.
- In many areas, emergency service 24 hours a day.
- Complete parts support including reliability components.
- Product information and literature.

*To further assure your complete satisfaction, we have developed the following procedure to be followed in the event you have a problem that has not been handled satisfactorily.*

### Step One

Discuss your problem with a member of management from the authorized service outlet. Frequently complaints are the result of a breakdown in communication and can quickly be resolved by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. If your complaint originates with a dealer, explain the matter to a management member of the distributorship with whom the dealer has his service agreement.

### Step Two

When it appears that your problem cannot readily be resolved at the distributor level without additional assistance, contact the Detroit Diesel Corporation Regional Product Support or Operations Manager responsible for your local distributor. You will be assisted by a member of the Manager's staff, depending upon the nature of your problem.

Prior to this contact, have the following information available:

- Name and location of authorized service outlet.
- Type and make of equipment.
- Engine delivery date, serial and model number and accumulated hours of operation.
- Nature of problem.
- Chronological summary of engine's history.

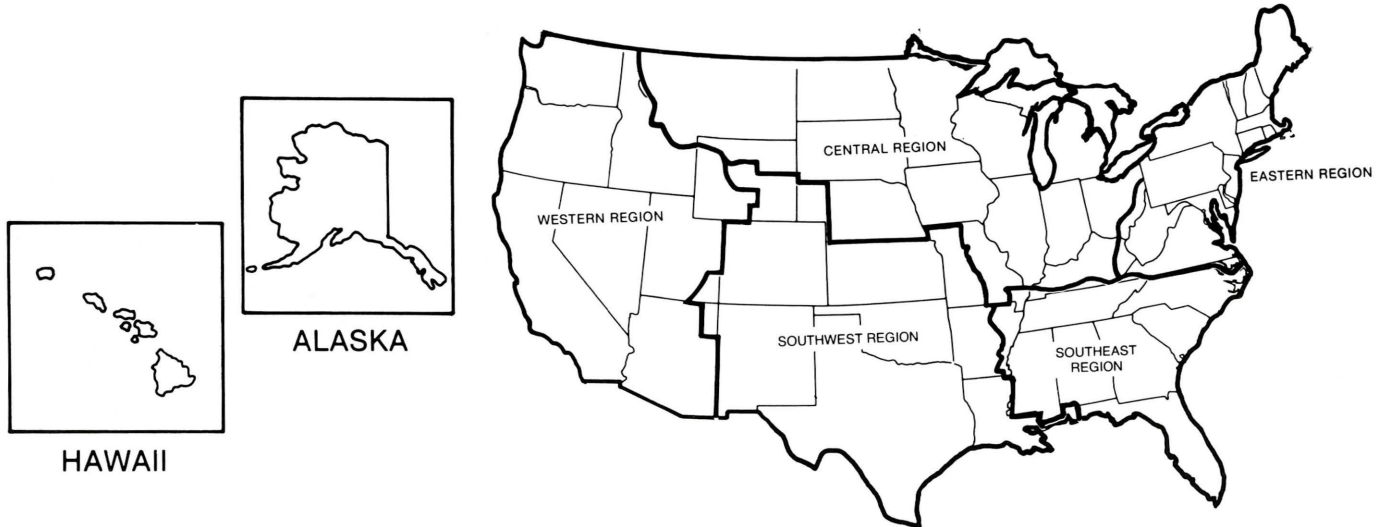
### Step Three

If you are still not satisfied, present the entire matter in writing or by phone to:

**Director,  
Reliability and Materials Engr.**  
Detroit Diesel Corporation  
13400 Outer Drive, West  
Detroit, Michigan 48239-4001  
Phone: (313) 592-7357

When contacting the regional or home office, please keep in mind that ultimately your problem will likely be resolved at the distributor or dealership, utilizing their facilities, equipment, and personnel. Therefore, it is suggested that you follow the above steps in sequence when experiencing a problem.

Identify the U.S. regional area from the map below:



## Regional Offices Worldwide

Let us solve your power generation needs. Please contact the nearest Detroit Diesel Regional Office for assistance.

**Eastern Region**  
**Long Branch, New Jersey**  
187 Monmouth Park Highway  
West Long Branch, NJ 07764  
Phone: (908) 222-1888  
Fax: (908) 222-3411

**Southeastern Region**  
**Atlanta, Georgia**  
100 Galleria Parkway  
Suite 1170  
Atlanta, GA 30339  
Phone: (404) 953-3696  
Fax: (404) 952-5482

**Central Region**  
**Detroit, Michigan**  
13400 Outer Drive, West  
Detroit, MI 48239-4001  
Phone: (313) 592-5990  
Fax: (313) 592-5158

**Southwestern Region**  
**Dallas, Texas**  
2711 LBJ Freeway  
Suite 1036  
Dallas, TX 75234  
Phone: (214) 247-4313  
Fax: (214) 247-4316

**Western Region**  
**Downey, California**  
10645 Studebaker Road  
Downey, CA 90241  
Phone: (310) 929-7016  
Fax: (310) 864-0502

**Canadian Region**  
**London, Ontario**  
Detroit Diesel of Canada Ltd.  
150 Dufferin Ave., Suite 701  
London, ON N6A 5N6  
Phone: (519) 661-0149  
Fax: (519) 661-0171

**Latin American Region**  
**Miami, Florida**  
2277 N.W. 14th Street  
Miami, FL 33125-0068  
Phone: (305) 637-1555  
Fax: (305) 637-1580

**Asian Region**  
**Singapore**  
7 Jurong Pier Rd.  
Singapore 2261  
Phone: (65) 265-4697  
Fax: (65) 265-9530

**Pacific Region**  
**Australia**  
13 Lynette Ave.  
Beaumaris, Victoria 3193  
Australia  
Phone: (61) 3-5895181  
Fax: (61) 3-5893424

**Europe, Middle East, Africa (EMA) Region**  
**Switzerland**  
Schafftenholzweg 54/Postfach  
CH-2557 Studen (Biel Bienne)  
Switzerland  
Phone: (41) 32-215650  
Fax: (41) 32-535162

**Mexico**  
**Detroit Diesel-Allison de Mexico, S.A.**  
Reforma 2977  
Colonia, Cuajimalpa  
Mexico, D.F. 05000, Mexico  
Phone: (52) 5-570-3860  
Fax: (52) 5-570-3109

**DETROIT DIESEL**  
CORPORATION



13400 Outer Drive, West / Detroit, Michigan 48239-4001  
Telephone: 313-592-5000  
Telex: 4320091 / TWX: 810-221-1649  
FAX: 313-592-7288

# **KOHLER**<sup>®</sup> POWER SYSTEMS

parts listing for  
**Fast Response II**  
**Diesel-Fueled Generator Sets**  
**20-180ROZJ**  
(John Deere-Powered)

(Contains generator components  
and some engine components.  
See Group 701. Literature for  
Engine Parts Catalog)

Series 189



TP-5408  
5/91

## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER	<i>Air Intake</i>	<i>Fuel System</i>	<i>Coolant System</i>	<i>Engine</i>	<i>Nameplates and Decals</i>	<i>Oil Pressure Switches</i>	<i>Skid and Plant Mounting</i>	<i>Water Temperature Switches</i>	<i>Starter</i>	<i>Generator and Mounting</i>	<i>Controller and Mounting</i>	<i>Accessories</i>	<i>Literature</i>
GROUP NO.	101	103	104	105	107	108	109	110	112	201	301	601	701
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107
GRID													
SPEC. NO.	VARIATION NUMBER												
<b>20ROZJ</b>													
189001	4	2	4	2	10	1	1	1	-	12	10	-	6
189002	4	2	4	2	11	1	1	1	-	17	12	-	6
189003	4	2	4	2	10	1	1	1	-	10	10	-	6
189004	4	2	4	2	10	1	1	1	-	12	@	-	6
189005	4	2	4	2	11	1	1	1	-	17	@	-	6
189006	4	2	4	2	10	1	1	1	-	10	@	-	6
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189013	4	2	@	12	10	1	1	1	-	12	@	-	11
189014	4	2	@	12	10	1	1	1	-	10	@	-	11
189015	4	2	@	12	11	1	1	1	-	17	@	-	11
<b>30ROZJ</b>													
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189102	4	2	4	2	12	1	1	1	-	13	12	-	5
189103	4	2	4	2	8	1	1	1	-	11	10	-	5
189104	4	2	4	2	8	1	1	1	-	10	@	-	5
189105	4	2	4	2	12	1	1	1	-	13	@	-	5
189106	4	2	4	2	8	1	1	1	-	11	@	-	5
189107	4	2	@	2	8	1	1	1	-	10	@	-	5
189108	4	2	@	2	8	1	1	1	-	11	@	-	5
189109	4	2	@	2	12	1	1	1	-	13	@	-	5

@ See standard accessories list in Accessories section.

## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER	Air Intake	Fuel System	Coolant System	Engine	Nameplates and Decals	Oil Pressure Switches	Skid and Plant Mounting	Water Temperature Switches	Starter	Generator and Mounting	Controller and Mounting	Accessories	Literature	
	101	103	104	105	107	108	109	110	112	201	301	601	701	
GROUP NO.	101	103	104	105	107	108	109	110	112	201	301	601	701	
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107	
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189203	4	2	4	2	9	1	1	1	-	1	15	-	8	
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189212	4	2	4	12	9	1	1	1	-	1	15	-	13	
189213	4	2	@	12	9	1	1	1	-	11	@	-	13	
189214	4	2	@	12	9	1	1	1	-	1	@	-	13	
189215	4	2	@	12	13	1	1	1	-	14	@	-	13	

@ See standard accessories list in Accessories section.

## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER	Air Intake	Fuel System	Coolant System	Engine	Nameplates and Decals	Oil Pressure Switches	Skid and Plant Mounting	Water Temperature Switches	Starter	Generator and Mounting	Controller and Mounting	Accessories	Literature
	101	103	104	105	107	108	109	110	112	201	301	601	701
GROUP NO.	101	103	104	105	107	108	109	110	112	201	301	601	701
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107
GRID													
SPEC. NO.	VARIATION NUMBER												
<b>50ROZJ</b>													
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189304	1	1	1	3	1	1	1	1	-	1	@	-	1
189305	1	1	1	3	14	1	1	1	-	2	@	-	1
189306	1	1	1	3	1	1	1	1	-	3	@	-	1
189307	1	1	@	3	1	1	1	1	-	1	@	-	1
189308	1	1	@	3	1	1	1	1	-	3	@	-	1
189309	1	1	@	3	14	1	1	1	-	2	@	-	1
<b>60ROZJ</b>													
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189402	1	1	1	3	15	1	1	1	-	4	4	-	7
189403	1	1	1	3	2	1	1	1	-	3	@	-	7
189404	1	1	1	3	15	1	1	1	-	4	@	-	7
189405	1	1	@	3	2	1	1	1	-	3	@	-	7
189406	1	1	@	3	15	1	1	1	-	3	@	-	7
<b>80ROZJ</b>													
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189502	2	4	2	4	16	3	2	3	-	15	14	-	2
189503	2	4	2	4	3	3	2	3	-	6	5	-	2
189504	2	4	2	4	3	3	2	3	-	5	@	-	2
189505	2	4	2	4	16	3	2	3	-	15	@	-	2
189506	2	4	2	4	3	2	3	3	-	6	@	-	2
189507	2	4	@	4	3	3	2	3	-	5	@	-	2

@ See standard accessories list in Accessories section.

## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER														
	<i>Air Intake</i>	<i>Fuel System</i>	<i>Coolant System</i>	<i>Engine</i>	<i>Nameplates and Decals</i>	<i>Oil Pressure Switches</i>	<i>Skid and Plant Mounting</i>	<i>Water Temperature Switches</i>	<i>Starter</i>	<i>Generator and Mounting</i>	<i>Controller and Mounting</i>	<i>Accessories</i>	<i>Literature</i>	
<b>GROUP NO.</b>	<b>101</b>	<b>103</b>	<b>104</b>	<b>105</b>	<b>107</b>	<b>108</b>	<b>109</b>	<b>110</b>	<b>112</b>	<b>201</b>	<b>301</b>	<b>601</b>	<b>701</b>	
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107	
GRID														
<b>SPEC. NO.</b>	<b>VARIATION NUMBER</b>													
<b>80ROZJ</b>														
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189509	2	4	@	4	3	16	2	3	-	15	@	-	2	
<b>100ROZJ</b>														
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189605	2	4	2	5	17	3	2	3	-	16	@	-	9	
189606	2	4	2	5	4	3	2	3	-	20	@	-	9	
189607	2	4	@	5	4	3	2	3	-	6	@	-	9	
189608	2	4	@	5	4	3	2	3	-	20	@	-	9	
189609	2	4	@	5	17	3	2	3	-	16	@	-	9	
<b>125ROZJ</b>														
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189702	3	-	3	6	18	2	3	2	-	18	14	-	3	
189703	3	-	3	6	5	2	3	2	-	8	@	-	3	
189704	3	-	3	6	18	2	3	2	-	18	@	-	3	
189705	3	-	3	6	5	2	3	2	-	8	20	-	3	
189706	3	-	@	6	5	2	3	2	-	8	@	-	3	
189707	3	-	@	6	18	2	3	2	-	18	@	-	3	
<b>150ROZJ</b>														
189801	3	-	3	7	6	2	3	2	-	8	8	-	10	
189802	3	-	3	7	19	2	3	2	-	18	17	-	10	
189803	3	-	5	9	21	2	4	2	-	21	19	-	10	

@ See standard accessories list in Accessories section.

## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER	Air Intake	Fuel System	Coolant System	Engine	Nameplates and Decals	Oil Pressure Switches	Skid and Plant Mounting	Water Temperature Switches	Starter	Generator and Mounting	Controller and Mounting	Accessories	Literature	
	GROUP NO.	101	103	104	105	107	108	109	110	112	201	301	601	701
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107	
GRID														
SPEC. NO.	VARIATION NUMBER													
<b>150ROZJ</b>														
189804	3	-	3	7	6	2	3	2	-	8	@	-	10	
189805	3	-	3	7	19	2	3	2	-	18	@	-	10	
189806	3	-	5	9	21	2	4	2	-	21	@	-	10	
189807	3	-	3	7	6	2	3	2	-	8	21	-	10	
189808	2	-	@	7	6	2	3	2	-	8	@	-	10	
189809	3	-	@	9	21	2	4	2	-	21	@	-	10	
189810	3	-	@	7	19	2	3	2	-	18	@	-	10	
<b>180ROZJ</b>														
189901	3	-	5	8	7	2	4	2	-	9	9	-	4	
189902	3	-	5	8	20	2	4	2	-	19	18	-	4	
189903	3	-	5	8	7	2	4	2	-	22	9	-	4	
189904	3	-	5	8	7	2	4	2	-	9	@	-	4	
189905	3	-	5	8	20	2	4	2	-	19	@	-	4	
189906	3	-	5	8	7	2	4	2	-	22	@	-	4	
189911	3	-	6	8	7	2	4	2	-	9	9	-	4	
189912	3	-	6	8	20	2	4	2	-	19	18	-	4	
189913	3	-	6	8	7	2	4	2	-	22	9	-	4	
189914	3	-	6	8	7	2	4	2	-	9	@	-	4	
189915	3	-	6	8	20	2	4	2	-	2	19	-	4	
189916	3	-	6	8	7	2	4	2	-	22	@	-	4	
189917	3	-	@	8	7	2	4	2	-	9	@	-	4	
189918	3	-	@	8	7	2	4	2	-	22	@	-	4	
189919	3	-	@	8	20	2	4	2	-	19	@	-	4	

@ See standard accessories list in Accessories section.



## SPECIFICATION NUMBER INDEX

GROUP TITLE & NUMBER	<i>Air Intake</i>	<i>Fuel System</i>	<i>Coolant System</i>	<i>Engine</i>	<i>Nameplates and Decals</i>	<i>Oil Pressure Switches</i>	<i>Skid and Plant Mounting</i>	<i>Water Temperature Switches</i>	<i>Starter</i>	<i>Generator and Mounting</i>	<i>Controller and Mounting</i>	<i>Accessories</i>	<i>Literature</i>
GROUP NO.	101	103	104	105	107	108	109	110	112	201	301	601	701
PAGE	1	2	3	7	11	14	15	17	-	19	27	33	107
GRID													
SPEC. NO.	VARIATION NUMBER												
<b>180ROZJ</b>													
189920	3	-	6	8	7	2	4	2	-	24	9	-	4
189921	3	-	6	8	20	2	4	2	-	25	18	-	4
189922	3	-	6	8	7	2	4	2	-	26	9	-	4
189923	3	-	@	8	7	2	4	2	-	24	@	-	4
189924	3	-	@	8	7	2	4	2	-	26	@	-	4
189925	3	-	@	8	7	2	4	2	-	26	@	-	4

@ See standard accessories list in Accessories section.

# INTRODUCTION

This manual contains a complete listing of alternator service replacement parts and some engine engine components for Kohler 20–180 ROZJ Generator sets with specification series code 189. The manual includes the following main sections in the sequence listed.

1. *Generator Specification Number Index:* Listing of generator set spec. numbers arranged in numerical sequence on each page. Group variation numbers are listed in the horizontal line to the right of each spec. number.

2. *Group Parts List:* Indicates specific parts for each specification. Illustrations of parts are shown for some of the various parts. Illustrations are keyed to the part numbers found in the parts group listings.

**NOTE:** Common hardware is generally not illustrated. All hex. head screws/bolts are hardness grade (gr.) 5, except where noted. Socket head screws are similar to grade 8. All other hardware is grade 2, except where noted. Do not substitute with inferior grade hardware. Refer to the back of the Parts Catalog for more information regarding hardware.

## NUMBER SIGNIFICANCE

There are various numbers which must be used in the determining how to identify a part number. The significance of each of these numbers is explained as follows:

**GENERATOR SPECIFICATION NUMBER:** The generator set specification number, which is found on the nameplate attached to the frame of the generator, indicates model variation or the combination of groups used to build that particular generator set. The spec. number is, in effect, a coded number. The first three digits, which are the code designation for generator set size and engine model, remain constant in this series while the remaining digits in the spec. number are issued in numerical sequence. When the sequential number reaches 99, the next number will be 100 for example: 110199 is followed by 1101100 – note that the spec. number goes from a 6 digit to a 7 digit number in this example.

**ENGINE MODEL NUMBER:** The engine number, which is found on the nameplate attached to the engine.

**GROUP NUMBER:** The group consists of related parts needed to provide one or more related functions.

**GROUP VARIATION NUMBER:** There may be various groupings of parts designed to provide the same function, however, with minor differences. Each of these differences necessitates the assignment of a group variation number. Example, dry air cleaner or oil bath air cleaner – both perform the same function, however, use different parts.

**PART NUMBER:** The part number is the number by which an individual piece (or assembly) of a generator set is identified and ordered.

## HOW TO FIND PART NUMBERS

Following is a step-by-step procedure to be used in identifying and ordering a specific part.

*Item to be ordered: ROTOR ASSEMBLY*

**STEP 1:** Record the *Generator set* specification number from the nameplate on the generator set. (Sample: 189001)

**STEP 2:** In the Generator Specification Number Index, find spec. no. 189001 in the left-hand vertical column. Under

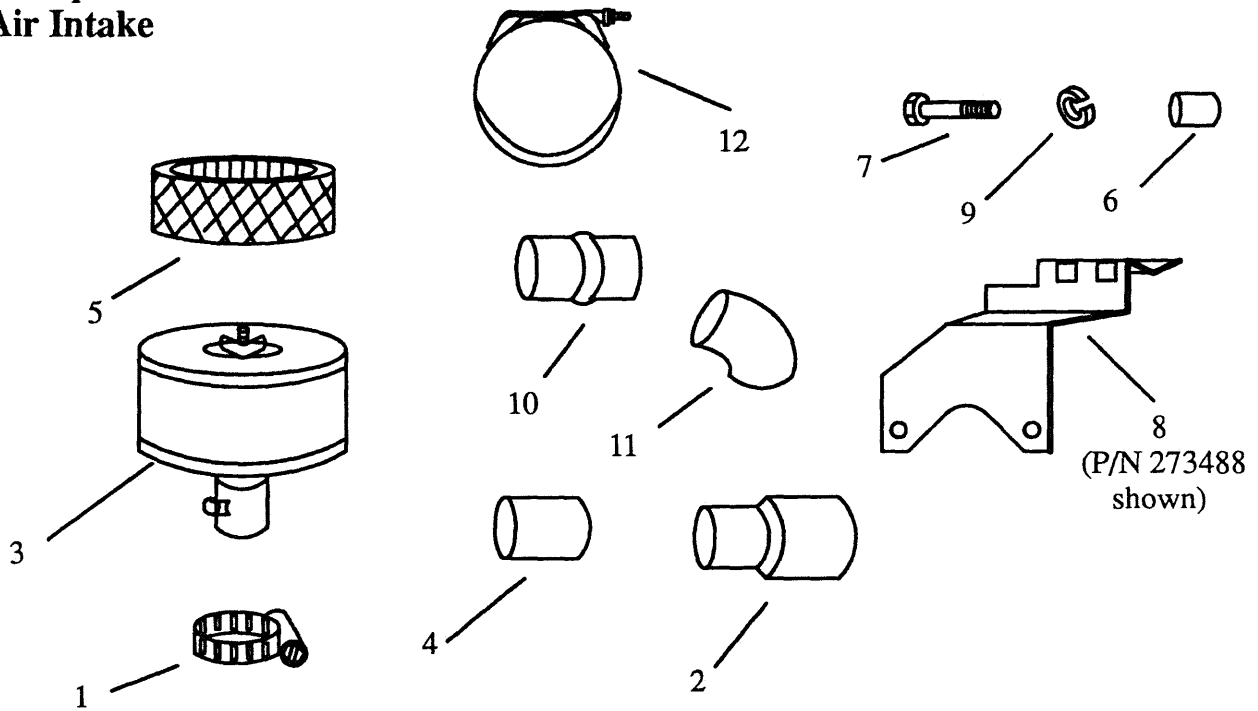
Group 201 – Generator and Mounting column, locate the variation number assigned to specification 189001. The variation number is 12.

**NOTE:** In other reference material the group/variation number may appear as 201–184–12. All group numbers used in this catalog have the same middle numbers: –184–.

**STEP 3:** Turn to Part Group 201 – Generator and Mounting. Note the Rotor assemblies are identified with Item Number 27 – under this number locate Variation 12. Rotor assembly A–258980 is assigned to this variation.

## Series 189

### Group 101 Air Intake

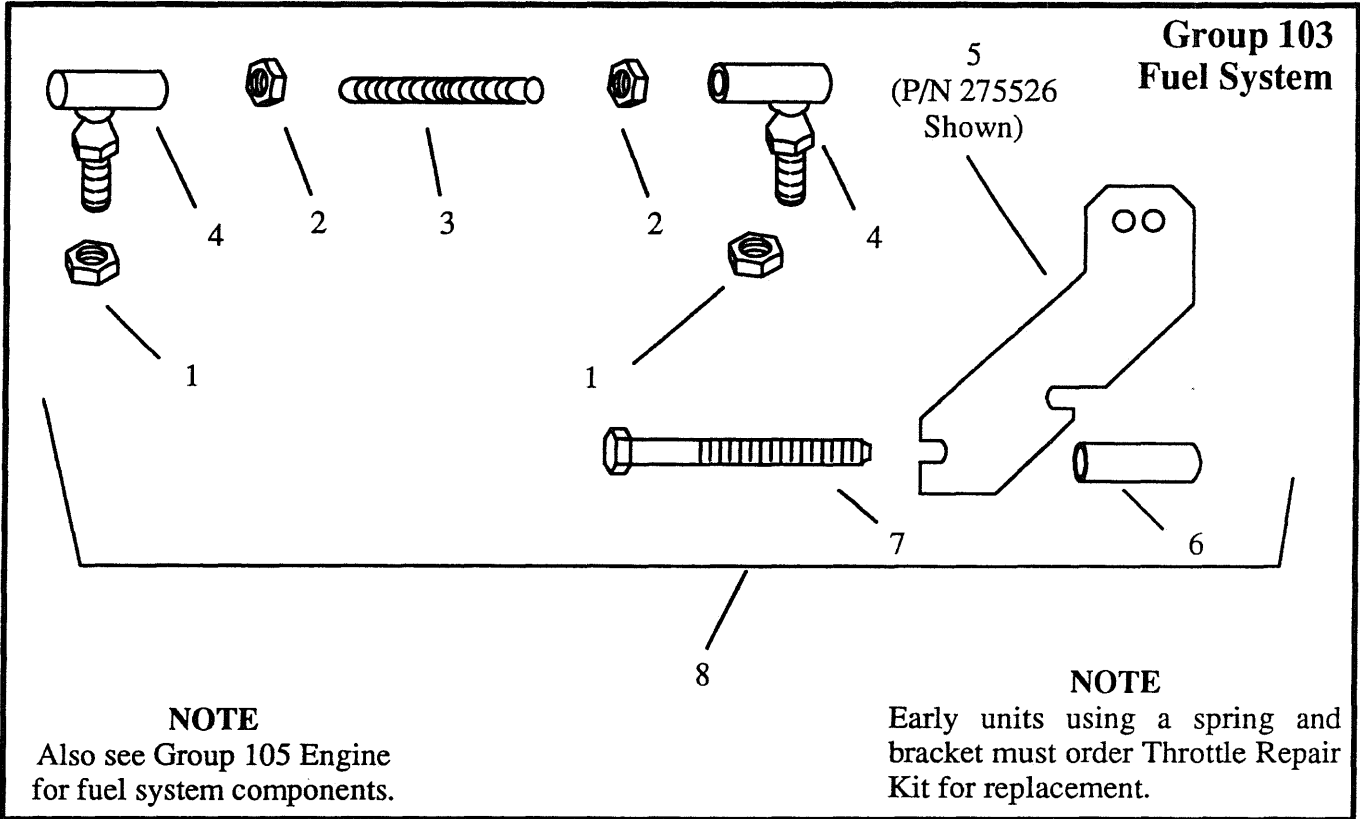


Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	2	Clamp, 3-3/4 hose	X-426-1	6	2	Spacer, 11/32 x 3/4 x 13/16	X-400-37
	1	1		2	2	2	
	1	Clamp, 3-3/4 hose	X-426-13	2	2	Spacer, 13/32 x 5/8 x 2-17/32	X-400-132
	2	2		3	2	3	
	2	Clamp, 4-1/2 hose	X-426-5	7	2	Screw, 1/4-20 x 2+1/4, gr. 5	X-6238-13
	2	2,3		2	2	2	
	2	Clamp, 3 hose	250081	2	2	Screw, 1/4-20 x 2-1/2, gr. 5	X-6238-12
	4	4		3	3	3	
2	1	Hose, reducer	255520	8	1	Bracket, air cleaner	273488
	4	4		2	1	2	
3	1	Cleaner assembly, air	A-273699	1	1	Bracket, air cleaner	273440
	1	1		3	1	3	
	1	Cleaner assembly, air	A-273700	9	2	Washer, 3/8 split lock	X-22-1
	1	2,3		3	2	3	
	1	Cleaner assembly, air	258883	10	1	Hose, hump 3 id x 5-1/2	253481
	4	4		2	1	2	
4	1	Hose, 3 id x 2.25 in.	X-507-1			(air cleaner)	
	1	1		11	1	Hose, elbow 45 deg.	273442
5	1	Element	253107	3	1	3	
	1	1		12	1	Clamp, 4-3/4 hose (band)	254087
	1	2,3	253108	2,3			
	1	Element	254471				
	4	4					

X Not Sold Separately

# Series 189

## Group 103 Fuel System

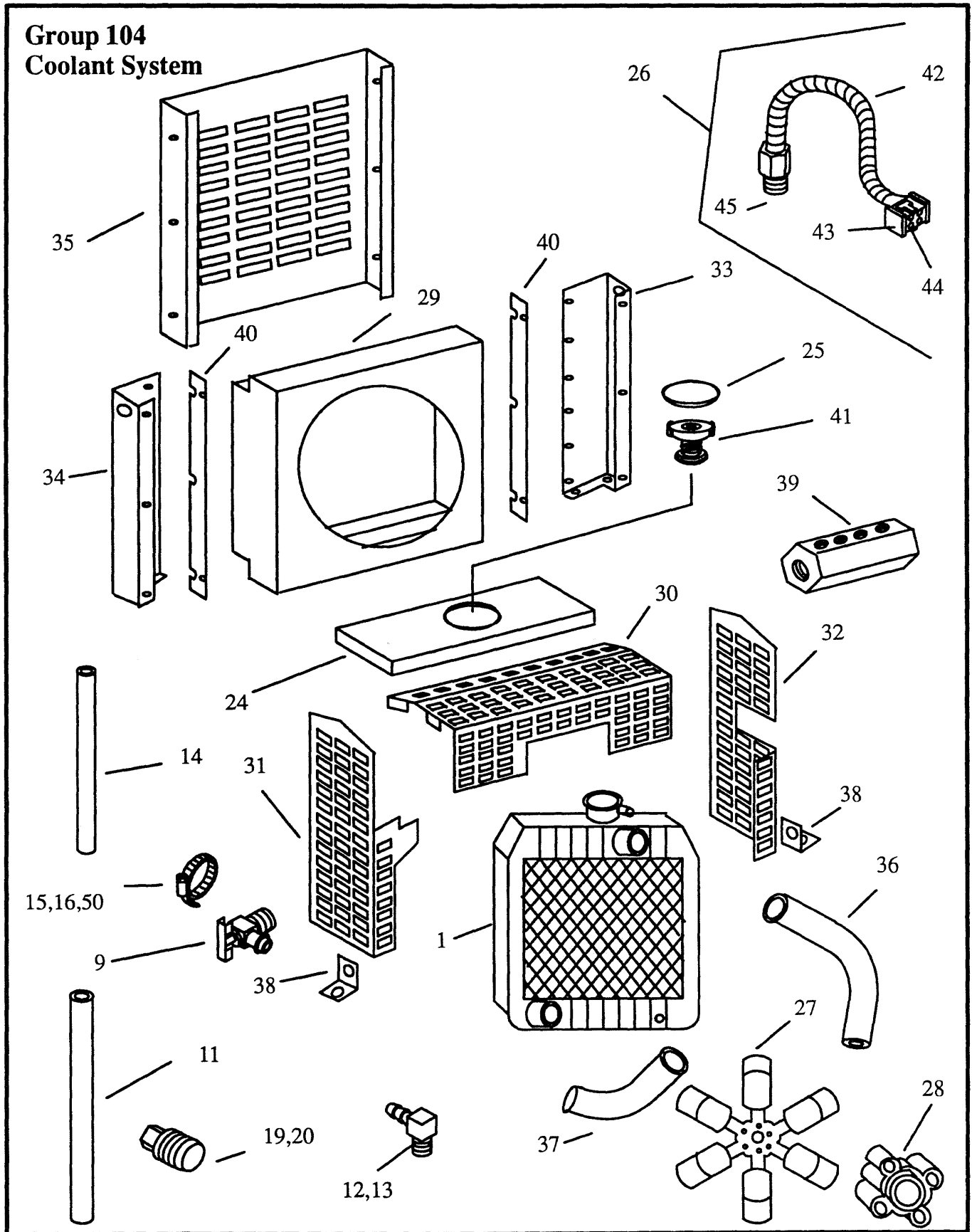


Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	2	Nut, 1/4-28 lock 1,2,4	X-101-7	8	1	Throttle repair kit 1	275548
2	2	Nut, 1/4-28 1,2,4	X-81-2		1	Throttle repair kit 2	275547
3	1	Stud 1,2,4	253424		1	Throttle repair kit 4	275525
4	2	Ball joint 1,2,4	271097				
5	1	Bracket, mounting 1	275526				
	1	Bracket, mounting 2	275543				
	1	Bracket, mounting 4	275525				
6	2	Spacer, 13/32 x 3/4 x 1-3/4 2,4	X-400-5				
7	2	Screw, 3/8-16 x 3, gr.5 2,4	X-6238-9				

**NOTE:** Item 8 Throttle repair kit includes Items 1-7.

# Series 189

## Group 104 Coolant System



X Not Sold Separately

# Series 189

## Group 104 Coolant System

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Radiator assembly 1	A-276522	13	2	Connector, 5/8 x 1/2NPT hose 4 elbow (early)	X-391-19
	1	Radiator assembly 2	A-276526	14	1	Line, 1/2 ID x 6-1/2" flex fuel 4	X-422-26
	1	Radiator assembly 3,5	A-273433	15	2	Clamp, 2-1/4" hose 1,4	X-426-4
	1	Radiator assembly 4	A-273596	16	2	Clamp, 2-1/2" hose 1,4	X-426-6
	1	Radiator assembly 6	A-273927	17	2	Screw, 1/4-20 x 1/2 1,4	X-465-6
2	4	Screw, 5/16-18 x 3, Gr. 5 1,4	X-125-28	2	2	Screw, 1/4-20 x 5/8 3	X-465-2
3	6	Screw, 5/16-18 x 3/4, Gr. 5 1,4	X-125-3	18	2	Tie, cable 1,2,4	X-468-2
	14	Screw, 5/16-18 x 3/4, Gr. 5 3,5,6	X-125-3	3	3	Tie, cable 3,5,6	X-468-2
4	6	Screw, 5/16-18 x 1, Gr. 5 1,2,3,4,5,6	X-125-5	19	1	Plug, 1/4 NPT sq. head pipe 4 (early)	X-75-2
5	2	Washer, 1/4 in. split lock 1,4	X-20-1	20	1	Plug, pipe 1/2NPT 4	X-75-28
	4	Washer, 1/4 in. split lock 3,5,6	X-20-1	21	30	Screw, 1/4-14 drill 1,3,4,5,6	X-794-1
6	1	Bushing, reducer 3/8 F x 1/2 M 1,4 (early)	X-202-28	34	34	Screw, 1/4-14 drill 2	X-794-1
	1	Bushing, reducer 1/4 F x 1/2 M 3,5,6	X-202-12	22	4	Washer, 21/64 x 23/32 x 1/8 1,4	X-801-4
7	12	Washer, 5/16 in. split lock 1,4	X-21-1		4	Washer 13/32 x 13/16 x 3/64 2 hardened	X-801-3
	4	Washer, 5/16 in. split lock 2	X-21-1	6	6	Washer, 13/32 x 13/16 x 3/64 3,5,6 hardened	X-801-3
	20	Washer, 5/16 in. split lock 5,6	X-21-1	23	6	Nut, 5/16-18 1,3,4,5,6	X-82-2
8	6	Washer, 11/32 x 11/16 x 3/64 plain 1,4	X-25-85		4	Nut, 5/16-18 2	X-82-2
	4	Washer, 11/32 x 11/16 x 3/64 plain 2	X-25-85	24	1	Cover, radiator 1,2,4	253071
	12	Washer, 11/32 x 11/16 x 3/64 plain 5,6	X-25-85		1	Cover, radiator 3	273441
9	2	Valve, drain 1/4NPT 1,2,4	X-256-3		1	Cover, radiator 5,6	273507
	1	Valve, drain 1/4NPT 5,6	X-256-3	25	1	Plug, 4" plastic 1,2,3,4,5,6	253268
10	1	Valve, 1/2NPT drain 4	X-256-5	26	1	Switch assembly, coolant level 1,2,3,4,5,6	273404
11	1	Hose, 5/8 ID x 4-1/2" 4	X-312-41				
12	1	Connector, 1/2 x 3/8 NPT elbow 1,4 (early)	X-391-13				

X Not Sold Separately

## Series 189

### Group 104 Coolant System

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
27	1	Fan, blower 1	273405	33	1	Support, radiator (right) 1,4	273414
	1	Fan, blower 2	275552		1	Support, radiator (right) 2	273473
	1	Fan, blower 3,5	273437		1	Support, radiator (right) 3	273451
	1	Fan, blower 4	273492		1	Support, radiator (right) 5	273518
	1	Fan, blower 6	273929		1	Support, radiator (right) 6	273860
28	1	Spacer, fan 1,4	273407	34	1	Support, radiator (left) 1,4	273415
	1	Spacer, fan 2	273406		1	Support, radiator (left) 2	273474
	1	Spacer, fan 5,6	273756		1	Support, radiator (left) 3	273436
29	1	Shroud, fan 1	273408		1	Support, radiator (left) 5	273512
	1	Shroud, fan 2	273480		1	Support, radiator (left) 6	273859
	1	Shroud, fan 3,5	273438	35	1	Shroud, radiator 1,4	273416
	1	Shroud, fan 4	273493		1	Shroud, radiator 2	273475
	1	Shroud, fan 6	273858		1	Shroud, radiator 3	273439
30	1	Guard, fan (top) 1,4	273409		1	Shroud, radiator 5	273861
	1	Guard, fan (top) 2	273485		1	Shroud, radiator 6	273417
	1	Guard, fan (top) 3	273453	36	1	Hose, upper radiator 1,4	273417
	1	Guard, fan (top) 5	273757		1	Hose, upper radiator 2	273462
	1	Guard, fan (top) 6	273862		1	Hose, upper radiator 3,5,6	273444
31	1	Guard, fan (left) 1,4	273410	37	1	Hose, lower radiator 1,4	273418
	1	Guard, fan (left) 2	273486		1	Hose, lower radiator 2	273463
	1	Guard, fan (left) 3	273449		1	Hose, lower radiator 3	273443
	1	Guard, fan (left) 5	273510		1	Hose, lower radiator 5	273777
	1	Guard, fan (left) 6	273863		1	Hose, lower radiator 6	273930
32	1	Guard, fan (right) 1,4	273411	38	1	Bracket, guard mounting 1,4 (early models only)	273658
	1	Guard, fan (right) 2	273487		1	Bracket, guard mounting 3	273489
	1	Guard, fan (right) 3	273448		1	Bracket, guard mounting 5,6	273626
	1	Guard, fan (right) 5	273511				
	1	Guard, fan (right) 6	273864				

X Not Sold Separately

# Series 189

## Group 104 Coolant System

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
39	1	Manifold, water temp. (early) 4	273659				
40	2	Spacer, radiator support 1,4	273911				
41	1	Cap, radiator 7 psi (48 kPa) 1-5 (Radiator Specialties)	224358				
	1	Cap, radiator 7 psi (48 kPa) 3,5,6 (Modine)	224357				
42	1	Conduit, plastic 1,2,3,4,5,6	X-6003-17				
43	1	Connector, pin housing 1,2,3,4,5,6	239411				
44	3	Pin 1,2,3,4,5,6	239516				
45	1	Sensor, low coolant 1,2,3,4,5,6	273520				
46	4	Washer, 3/8 split lock 2	X-22-1				
47	4	Screw, 3/8-16 x 3/4, Gr. 5 2	X-6238-10				
	4	Screw, 3/8-16 x 3, Gr. 5 2	X-6238-9				
	6	Screw, 3/8-16 x 1-3/4, Gr. 5 3	X-6238-1				
	4	Screw, 1/4-20 x 5/8, Gr. 5 3,5,6	X-465-2				
	6	Screw, 3/8-16 x 3-1/2, Gr. 5 5,6	X-6238-12				
48	4	Nut, 1/4-20 3,5,6	X-81-1				
49	4	Washer, 9/32 x 5/8 x 1/16 plain 5,6	X-25-40				
50	4	Clamp, 3 ID hose 2,3,5,6	250081				

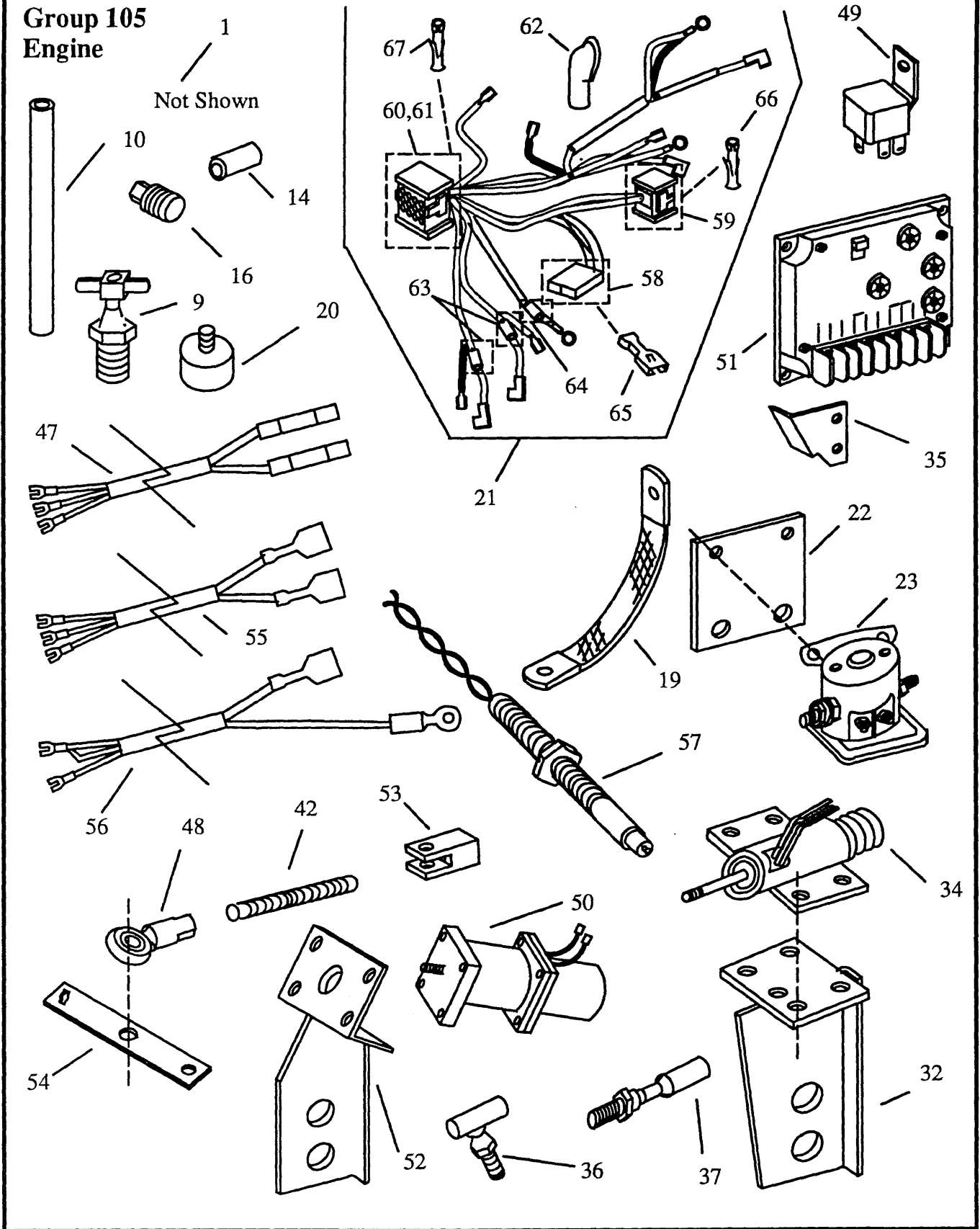
**NOTE;** Item 1 Radiator assembly includes Item 41 Radiator Cap.  
Item 26, Coolant level switch assembly includes Items 42-45.  
*Early* models are defined as 20ROZJ with specs. below 189010, 30ROZJ with specs. below 189110, 40ROZJ with specs. below 189210, and 50/60 ROZJ with serial nos. below 257821. If the original radiator assembly is replaced, unit is no longer considered an early version.

X Not Sold Separately



# Series 189

## Group 105 Engine



X Not Sold Separately

# Series 189

## Group 105 Engine

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Engine assembly 2	C-273461	11	2	Screw, 1/4-20 x 1/2 2-9,12	X-465-6
	1	Engine assembly 3	A-273458	12	1	Tie, cable 2,3,6,7,9,12	X-468-1
	1	Engine assembly 4	A-273459	8	8	Tie cable 8	X-468-1
	1	Engine assembly 5	A-273460	13	3	Tie, cable 2,-5,12	X-468-2
	1	Engine assembly 6	A-273454	14	1	Cap, plastic 2	X-6214-3
	1	Engine assembly 7	A-273455	1	1	Cap, plastic 3-8,12	X-6214-2
	1	Engine assembly 8	A-273456	15	1	Nut, 10-32 2,3,6-8,12	X-70-3
	1	Engine assembly 9	A-273839	2	2	Nut, 10-32 4,5,9	X-70-3
	1	Engine assembly 12	C-273461	16	1	Plug, 1/2 NPT 2-5,12	X-75-28
2	2	Screw, 1/2-13 x 1, Gr. 5 2,3,4,5,12	X-129-17	17	2	Nut, 1/4-20 2-5,12	X-81-1
	2	Screw, 1/2-13 x 1-1/4, Gr. 5 6,7	X-129-18	6	6	Nut, 1/4-20 6-9	X-81-1
	1	Screw, 1/2-13 x 1-1/4, Gr. 5 8,9	X-129-18	18	1	Nut, 5/16-18 7	X-82-2
3	1	Washer, #10 split lock 2,3,4,5,6,7,9,12	X-19-1	2	2	Nut, 5/16-18 9	X-82-2
	6	Washer, #10 split lock 8	X-19-1	19	1	Strap, ground 2-9,12	223033
4	2	Washer, 1/4" split lock 2,3,4,5,12	X-20-1	20	2	Bumper 2-9,12	259632
	7	Washer, 1/4" split lock 6,7	X-20-1	21	1	Harness, wiring (Delco B.C. alt.) 2,3,12	275564
	8	Washer, 1/4" split lock 8,9	X-20-1	1	1	Harness, wiring (Motorola B.C. alt.) 2,3	276516
5	2	Washer, 1/4 int./ext. tooth lock 2-9,12	X-22-12	1	1	Harness, wiring (Delco B.C. alt.) 4,5	275565
6	3	Washer, 1/2" int./ext. tooth lock 2-7,12	X-22-26	1	1	Harness, wiring (Motorola B.C. alt.) 4,5	276517
	2	Washer, 1/2 " int./ext. tooth lock 8,9	X-22-26	1	1	Harness, wiring (Delco B.C. alt.) 6-9	275563
7	1	Washer, 1/2 split lock 2-8,12	X-24-6	1	1	Harness, wiring (Motorola B.C. alt.) 6-9	276515
8	1	Washer, 9/32 x 5/8 x 1/16 plain 2-9,12	X-25-40	22	1	Bracket, relay mounting 2-5,12	273426
9	1	Valve, drain 2-5,12	X-256-3	1	1	Bracket, relay mounting 6,7	273471
10	1	Hose, 3/4 ID x 66" 2,3,12	X-373-10	1	1	Bracket, relay mounting 8,9	273732
	1	Hose, 3/4 ID x 78" 4,5	X-373-12				
	1	Hose, 3/4 ID x 60" 6-9	X-373-11				

X Not Sold Separately

## Series 189

### Group 105 Engine

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
23	1	Solenoid starter 2-9,12	291891	42	1	Stud, 1/4-28 x 2-1/4 8	X-352-72
24	1	Washer, 1/2 int. tooth lock 4-9	X-22-4	43	6	Screw, 1/4-20 x 1, Gr. 5 8	X-465-7
25	1	Washer, #10 int. tooth lock 4-7,9	X-22-9	44	2	Screw, 5/8-11 x 1, Gr. 5 8,9	X-6021-3
26	1	Nut, 1/2-13 4-7	X-89-8	45	1	Nut, M6-1 8	X-6053-1
	2	Nut, 1/2-13 8,9	X-89-8	46	5	Nut, 10-24 8	X-70-2
27	1	Washer, 17/32 x 17/32 x 3/32 plain 2-9,12	X-25-26	47	1	Cable, shielded 43 in. 8	254210
28	2	Washer, 3/4 split lock 6-9	X-26-10	48	2	Ball joint 8	254229
29	4	Screw, 1/4-20 x 3/4 6,7,9	X-465-16	49	1	Relay 8	259391
30	2	Screw, 3/4-10 x 1-1/2 6-9	X-6239-2	50	1	Actuator, linear 8	273748
31	2	Nut, 1/4-28 jam 6,7,9	X-81-9	51	1	Control, governor 8	273749
32	1	Bracket, solenoid (see Note) 6	276571	52	1	Bracket, actuator mounting 8	273750
	1	Bracket, solenoid (see Note) 7,9	276572	53	1	Yoke 8	273751
33	2	Screw, M8-1.25 x 35 6-9	X-6049-2	54	1	Lever, shut-off 8	273752
34	1	Solenoid, fuel shutoff 6,7,9	273719	55	1	Cable shielded 8	273753
35	1	Bracket, throttle 6-9	275546	56	1	Cable, shielded 8	273754
36	1	Ball joint (see Note) 6,7,9	276570	57	1	Pickup, rpm 8	273758
37	1	Ball joint 6,7,9	273731	58	1	Connector, 2-pin male/plug 2-9,12 (battery charging alt.)	254986
38	2	Nut, 1/4-28 nylon lock 8	X-101-7	59	1	Connector, 4-pin male/plug (P2) 2-9,12	239408
39	2	Nut, 1/4-20 nylon lock 8	X-101-8	60	1	Connector, 24-pin (P1) 2-9,12	295145
40	5	Screw, 10-24 x 5/8, Gr. 5 8	X-117-5	61	1	Housing, strain relief (red) 2-9,12 (used with P1 connector)	292800
41	4	Washer, #3 ext. tooth lock 8,9	X-22-43				

X Not Sold Separately

# Series 189

## Group 105 Engine

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
62	2	Boot, rubber 2-9,12	290262				
63	2	Diode 2-9,12	241739				
64	1	Diode (with eyelet terminal) 2-9,12	253799				
65	2	Terminal, 1/4 female push-on 2-9,12 (with locking tab)	X-431-18				
66	4	Pin, female/socket (.058 dia.) 2-9,12	241606				
67	24	Pin, female/socket (.0665 dia.) 2-9,12	292879				
<p><b>NOTE:</b> Items 21 Wiring Harness includes Items 58-67. Item 58 connector uses Item 65 terminal. Item 59 connector uses Item 66 terminal. Item 60 connector uses Item 67 terminal.</p> <p>Items 32 and 36. Early models used different components. If replacement is necessary on early models, order both Items 32 and 36.</p>							

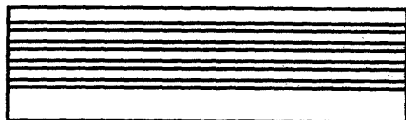
X Not Sold Separately

# Series 189

## Group 107 Nameplates and Decals

NOTE: Items 15-18 are found on a following page.

### KOHLER POWER SYSTEM



1,2

5  
Not Shown

3

11

FAST RESPONSE

**⚠ DANGER**

**Hazardous voltage.**  
Will cause severe injury or death.

**Moving rotor.**  
Will cause severe injury.

Do not operate generator set without all guards and electrical enclosures in place.

Operate and service by trained personnel only. Refer to manual prior to installation, operation or service. Manuals available from Kohler Co. Kohler, Wisconsin 53044.

599723

**⚠ WARNING**

**Rotating parts.**  
Can cause severe injury.

Do not operate generator set without all guards, screens or covers in place.

249808

**⚠ CAUTION**

**Hot engine and exhaust system.**  
Can cause severe burns.

Do not work on generator set until unit is allowed to cool.

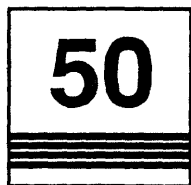
249809

**⚠ WARNING**

**Hazardous voltage. Backfeed to utility system can cause electrocution or property damage.**

When generator is used for standby power, use of automatic transfer switch is recommended to prevent inadvertent interconnection of standby and normal sources of supply.

258815



4

9

**WARNING! THIS IS A POSITIVE TERMINAL ONLY. DO NOT ATTACH NEGATIVE LEAD!**

238402

6

13

**EQUIPMENT GROUND**

290435

**GENERATOR CONNECTIONS**

**SINGLE PHASE**  
SOME SETS NOT RATED FOR SINGLE PHASE - SEE MANUALS  
CT3 - NOT USED

60HZ-120/240 VOLT  
50HZ-110/220 VOLT  
REMOVE V9 FROM TERMINAL STRIP AND TAPE.

**3 PHASE DELTA**

110/220 VOLT 50HZ  
120/240 VOLT 60 HZ

**3 PHASE WYE**

190-208 VOLT 50 HZ  
208-240 VOLT 60HZ

**3 PHASE WYE**

380-416 VOLT 50 HZ  
416-480 VOLT 60HZ

NOTE: CURRENT TRANSFORMER DOT OR "H" TOWARD GENERATOR.

**⚠ WARNING**

**Hazardous voltage. Backfeed to utility system can cause electrocution or property damage.**

When generator is used for standby power, use of automatic transfer switch is recommended to prevent inadvertent interconnection of standby and normal sources of supply.

28828

# Series 189

## Group 107 Nameplates and Decals

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	2	Decal, "stripes" (24 in.) 1-6,8-19	X-6232-1	12	1	Nameplate, kW rating 1-20	not available
	1	Decal, "stripes" (50 in.) 7,20,21	X-6232-3	13	1	Decal, equipment ground 1-21	290435
2	1	Decal, "stripes" (33 in.) 1-6,8-19	X-6232-2	14	2	Decal, warning (hazard volt./ moving parts) 1-21	290733
	2	Decal, "stripes" (33 in.) 7,20,21	X-6232-2	15	1	Decal, caution (This lifting support...) 11-20	239776
3	2	Decal, Kohler Power Systems 1-6,8-19	X-6246-1	16	1	Decal (For standby service...) 11-20	255882
	2	Decal, Kohler Power Systems 7,20,21	X-6246-2	17	1	Nameplate, electrical equip. (rating) 11-20	259954
4	2	Decal, 50kW 1,14	X-6247-6	18	2	Decal, Fast Response II 4	255084
	2	Decal, 60kW 2,15	X-6247-7	19	1	Decal, warning (unbalanced weight) (GRP 201) all	257437
	2	Decal, 80kW 3,16	X-6247-9	20	1	Decal, warning (hazard voltage/ moving parts) (GRP 201) all	257438
	2	Decal, 100kW 4,17	X-6247-10	21	1	Decal, warning (unbalanced weight) (GRP 201) all	257441
	2	Decal, 125kW 5,18	X-6247-11				
	2	Decal, 150kW 6,19,21	X-6247-12				
	2	Decal, 180kW 7,20	X-6247-13				
	2	Decal, 30kW 8,12	X-6247-2				
	2	Decal, 40kW 9,13	X-6247-4				
	2	Decal, 20kW 10,11	X-6247-1				
5	4	Rivet, 1/8 x 3/16 pop 1-15,21	X-781-1				
	8	Rivet, 1/8 x 3/16 pop 16-20	X-781-1				
6	1	Decal, positive terminal 1-21	238402				
7	1	Decal, warning (rotating parts) 1-21	249808				
8	1	Decal, warning (hot engine) 1-21	249809				
9	1	Decal, warning (backfeed) 1-21	258815				
10	1	Decal, generator connections 1-21	259365				
11	2	Decal, Fast Response 1-6,8-19	273739				
	2	Decal, Fast Response 7,20,21	273740				

# Series 189

## Group 107 Nameplates and Decals (cont'd.)

18  
FAST RESPONSE II

15  
**⚠ CAUTION**

"THIS LIFTING SUPPORT IS NOT TO BE USED TO LIFT THE ENTIRE MACHINE. ONLY THE COMPONENT ATTACHED DIRECTLY TO THIS SUPPORT MAY BE SAFELY LIFTED BY THE SUPPORT"

**⚠ ATTENTION**

"CE SUPPORT DE LEVAGE NE DOIT PAS ETRE UTILISE POUR SOULEVER LE POIDS TOTAL DE LA MACHINE. SEUL L'ELEMENT QUI REPOSE DIRECTEMENT SUR LE SUPPORT PUT ETRE SOULEVE EN TOUTE SECURITE"

239776

**CAUTION:** FOR STAND-BY SERVICE CONNECT OUTPUT OF GENERATOR TO SUITABLY RATED TRANSFER SWITCH IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE, PART 1.

**ATTENTION:** POUR L'ALIMENTATION DE RESERVE, CONNECTER LA SORTIE DE LA GENERATRICE A UN COMMUTATEUR DE CALIBRE APPROPRIE, CONFORMEMENT AU CODE CANADIEN DE L'ELECTRICITE, PREMIERE PARTIE.

255882

**ELECTRICAL EQUIPMENT ONLY  
POUR MATERIEL ELECTRIQUE SEULEMENT**



**NOTICE:**

RATINGS ON ABOVE NAMEPLATE ARE FOR GENERATOR SET. GENERATOR IS RATED AT 40°C. NEMA CLASS F. PRIME POWER RATING (WHEN USED) IS EQUIVALENT TO CSA CONTINUOUS RATING (10 PERCENT OVERLOAD FOR 2 HOURS IN A 24 HOUR PERIOD). CONTINUOUS STANDBY RATING (WHEN USED) IS EQUIVALENT TO CSA STANDBY SERVICE.

**KOHLER**

KOHLER CO. KOHLER, WISCONSIN USA

26084

**⚠ DANGER**



**Hazardous voltage.  
Will cause severe  
injury or death.**



**Moving rotor.  
Will cause severe  
injury.**

Do not operate generator set without all guards and electrical enclosures in place.

Operate and service by trained personnel only. Refer to manual prior to installation, operation or service. Manuals available from Kohler Co. Kohler, Wisconsin 53044

257438

**⚠ WARNING**

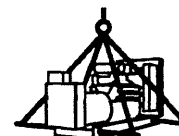


**Unbalanced weight.  
Improper lift can cause  
personal injury and  
equipment damage.**

Do not lift complete generator set with lifting eyes.

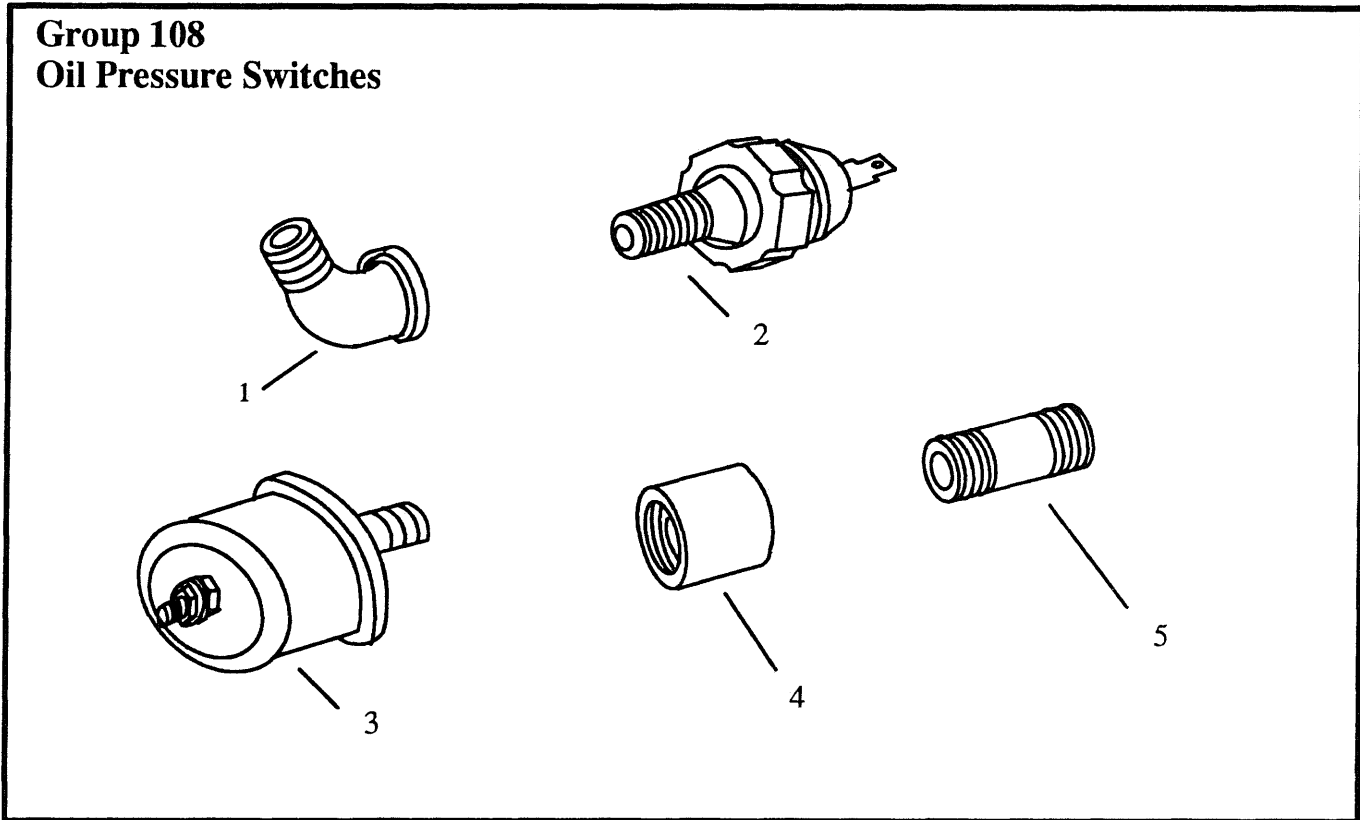
Use lifting bars thru holes in skid to lift set.

**SLING METHOD**



257438

## Series 189

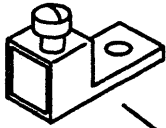


Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Elbow, 1/8 NPT, 45 deg. street 1,3	X-274-4				
2	1	Switch, oil pressure 1-3	240978				
3	1	Sender, oil pressure 1-3	264390				
4	1	Coupling, 1/8 NPT x 13/16 pipe 2	X-216-24				
5	1	Nipple, 1/8 NPT x 3/4 pipe 2	X-217-6				

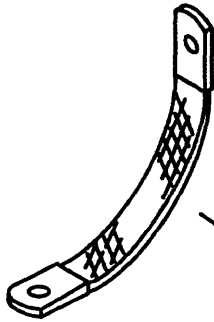


# Series 189

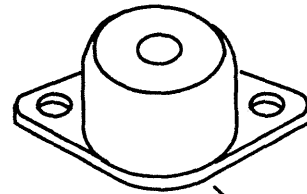
## Group 109 Skid and Plant Mounting



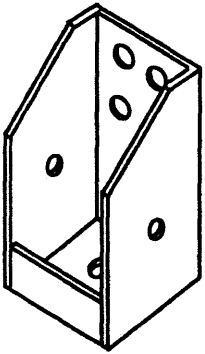
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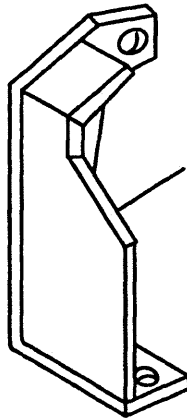
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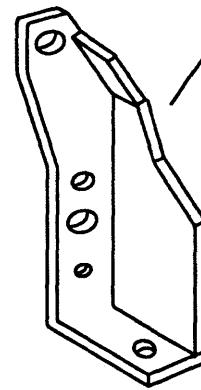
14



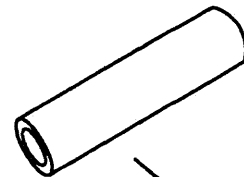
17



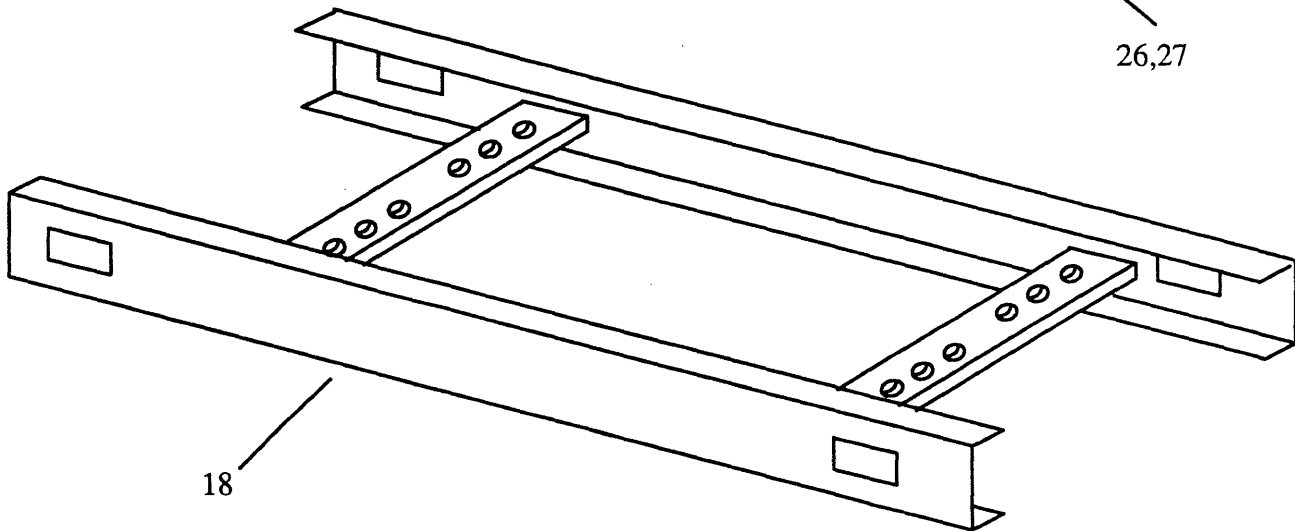
16



15



26,27



18

X Not Sold Separately

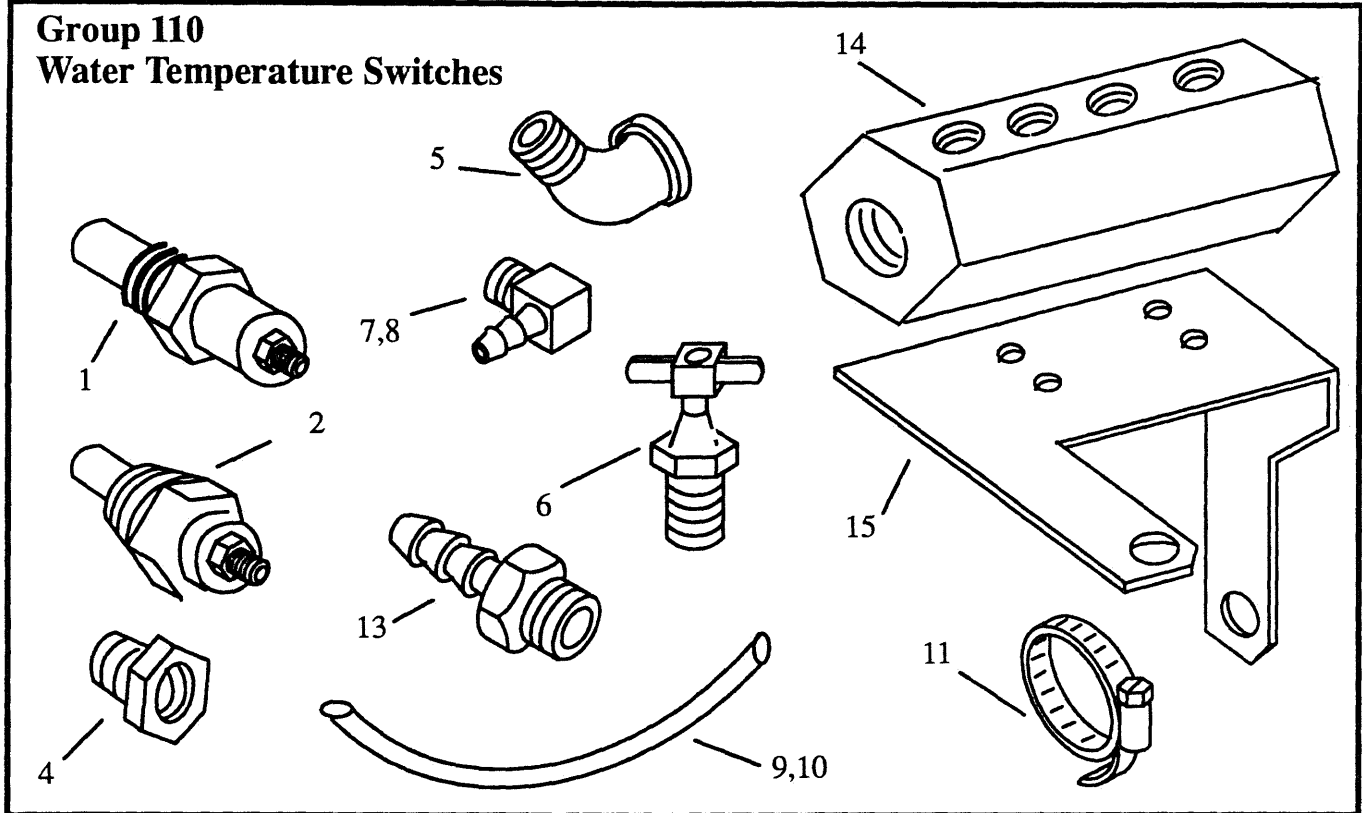
# Series 189

## Group 109 Skid and Plant Mounting

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	2	Screw, 5/16-18 x 1", Gr.5 1,2,3,4	X-125-5	17	2	Support, engine 3	273435
2	8	Screw, 1/2-13 x 1, Gr.5 1,2	X-129-17		2	Support, engine 4	273513
3	4	Screw, 1/2-13 x 1-1/2, Gr.5 1,2	X-129-19	18	1	Skid 1	273421
4	2	Screw, 1/2-13 x 2 Gr. 5 1,2	X-129-21		1	Skid 2	273477
5	4	Washer, 5/16 int. tooth lock 1,2,4	X-22-16		1	Skid 3	276573
	2	Washer, 5/16 int. tooth lock 3	X-22-16		1	Skid 4	273497
6	2	Washer, 1/2 int./ext. tooth lock 1,2	X-22-26	19	1	Strap, ground 1,2,3,4	290418
7	4	Washer, 5/8 split lock 1,2	X-24-1	20	14	Nut, 1/2-13 2	X-89-8
8	13	Washer, 1/2 split lock 1,2	X-24-6	21	4	Nut, 1/2-13 nylon lock 3,4	X-101-23
9	2	Washer, 17/32 x 7/8 x 1/16 plain 1,2	X-25-97	22	4	Screw, 1/2-13 x 4, Gr.5 3,4	X-129-29
10	1	Terminal, grounding 1,2,3,4	X-377-11	23	1	Washer, 3/4 int. tooth lock 3,4	X-22-17
11	4	Screw, 5/8-11 x 1, Gr. 5 1,2	X-6021-3	24	4	Washer, 17/32 x 1-1/2 x 1/8 plain 3,4	X-25-110
12	2	Nut, 5/16-18 1-4	X-82-2	25	3	Washer, 3/4 split lock 3,4	X-26-10
13	14	Nut, 1/2-13 1	X-89-8	26	2	Spacer, rear .509 x .609 x 2.9 3,4	X-400-171
14	4	Damper, vibration 1	244210	27	2	Spacer, front .509 x .609 x 2.75 3,4	X-400-173
	2	Damper, vibration 2	244210	28	4	Screw, 3/4-10 x 1-1/2, Gr. 5 3,4	X-6239-2
	2	Damper, vibration (red) 2	273514				
	4	Damper, vibration (4 dia.) 3,4	286019				
	4	Damper, vibration (2-1/2 dia.) 3,4	286020				
15	1	Support, engine (left) 1,2	273419				
16	1	Support, engine (right) 1,2	273420				

X Not Sold Separately

## Series 189



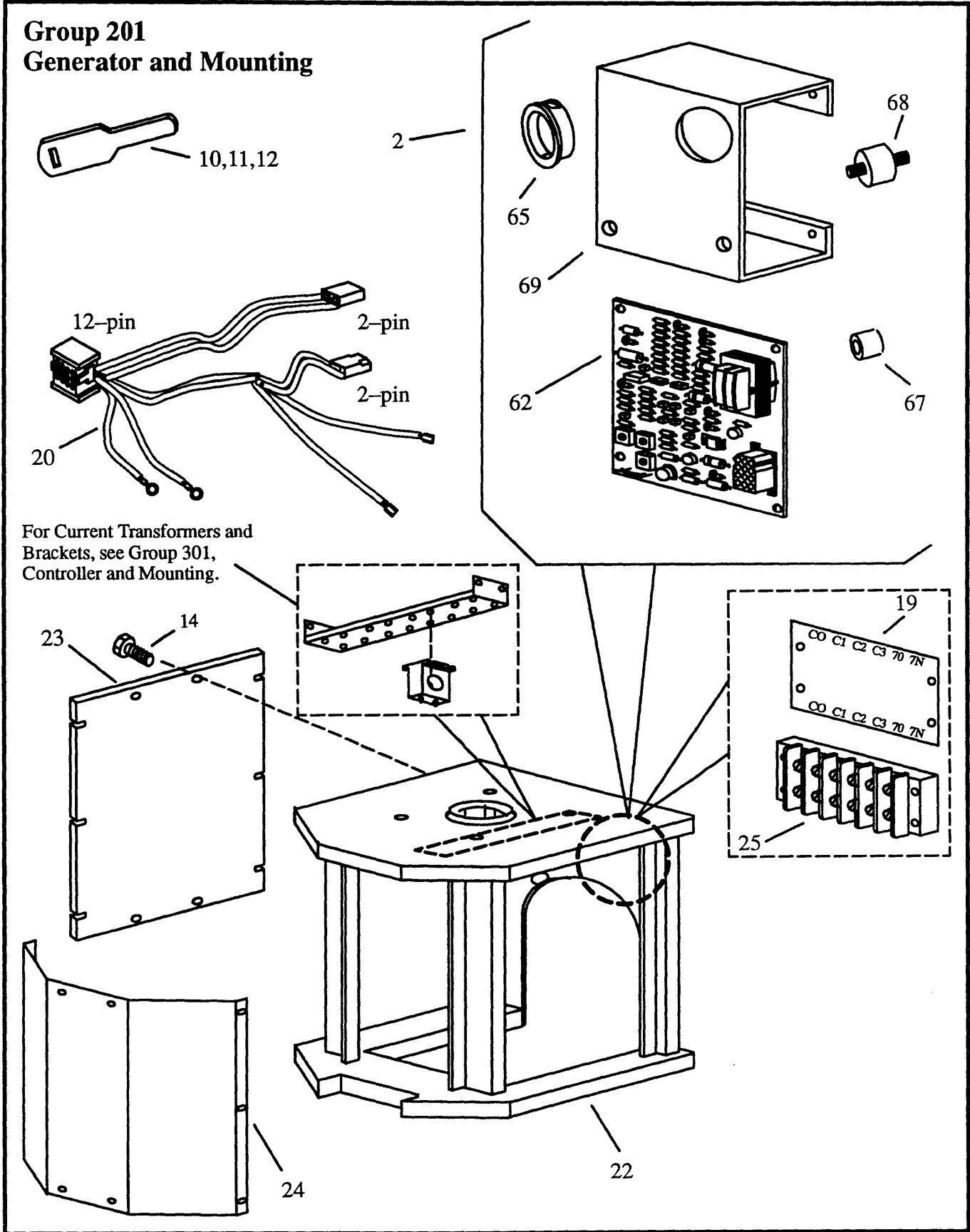
Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Switch, water temp. shutdown 1,4	241481	10	1	Line, 1/2 I.D. x 7 in. flex fuel 4	X-422-26
	1	Switch, water temp. shutdown 2,3	241308	11	2	Clamp, 1 in. hose 4	X-426-10
2	1	Sender, water temperature 1-4	268298	12	2	Screw, 1/4-20 x 1/2 4	X-465-6
3	2	Washer, 1/4 lock 4	X-20-1	13	1	Adapter, hose (1/8 NPT x 4 5/16 hose I.D.)	X-582-5
4	1	Bushing, 3/8 x 1/2 reducer 4	X-202-28	14	1	Manifold, water temperature 4 (sensor block)	273659
5	1	Elbow, 1/2 NPTF street 4	X-211-1	15	1	Bracket, mounting 4	275529
6	1	Valve 1/2 NPTF drain 4	X-256-5				
7	1	Connector, 3/8 NPT, 1/2 hose I.D. 4 elbow	X-391-13				
8	1	Connector, 1/4 NPT, 1/2 hose I.D. 4 elbow	X-391-15				
9	1	Line, 1/2 I.D. x 16 in. flex. fuel 4	X-422-23				

X Not Sold Separately

## NOTES

# Series 189

## Group 201 Generator and Mounting



X Not Sold Separately

# Series 189

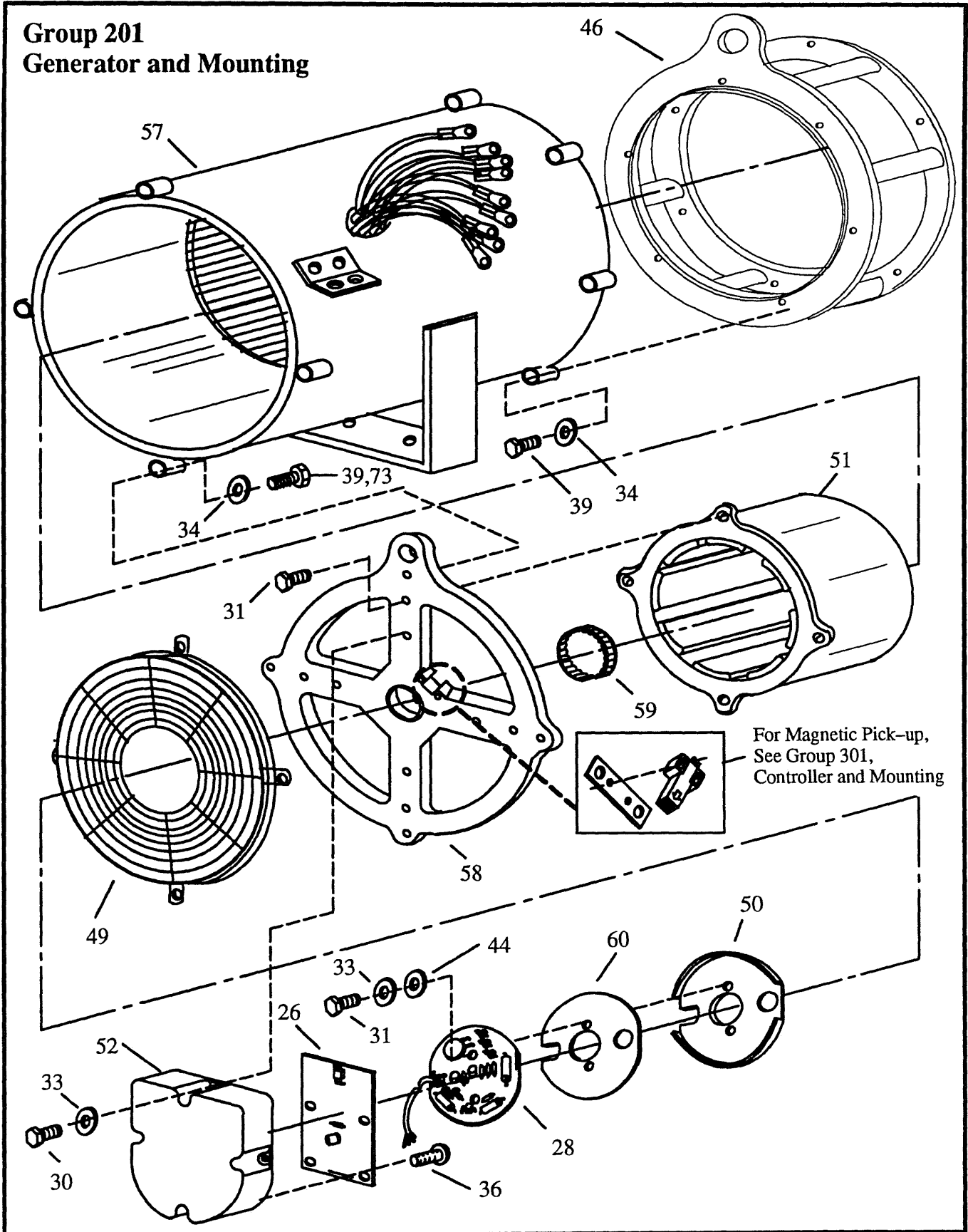
## Group 201 Generator and Mounting

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Alternator assembly 1-6,8-22,24-26	not avail.	18	8	Nut, 3/8-16, Gr. 5 1-6, 8, 10-14, 17, 20	X-83-2
2	1	Regulator assembly, voltage 1-6,8-22,24-26	B-292789	8	8	Nut, 1/2-13, Gr. 5 9,19,21,22,24-26	X-89-17
3	4	Screw, 5/16-18 x 1, Gr.5 1-6,8-22,24-26	X-125-5	12	12	Nut, 3/8-16, Gr. 5 15,16,18	X-83-2
4	5	Washer, #8 split lock 1-6,8-22,24-26	X-18-2	19	1	Marker, strip 1-6,8-22,24-26	255080
5	4	Washer, 5/16" split lock 1-6,8-22,24-26	X-21-1	20	1	Harness, wiring 1-6,8-22,24-26	255481
6	2	Washer, 5/16 int./ext. tooth lock 1-6,8,10-18,20	X-22-16	21	6	Screw, 3/8-16 x 1-1/2, Gr.8 1-6,8,10-18,20	270158
7	4	Washer, 11/32 x 11/16 x 1/16 plain 1-6,8-20,22,24-26	X-25-85	22	1	Box, junction 1-4,10-14,17	273428
8	8	Stud, 3/8-16 x 4 1-6, 8,10-18, 20	X-352-63	1	1	Box, junction 5,6,15,16,20	273482
	8	Stud, 1/2-13 x 3 9,19,21,22,24-26	X-352-71	1	1	Box, junction 8,18	258270
9	8	Spacer, 13/32 x 5/8 x 2-1/2 1-6,8,10-18,20	X-400-132	1	1	Box, junction 9,19,22,24-26	273494
	8	Spacer, 17/32 x 1 x 3/4 9,19,21,22,24-26	X-400-161	1	1	Box, junction 21	273841
10	1	Tag, lead L1 1-6,8-22,24-26	X-452-2	23	2	Cover, side 1-4,10-14,17	273429
11	1	Tag, lead L2 1-6,8-22,24-26	X-452-3	2	2	Cover, side 5,6,8,15,16,18,20	273484
12	1	Tag, lead L3 1-6,8-22,24-26	X-452-4	2	2	Cover, side 9,19,21,22,24-26	273495
13	2	Screw, 8-32 x 3/4 1-6,8-22,24-26	X-51-11	24	1	Cover, rear 1-4,10-14,17	273430
14	16	Screw, 10-24 x 1/2 1-6,8,10-18,20	X-6216-1	1	1	Cover, rear 5,6,15,16,20	273483
	20	Screw, 10-24 x 1/2 9,19,21,22,24-26	X-6216-1	1	1	Cover, rear 8	258275
15	5	Nut, 8-32 1-6,8-22,24-26	X-72-4	1	1	Cover, rear 9,19,21,22,24-26	273496
16	6	Washer, 13/32 x 13/16 x 3/64 1-6,8,10-18, 20 hardened	X-801-3	25	1	Block terminal (6-terminal) 1-6,8-22,24-26	295314
	8	Washer, 15/32 x 59/64 x 3/64 9,19,21,22,24-26 hardened	X-801-6	26	1	Board assembly, circuit (L.E.D.) 1-6,8-22,24-26	A-257099
17	4	Nut, 5/16-18 1-6,8-22,24-26	X-82-2	27	1	Rotor, assembly 1,2	A-258977
				1	1	Rotor assembly 3,4	A-258975
				1	1	Rotor assembly 5,15	A-257521
				1	1	Rotor assembly 6,16	A-257522
				1	1	Rotor assembly 8,18,20	A-257523

X Not Sold Separately

# Series 189

## Group 201 Generator and Mounting



X Not Sold Separately

# Series 189

## Group 201 Generator and Mounting

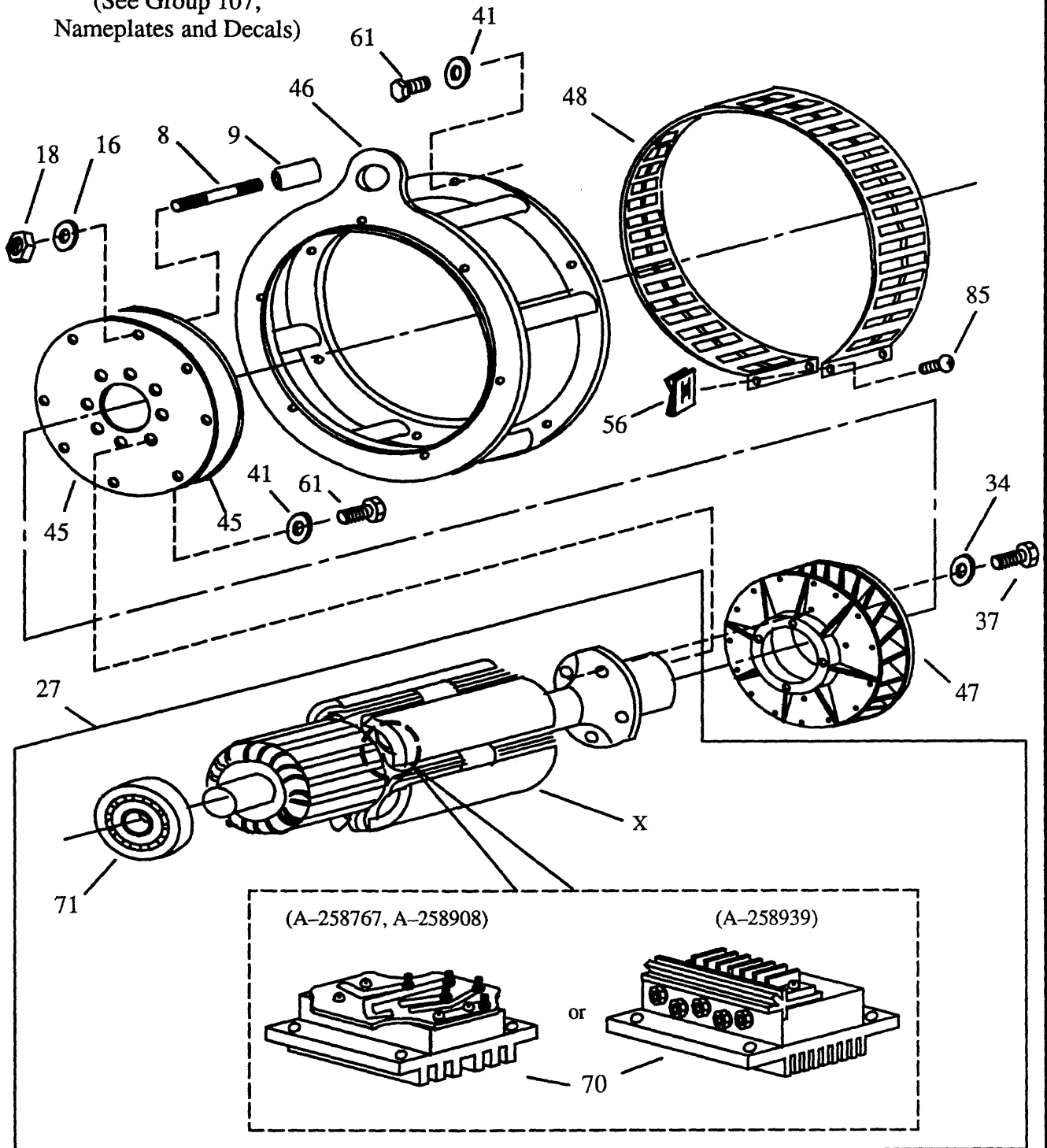
Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
27 (cont'd.)	1	Rotor assembly 10,13	A-258979	38	4	Screw, 3/8-16 x 1-1/4, Gr.5 1,2,3,4,10-14,17,24-26	X-6238-4
	1	Rotor assembly 11,14	A-258978		4	Screw, 3/8-16 x 1-3/4, Gr. 5 9,19,21,22,24-26	X-6238-1
	1	Rotor assembly 12,17	A-258980	39	10	Screw, 3/8-16 x 2, Gr. 5 1-4,10-14,17	X-6238-6
	1	Rotor assembly 9,19,21	A-257837		10	Screw, 3/8-16 x 3, Gr.5 5,6,8,15,16,18,20	X-6238-9
	1	Rotor assembly 22	A-257838				
	1	Rotor assembly 24,25	A-257959	40	2	Screw, 10-24 x 3/4 1-6,8,10-18,20	X-67-51
	1	Rotor assembly 26	A-257960		4	Screw, 10-24 x 3/4 9,19,21,22,25,26	X-67-51
28	1	Board assembly, circuit (photo 1-6,8-22,24-26 transistor)	B-292902	41	12	Washer, 13/32 x 13/16 x 3/64 plain 1,2,10-14,17 hardened	X-801-3
29	5	Nut, 6-32 nylon lock 1-4,8,10-18,20	X-101-22	12	Washer, 13/32 x 13/16 x 3/64 plain 5,6,8,9,15,16,19-22,24-26 hardened	X-801-3	
30	6	Screw, 10-24 x 5/8 1-6,8-22,24-26	X-117-5	42	4	Nut, 1/4-20 1,2,3,4,10-14,17	X-81-1
31	4	Screw, 5/16-18 x 1-1/2, Gr.5 1-6,8,10-18,20	X-125-34	43	1	Stud, 1/4-20 x 2 terminal 1,2,3,4,10-14,17	168068
32	4	Washer, 1/4 int. tooth lock 1,2,3,4,10-14,17	X-22-11		1	Stud, 5/16-18 x 2 5,6,8,15,16,18,20	X-352-52
	4	Washer, 3/8 int. tooth lock 9,19,21,22	X-22-10		1	Stud, 3/8-16 x 2-1/2 9,19,21,22,24-26	X-352-59
	5	Washer, 3/8 int. tooth lock 24-26	X-22-10				
33	6	Washer, #10 int. tooth lock 1-6,8-22,24-26	X-22-9	44	2	Washer, 7/32 x 1/2 x 1/16 insulated 1-4,8,10-20,22,24-26	243321
34	20	Washer, 13/32 x 3/4 x 1/8 plain 1-4,10-14,17,18	X-25-93	45	2	Disc, armature drive 1-4,10-14,17	257015
	14	Washer, 13/32 x 3/4 x 1/8 plain 5,6,8,15,16,20	X-25-93	3	Disc, armature drive 5,6,8,18,20	257103	
	8	Washer, 13/32 x 3/4 x 1/8 plain 9,19,21,22,24-26	X-25-93	4	Disc, armature drive 9,19,21,22,24-26	257581	
35	4	Terminal, #8 eyelet 1-4,8,10-18,20	X-283-7	1	Disc, armature drive 15,16	257103	
	4	Terminal, #6 spade 19,22,25	X-285-1	46	1	Adapter, generator 1-4,10-14,17	257019
	4	Terminal, 1/4 ins. F push-on 22,24,26	X-431-25	1	Adapter, generator 5,6,8,15,16,18,20	257175	
36	4	Screw, #10 x 3/8 sheet metal 1-6,8-22,24-26	X-6071-1	1	Adapter, generator 9,19,21,22,24-26	257579	
				47	1	Fan, generator 1-4,10-14,17	257020
37	4	Screw, 3/8-16 x 1, Gr. 5 1-6,8,10-18,20	X-6238-11	1	Fan, generator 5,6,8,15,16,18,20	257173	
	8	Screw, 3/8-16 x 1, Gr.5 9,19,21,22,24-26	X-6238-11	1	Fan, generator 9,19,21,22,24-26	257855	



# Series 189

## Group 201 Generator and Mounting

For Items 53,54,55 Decals  
(See Group 107,  
Nameplates and Decals)



X Not Sold Separately

# Series 189

## Group 201 Generator and Mounting

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
48	1	Guard, generator fan (3-11/16 wide) 1-4,10-14,17	257046	57	1	Stator, assembly 10	257766
	1	Guard, generator fan (4-3/8 wide) 5,6,8,15,16,18,20	257179	(cont'd.)	1	Stator assembly 11	257767
	1	Guard, generator fan (5-7/8 wide) 9,19,21,22	257582		1	Stator assembly 12	257765
	2	Guard, generator fan (5-7/8 wide) 24-26	257582		1	Stator assembly 13	257771
49	1	Guard, generator 14-3/4 dia. (mesh) 2,4,13,14,17	273733		1	Stator assembly 14	257772
	1	Guard, generator 17-3/4 dia. (mesh) 15,16,18	273734		1	Stator assembly 15	257690
	1	Guard, generator 23-5/8 dia. (mesh) 19,25	274598		1	Stator assembly 16	257691
50	1	Actuator, magnetic 1-6,8-22,24-26	257077		1	Stator assembly 17	257770
51	1	Exciter assembly, field 1-6,8,11,14-16,18,20	257081		1	Stator assembly 18	257692
	1	Exciter assembly, field 9,19,21,22	257569		1	Stator assembly 19,25	257777
	1	Exciter assembly, field 10,12,13,17	257080		1	Stator assembly 22,26	257574
	1	Exciter assembly, field 24-26	257963	58	1	Bracket, end (tolerance ring style) 1-4,10-14,17	257829
52	1	Cover, circuit board 1-6,8-22,24-26	257258		1	Bracket, end (tolerance ring style) 5,6,8,15,16,18,20	257167
53	1	Decal, warning (unbalanced 1-6,8-22,24-26 weight)	257437		1	Bracket, end (tolerance ring style) 9,19,21,22	257587
54	1	Decal, warning (hazard voltage/ 1-6,8-22,24-26 moving parts)	257438		1	Bracket, end (machined sleeve style) 9,19,21,22,24-26	257982
55	1	Decal, warning (unbalanced 1-6,8-22,24-26 weight)	257441	59	1	Ring, tolerance (used on 257829) 1-4,10-14,17	257830
56	2	Clip, 10-24 'J' speed 1-6,8-22,24-26	257442		1	Ring, tolerance (used on 257167) 5,6,8,15,16,18,20	257168
57	1	Stator assembly 1	257768		1	Ring, tolerance (used on 257587) 9,19,21,22	257588
	1	Stator assembly 2	257773	60	1	Insulator 1-4,8,10-20,22,24-26	257850
	1	Stator assembly 3	257769	61	8	Screw, 3/8-16 x 1-1/4, Gr. 8 1-4,8,10-14,17	270956
	1	Stator assembly 4	257774		12	Screw, 3/8-16 x 1-1/4, Gr. 8 5,6,15,16,18,20	270956
	1	Stator assembly 5	257687		12	Screw, 3/8-16 x 1-1/2, Gr. 8 9,19,21,22,24-26	270158
	1	Stator assembly 6	257688	62	1	Board assembly, circuit (voltage 1-6,8-22,24-26 regulator)	B-255670
	1	Stator assembly 8,20	257689	63	8	Washer, #8 ext. tooth lock 1-6,8-22,24-26	X-22-20
	1	Stator assembly 9,21,24	257573	64	5	Screw, 8-32 x 3/4 1-6,8-22,24-26	X-51-11
				65	1	Bushing, 1-1/2 plastic hole 1-6,8-22,24-26	X-634-16



## NOTES



# Series 189

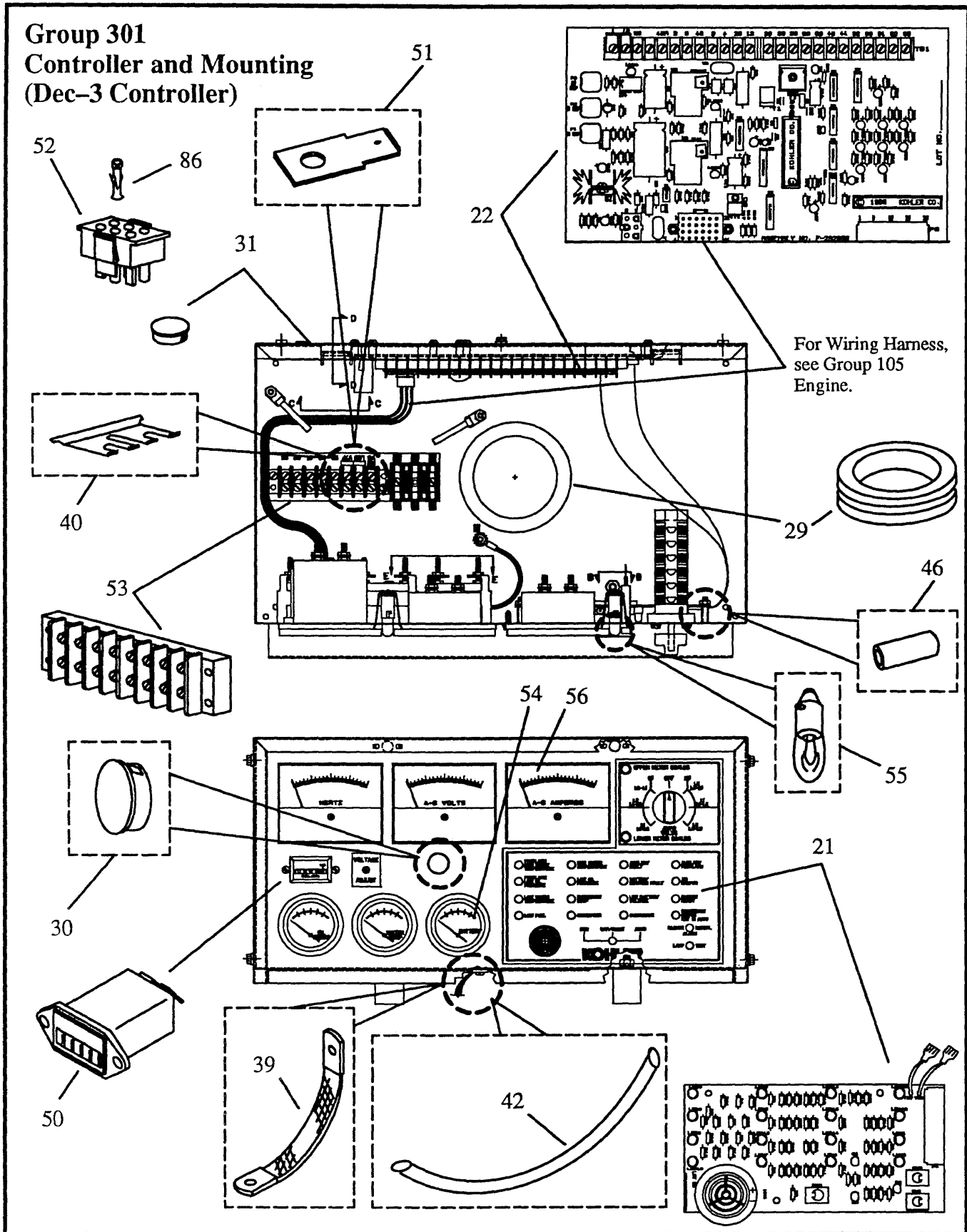
## Group 301 Controller and Mounting (Dec-3 Controller)

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
1	1	Controller assembly 2,13	B-292830	9	3	Tie, cable 2	X-468-1
	1	Controller assembly 4	B-292930		3	Tie, cable 4-10,12-15,17-21	X-468-2
	1	Controller assembly 5	B-292831	10	2	Screw, 4-40 x 7/8 2,4-10,12-15,17-21	X-49-35
	1	Controller assembly 6	B-292832	11	12	Screw, 10-24 x 1/2 2,4-6,10,12-15	X-50-15
	1	Controller assembly 7	B-292909	12	12	Screw, 10-24 x 5/8 7-9,17-21	X-50-8
	1	Controller assembly 8,19	B-272606	12	1	Conduit plastic 2,4,13-15,17,18	X-6003-17
	1	Controller assembly 9	A-292362	13	4	Screw, 10-24 x 1/2 2,4-8,10,12-15,17,19-21	X-6216-1
	1	Controller assembly 10	B-292827	14	12	Nut, 10-24 2,4-8,10,12-15,17,19-21	X-70-2
	1	Controller assembly 12	B-292826	15	1	Sensor, ferromagnetic (speed) 2,4-10,12-15,17-21	241623
	1	Controller assembly 14	B-292931	16	1	Harness, wiring 2,4-10,12-15,17-21	255040
	1	Controller assembly 15	B-292829	17	1	Bracket, sensor mounting 2,4-10,12-15,17-21	257070
	1	Controller assembly 17	B-292932	18	3	Transformer, current 2,10,13	259360
	1	Controller assembly 18	A-292363		3	Transformer, current 4,15	259414
	1	Controller assembly 20	A-273591		3	Transformer, current 5,14	255860
	1	Controller assembly 21	B-272906		3	Transformer, current 6,17	253503
2	4	Screw, 10-24 x 5/8 2,4,5,10,12,13,15	X-117-5		3	Transformer, current 7,18,20	273257
	2	Screw, 10-24 x 5/8 6-9,14,17-21	X-117-5		3	Transformer, current 8,19,21	253610
3	12	Screw, 5/16-18 x 3-1/2 2,4,5,10,12,13,15	X-125-23		3	Transformer, current 9	272691
	4	Screw, 5/16-18 x 3-1/2 6-9,14,17-21	X-125-23		3	Transformer, current 12	259359
4	12	Washer, #10 split lock 2,4-10,12-15,17-21	X-19-1	19	1	Bracket, current transformer 2,4,5,10,12,13,15	273427
5	4	Washer, 5/16 split lock 2,4-6,9,10,12-15,18,19	X-21-1		1	Bracket, current transformer 6-8,14,17,20,21	273967
	3	Washer, 5/16 split lock 7,8,17,20,21	X-21-1		1	Bracket, current transformer 19	273840
6	2	Washer, #4 int. tooth lock 2,4-10,12-15,17-21	X-22-24	20	1	Potentiometer assembly 2,4-10,12-15,17-21	A-255041
7	2	Washer, #10 int. tooth lock 2,4-10,12-15,17-21	X-22-9				
8	12	Washer, 15/64 x 1/2 x 3/64 plain 2,4-10,12-15,17-21	X-25-36				

X Not Sold Separately

# Series 189

## Group 301 Controller and Mounting (Dec-3 Controller)



X Not Sold Separately

# Series 189

## Group 301 Controller and Mounting (Dec-3 Controller)

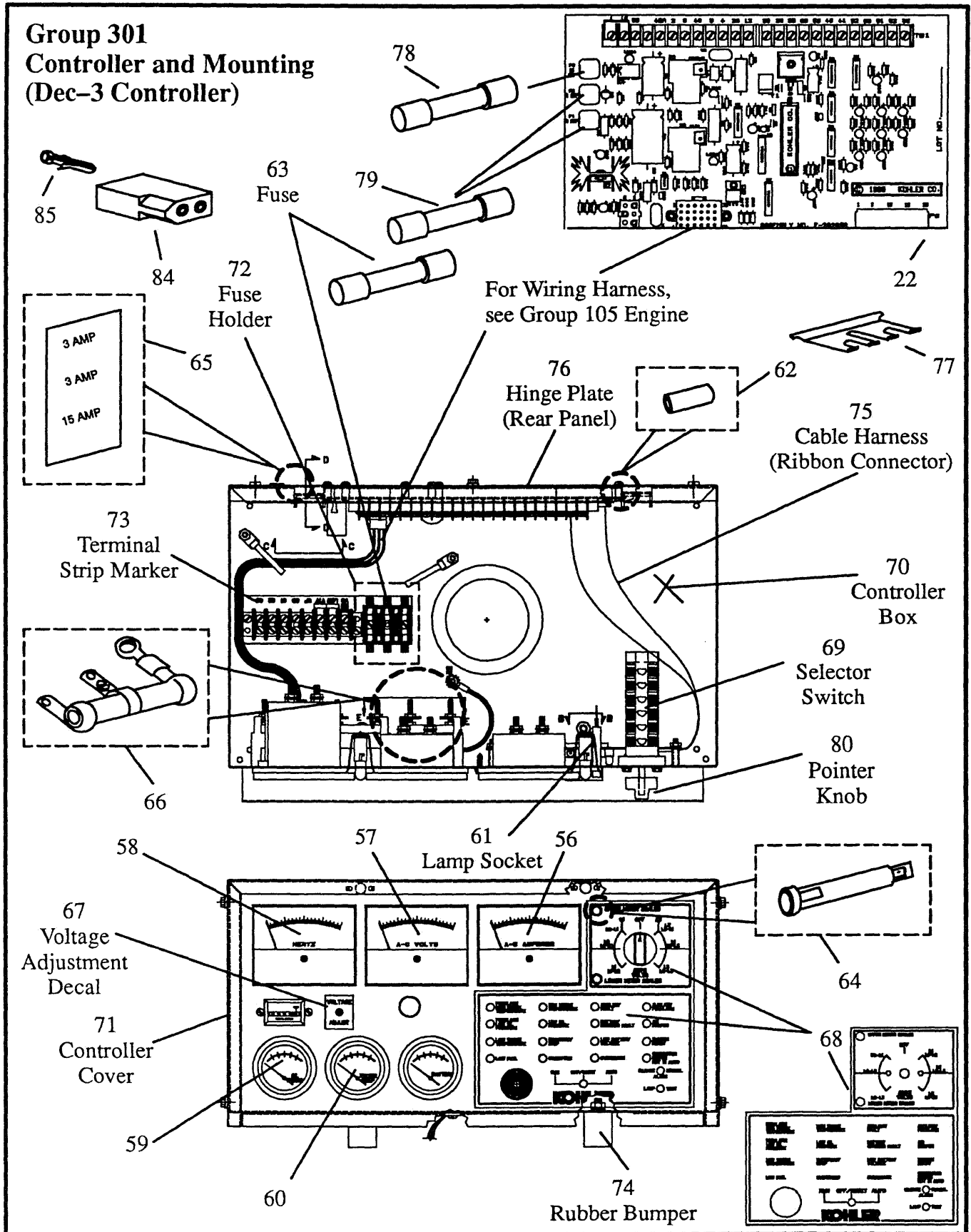
Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
21	1	Board assembly, circuit 2,4-10,12-15,17-21	A-292357	40	1	Jumper, two-terminal 2,4-10,12-15,17-21	X-6048-2
22	1	Board assembly, circuit (main) 2,4-10,12-15,17-21	F-292806	41	9	Screw, 10-24 x 1/2 2,4-10,12-15,17-21	X-6216-1
23	9	Washer, #6 split lock 2,4-10,12-15,17-21	X-18-1	42	1	Sleeving 2,4-10,12-15,17-21	X-696-5
24	6	Washer, #8 split lock 2,4,5,6-10,12-15,18-21	X-18-2	43	8	Nut, 10-24 2,4-10,12-15,17-21	X-70-2
25	8	Washer, #10 split lock 2,4-10,12-15,17-21	X-19-1	44	2	Nut, 10-32 2,4-10,12-15,17-21	X-70-3
26	4	Washer, 5/16 split lock 2,4-10,12-15,17-21	X-21-1	45	4	Nut, 6-32 2,4-10,12-15,17-21	X-71-2
27	2	Washer, #10 int./ext. tooth 2,4-10,12-15,17-21 lock	X-22-13	46	4	Spacer, #8-32 x 1/4 x 1 2,4,5,8-10,12,13,15,18-21	X-712-9
28	1	Washer, #6 int. tooth lock 2,4,5,10,12,13,15	X-22-6	47	6	Nut, 8-32 2,4-10,12,13,15,18-21	X-72-4
	8	Washer, #6 int. tooth lock 6,7,14,17	X-22-6	2	Nut, 8-32 14,17,21,23	X-72-4	
	4	Washer, #6 int. tooth lock 8,9,18-21	X-22-6	48	2	Screw, #8-18 drill 2,4,5,8-10,12,13,15,18-21	X-794-2
29	1	Grommet, 3 x 3-1/2 x 5/64 2,4-10,12-21	X-284-31	49	4	Nut, 5/16-18 2,4-10,12-15,17-21	X-82-2
30	1	Plug, 7/8 plastic button 2,4,5,8-10,12,13,15,18-21	X-301-29	50	1	Hourmeter 2,4-10,12-15,17-21	238736
31	1	Plug, 7/16 plastic button 2,4,5,8-10,12,13,15,18-21	X-301-34	51	1	Terminal, 1/4 push-on 2,4-10,12-15,17-21	238898
32	4	Tie, cable 2,4-10,12-15,17-21	X-468-3	52	1	Connector, plug (P2) 2,4-10,12-15,17-21	241617
33	2	Screw, 6-32 x 3/8 2,4-10,12-15,17-21	X-49-2	53	1	Block, terminal (8-terminal) 2,4-10,12-15,17-21	246115
34	18	Screw, 6-32 x 1/4 2,4-10,12-15,17-21	X-49-25	54	1	DC Voltmeter 2,4-10,12-15,17-21	253329
35	2	Screw, 6-32 x 1/2 2,4-10,12-15,17-21	X-49-39	55	2	Lamp (bulb) no. 1892 2,4-10,12-15,17-21	255126
36	4	Screw, 10-24 x 3/4 2,4-10,12-15,17-21	X-50-3	56	1	AC ammeter 2,10,13	282801
37	1	Screw, 10-24 x 1 2,4-10,12-15,17-21	X-50-7	1	AC ammeter 4,15	282802	
38	2	Screw, 8-32 x 5/8 2,4,5,7-10,12-15,17-19	X-51-9	1	AC ammeter 5,14	282804	
	2	Screw, 8-32 x 5/8 round head 20,21	X-51-53	1	AC ammeter 6,17	282805	
39	1	Strap, ground 2,4-10,12-15,17-21	X-6046-2	1	AC ammeter 7,18,20	282806	

X Not Sold Separately



# Series 189

## Group 301 Controller and Mounting (Dec-3 Controller)



# Series 189

## Group 301 Controller and Mounting (Dec-3 Controller)

Item	Qty.	Description Variation No.	Part No.	Item	Qty.	Description Variation No.	Part No.
56	1	AC ammeter 8, 19, 21	282807	73	1	Marker, terminal strip (decal) 2,4-10,12-15,17-21	292823
	1	AC ammeter 9	282808	74	4	Bumper, rubber 2,4-10,12-15,17-21	292834
	1	AC ammeter 12	282800	75	1	Harness, cable (ribbon connector) 2,4-10,12-15,17-21	292836
57	1	AC Voltmeter 2,4,12-14,17,18	282817	76	1	Plate, hinge (rear panel) 2,4-10,12-15,17-21	292908
	1	AC Voltmeter 5-10,15,19-21	282816	77	1	Jumper, 2-terminal 2,4-7,9,10,12-15,17,18	X-6048-2
58	1	Meter, frequency 2,4-10,12-15,17-21	282818	78	2	Fuse, 3 Amp. 2,4-7,9,10,12-15,17,18	243273
59	1	Gauge, oil pressure 2,4-10,12-15,17-21	282897	79	1	Fuse, 15 Amp. 2,4-7,9,10,12-15,17,18	283645
60	1	Gauge, water temperature 2,4-10,12-15,17-21	282898	80	1	Knob, pointer (selective switch) 6,7,14,17	269356
61	2	Socket, lamp 2,4-10,12-15,17-21	284990	81	1	Washer, 1/4 split lock 7,17	X-20-1
62	9	Spacer, circuit board 2,4-10,12-15,17-21	287948	82	8	Screw, 10-24 x 1/2 7,14,17	X-50-15
63	3	Fuse, 1.5 Amp. 2,4-10,12-15,17-21	291207	83	1	Washer, 5/16 int./ext. tooth lock 7,8,17,20,21	X-22-16
64	2	Lamp, neon 120 V. 2,4-10,12-15,17-21	291740	84	1	Connector, male 2,4-10,12-15,17-21	269166
65	1	Decal, fuse rating 2,4-10,12-15,17-21	292347	85	2	Pin, male .093 dia. (16-20 ga.) 2,4-10,12-15,17-21	237662
66	1	Resistor 2,4,12-14,18	292352	86	6	Pin, female .130 dia. (14-20 ga.) 2,4-10,12-15,17-21	269619
67	1	Decal, voltage adjustment 2,4-10,12-15,17-21	292361	<b>NOTE:</b> Item 1 Controller assembly includes Items 20-76 and 80-83. Item 20 Pot. assembly includes Items 84 and 85. Item 21 Circuit board assembly (16-lite) is mounted directly to controller box. Early models may have used a separate front panel 292358. If this (metal) front panel is required, order a new controller box (Item 70) as the service replacement. Item 22 Circuit board assembly includes Items 77-79. Item 86 female pin is used with Item 52.			
68	1	Nameplate (3PH.) 2,4,9,12,13,18	292383				
	1	Nameplate (1PH. /3PH.) 5,8,10,15,19-21	292382				
69	1	Switch, selector 2,4,7,9,12-14,17,18	292374				
	1	Switch selector 5,6,8,10,15,19-21	292373				
70	1	Box, controller 2,4-10,12-15,17-21	292375				
71	1	Cover, controller 2,4-10,12-15,17-21	292818				
72	1	Holder, fuse 2,4-10,12-15,17-21	292821				

X Not Sold Separately

# Series 189

## ACCESSORY KIT NUMBERS

	20ROZJ	30ROZJ	40ROZJ	50ROZJ	60ROZJ
<b>GROUP 104 STANDARD ACCESSORIES (one used) *</b>					
Cooling, 105 deg. radiator kit	275443	275443	275443	275444	275444
Cooling, 125 deg. radiator kit	276636	275560	275560	279575	279575
Cooling, city water cooled kit	use	274703	for all	20-60ROZJ	
Cooling, remote radiator set-up kit (less radiator)	274702	274702	274702	274702	274702
<b>GROUP 301 STANDARD ACCESSORIES (one used) *</b>					
Dec-3 (14-lite) controller kit	273395	273395	273396	273397	273397
Dec-3 (14-lite) controller kit 600 Volt	275420	275420	275421	275421	275423
Dec-3 (14-lite) controller kit, w/oversize meterbox	273867	273867	273870	273873	273873
Dec-3 (14-lite) contr. kit, 600 V., w/oversize meterbox	273888	273888	273891	273891	273897
6-Lite controller kit	273866	273866	273869	273872	273872
6-Lite controller kit, w/oversize meterbox	273868	273868	273871	273874	273874
6-Lite controller kit, 600 Volt	273887	273887	273890	273890	273896
6-Lite controller kit, 600 Volt, w/oversize meterbox	273889	273889	273892	273892	273898
Manual controller kit	275428	275428	275429	275430	275430
Manual controller kit, 600 V.	275435	275435	275436	275436	275438
Meterbox for switchgear, no controls or AC meters **	N/A	N/A	N/A	N/A	N/A
<b>OPTIONAL ACCESSORIES</b>					
Adapter bushing for loose silencer end in critical	N/A	N/A	N/A	N/A	N/A
Adapter bushing for loose silencer side in critical	N/A	N/A	N/A	N/A	N/A
Adapter bushing for loose silencer end in residential	N/A	N/A	N/A	N/A	N/A
Adapter bushing for loose silencer side in residential	N/A	N/A	N/A	N/A	N/A
Air cleaner - heavy duty	274720	274720	274720	274727	274727
Air cleaner restriction indicators	use	274608	for all	20-60ROZJ	
Anticipatory alarms	use	273583	for all	20-60ROZJ	
Auxiliary fuel pump, gasoline or diesel	use	247076	for all	20-60ROZJ	
Battery(ies)	use	PA-253357	for all	20-60ROZJ	
Battery charger, float type, 12 Volt without alarms	use	PAA-292862		for all models	
Battery charger, float type, 12 Volt with alarms	use	PAA-292863		for all models	
Battery charger, float type, 24 Volt without alarms	use	PAA-292864		for all models	
Battery charger, float type, 24 Volt with alarms	use	PAA-292865		for all models	
Battery charger, trickle type	use	PAA-248952		for all models	
Battery heater	use	258885	for all	20-60ROZJ	
Battery rack and cables	use	273400	for all	20-60ROZJ	
Block heater, 110 to 120 Volt AC, 90 deg. rise	use	275584	for all	20-60ROZJ	
Block heater, 190 to 240 Volt AC, 90 deg. rise	use	275589	for all	20-60ROZJ	
Block heater, 380 to 480 Volt AC, 90 deg. rise	N/A	N/A	N/A	N/A	N/A
Common failure relay	use	273914	for all	20-60ROZJ	
Current transformer kit - std. Volt	275492	275492	275496	275499	275499
Current transformer kit - 600 Volt	275491	275491	275492	275492	275496
Customer connection terminal strip kit	use	273915	for all	20-60ROZJ	
Dry contact kit, single relay	use	PA-273912	for all	20-60ROZJ	
Dry contact kit, 10 relay	use	PA-273913	for all	20-60ROZJ	
Electronic governor, isochronous (B.C. 8000)	use	273678	for all	20-60ROZJ	
Electronic governor, isochronous (B.C. 2500)	N/A	N/A	N/A	276565	276565
Exhaust manifold insulation kit	275477	275477	275477	275483	275483
Fast check (troubleshooting equipment)	use	PA-272766		for all models	
Flexible exhaust conn. stainless steel, single outlet	PA-273674	PA-273674	PA-273674	PA-273675	PA-273675
Flexible exhaust conn. stainless steel, dual outlet	N/A	N/A	N/A	N/A	N/A
Flexible fuel lines, diesel	use	273618	for all	20-60ROZJ	
Fuel Pressure Gauge Kit	use	275541	for all	20-60ROZJ	
Generator heater, reconnectable 95 to 240 Volt AC	use	253213	for all	20-60ROZJ	
Housing, removable rear door	use	254479	for all	20-60ROZJ	

\* If Specification Number Index did not contain a variation number for a particular specification in Group 104 and/or Group 301, use the above Standard Accessories data to determine part numbers of components.

\*\* If meterbox for switchgear (no controls or AC meters) and safeguard breaker are used, current trans. kit is required.

# Series 189

## ACCESSORY KIT NUMBERS

ACCESSORY	20ROZJ	30ROZJ	40ROZJ	50ROZJ	60ROZJ
<b>OPTIONAL ACCESSORIES</b>					
Line circuit breaker, 50 Hz.110/190 Volt, 3 Phase	273571	273572	273573	273579	273698
Line circuit breaker, 50 Hz.110/220 Volt, 3 Phase	273572	273573	273573	273698	273698
Line circuit breaker, 50 Hz. 220/380 Volt, 3 Phase	273569	273570	273571	273572	273572
Line circuit breaker, 50 Hz. 240/416 Volt, 3 Phase	273569	273570	273571	273571	273571
Line circuit breaker, 50 Hz. 220 Volt, 3 Phase	273571	273572	273573	273579	273579
Line circuit breaker, 60 Hz. 120/208 Volt, 3 Phase	273572	273573	273573	273698	273698
Line circuit breaker, 60 Hz. 120/240 Volt, 3 Phase	273573	273573	273698	273698	273698
Line circuit breaker, 60 Hz. 240/416 Volt, 3 Phase	273576	273570	273571	273572	273577
Line circuit breaker, 60 Hz. 277/480 Volt, 3 Phase	273570	273570	273570	273572	273572
Line circuit breaker, 60 Hz. 347/600 Volt, 3 Phase	273582	273569	273576	273570	273574
Line circuit breaker, 60 Hz. 240 Volt, 3 Phase	273571	273572	273573	273579	273698
Load connection kit	use	274689	for all	20-60ROZJ	
Load share module, electronic governor	use	273775	for all	20-60ROZJ	
Local emergency stop (meterbox front)	use	273845	for all	20-60ROZJ	
Meterbox relocation kit	use	PAB-258849	for all	20-60ROZJ	
NFPA literature	use	PA-276554	for all	20-60ROZJ	
Oil drain kit	273726	273726	273726	276551	276551
Oil temperature gauge	276501	276501	276501	276502	276502
Overvoltage protection	use	291746	for all	20-60ROZJ	
Radiator duct flange (with radiator shroud)	273402	273402	273402	273402	279645
Radiator duct flange (without radiator shroud)	N/A	N/A	N/A	N/A	N/A
Reactive droop compensator	290939	290939	290939	290940	290940
Remote annunciator, 16 lite (flush mount)	use	PA-286484	for all	20-60ROZJ	
Remote annunciator, 16 lite (surface mount)	use	PA-256471	for all	20-60ROZJ	
Remote audio/visual alarm	use	PA-292856	for all	20-60ROZJ	
Remote emergency stop	use	PA-292366	for all	20-60ROZJ	
Rodent proofing kit	use	273968	for all	20-60ROZJ	
Rodent proofing kit, 600 Volt	use	274599	for all	20-60ROZJ	
Run relay	use	273743	for all	20-60ROZJ	
Safeguard breaker, 50 Hz.110/190 Volt, 3 phase	255128	255131	255131	255128	255131
Safeguard breaker, 50 Hz.110/220 Volt, 1 phase	255131	255127	255131	255131	255131
Safeguard breaker, 50 Hz. 220/380 Volt, 3 phase	255128	255131	255131	255128	255131
Safeguard breaker, 50 Hz. 240/416 Volt, 3 phase	use	255128	for all	20-60ROZJ	
Safeguard breaker, 50 Hz. 220 Volt, 3 phase	use	255128	for all	20-60ROZJ	
Safeguard breaker, 60 Hz.120/208 Volt, 3 phase	255128	255127	255131	255131	255131
Safeguard breaker, 60 Hz. 120/240 Volt, 1 phase	255131	255129	255127	255131	255127
Safeguard breaker, 60 Hz. 240/416 Volt, 3 phase	255128	255127	255131	255131	255131
Safeguard breaker, 60 Hz. 277/480 Volt, 3 phase	255128	255131	255128	255128	255128
Safeguard breaker, 60 Hz. 347/600 Volt, 3 phase	255127	255127	255129	255127	255129
Safeguard breaker, 60 Hz. 240 Volt, 3 phase	255128	255131	255128	255128	255128
Safeguard breaker, all voltage reconnection selection	255131	255129	255127	255131	255127
Shunt trip line breaker, 50 Hz.110/190 Volt, 3 phase	274484	274485	274472	274475	274480
Shunt trip line breaker, 50 Hz.110/220 Volt, 1 phase	274485	274472	274472	274480	274480
Shunt trip line breaker, 50 Hz. 220/380 Volt, 3 phase	274482	274483	274484	274485	274485
Shunt trip line breaker, 50 Hz. 240/416 Volt, 3 phase	274482	274483	274484	274484	274484
Shunt trip line breaker, 50 Hz. 220 Volt, 3 phase	274484	274485	274472	274475	274475
Shunt trip line breaker, 60 Hz. 120/208 Volt, 3 phase	274482	274472	274472	274480	274480
Shunt trip line breaker, 60 Hz. 120/240 Volt, 3 phase	274472	274472	274480	274480	274480
Shunt trip line breaker, 60 Hz. 240/416 Volt, 3 phase	274486	274483	274484	274485	274481
Shunt trip line breaker, 60 Hz. 277/480 Volt, 3 phase	274483	274483	274483	274485	274485
Shunt trip line breaker, 60 Hz. 347/600 Volt, 3 phase	274467	274482	274486	274483	274473
Shunt trip line breaker, 60 Hz. 240 Volt, 3 phase	274484	274485	274472	274475	274480

# Series 189

## ACCESSORY KIT NUMBERS

ACCESSORY OPTIONAL ACCESSORIES	20ROZJ	30ROZJ	40ROZJ	50ROZJ	60ROZJ
Silencer mounting, critical on housing	273602	273602	273602	273604	273604
Silencer mounting, industrial on housing	273601	273601	273601	273603	273603
Silencer mounting, residential on housing	N/A	N/A	N/A	N/A	N/A
Silencer, critical for housing	use	253305	for all	20-60ROZJ	
Silencer, critical, end in/end out, flange or NPT	use	290496	for all	20-60ROZJ	
Silencer, critical, side in/end out, flange or NPT	use	253236	for all	20-60ROZJ	
Silencer, industrial for housing	use	253143	for all	20-60ROZJ	
Silencer, industrial, end in/end out, flange or NPT	use	273669	for all	20-60ROZJ	
Silencer, industrial, side in/end out, flange or NPT	use	273718	for all	20-60ROZJ	
Silencer, residential for housing	N/A	N/A	N/A	N/A	N/A
Silencer, residential, end in/end out, flange	N/A	N/A	N/A	N/A	N/A
Silencer, residential, side in/end out, flange or NPT	N/A	N/A	N/A	N/A	N/A
Skid end cap	use	275463	for all	20-60ROZJ	
Speed potentiometer, electronic governor	use	273768	for all	20-60ROZJ	
Spring isolators	N/A	N/A	N/A	N/A	N/A
Subbase fuel tank, 30 gal.	use	273986	for all	20-60ROZJ	
Subbase fuel tank, 60 gal.	use	273987	for all	20-60ROZJ	
Subbase fuel tank, 100 gal.	use	273988	for all	20-60ROZJ	
Subbase fuel tank, 150 gal.	N/A	N/A	N/A	N/A	N/A
Subbase fuel tank, 200 gal.	N/A	N/A	N/A	N/A	N/A
Subbase fuel tank, 250 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/fuel gage, 30 gal.	use	292265	for all	20-60ROZJ	
Subbase tank w/fuel gage, 60 gal.	use	292266	for all	20-60ROZJ	
Subbase tank w/fuel gage, 100 gal.	292267	292267	292267	292267	292267
Subbase tank w/fuel gage, 150 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/fuel gage, 200 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/fuel gage, 250 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/low fuel switch, 30 gal.	use	292282	for all	20-60ROZJ	
Subbase tank w/low fuel switch, 60 gal.	use	292283	for all	20-60ROZJ	
Subbase tank w/low fuel switch, 100 gal.	292284	292284	292284	292284	292284
Subbase tank w/low fuel switch, 150 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/low fuel switch, 200 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/low fuel switch, 250 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/float switch, 30 gal.	use	274797	for all	20-60ROZJ	
Subbase tank w/float switch, 60 gal.	use	274797	for all	20-60ROZJ	
Subbase tank w/float switch, 100 gal.	use	274798	for all	20-60ROZJ	
Subbase tank w/float switch, 150 gal.	use	274798	for all	20-60ROZJ	
Subbase tank w/float switch, 200 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank w/float switch, 250 gal.	N/A	N/A	N/A	N/A	N/A
Subbase tank transfer pump, 1 ph. 50/60 Hz.	use	274781	for all	20-60ROZJ	
Tachometer	use	274888	for all	20-60ROZJ	
Tailpipe & rain cap w/housed silencer (critical)	use	273920	for all	20-60ROZJ	
Tailpipe & rain cap w/housed silencer (industrial)	use	273919	for all	20-60ROZJ	
Tailpipe & rain cap w/housed silencer (residential)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 3/0-08 (1 wire/terminal)	use	274693	for all	20-60ROZJ	
Terminal lug kit, 350MCM-06 (1 wire/terminal)	use	274694	for all	20-60ROZJ	
Terminal lug kit, 350MCM-06 (2 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 500MCM-04 (1 wire/terminal)	use	274695	for all	20-60ROZJ	
Terminal lug kit, 600MCM-02 (2 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 600MCM-02 (4 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 600MCM-04 (1 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 750MCM-3/0 (3 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Voltage regulator, remote mounting kit	use	273611	for all	20-60ROZJ	
Wattmeter kit, 50 Hz. 120/208 Volt, 3 ph wye only	274358	274359	274360	274360	274361
Wattmeter kit, 60 Hz. 120/208 Volt, 3 ph wye only	274358	274359	274360	274360	274361
Wattmeter kit, 60 Hz. 120/240 Volt, 3 ph delta only	274365	274366	274367	274367	274368
Wattmeter kit, 60 Hz. 277/480 Volt, 3 ph delta only	274371	274372	274373	274373	274374

# Series 189

## ACCESSORY KIT NUMBERS

	80ROZJ	100ROZJ	125ROZJ	150ROZJ	180ROZJ
<b>GROUP 104 STANDARD ACCESSORIES (one used) *</b>					
Cooling, 105 deg. radiator kit	275445	275445	275446	275446	275447
Cooling, 125 deg. radiator kit	276528	276528	N/A	N/A	276530
Cooling, 105 deg. radiator kit oversize generator	N/A	N/A	N/A	276500	N/A
Cooling, city water cooled kit	274705	274705	274707	274707	274709
Cooling, city water cooled kit oversize generator	N/A	N/A	N/A	274709	N/A
Cooling, remote radiator set-up kit (less radiator)	274704	274704	274706	274706	274708
Cooling, remote rad. set-up kit (less rad.) oversize gen.	N/A	N/A	N/A	274708	N/A
<b>GROUP 301 STANDARD ACCESSORIES (one used) *</b>					
Dec-3 (14-lite) controller kit	273397	273398	273399	275418	275419
Dec-3 (14-lite) controller kit oversize generator	N/A	N/A	N/A	275553	N/A
Dec-3 (14-lite) controller kit, 600 Volt	275424	275424	275424	275426	275427
Dec-3 (14-lite) controller kit, w/oversize meterbox	273873	273876	273879	273882	273885
Dec-3 (14-lite) contr. kit, w/ O/S meterbox w/ O/S gen.	N/A	N/A	N/A	275555	N/A
Dec-3 (14-lite) contr. kit, 600 V., w/oversize meterbox	273900	273900	273900	273906	273909
6-Lite controller kit	273872	273875	273878	273881	273884
6-Lite controller kit, oversize generator	N/A	N/A	N/A	275554	N/A
6-Lite controller kit, w/oversize meterbox	273874	273877	273880	273883	273886
6-Lite contr. kit, w/oversize meterbox w/oversize gen.	N/A	N/A	N/A	275556	N/A
6-Lite controller kit, 600 Volt	273899	273899	273899	273905	273908
6-Lite controller kit, 600 Volt, w/oversize meterbox	273901	273901	273901	273907	273910
Manual controller kit	275430	275431	275432	275433	275434
Manual controller kit, oversize generator	N/A	N/A	N/A	275557	N/A
Manual controller kit, 600 V.	275439	275439	275439	275441	275442
Meterbox for switchgear, no controls or AC meters **	N/A	N/A	N/A	N/A	N/A
<b>OPTIONAL ACCESSORIES</b>					
Adapter bushing for loose silencer end in critical	N/A	N/A	N/A	PA-275521	PA-275521
Adapter bushing for loose silencer side in critical	N/A	N/A	N/A	PA-275521	PA-275521
Adapter bushing for loose silencer end in residential	N/A	N/A	N/A	PA-275521	PA-275521
Adapter bushing for loose silencer side in residential	N/A	N/A	N/A	PA-275521	PA-275521
Air cleaner – heavy duty	274731	274731	275448	275448	275594
Air cleaner – heavy duty w/oversize generator	N/A	N/A	N/A	275594	N/A
Air cleaner restriction indicators	use	274608	for all	80-180ROZJ	
Anticipatory alarms	273696	273696	273697	273697	273697
Auxiliary fuel pump, gasoline or diesel	use	247076	for all	80-180ROZJ	
Battery(ies)	PA-253357	PA-253357	PA-253728	pa-253728	PA-253728
Battery charger, float type, 12 Volt without alarms	use	PAA-292862		for all models	
Battery charger, float type, 12 Volt with alarms	use	PAA-292863		for all models	
Battery charger, float type, 24 Volt without alarms	use	PAA-292864		for all models	
Battery charger, float type, 24 Volt with alarms	use	PAA-292865		for all models	
Battery charger, trickle type	use	PAA-248952		for all models	
Battery heater	258885	258885	273564	273564	273564
Battery rack and cables	273642	273642	273523	273523	273401
Battery rack and cables w/oversize generator	N/A	N/A	N/A	273401	N/A
Block heater, 110 to 120 Volt AC, 90 deg. rise	275585	275585	275586	275586	275587
Block heater 110 to 120 Volt AC, 90 deg. rise O/S gen.	N/A	N/A	N/A	275587	N/A
Block heater, 190 to 240 Volt AC, 90 deg. rise	275590	275590	275591	275591	275592
Block heater, 190 to 240 Volt AC, 90 deg. rise	N/A	N/A	N/A	275292	N/A
Block heater, 380 to 480 Volt AC, 90 deg. rise	N/A	N/A	N/A	N/A	N/A
Common failure relay	use	273914	for all	80-180ROZJ	
Current transformer kit – std. Volt	275499	275505	275508	275511	275515
Current transformer kit – 600 Volt	275499	275499	275499	275505	274832
Customer connection terminal strip kit	use	273915	for all	80-180ROZJ	

\* If Specification Number Index did not contain a variation number for a particular specification in Group 104 and/or Group 301, use the above Standard Accessories data to determine part numbers of components.

\*\* If meterbox for switchgear (no controls or AC meters) and safeguard breaker are used, current trans. kit is required.

## Series 189

### ACCESSORY KIT NUMBERS

	80ROZJ	100ROZJ	125ROZJ	150ROZJ	180ROZJ
Dry contact kit, single relay	use	PA-273912	for all	80-180ROZJ	
Dry contact kit, 10 relay	use	PA-273913	for all	80-180ROZJ	
Electronic governor, isochronous (B.C. 8000)	273679	273679	273545	275544	276555
Electronic governor, isochronous (B.C. 2500)	276568	276568	N/A	N/A	N/A
Exhaust manifold insulation kit	275478	275478	276558	275479	275479
Fast check (troubleshooting equipment)	use	PA-272766		for all models	
Flexible exhaust conn. stainless steel, single outlet	use	PA-273676	for all	80-180ROZJ	
Flexible exhaust conn. stainless steel, dual outlet	N/A	N/A	N/A	N/A	N/A
Flexible fuel lines, diesel	273628	273628	273546	273546	273917
Fuel pressure gauge kit	275541	275541	275538	275538	275538
Generator heater, reconnectable 95 to 240 Volt AC	use	253213	for all	80-180ROZJ	
Housing, removable rear door	254481	254481	273982	273982	273547
Housing, removable rear door, oversize generator	N/A	N/A	N/A	273547	N/A
Line circuit breaker, 50 Hz. 110/190 Volt, 3 Phase	273525	273580	273527	273527	273536
Line c. b., 50 Hz. 110/190 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273535	N/A
Line circuit breaker, 50 Hz. 110/220 Volt, 3 Phase	273627	273528	273527	273527	N/A
Line c. b., 50 Hz. 110/220 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273535	N/A
Line circuit breaker, 50 Hz. 220/380 Volt, 3 Phase	273526	273524	273524	273627	273534
Line c. b., 50 Hz. 220/380 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	275567	N/A
Line circuit breaker, 50 Hz. 240/416 Volt, 3 Phase	273526	273526	273625	273524	273534
Line c. b., 50 Hz. 240/416 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273533	N/A
Line circuit breaker, 50 Hz. 220 Volt, 3 Phase	273627	273580	273528	273528	273535
Line c. b., 50 Hz. 220 Volt, 3 Phase, oversize generator	N/A	N/A	N/A	275568	N/A
Line circuit breaker, 60 Hz. 120/208 Volt, 3 Phase	273580	273580	273527	273529	273537
Line c. b., 60 Hz. 120/208 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273536	N/A
Line circuit breaker, 60 Hz. 120/240 Volt, 3 Phase	273525	273528	273527	273529	N/A
Line c. b., 60 Hz. 120/240 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273536	N/A
Line circuit breaker, 60 Hz. 240/416 Volt, 3 Phase	273526	273625	273524	273525	273842
Line c. b., 60 Hz. 240/416 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	273534	N/A
Line circuit breaker, 60 Hz. 277/480 Volt, 3 Phase	273526	273526	273625	273627	273534
Line c. b., 60 Hz. 277/480 Volt, 3 Phase, oversize gen.	N/A	N/A	N/A	275567	N/A
Line circuit breaker, 60 Hz. 347/600 Volt, 3 Phase	273575	273581	273526	273625	273533
Line c. b., 60 Hz. 347/600 Volt, 3 Phase	N/A	N/A	N/A	275566	N/A
Line circuit breaker, 60 Hz. 240 Volt, 3 Phase	273627	273580	273528	273527	273536
Line c. b., 60 Hz. 240 Volt, 3 Phase, oversize generator	N/A	N/A	N/A	273535	N/A
Load connection kit	274690	274690	274691	274691	274692
Load connection kit, oversize generator	N/A	N/A	N/A	274996	N/A
Load share module, electronic governor	use	273775	for all	80-180ROZJ	
Local emergency stop (meterbox front)	use	273845	for all	80-180ROZJ	
Meterbox relocation kit	use	PAB-258849	for all	80-180ROZJ	
NFPA literature	PA-273715	PA-273715	PA-273685	PA-273685	PA-273685
Oil drain kit	273728	273728	273846	273846	273847
Oil drain kit, oversize generator	N/A	N/A	N/A	273847	N/A
Oil temperature gauge	276502	276502	276504	276504	276504
Overvoltage protection	use	291746	for all	80-180ROZJ	
Radiator duct flange (with radiator shroud)	273402	273402	273467	273467	273932
Radiator duct flange (without radiator shroud), 125 deg.	N/A	N/A	N/A	N/A	279645
Reactive droop compensator	290941	290942	290943	290943	290943
Remote annunciator, 16 lite (flush mount)	use	PA-256484	for all	80-180ROZJ	
Remote annunciator, 16 lite (surface mount)	use	PA-256471	for all	80-180ROZJ	
Remote audio/visual alarm	use	PA-292856	for all	80-180ROZJ	
Remote emergency stop	use	PS-292366	for all	80-180ROZJ	
Rodent proofing kit	273969	273969	273969	273969	273970
Rodent proofing kit, oversize generator	N/A	N/A	N/A	273970	N/A
Rodent proofing kit, 600 Volt	274600	274600	274600	274600	274601
Rodent proofing kit, 600 Volt, oversize generator	N/A	N/A	N/A	274601	N/A
Run relay	use	273743	for all	80-180ROZJ	

# Series 189

## ACCESSORY KIT NUMBERS

ACCESSORY OPTIONAL ACCESSORIES	80ROZJ	100ROZJ	125ROZJ	150ROZJ	180ROZJ
Safeguard breaker, 50 Hz. 110/190 Volt, 3 phase	255130	255130	255130	255127	272747
Safeguard breaker, 50 Hz. 110/220 Volt, 1 phase	255130	255127	255129	255127	N/A
Safeguard breaker, 50 Hz. 220/380 Volt, 3 phase	255130	255130	255130	255127	272747
Safeguard breaker, 50 Hz. 240/416 Volt, 3 phase	255130	255127	255127	255127	272746
Safeguard breaker, 50 Hz. 220 Volt, 3 phase	255127	255131	255127	255131	272746
Safeguard breaker, 60 Hz. 120/208 Volt, 3 phase	255129	255130	255130	255130	272747
Safeguard breaker, 60 Hz. 120/240 Volt, 1 phase	255130	255130	255129	255129	N/A
Safeguard breaker, 60 Hz. 240/416 Volt, 3 phase	255129	255130	255130	255130	272747
Safeguard breaker, 60 Hz. 277/480 Volt, 3 phase	255127	255127	255127	255127	272746
Safeguard breaker, 60 Hz. 347/600 Volt, 3 phase	255129	255129	255129	255130	275595
Safeguard breaker, 60 Hz. 240 Volt, 3 phase	255130	255127	255127	255127	272746
Safeguard breaker, all voltage reconnection selection	255129	255130	255129	255129	272747
Shunt trip line breaker, 50 Hz. 110/190 Volt, 3 phase	274468	274476	274470	274470	273964
Shunt trip line brkr., 50 Hz. 110/190 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275569	N/A
Shunt trip line breaker, 50 Hz. 110/220 Volt, 1 phase	274479	274471	274470	274470	N/A
Shunt trip line brkr., 50 Hz. 110/220 Volt, 1 ph, O/S gen.	N/A	N/A	N/A	275569	N/A
Shunt trip line breaker, 50 Hz. 220/380 Volt, 3 phase	274469	274467	274467	274479	273962
Shunt trip line brkr., 50 Hz. 220/380 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275570	N/A
Shunt trip line breaker, 50 Hz. 240/416 Volt, 3 phase	274469	274469	274478	274467	273962
Shunt trip line brkr., 50 Hz. 240/416 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	273961	N/A
Shunt trip line breaker, 50 Hz. 220 Volt, 3 phase	274479	274476	274471	274471	275569
Shunt trip line brkr., 50 Hz. 220 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275571	N/A
Shunt trip line breaker, 60 Hz. 120/208 Volt, 3 phase	274476	274476	274470	273960	273965
Shunt trip line brkr., 60 Hz. 120/208 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	273964	N/A
Shunt trip line breaker, 60 Hz. 120/240 Volt, 3 phase	274468	274471	274470	273960	N/A
Shunt trip line brkr., 60 Hz. 120/240 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	273964	N/A
Shunt trip line breaker, 60 Hz. 240/416 Volt, 3 phase	274469	274478	274467	274468	273966
Shunt trip line brkr., 60 Hz. 240/416 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	273962	N/A
Shunt trip line breaker, 60 Hz. 277/480 Volt, 3 phase	274469	274469	274478	274479	273962
Shunt trip line brkr., 60 Hz. 277/480 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275570	N/A
Shunt trip line breaker, 60 Hz. 347/600 Volt, 3 phase	274474	274477	274469	274478	273961
Shunt trip line brkr., 60 Hz. 347/600 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275572	N/A
Shunt trip line breaker, 60 Hz. 240 Volt, 3 phase	274479	274476	274471	274471	273964
Shunt trip line brkr, 60 Hz. 240 Volt, 3 ph, O/S gen.	N/A	N/A	N/A	275571	N/A
Silencer mounting, critical on housing	273605	273605	273548	273548	273548
Silencer mounting, industrial on housing	273605	273605	N/A	N/A	N/A
Silencer mounting, residential on housing	N/A	N/A	273548	273548	273548
Silencer, critical for housing	253615	253615	273652	273652	273652
Silencer, critical, end in/end out, flange or NPT	290490	290490	290490	290493	290493
Silencer, critical, side in/end out, flange or NPT	273720	273720	273720	273844	273844
Silencer, industrial for housing	253616	253616	N/A	N/A	N/A
Silencer, industrial, end in/end out, flange or NPT	273670	273670	273670	N/A	N/A
Silencer, industrial, side in/end out, flange or NPT	273719	273719	273719	N/A	N/A
Silencer, residential for housing	N/A	N/A	273653	273653	273653
Silencer, residential, end in/end out, flange	N/A	N/A	N/A	290488	290488
Silencer, residential, side in/end out, flange or NPT	N/A	N/A	N/A	273843	273843
Skid end cap	275463	275463	275464	275464	275465
Skid end cap, oversize generator	N/A	N/A	N/A	275465	N/A
Speed potentiometer, electronic governor	use	273768	for all	80-180ROZJ	
Spring isolators	N/A	N/A	N/A	N/A	N/A



# Series 189

## ACCESSORY KIT NUMBERS

ACCESSORY OPTIONAL ACCESSORIES	80ROZJ	100ROZJ	125ROZJ	150ROZJ	180ROZJ
Subbase fuel tank, 30 gal.	273989	273989	N/A	N/A	N/A
Subbase fuel tank, 60 gal.	273990	273990	273992	273992	273996
Subbase fuel tank, 60 gal., oversize generator	N/A	N/A	N/A	273996	N/A
Subbase fuel tank, 100 gal.	273991	273991	273993	273993	273997
Subbase fuel tank, 100 gal. oversize generator	N/A	N/A	N/A	273997	N/A
Subbase fuel tank, 150 gal.	N/A	N/A	273994	273994	273998
Subbase fuel tank, 150 gal., oversize generator	N/A	N/A	N/A	273998	N/A
Subbase fuel tank, 200 gal.	N/A	N/A	N/A	N/A	273372
Subbase fuel tank, 250 gal.	N/A	N/A	273995	273995	273999
Subbase fuel tank, 250 gal., oversize generator	N/A	N/A	N/A	273999	N/A
Subbase tank w/fuel gage, 30 gal.	292265	292265	N/A	N/A	N/A
Subbase tank w/fuel gage, 60 gal.	292266	292266	292265	292265	292265
Subbase tank w/fuel gage, 100 gal.	292267	292267	292266	292266	292266
Subbase tank w/fuel gage, 150 gal.	N/A	N/A	292267	292267	292267
Subbase tank w/fuel gage, 200 gal.	N/A	N/A	N/A	N/A	292267
Subbase tank w/fuel gage, 250 gal.	N/A	N/A	292268	292268	292268
Subbase tank w/low fuel switch, 30 gal.	292282	292282	N/A	N/A	N/A
Subbase tank w/low fuel switch, 60 gal.	292283	292283	292283	292283	292282
Subbase tank w/low fuel switch, 60 gal., oversize gen.	N/A	N/A	N/A	292282	N/A
Subbase tank w/low fuel switch, 100 gal.	292284	292284	292284	292284	292283
Subbase tank w/low fuel switch, 100 gal., oversize gen.	N/A	N/A	N/A	292283	N/A
Subbase tank w/low fuel switch, 150 gal.	N/A	N/A	292285	292285	292283
Subbase tank w/low fuel switch, 150 gal., oversize gen.	N/A	N/A	N/A	292283	N/A
Subbase tank w/low fuel switch, 200 gal.	N/A	N/A	N/A	N/A	292284
Subbase tank w/low fuel switch, 250 gal.	N/A	N/A	N/A	N/A	292271
Subbase tank w/float switch, 30 gal.	274797	274797	N/A	N/A	N/A
Subbase tank w/float switch, 60 gal.	use	272797	for all	80-180ROZJ	
Subbase tank w/float switch, 100 gal.	274798	274798	274797	274797	274797
Subbase tank w/float switch, 150 gal.	274798	274798	274798	274798	274797
Subbase tank w/float switch, 200 gal.	N/A	N/A	N/A	N/A	274798
Subbase tank w/float switch, 250 gal.	N/A	N/A	274798	274798	274798
Subbase tank transfer pump, 1 ph. 50/60 Hz.	use	274781	for all	80-180ROZJ	
Tachometer	use	274888	for all	80-180ROZJ	
Tailpipe & rain cap w/housed silencer (critical)	273921	273921	273928	273928	273928
Tailpipe & rain cap w/housed silencer (industrial)	273921	273921	N/A	N/A	N/A
Tailpipe & rain cap w/housed silencer (residential)	N/A	N/A	273928	273928	273928
Terminal lug kit, 3/0-08 (1 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 350MCM-06 (1 wire/terminal)	274694	274694	N/A	N/A	N/A
Terminal lug kit, 350MCM-06 (2 wire/terminal)	274696	274696	N/A	N/A	274696
Terminal lug kit, 500MCM-04 (1 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 600MCM-02 (2 wire/terminal)	N/A	N/A	274778	274778	274698
Terminal lug kit, 600MCM-02 (4 wire/terminal)	N/A	N/A	N/A	N/A	N/A
Terminal lug kit, 600MCM-04 (1 wire/terminal)	N/A	N/A	274697	274697	274700
Terminal lug kit, 750MCM-3/0 (3 wire/terminal)	N/A	N/A	274779	274779	274699
Voltage regulator, remote mounting kit	use	273611	for all	80-180ROZJ	
Wattmeter kit, 50 Hz. 120/208 Volt, 3 ph wye only	274361	274362	274362	274363	274363
Wattmeter kit, 60 Hz. 120/208 Volt, 3 ph wye only	274361	274362	274362	274363	274363
Wattmeter kit, 60 Hz. 120/240 Volt, 3 ph delta only	274368	274369	274369	274370	274370
Wattmeter kit, 60 Hz. 277/480 Volt, 3 ph delta only	274374	274375	274375	274376	274376

# Series 189

## Accessories

### Group 104 Standard Accessories

Qty.	Description	Part No.	Qty.	Description	Part No.
	RADIATOR KIT, REMOTE	274702		RADIATOR KIT, REMOTE	274704
4	Washer, 3/8 split lock	X-22-1	4	Washer, 3/8 split lock	X-22-1
4	Washer, 13/32 x 13/16 x 1/16 plain	X-25-37	1	Hose, 2-1/4 x 18 in.	X-6014-22
2	Clamp, 1-3/8 hose	X-426-4	4	Screw, 3/8-16 x 1, Gr. 5	X-6238-11
2	Clamp, 1-9/16 hose	X-426-6	14	Screw, 1/4-14 x 3/4 drill	X-794-1
4	Screw, 3/8-16 x 1, Gr. 5	X-6238-11	4	Nut, 5/16-18	X-82-2
24	Screw, 1/4-14 x 3/4 drill	X-794-1	4	Clamp, 3 ID hose	250081
4	Nut, 3/8-16	X-83-2	1	Hose, lower radiator	273463
1	Hose, 1-1/2 ID (upper)	273417	1	Guard, belt (left)	274652
1	Hose, 1-7/8 ID (lower)	273418	1	Guard, belt (right)	274653
1	Guard, belt (left)	274643	1	Guard, belt (center)	274654
1	Guard, belt (right)	274644	1	Bracket, expansion tank	274655
1	Bracket, expansion	274647			
1	Guard, belt (center)	274669			
	COOLING KIT, CITY WATER	274703		COOLING KIT, CITY WATER	274705
2	Elbow, 1-1/2 NPTF street	A-27	2	Elbow, 1-1/2 NPTF street	A-27
1	Elbow, 1-1/4 NPTF street	EH-2226	1	Elbow, 3/4 NPTF	SA-472
1	Elbow, 3/4 NPTF	SA-472	4	Screw, 5/16-18 x 3/4	X-125-3
4	Screw, 5/16-18 x 3/4	X-125-3	2	Bushing, 3/4 x 1 reducer	X-202-1
2	Bushing, 3/4 x 1 reducer	X-202-1	1	Nipple, 3/4 NPTF x 1-3/8 pipe	X-206-9
1	Nipple, 3/4 NPTF x 1-3/8 pipe	X-206-9	1	Nipple, 1/2 x 3 pipe	X-209-11
1	Nipple, 1/2 x 3 pipe	X-209-11	4	Washer, 5/16 split lock	X-21-1
4	Washer, 5/16 split lock	X-21-1	1	Nipple, 1-1/4 x 1-5/8 pipe	X-210-8
12	Washer, 3/8 split lock	X-22-1	3	Coupling, 1-1/2 pipe	X-216-21
12	Washer, 13/32 x 13/16 x 1/16 plain	X-25-37	16	Washer, 3/8 split lock	X-22-1
2	Valve, 3/8 drain	X-256-1	12	Washer, 13/32 x 13/16 x 1/16 plain	X-25-37
1	Clamp, 1/2 hose	X-309-14	2	Valve, 3/8 drain	X-256-1
1	Valve, solenoid	X-350-8	1	Clamp, 1/2 hose	X-309-14
1	Line, 5/16 x 36 in. flex. fuel	X-386-36	1	Valve, solenoid	X-350-8
1	Clip, 9/16 x 11/32 tube	X-414-1	1	Line, 5/16 x 36 in. flex fuel	X-386-36
2	Clamp, 1-3/8 hose	X-426-4	2	Clamp, 1-9/16 hose	X-426-6
4	Clamp, 1-9/16 hose	X-426-6	1	Hose, 2 ID x 32 in. radiator	X-6014-10
1	Adapter, 1 NPT	X-570-16	16	Screw, 3/8-16 x 1, Gr. 5	X-6238-11
1	Hose, 2 ID x 32 in. radiator	X-6014-10	1	Clamp, insulating	X-672-4
1	Hose, 1-1/2 ID x 19 in.	X-6014-2	14	Screw, 1/4-14 x 3/4	X-794-1
12	Screw, 3/8-16 x 1, Gr. 5	X-6238-11	8	Nut, 5/16-18	X-82-2
1	Clamp, insulating	X-672-4	12	Nut, 3/8-16	X-83-2
18	Screw, 1/4-14 x 3/4	X-794-1	1	Bushing, 2-1/16 x 1-1/4 x 1-1/2	153016
4	Nut, 5/16-18	X-82-2	1	Nipple, 1-1/2 x pipe	155029
12	Nut, 3/8-16	X-83-2	4	Clamp, 3 dia. hose	250081
1	Nipple, 1-1/2 x 6 pipe	155029	1	Cap, pressure (7 psi)	258037
1	Cap, pressure (7 psi)	258037	1	Hose, 1-7/8 ID	273418
1	Hose, 1-7/8 ID	273418	1	Hose, lower radiator	273463
2	Bracket, exchanger	274642	1	Guard, belt (center)	273690
1	Guard, belt (left)	274643	2	Bracket, exchanger	274642
1	Guard, belt (right)	274644	1	Tank, expansion	274645
1	Tank, expansion	274645	1	Guard, belt (left)	274652
1	Bracket, expansion	274647	1	Guard, belt (right)	274653
1	Guard, belt (top)	274669	1	Bracket, expansion	274655
2	Decal, water drain	280561	1	Hose, upper radiator	274789
1	Exchanger, heat	285662	2	Decal, water drain	280561
2	Adapter, 1-1/2 NPT x 2 O.D. hose	285685	1	Exchanger, heat	285662
1	Regulator, water	290176	2	Adapter, 1-1/2 NPT x 2 O.D. hose	285685
2	Plate, heat exchanger mounting	290377	1	Regulator, water	290176
			2	Plate, heat exchanger	290377

X Not Sold Separately

# Series 189

## Accessories

### Group 104 Standard Accessories (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	RADIATOR KIT, REMOTE	274706		RADIATOR KIT, REMOTE	274708
4	Screw, 5/16-18 x 1	X-125-5	4	Screw, 5/16-18	X-125-5
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
27	Screw, 1/4-14 x 3/4 drill	X-794-1	27	Screw, 1/4-14 x 3/4 drill	X-794-1
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
4	Clamp, 3 dia. hose	250081	4	Clamp, 3 dia. hose	250081
1	Hose, radiator (lower)	273443	1	Hose, radiator (lower)	273443
1	Hose, radiator (upper)	273444	1	Hose, radiator (upper)	273444
1	Guard, right belt	274711	1	Guard, belt (lower left)	274761
1	Guard, lower left belt	274712	1	Guard, belt (upper right)	274762
1	Guard, upper left belt	274713	1	Guard, belt (upper left)	274763
1	Guard, belt (shroud)	274714	2	Bracket, heat exchanger	274764
1	Guard, belt (center)	274759	1	Guard, belt (shroud)	274765
			1	Guard, belt (center)	274822
	COOLING KIT, CITY WATER	274707		COOLING KIT, CITY WATER	274709
2	Elbow, 1-1/2 NPTF street	A-27	2	Elbow, 1-1/2 NPTF street	A-27
1	Elbow, 3/4NPTF	SA-472	4	Screw, 5/16-18 x 3/4	X-125-3
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 1	X-125-5
4	Screw, 5/16-18 x 1	X-125-5	1	Bushing, 3/4 x 1 reducer	X-202-1
1	Bushing, 3/4 x 1 reducer	X-202-1	1	Bushing, 1 x 1-1/2 reducer	X-202-11
1	Nipple, 3/4 NPTF x 1-3/8 pipe	X-206-9	8	Washer, 5/16 split lock	X-21-1
1	Nipple, 1/2 x 3 pipe	X-209-11	1	Nipple, 1-1/4 x 2	X-210-3
8	Washer, 5/16 split lock	X-21-1	2	Nipple, 2 NPTF x 4 in. pipe	X-219-6
1	Nipple, 1-1/4 x 2 pipe	X-210-3	8	Washer, 3/8 split lock	X-22-1
4	Washer, 3/8 split lock	X-210-3	4	Washer, 13/32 x 13/16 x 1/16 plain	X-25-37
4	Washer, 13/32 x 13/16 x 1/16 plain	X-22-1	2	Coupling, 1-1/2 reducer	X-250-1
2	Valve, 3/8 drain	X-25-37	2	Valve, 3/8 drain	X-256-1
1	Clamp, 1/2 hose	X-309-14	1	Clamp, 1/2 hose	X-309-14
1	Valve, solenoid	X-350-8	1	Valve, solenoid	X-350-8
1	Line, 5/16 x 36in. flex. fuel	X-386-36	1	Line, 5/16 x 36 in/ flex. fuel	X-386-36
1	Clip, 9/16 x 11/32 (tube)	X-414-1	1	Clip, 9/16 x 11/32 tube	X-414-1
2	Clamp, 1-9/16 hose	X-426-6	2	Clamp, 1-9/16 hose	X-426-6
2	Adapter, 1-1/2 NPT x 2-1/2 OD hose	X-570-3	2	Adapter, 1-1/2 NPT x 2-1/2 OD hose	X-570-3
1	Hose, 2 ID x 32 in. radiator	X-6014-10	1	Hose, 2 ID x 32 in. radiator	X-6014-10
16	Screw, 3/8-16 x 1, Gr.5	X-6238-11	4	Screw, 3/8-16 x 1, Gr. 5	X-6238-11
1	Clamp, insulating	X-672-4	4	Screw, 3/8-16 x 1-1/4, Gr. 5	X-6238-4
27	Screw, 1/4-14 x 3/4	X-794-1	1	Plug, 1-1/2 pipe	X-75-16
8	Nut, 5/16-18	X-82-2	1	Plug, 1/2 pipe	X-75-28
4	Nut, 3/8-16	X-83-2	27	Screw, 1/4-14 x 3/4 drill	X-794-1
1	Elbow, 1-1/2 NPT 90 deg.	151771	8	Nut, 5/16-18	X-82-2
1	Bushing, 1-14 x 1-1/2	153016	8	Nut, 3/8-16	X-83-2
1	Bushing, 1/2 x 1 reducer	168848	1	Elbow, 1 NPTF	151385
4	Clamp, 3 dia. hose	250081	2	Elbow, 1-1/2 NPT 90 deg.	151771
1	Cap, pressure (7 psi)	258037	1	Bushing, 2-1/16 x 1-1/	153016
2	Hose, radiator (upper & lower)	273445	2	Nipple, 1-1/2 x 1-3/4 pipe	155040
1	Tank, expansion	274645	4	Clamp, 3 dia. hose	250081
1	Guard, right belt	274711	1	Cap, pressure (7 psi)	258037
1	Guard, left belt	274712	2	Hose, radiator (upper & lower)	273443
1	Guard, upper belt	274713	1	Tank, expansion	274645
1	Guard, belt (shroud)	274714	1	Guard, belt (center)	274760
2	Bracket, heat exchanger	274751	1	Guard, belt (lower left)	274761
1	Guard, belt (center)	274759	1	Guard, belt (upper right)	274762
2	Decal, water (drain)	280561	1	Guard, belt (upper left)	274763
1	Exchanger, heat	285662	2	Bracket, heat exchanger	274764
2	Adapter, 1-1/2 NPT x 2 OD hose	285685	1	Guard, belt (shroud)	274765
1	Regulator, water	290176	2	Decal, water drain	280561
2	Plate, heat exchanger mounting	290377	2	Adapter, 1-1/2 NPT x 2 OD hose	285685
			1	Exchanger, heat	286143
			1	Regulator, water	289477

X Not Sold Separately

# Series 189

## Accessories

**Group 104**  
**Standard Accessories**  
**(cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
	COOLING, RADIATOR KIT	275443		COOLING, RADIATOR KIT	276530
	(See Group 104, Variation 4)		1	Radiator assembly	A-276531
	COOLING, RADIATOR KIT	275444	14	Screw, 5/16-18 x 3/4	X-125-3
	(See Group 104, Variation 1)		7	Screw, 5/16-18 x 1	X-125-5
	COOLING, RADIATOR KIT	275444	1	Screw, 1/2-13 x 2	X-129-21
	(See Group 104, Variation 2)		4	Washer, 1/4 split lock	X-20-1
	COOLING, RADIATOR KIT	275445	1	Bushing, 1/4 x 1/2 reducer	X-202-12
	(See Group 104, Variation 3)		21	Washer, 5/16 split lock	X-21-1
	COOLING, RADIATOR KIT	275446	1	Washer, 3/8 split lock	X-22-1
	(See Group 104, Variation 6)		1	Washer, 1/2 split lock	X-24-6
	COOLING, RADIATOR KIT	275447	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
	(See Group 104, Variation 3)		13	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
	COOLING, RADIATOR KIT	275446	1	Valve, 1/4 NPT drain	X-256-3
	(See Group 104, Variation 3)		4	Screw, 1/4-20 x 5/8	X-465-2
	COOLING, RADIATOR KIT	275447	3	Tie, cable	X-468-2
	(See Group 104, Variation 6)		6	Screw, 3/8-16 x 3-1/2	X-6238-12
	COOLING, RADIATOR KIT	275447	1	Screw, 3/8-16 x 2	X-6238-6
	(See Group 104, Variation 6)		19	Screw, 1/4-14 x 3/4 drill	X-794-1
	COOLING, RADIATOR KIT	275560	6	Washer, 13/32 x 13/16 x 1/16 hardened	X-801-3
	(See Group 104, Variation 6)		4	Nut, 1/4-20	X-81-1
	COOLING, RADIATOR KIT	275560	7	Nut, 5/16-18	X-82-2
	(See Group 104, Variation 6)		1	Nut, 3/8-16	X-83-2
	COOLING, RADIATOR KIT	275560	1	Nut, 1/2-13	X-89-8
	(See Group 104, Variation 6)		4	Clamp, 3 in. hose	250081
1	Radiator assembly	A-276522	1	Plug, 4 in. plastic	253268
4	Screw, 5/16-18 x 3 in., Gr. 5	X-125-28	1	Switch assembly, level	273404
6	Screw, 5/16-18 x 3/4 in.	X-125-3	1	Spacer, fan	273407
6	Screw, 5/16-18 x 1	X-125-5	1	Guard, fan (top)	273409
6	Screw, 5/16-18 x 1	X-125-5	1	Guard, fan (left)	273410
12	Washer, 5/16 split lock	X-21-1	1	Guard, fan (right)	273411
6	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	1	Support, radiator (right)	273414
1	Valve, drain 1/4 NPT	X-256-3	1	Support, radiator (left)	273415
2	Clamp, 2-1/4 in. hose	X-426-4	1	Shroud, radiator	273416
2	Clamp, 2-1/2 in. hose	X-426-6	1	Hose, upper radiator	273417
2	Tie, cable	X-468-2	1	Hose, lower radiator	273418
30	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Fan, blower	273492
4	Washer, 21/64 x 23/32 x 1/8 hardened	X-801-4	1	Shroud, fan	273493
6	Nut, 5/16-18	X-82-2	1	Spacer, radiator support	273911
1	Cover, radiator	253071		COOLING, RADIATOR KIT	276500
1	Plug, 4 in. plastic	253268		(See Group 104, Variation 5)	
1	Switch assembly, level	273404			
1	Spacer, fan	273407			
1	Guard, fan (top)	273409			
1	Guard, fan (left)	273410			
1	Guard, fan (right)	273411			
1	Support, radiator (right)	273414			
1	Support, radiator (left)	273415			
1	Shroud, radiator	273416			
1	Hose, upper radiator	273417			
1	Hose, lower radiator	273418			
1	Fan, blower	273492			
1	Shroud, fan	273493			
2	Spacer, radiator support	273911			
	COOLING, RADIATOR KIT	276500			
	(See Group 104, Variation 5)				

X Not Sold Separately

# Series 189

## Accessories

**Group 104**  
**Standard Accessories**  
**(cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
	COOLING, RADIATOR KIT	276636			
1	Radiator assembly	A-276635			
4	Screw, 5/16-18 x 3	X-125-28			
6	Screw, 5/16-18 x 3/4	X-125-3			
6	Screw, 5/16-18 x 1	X-125-5			
12	Washer, 5/16 split lock	X-21-1			
6	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85			
1	Valve, drain 1/4 NPT	X-256-3			
2	Clamp, 2-1/4 hose	X-426-4			
2	Clamp, 2-1/2 hose	X-426-6			
2	Tie, cable	X-468-2			
30	Screw, 1/4-14 x 3/4 drill	X-794-1			
4	Washer, 21/64 x 23/32 x 1/8 hardened	X-801-4			
6	Nut, 5/16-18	X-82-2			
1	Cover, radiator	253071			
1	Plug, 4 in. plastic	253268			
1	Switch assembly, level	273404			
1	Spacer, fan	273407			
1	Guard, fan (top)	273409			
1	Guard, fan (left)	273410			
1	Guard, fan (right)	273411			
1	Support, radiator (right)	273414			
1	Support, radiator (left)	273415			
1	Shroud, radiator	273416			
1	Hose, upper radiator	273417			
1	Hose, lower radiator	273418			
1	Fan, blower	273492			
1	Shroud, fan	273493			
2	Spacer, radiator support	273911			
	COOLING, RADIATOR KIT	279575			
1	Radiator assembly	A-273512			
4	Screw, 5/16-18 x 3	X-125-28			
6	Screw, 5/16-18 x 3/4	X-125-3			
6	Screw, 5/16-18 x 1	X-125-5			
12	Washer, 5/16 split lock	X-21-1			
6	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85			
1	Valve, drain 1/4 NPT	X-256-3			
2	Clamp, 2-1/4 hose	X-426-4			
2	Clamp, 2-1/2 hose	X-426-6			
2	Tie, cable	X-468-2			
30	Screw, 1/4-14 x 3/4 drill	X-794-1			
4	Washer, 21/64 x 23/32 x 1/8 hardened	X-801-4			
6	Nut, 5/16-18	X-82-2			
1	Cover, radiator	253071			
1	Plug, 4 in. plastic	253268			
1	Switch assembly, level	273404			
1	Spacer, fan	273407			
1	Guard, fan (top)	273409			
1	Guard, fan (left)	273410			
1	Guard, fan (right)	273411			
1	Support, radiator (right)	273414			
1	Support, radiator (left)	273415			
1	Shroud, radiator	273416			
1	Hose, upper radiator	273417			
1	Hose, lower radiator	273418			
1	Fan	275551			
2	Spacer, radiator support	273911			

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**Dec-3 Controller Kits**

Qty. Description	Part No.	Qty. Description	Part No.
DEC-3 CONTROLLER KIT J1	273395	DEC-3 CONTROLLER KIT J24	273900
DEC-3 CONTROLLER KIT J2	273396	DEC-3 CONTROLLER KIT J25	273906
DEC-3 CONTROLLER KIT J3	273397	DEC-3 CONTROLLER KIT J26	273909
DEC-3 CONTROLLER KIT J4	273398	DEC-3 CONTROLLER KIT J6	275418
DEC-3 CONTROLLER KIT J5	273399	DEC-3 CONTROLLER KIT J7	275419
DEC-3 CONTROLLER KIT J14	273867	DEC-3 CONTROLLER KIT J8	275420
DEC-3 CONTROLLER KIT J15	273870	DEC-3 CONTROLLER KIT J9	275421
DEC-3 CONTROLLER KIT J16	273873	DEC-3 CONTROLLER KIT J10	275423
DEC-3 CONTROLLER KIT J20	273876	DEC-3 CONTROLLER KIT J11	275424
DEC-3 CONTROLLER KIT J21	273879	DEC-3 CONTROLLER KIT J12	275426
DEC-3 CONTROLLER KIT J22	273882	DEC-3 CONTROLLER KIT J13	275427
DEC-3 CONTROLLER KIT J23	273885	DEC-3 CONTROLLER KIT J69	275553
DEC-3 CONTROLLER KIT J17	273888	DEC-3 CONTROLLER KIT J70	275555
DEC-3 CONTROLLER KIT J18	273891	<b>NOTE:</b> Use the variation number found on this page for the given controller kit and use the following pages to determine service parts. Items not in bold are included with controller assembly.	
DEC-3 CONTROLLER KIT J19	273897		

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**Dec-3 Controller Kits (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
1	Controller assembly J1	B-292827	9	Washer, #6 split lock all	X-18-1
1	Controller assembly J2	B-292829	6	Washer, #8 split lock J1-3,5-26,69,70	X-18-2
1	Controller assembly J3	B-292831	2	Washer, #8 split lock J4	X-18-2
1	Controller assembly J4	B-292832	8	Washer, #10 split lock J1-3,5-26,69,70	X-19-1
1	Controller assembly J5	A-273591	6	Washer, #10 split lock J4	X-19-1
1	Controller assembly J6,J69	B-272606	4	Washer, 1/4 split lock J14-26,70	X-20-1
1	Controller assembly J7	A-292362	4	Washer, 5/16 split lock all	X-21-1
1	Controller assembly J8	A-292826	2	Washer, #10 int./ext. tooth lock all	X-22-13
1	Controller assembly J9	B-292830	4	Washer, #6 int./ext. tooth lock all	X-22-6
1	Controller assembly J10	B-292930	8	Washer, 17/64 x 1 x 1/16 plain J14-17,19-26,70	X-25-73
1	Controller assembly J11	B-292931	8	Washer, 13/16 x 11/32 x 1/16 plain J18	X-25-74
1	Controller assembly J12	B-292932	1	Grommet, 3 x 3-1/2 all	X-284-31
1	Controller assembly J13	A-292363	4	Terminal, #6 spade, 22-16 ga. J23	X-285-9
1	Controller assembly J14	A-273812	1	Plug, 7/8 plastic button all	X-301-29
1	Controller assembly J15	A-273814	1	Plug, 7/16 plastic button all	X-301-34
1	Controller assembly J16	A-273816	4	Tie, cable all	X-468-3
1	Controller assembly J17	A-273811	2	Screw, 6-32 x 3/8 pan head all	X-49-2
1	Controller assembly J18	A-273815	18	Screw, 6-32 x 1/4 pan head all	X-49-25
1	Controller assembly J19	A-273817	2	Screw, 6-32 x 1/2 pan head all	X-49-39
1	Controller assembly J20	A-273818	4	Screw, 10-24 x 3/4 pan head all	X-50-3
1	Controller assembly J21	A-273598	1	Screw, 10-24 x 1 pan head all	X-50-7
1	Controller assembly J22,70	A-273835			
1	Controller assembly J23	A-273836			
1	Controller assembly J24	A-273819			
1	Controller assembly J25	A-273821			
1	Controller assembly J26	A-273837			
1	Potentiometer assembly all	A-255041			
1	Board assembly, circuit (16-lite) all	A-292357			
1	Board assembly, circuit (main) all	E-292806			

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**Dec-3 Controllers (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
2	Screw, 8-32 x 5/8 round head all	X-51-53	2	Resistor J23	268297
1	Strap, ground all	X-6046-2	4	Bumper (1 dia.) J14-18,20-26,70	255443
1	Jumper, 2-terminal all	X-6048-2	1	Ammeter, AC J1,9,14,18	282801
9	Screw, 10-24 x 1/2 Phillips J1-13,69	X-6216-1	1	Ammeter, AC J2,10,15,19	282802
10	Screw, 10-24 x 1/2 Phillips J14-26,70	X-6216-1	1	Ammeter, AC J3	282803
1	Sleeving all	X-696-5	1	Ammeter, AC J4,12,20,25	282805
8	Nut, 10-24 all	X-70-2	1	Ammeter, AC J5,13,21,26	282806
2	Nut, 10-32 all	X-70-3	1	Ammeter, AC J6,22,69,70	282807
4	Nut, 6-32 all	X-71-2	1	Ammeter, AC J7,23	282808
4	Spacer all	X-712-9	1	Ammeter, AC J8,17	282800
6	Nut, 8-32 all	X-72-4	1	Ammeter, AC J11,16,24	282804
2	Screw, 8-18 x 1/2 drill all	X-794-2	1	Voltmeter, AC J1-7,14-16,20-23,69,70	282816
4	Nut, 1/4-20 J14-26,70	X-81-1	1	Voltmeter, AC J8-13,17-19,24-26	282817
4	Nut, 5/16-18 all	X-82-2	1	Meter, frequency all	282818
1	Hourmeter all	238736	1	Gauge, oil pressure all	282897
1	Terminal, 1/4 M push-on, 9/64 dia. hole all	238898	1	Gauge, water temperature all	282898
1	Plug, connector all	241617	2	Socket, lamp J1-13,69	284990
1	Block, terminal (8-terminal) all	246115	3	Socket, lamp J14-26,70	284990
1	Voltmeter all	253329	9	Spacer, circuit board all	287948
2	Lamp (No. 1892) J1-13,69	255126	3	Fuse, 1.5 Amp. all	291207
3	Lamp (No. 1892) J14-26,70	255126	2	Lamp, neon 120 Volt all	291740
			1	Decal, fuse all	292347
			1	Resistor J8-13,17,24,25	292352
			1	Decal, voltage adjustment all	292361

X Not Sold Separately



# Series 189

## Accessories

### Group 301

#### Standard Accessories

#### Dec-3 Controllers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
1	Switch, selector J1-6,14-16,20-22,69,70	292373	3	Tie, cable all	X-468-2
1	Switch selector J7-13,17-19,23-26	292374	2	Screw, 4-40 x 7/8 round head all	X-49-35
1	Box, controller J1-13,69	292375	12	Screw, 10-24 x 5/8 pan head all	X-50-8
1	Box, controller J14-26,70	273813	1	Conduit, plastic J2,9-13,15,18,19,24-2	X-6003-17
1	Nameplate J1-6,14-16,20-22,69,70	292382	4	Screw, 10-24 x 1/2 Phillips J1-6,8-12,14-22,24,25,69,70	X-6216-1
1	Nameplate J7-13,17-19,23-26	292383	12	Nut, 10-24 J1-6,8-12,14-22,24,25,69,70	X-70-2
1	Cover, controller J1-13,69	292818	1	Sensor, ferromagnetic all	241623
1	Cover, controller J14-26,70	273838	1	Wiring, harness all	255040
1	Holder, fuse all	292821	1	Bracket, sensor mounting all	257070
1	Marker, strip all	292823	3	Transformer, current J1,9,14,18,	259360
4	Bumper, 1-1/4 dia. all	292834	3	Transformer, current J2,10,15,19	259414
1	Harness, cable all	292836	3	Transformer, current J3,11,16,24	255860
1	Plate, hinge J1-13,69	292908	3	Transformer, current J4,12,20,25	253503
1	Plate, hinge J14-26,70	273785	3	Transformer, current J5,21	273257
2	Screw, 10-24 x 5/8, Gr. 2 all	X-117-5	3	Transformer, current J6,22	272691
4	Screw, 5/16-18 x 5/8, Gr. 5 all	X-125-23	3	Transformer, current J7,23	253359
12	Washer, #10 split lock all	X-19-1	3	Transformer, current J8,17	259359
3	Washer, 5/16 split lock all	X-21-1	3	Transformer, current J13,26	272690
1	Washer, 5/16 int./ext. tooth lock J1-6,8-12,14-22,24,25,70	X-22-16	3	Transformer, current J69,70	253610
2	Washer, #4 int. tooth lock all	X-22-24	1	Bracket, current transformer mounting J1-6,8-12,14-22,24,25	273967
2	Washer, #10 int. tooth lock all	X-22-9	1	Bracket, current transformer mounting J69,70	273840
12	Washer, 7/32 1/2 x 3/64 plain all	X-25-36			

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**6-Lite Controllers**

Qty.	Description	Part No.	Qty.	Description	Part No.
	6-LITE CONTROLLER KIT J27	273866		6-LITE CONTROLLER KIT J42	273889
	6-LITE CONTROLLER KIT J28	273868		6-LITE CONTROLLER KIT J43	273890
	6-LITE CONTROLLER KIT J29	273869		6-LITE CONTROLLER KIT J44	273892
	6-LITE CONTROLLER KIT J30	273871		6-LITE CONTROLLER KIT J45	273896
	6-LITE CONTROLLER KIT J31	273872		6-LITE CONTROLLER KIT J46	273898
	6-LITE CONTROLLER KIT J32	273874		6-LITE CONTROLLER KIT J47	273899
	6-LITE CONTROLLER KIT J33	273875		6-LITE CONTROLLER KIT J48	273901
	6-LITE CONTROLLER KIT J34	273877		6-LITE CONTROLLER KIT J49	273905
	6-LITE CONTROLLER KIT J35	273878		6-LITE CONTROLLER KIT J50	273907
	6-LITE CONTROLLER KIT J36	273880		6-LITE CONTROLLER KIT J51	273908
	6-LITE CONTROLLER KIT J37	273881		6-LITE CONTROLLER KIT J52	273910
	6-LITE CONTROLLER KIT J38	273883		6-LITE CONTROLLER KIT J66	275554
	6-LITE CONTROLLER KIT J39	273884		6-LITE CONTROLLER KIT J67	275556
	6-LITE CONTROLLER KIT J40	273886			
	6-LITE CONTROLLER KIT J41	273887			
			<p><b>NOTE:</b> Use the variation number found on this page for the given controller kit and use the following pages to determine service parts. Items not in bold are included with controller assembly.</p>		

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**6-Lite Controllers (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
1	Controller assembly J27	A-292388	1	Potentiometer assembly all	A-255041
1	Controller assembly J28	A-273784	1	Board assembly, circuit (6-lite) all	A-292381
1	Controller assembly J29	A-292390	1	Board assembly, circuit (main) all	F-292806
1	Controller assembly J30	A-273786	9	Washer, #6 split lock all	X-18-1
1	Controller assembly J31	A-273392	6	Washer, #8 split lock all	X-18-2
1	Controller assembly J32	A-273788	8	Washer, #10 split lock all	X-19-1
1	Controller assembly J33	A-292394	4	Washer, 1/4 split lock J28,30,32,34,36,38,40,41,44,46,48,50,52,67	X-20-1
1	Controller assembly J34	A-273790	4	Washer, 5/16 split lock all	X-21-1
1	Controller assembly J35	A-273538	4	Washer, 3/8 split lock J34	X-22-1
1	Controller assembly J36	A-273597	2	Washer, #10 int./ext. tooth lock all	X-22-13
1	Controller assembly J37,66	A-292463	4	Washer, #6 int. tooth lock all	X-22-6
1	Controller assembly J38,67	A-273807	8	Washer, 17/64 x 1 x 1/16 plain J28,30,32,34,36,38,40,41,44,45,48,50,52,67	X-25-73
1	Controller assembly J39	A-292464	1	Grommet, 3 x 3-1/2 all	X-284-31
1	Controller assembly J40	A-273808	1	Plug, 7/8 plastic button all	X-301-29
1	Controller assembly J41	A-292389	1	Plug, 7/16 plastic button all	X-301-34
1	Controller assembly J42	A-273783	4	Tie, cable all	X-468-3
1	Controller assembly J43	A-292391	2	Screw, 6-32 x 3/8 pan head all	X-49-2
1	Controller assembly J44	A-273787	18	Screw, 6-32 x 1/4 pan head all	X-49-25
1	Controller assembly J45	A-273393	2	Screw, 6-32 x 1/2 pan head all	X-49-39
1	Controller assembly J46	A-273789			
1	Controller assembly J47	A-292395			
1	Controller assembly J48	A-273791			
1	Controller assembly J49	A-292397			
1	Controller assembly J50	A-273796			
1	Controller assembly J51	A-292465			
1	Controller assembly J52	A-273809			

X Not Sold Separately

# Series 189

## Accessories

### Group 301 Standard Accessories 6-Lite Controllers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
4	Screw, 10-24 x 1/2 J27,29	X-50-15	1	Block, terminal (8-terminal) all	246115
4	Screw, 10-24 x 3/4 all	X-50-3	1	Voltmeter all	253329
1	Screw, 10-24 x 1 all	X-50-1	2	Lamp (No 1892) J27,29,31,33,35,37,39,41,43,45,47,49,51,66	255126
2	Screw, 8-32 x 5/8 round head all	X-51-53	3	Lamp (No 1892) J28,30,32,34,36,38,40,42,44,46,48,50,52,67	255126
1	Strap, ground all	X-6046-2	4	Bumper, 1 dia. J28,30,32,34,36,38,40,42,44,46,48,50,52	255443
1	Jumper, two-terminal all	X-6048-2	1	Ammeter, AC J27,28,43,44	282801
9	Screw, 10-24 x 1/2 Phillips J27,29,31,33,35,37,39,41,43,45,47,49,51,66	X-6216-1	1	Ammeter, AC J29,30,45,46	282802
10	Screw, 10-24 x 1/2 Phillips J28,30,32,34,36,38,40,42,44,46,48,50,52,67	X-6216-1	1	Ammeter, AC J31,32,47,48	282804
1	Sleeving all	X-696-5	1	Ammeter, AC J33,34,49	282805
8	Nut, 10-24 all	X-70-2	1	Ammeter, AC J35,36,50-52	282806
2	Nut, 10-32 all	X-70-3	1	Ammeter, AC J37,38,66,67	282807
4	Nut, 6-32 all	X-71-2	1	Ammeter, AC J39,40	282808
4	Spacer all	X-712-9	1	Ammeter, AC J41,42	282800
6	Nut, 8-32 all	X-72-4	1	Voltmeter, AC J27-40,66,67	282816
2	Screw, 8-18 x 1/2 drill all	X-794-2	1	Voltmeter, AC J41-52	282817
4	Nut, 1/4-20 J28,30,32,34,38,40,42,44,46,50,52,67	X-81-1	1	Meter, frequency all	282818
4	Nut, 5/16-18 all	X-82-2	1	Gauge, oil pressure all	282897
1	Hourmeter all	238736	1	Gauge, water temperature all	282898
1	Terminal, 1/4 M push-on, 9/64 dia. hole all	238898	2	Socket, lamp J27,29,31,33,35,37,39,41,43,45,47,49,51,66	284990
1	Plug, connector all	241617	3	Socket, lamp J28,30,32,34,36,38,40,42,44,46,48,50,52,67	284990
			9	Spacer, circuit board all	287948
			3	Fuse, 1.5 Amp. all	291207
			2	Lamp, neon 120 Volt all	291740

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**6-Lite Controllers (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
1	Decal, fuse all	292347	2	Washer, #4 int. tooth lock all	X-22-24
1	Resistor J41-52	292352	2	Washer, #10 int. tooth lock all	X-22-9
1	Decal, voltage adjustment all	292361	12	Washer, 7/32 x 1/2 x 3/64 plain all	X-25-36
1	Switch, selector J27-38,66,67	292373	3	Tie, cable all	X-468-2
1	Switch, selector J39-52	292374	2	Screw, 4-40 x 7/8 round head all	X-49-35
1	Box, controller J27,29,31,33,35,37,39,41,43,45,47,49,51,66	292375	12	Screw, 10-24 x 5/8 pan head all	X-50-8
1	Box, controller J28,30,32,34,36,38,40,42,44,46,48,50,52,67	273813	1	Conduit, plastic J30,43-52	X-6003-17
1	Nameplate J27-38,66,67	292384	4	Screw, 10-24 x 1/2 Phillips J27-38,41-50,66	X-6216-1
1	Nameplate J39-52	292385	12	Nut, 10-24 J27-38,41-50,66,67	X-70-2
1	Cover, controller J27,29,31,33,35,37,39,41,43,45,47,49,51,66	292818	1	Sensor, ferromagnetic all	241623
1	Cover, controller J28,30,32,34,36,38,40,42,44,46,48,50,52,67	273838	1	Wiring, harness all	255040
1	Holder, fuse all	292821	1	Bracket, sensor mounting all	257070
1	Marker, strip all	292823	3	Transformer, current J27,28,43,44	259360
4	Bumper, 1-1/4 dia. all	292834	3	Transformer, current J29,30,45,46	259414
1	Harness, cable all	292836	3	Transformer, current J31,32,47,48	255860
1	Plate, hinge J27,29,31,33,35,37,39,41,43,45,47,49,51,66	292908	3	Transformer, current J33,34,49,50	253503
1	Plate, hinge J28,30,32,34,36,38,40,42,44,46,48,50,52,67	273785	3	Transformer, current J35,36,52	273257
2	Screw, 10-24 x 5/8 Gr. 2 all	X-117-5	3	Transformer, current J37,38,66,67	253610
4	Screw, 5/16-18 x 5/8, Gr. 5 all	X-125-23	3	Transformer, current J39,40	272691
12	Washer, #10 split lock all	X-19-1	3	Transformer, current J41,42	259359
3	Washer, 5/16 split lock all	X-21-1	3	Transformer, current J51	272690
1	Washer, 5/16 int. ext. tooth lock J27-38,41,43-50,66	X-22-16	1	Bracket, current transformer mounting J27-38,41-50	273967
			1	Bracket, current transformer mounting J66,67	273840

X Not Sold Separately

# Series 189

## Accessories

### Group 301 Standard Accessories Manual Controllers

Qty.	Description	Part No.	Qty.	Description	Part No.
	MANUAL CONTROLLER KIT J53	275428	1	Controller assembly J53	A-273380
			1	Controller assembly J54	A-273381
	MANUAL CONTROLLER KIT J54	275429	1	Controller assembly J55	A-273383
			1	Controller assembly J56	A-273385
	MANUAL CONTROLLER KIT J55	275430	1	Controller assembly J57	A-273392
			1	Controller assembly J58,68	A-273389
	MANUAL CONTROLLER KIT J56	275431	1	Controller assembly J59	A-273390
			1	Controller assembly J60	A-273379
	MANUAL CONTROLLER KIT J57	275432	1	Controller assembly J61	A-273382
			1	Controller assembly J62	A-273384
	MANUAL CONTROLLER KIT J58	275433	1	Controller assembly J63	A-273386
			1	Controller assembly J64	A-273387
	MANUAL CONTROLLER KIT J59	275434	1	Controller assembly J65	A-273391
			1	Board assembly, overspeed circuit all	A-249812
	MANUAL CONTROLLER KIT J60	275435	1	Potentiometer assembly all	A-255041
	MANUAL CONTROLLER KIT J61	275436	1	Board assembly, relay circuit all	C-239563
	MANUAL CONTROLLER KIT J62	275438	9	Washer, #6 split lock all	X-18-1
			4	Washer, #8 split lock all	X-18-2
	MANUAL CONTROLLER KIT J63	275439	4	Washer, #10 split lock all	X-19-1
	MANUAL CONTROLLER KIT J64	275441	4	Washer, 5/16 split lock all	X-21-1
	MANUAL CONTROLLER KIT J65	275442	2	Washer, #10 int./ext. tooth lock all	X-22-13
			4	Washer, #6 int. tooth lock all	X-22-6
	MANUAL CONTROLLER KIT J68	275557	1	Grommet, 3 x 3-1/2 all	X-284-31
			1	Plug, 1/2 plastic button all	X-301-23
			1	Plug, 7/16 plastic button all	X-304-34

**NOTE:** Use the variation number found on this page for the given controller kit and use the following pages to determine service parts. Items not in bold are included with controller assembly.

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**Manual Controllers (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
2	Terminal, 1/4 F push-on fully insulated all	X-431-25	1	Holder, fuse all	238426
2	Terminal, 1/4 M push-on fully insulated all	X-431-29	1	Hourmeter all	238736
2	Tie, cable all	X-468-3	1	Terminal, 1/4 M push-on, 9/64 dia. hole all	238898
2	Screw, 6-32 x 3/8 pan head all	X-49-2	1	Block, terminal (8-terminal) all	246115
18	Screw, 6-32 x 1/4 pan head all	X-49-25	1	Switch, rocker all	249406
2	screw, 6-32 x 1/2 pan head all	X-49-39	1	Voltmeter all	253329
2	Screw, 10-24 x 3/4 pan head all	X-50-3	2	Lamp, No. 1892 all	255126
1	Screw, 10-24 x 1 pan head all	X-50-7	1	Lamp, No. 1892 all	269373
2	Screw, 8-32 x 3/8 pan head all	X-51-12	1	Nameplate J53-59,68	273373
2	Screw, 8-32 x 5/8 round head all	X-51-53	1	Nameplate J60-65,68	273374
1	Strap, ground all	X-6046-2	1	Box, controller all	273375
1	Jumper, two-terminal all	X-6048-2	1	Plate, hinge all	273376
9	Screw, 10-24 x 1/2 Phillips all	X-6216-1	1	Harness, controller all	274710
1	Sleeving all	X-696-5	1	Ammeter, AC J53,61	282801
4	Nut, 10-24 all	X-70-2	1	Ammeter, AC J54,62	282802
2	Nut, 10-32 all	X-70-3	1	Ammeter, AC J55,63	282804
4	Nut, 6-32 all	X-71-2	1	Ammeter, AC J55,64	282805
4	Nut, 8-32 all	X-72-4	1	Ammeter, AC J57,65	282806
2	Screw, 8-18 x 1/2 drill all	X-794-2	1	Ammeter, AC J58,68	282807
4	Nut, 5/16-18 all	X-82-2	1	Ammeter, AC J59	282808
1	Fuse, 10 Amp. all	223316	1	Ammeter, AC J60	282800
			1	Voltmeter, AC J53-59,68	282816
			1	Voltmeter, AC J60,65	282817
			1	Meter, frequency all	282818

X Not Sold Separately

# Series 189

## Accessories

**Group 301**  
**Standard Accessories**  
**Manual Controllers (cont'd.)**

Qty.	Description	Part No.	Qty.	Description	Part No.
1	Gauge, oil pressure all	282897	2	Tie, cable all	X-468-2
1	Gauge, water temperature all	282898	12	Screw, 10-24 x 5/8 pan head all	X-50-8
2	Socket, lamp all	284990	1	Conduit, plastic J54,60-65	X-6003-17
9	Spacer, circuit board all	287948	4	Screw, 10-24 x 1/2 Phillips J53-58,60-64,68	X-6216-1
3	Fuse, 1.5 Amp. all	291207	12	Nut, 10-24 J53-58,60-64,68	X-70-2
2	Lamp, neon 120 Volt all	291740	1	Harness, wiring all	255040
1	Resistor J61-65	292352	3	Transformer, current J53,61	259360
1	Decal, voltage adjustment all	292361	3	Transformer, current J54,62	259414
1	Switch, selector J53-59,68	292373	3	Transformer, current J55,63	255860
1	Switch, selector J60-65	292374	3	Transformer, current J56,60,64	253503
1	Cover, controller all	292818	3	Transformer, current J57	273257
1	Holder, fuse all	292821	3	Transformer, current J58,68	253610
1	Marker, strip all	292823	3	Transformer, current J59	272691
4	Bumper, 1-1/4 dia. all	292834	3	Transformer, current J65	272690
1	Transformer, current all	295281	1	Nameplate J61	273373
4	Screw, 5/16-18 x 5/8, Gr. 5 all	X-125-23	1	Bracket, current transformer mounting J53-58,60-64	273967
12	Washer, #10 split lock all	X-19-1	1	Bracket, current transformer mounting J68	273840
3	Washer, 5/16 split lock J53-58,60-64,68	X-21-1			
4	Washer, 5/16 split lock J59,64	X-21-1			
1	Washer, 5/16 int.ext. tooth lock J53,54,57,58,60-64,68	X-22-16			
12	Washer, 7/32 x 1/2 x 3/64 plain all	X-25-36			

X Not Sold Separately



# Series 189

## Accessories

### Adapter Bushing

Qty.	Description	Part No.	Qty.	Description	Part No.
	ADAPTER BUSHING KIT	PA-275521			
1	Bushing, 4 x 6 adapter	X-202-42			

X Not Sold Separately

# Series 189

## Accessories

### Air Cleaner – Heavy Duty

Qty.	Description	Part No.	Qty.	Description	Part No.
	AIR CLEANER – HEAVY DUTY KIT	275448		AIR CLEANER – HEAVY DUTY KIT	274731
4	Nut, 3/8–16 lock	X-101-13	1	Cleaner assembly, air	A-274723
1	Washer, 5/8 split lock	X-24-1	1	Element, air cleaner	274729
4	Washer, 7/16 x 1 x 5/64 plain	X-25-1	1	Screw, 1/2–13 x 3/4, Gr. 5	X-129-15
2	Washer, 3/4 split lock	X-26-10	6	Washer, 3/8 split lock	X-22-1
1	Tube, steel	X-522-67	1	Washer, 17/32 x 1–1/16 x 3/32 plain	X-25-26
4	Screw, 3/8–16 x 1, Gr. 5	X-6238-11	1	Tube, steel	X-522-68
2	Screw, 3/4–10 x 1, Gr. 5	X-6239-1	5	Screw, 3/8–16 x 1, Gr. 5	X-6238-11
1	Cleaner, air	254004	1	Screw, 3/8–16 x 5/8, Gr. 5	X-6238-2
1	Element, A-C	254477	4	Nut, 3/8–16	X-83-2
1	Cap, rain	254010	1	Cap, rain	254006
2	Band, mounting	254012	1	Clamp, 5–3/4 hose	254344
2	Clamp, 6–1/2 dia.	254013	1	Hose, 4 ID	273442
2	Clamp, 4–3/4 hose	254087	3	Clamp, 4–1/2 hose	274545
2	Hose, hump	255516	1	Reducer, hose insert	274724
1	Elbow, 7 ID, 90 degree	272627	1	Bracket, air cleaner mounting	274730
1	Bracket, support	274665	1	Hose, reducer elbow	274768
1	Tube, 6 x 4	274671	2	Bracket, 11–7/8 dia. air cleaner	290956
	AIR CLEANER – HEAVY DUTY KIT	274720		AIR CLEANER – HEAVY DUTY KIT	275594
1	Air cleaner assembly	A-274721	4	Nut, 3/8–16 lock	X-101-13
1	Element, A-C	274726	1	Washer, 5/8 split lock	X-24-1
4	Screw, 5/16–18 x 1, Gr. 5	X-125-5	4	Washer, 7/16 x 1 x 5/64 plain	X-25-1
1	Screw, 1/2–13 x 3/4, Gr. 5	X-129-15	2	Washer, 3/4 split lock	X-26-10
4	Washer, 5/16 split lock	X-21-1	1	Tube, steel	X-522-67
1	Washer, 17/32 x 1–1/16 x 3/32 plain	X-25-25	4	Screw, 3/8–16 x 1, Gr. 5	X-6238-11
3	Clamp, 3–1/4 hose	X-426-2	2	Screw, 3/4–10 x 1, Gr. 5	X-6239-1
1	Tube, steel	X-522-69	1	Cleaner, air	254004
4	Nut, 5/16–18	X-82-2	1	Element, A-C	254477
1	Cap	253664	1	Cap, rain	254010
1	Hose, elbow	274722	2	Band, mounting	254012
1	Hose, hump	275522	2	Clamp	254013
1	Reducer, insert	275523	2	Clamp, hose	254087
1	Bracket, air cleaner	275528	2	Hose, hump	255516
2	Mount, 8 dia. air cleaner	279380	1	Elbow, 90 deg.	272627
1	Clamp, 4 dia. hose	291537	1	Tube	274671
	AIR CLEANER – HEAVY DUTY KIT	274727		Bracket, mounting	275593
1	Air cleaner assembly	A-274721			
1	Element, A-C	274726			
4	Screw, 5/16–18 x 1, Gr. 5	X-125-5			
1	Screw, 1/2–13 x 3/4, Gr. 5	X-129-15			
4	Washer, 5/16 split lock	X-21-1			
1	Washer, 17/32 x 1–1/16 x 3/32 plain	X-25-26			
2	Tube, steel	X-722-70			
4	Nut, 5/16–18	X-82-2			
1	Cap	253664			
4	Clamp, 4–3/4 dia. hose	254087			
2	Hose, 4 ID	273442			
1	Clamp, 4–1/2 hose	274545			
1	Hose, 90 deg. elbow	274719			
1	Reducer, hose insert	274724			
1	Bracket, air cleaner	275528			
2	Mount, 8 dia. air cleaner	279380			
1	Clamp, 4 dia. hose	291537			

# Series 189

## Accessories

### Air Cleaner Restriction Indicators

### Anticipatory Alarms

Qty.	Description	Part No.	Qty.	Description	Part No.
	RESTRICTION GAUGE KIT	274608		ANTICIPATORY ALARM KIT	273583
1	Gauge, restriction	273113	1	Switch, temperature (red)	240976
			1	Switch, oil pressure	271662
			1	Adapter, water temperature	273692
			1	O-ring	273693
			1	Switch, temperature (2-terminal)	290090
				ANTICIPATORY ALARM KIT	273696
			1	Bushing, reducer 3/8 x 1/2 (brass)	X-202-28
			1	Switch, pressure	271662
			1	Adapter, water temperature	273692
			1	O-ring	273693
			1	Switch, temperature (4-terminal)	273759
			1	Switch, temperature (2-terminal)	290090

X Not Sold Separately

# Series 189

## Accessories

**Auxiliary Fuel Pump,  
Gasoline or Diesel**

**Battery Kit**

Qty. Description	Part No.	Qty. Description	Part No.
AUXILIARY FUEL PUMP KIT, GASOLINE OR DIESEL	247076	BATTERY KIT	PA-253357
		1 Stud, conversion	254427
		1 Battery	291918
		BATTERY KIT	PA-253728
		2 Stud, conversion	254427
		2 Battery	291918

X Not Sold Separately

# Series 189

## Accessories

### Battery Chargers

Qty.	Description	Part No.	Qty.	Description	Part No.
	<b>BATTERY CHARGER KIT</b>	<b>PAA-248952</b>		<b>BATTERY CHARGER KIT</b>	<b>PAA-292862</b>
1	Charger assembly, battery	A-248952	1	Charger assembly, battery	A-292862
10	Washer, #8 split lock	X-18-2	1	Board assembly, 12 V., CO circuit	B-262377
1	Washer, #10 split lock	X-19-1	13	Washer, #6 split lock	X-81-1
2	Washer, #6 int./ext. tooth lock	X-22-25	4	Washer, #8 split lock	X-18-2
1	Terminal, #10 eyelet, 16-22 Ga.	X-283-8	4	Washer, #10 split lock	X-19-1
2	Block, terminal (2-terminal)	X-405-2	4	Washer, 1/4 split lock	X-20-1
1	Terminal, 1/4 F push-on	X-431-27	2	Washer, #8 int./ext. tooth lock	X-22-18
9	Terminal, .11 F push-on fully insulated	X-431-28	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Screw, 6-32 x 1/2	X-49-26	7	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9
6	Screw, 8-32 x 3/8	X-51-12	2	Terminal, #6 eyelet, 16-14 Ga.	X-283-1
4	Screw, 8-32 x 5/8	X-51-9	2	Terminal, 1/4 eyelet, 12-10 Ga.	X-283-11
2	Connector, non-metallic	X-567-1	3	Terminal, #8 eyelet, 16-14 Ga.	X-283-2
4	Screw, 8-32 x 3/8 self-tapping	X-67-43	8	Screw, 6-32 x 1/4	X-49-25
2	Nut, 10-32	X-70-3	4	Screw, 6-32 x 1/2 pan head (zinc)	X-49-26
1	Nut, 6-32	X-71-2	3	Screw, 6-32 x 1/2 pan head	X-49-39
10	Nut, 8-32	X-72-4	2	Screw, 6-32 x 3/4 pan head	X-49-6
4	Screw, 8-18 x 1/2 drill	X-794-2	2	Screw, 10-32 x 1/2	X-50-1
1	Holder, fuse	238426	2	Screw, 10-24 x 3/4	X-50-3
1	Cord, power	246185	1	Screw, 10-32 x 1/4	X-50-68
1	Cover, battery charger	246604-KCB	2	Screw, 8-32 x 3/4	X-51-11
1	Box, battery charger	248951-KCB	2	Screw, 8-32 x 1/2	X-51-15
1	Ammeter, DC	269202	4	Screw, 1/4-20 x 3/4	X-51-30
1	Transformer	269204	1	Screw, 8-32 x 5/8	X-51-9
4	Spacer, screen	270833	2	Tubing, heat shrink	X-6081-3
1	Fuse, 1.5 Amp	291207	2	Nut, 10-24	X-70-2
1	Lamp	291208	2	Nut, 10-32	X-70-3
1	Resistor, .56 Ohm	291209	2	Nut, 6-32	X-71-2
1	Switch, slide DPDT	291210	6	Nut, 8-32	X-72-4
1	Switch, slide DPDT (flush lever)	291211	4	Nut, 1/4-20	X-81-1
1	Rectifier, silicon	291212	1	Transformer	262388
1	Resistor	291213	1	Fuse, 25 Amp	262389
1	Cable (red)	291215	2	Holder, fuse	263156
1	Cable (black)	291216	4	Spacer, PC Board	287948
1	Nameplate, front panel	291220	1	Lamp	291208
1	Nameplate, part no./specifications	291221	1	Decal, Explosion (Battery gases...)	292387
1	Breaker, circuit	291265	1	Decal, Explosion (Relay causes sparks)	292469
1	Rheostat	291975	1	Sink, heat	292938
			1	Strip, terminal (4-terminal)	292940
			1	Ammeter, DC	292941
			1	Voltmeter, DC	292942
			1	Panel, silkscreen	292944
			1	Module, SCR	292945
			1	Resistor, power	292947
			1	Fuse, 7 Amp.	292948
			1	Harness, wiring	292958
			1	Nameplate, 12 Volt	292959
			1	Marker, strip (1-6)	292961
			1	Marker, strip (sense/output)	292962
			1	Box, battery charger	292974
			1	Decal, U.L.	292975
			1	Retainer	295010
			1	Block, terminal (6-terminal)	295314
			4	Nut, 6-32 captive	298810

X Not Sold Separately

# Series 189

## Accessories

### Battery Chargers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	<b>BATTERY CHARGER KIT</b>	<b>PAA-292863</b>		<b>BATTERY CHARGER KIT</b>	<b>PAA-292864</b>
1	Charger assembly, battery	A-292863	1	Charger assembly, battery	A-292864
1	Board assembly, 12 V., LO charger	B-262374	1	Board assembly, 24 V., CO charger	B-292378
1	Board assembly, 12 V., CO charger	B-262377	13	Washer, #6 split lock	X-18-1
17	Washer, #6 split lock	X-18-1	4	Washer, #8 split lock	X-18-2
4	Washer, #8 split lock	X-18-2	4	Washer, #10 split lock	X-19-1
4	Washer, #10 split lock	X-19-1	4	Washer, 1/4 split lock	X-20-1
4	Washer, 1/4 split lock	X-20-1	2	Washer, #8 int./ext. tooth lock	X-22-18
2	Washer, #8 int./ext. tooth lock	X-22-18	4	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36
4	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	7	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9
7	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9	2	Terminal, #6 eyelet, 16-14 Ga.	X-283-1
2	Terminal, #6 eyelet, 16-14 Ga.	X-283-1	2	Terminal, 1/4 eyelet, 12-10 Ga.	X-283-11
2	Terminal, 1/4 eyelet, 12-10 Ga.	X-283-11	3	Terminal, #8 eyelet, 16-14 Ga.	X-283-2
3	Terminal, #8 eyelet, 16-14 Ga.	X-283-2	8	Screw, 6-32 x 1/4	X-49-25
3	Terminal, #8 eyelet, 16-14 Ga.	X-283-2	4	Screw, 6-32 x 1/2 pan head (zinc)	X-49-26
2	Terminal #10 eyelet, 8 Ga.	X-283-23	3	Screw, 6-32 x 1/2 pan head	X-49-39
16	Screw, 6-32 x 1/4	X-49-25	2	Screw, 6-32 x 3/4 pan head	X-49-6
4	Screw, 6-32 x 1/2 pan head (zinc)	X-49-26	2	Screw, 10-32 x 1/2	X-50-1
3	Screw, 6-32 x 1/2 pan head	X-49-39	2	Screw, 10-24 x 3/4	X-50-3
2	Screw, 6-32 x 3/4 pan head	X-49-6	2	Screw, 10-32 x 1/4	X-50-68
2	Screw, 10-32 x 1/2	X-50-1	1	Screw, 8-32 x 3/4	X-51-11
2	Screw, 10-24 x 3/4	X-50-3	2	Screw, 8-32 x 1/2	X-51-15
1	Screw, 10-32 x 1/4	X-50-68	4	Screw, 1/4-20 x 3/4	X-51-30
2	Screw, 8-32 x 3/4	X-51-11	1	Screw, 8-32 x 5/8	X-51-9
2	Screw, 8-32 x 1/2	X-51-15	1	Tubing, heat shrink	X-6079-2
4	Screw, 1/4-20 x 3/4	X-51-30	2	Tubing, heat shrink	X-6081-3
1	Screw, 8-32 x 5/8	X-51-9	2	Nut, 10-24	X-70-2
2	Tubing, heat shrink	X-6081-3	2	Nut, 10-32	X-70-3
2	Nut, 10-24	X-70-2	2	Nut, 6-32	X-71-2
2	Nut, 10-32	X-70-3	6	Nut, 8-32	X-72-4
2	Nut, 6-32	X-71-2	4	Nut, 1/4-20	X-81-1
2	Nut, 8-32	X-72-4	1	Transformer	262388
4	Nut, 1/4-20	X-81-1	1	Fuse, 25 Amp	262389
1	Transformer	262388	2	Holder, fuse	263156
1	Fuse, 25 Amp	262389	8	Spacer, PC Board	287948
2	Holder, fuse	263156	1	Lamp	291208
8	Spacer, PC Board	287948	1	Decal, Explosion (Battery gases...)	292387
1	Lamp	291208	1	Decal, Explosion (Relay causes sparks...)	292469
1	Decal, Explosion (battery gases...)	292387	1	Sink, heat	292938
1	Decal, Explosion (Relay causes sparks...)	292469	1	Strip, terminal (4-terminal)	292940
1	Sink, heat	292938	1	Ammeter, DC	292941
1	Strip, terminal (4-terminal)	292940	1	Panel, silkscreen	292944
1	Ammeter, DC	292941	1	Module, SCR	292945
1	Voltmeter, DC	292942	1	Resistor, power	292947
1	Panel, silkscreen	292944	1	Fuse, 7 Amp	292948
1	Module, SCR	292945	1	Voltmeter, DC	292957
1	Resistor, power	292947	1	Harness, wiring	292958
1	Fuse, 7 Amp	292948	1	Nameplate, 24 Volt	292960
1	Harness, wiring	292958	1	Marker, strip (1-6)	292961
1	Marker, strip (1-6)	292961	1	Marker, strip (sense/output)	292962
1	Marker, strip (sense/output)	292962	1	Nameplate	292971
1	Nameplate	292971	1	Box, battery charger	292974
1	Box, battery charger	292974	1	Decal, U.L.	292975
1	Decal, U.L.	292975	1	Retainer	295010
1	Retainer	295010	1	Block, terminal (6-terminal)	295314
1	Block, terminal (6-terminal)	295314	4	Nut, 6-32 captive	298810
4	Nut, 6-32 captive	298810			

X Not Sold Separately

# Series 189

## Accessories

### Battery Chargers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	BATTERY CHARGER KIT	PAA-292865			
1	Charger assembly, battery	A-292865			
1	Board assembly, 24 V., LO circuit	B-262375			
1	Board assembly, 24 V., CO circuit	B-262378			
17	Washer, #6 split lock	X-18-1			
4	Washer, #8 split lock	X-18-2			
4	Washer, #10 split lock	X-19-1			
4	Washer, 1/4 split lock	X-20-1			
2	Washer, #8 int./ext. tooth lock	X-22-18			
4	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36			
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40			
7	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9			
2	Terminal, #6 eyelet, 16-14 Ga.	X-283-1			
2	Terminal, 1/4 eyelet, 12-10 Ga.	X-283-11			
3	Terminal, #8 eyelet, 16-14 Ga.	X-283-2			
2	Terminal, #10 eyelet, 8 Ga.	X-283-23			
16	Screw, 6-32 x 1/4	X-49-25			
4	Screw, 6-32 x 1/2 pan head (zinc)	x-49-26			
3	Screw, 6-32 x 1/2 pan head	X-49-39			
2	Screw, 6-32 x 3/4 pan head	X-49-6			
2	Screw, 10-32 x 1/2	X-50-1			
2	Screw, 10-24 x 3/4	X-50-3			
1	Screw, 10-32 x 1/4	X-50-68			
2	Screw, 8-32 x 3/4	X-51-11			
2	Screw, 8-32 x 1/2	X-51-15			
4	Screw, 1/4-2 x 3/4	X-51-30			
1	Screw, 8-32 x 5/8	X-51-9			
1	Tubing, heat shrink	X-6079-2			
2	Tubing, heat shrink	X-6081-3			
2	Nut, 10-24	X-70-2			
2	Nut, 10-32	x-70-3			
2	Nut, 6-32	X-71-2			
6	Nut, 8-32	X-72-4			
4	Nut, 1/4-20	X-81-1			
1	Transformer	262388			
1	Fuse, 25 Amp	262389			
2	Holder, fuse	263156			
8	Spacer, PC Board	287948			
1	Lamp	291208			
1	Decal, Explosion (Battery gases...)	292387			
1	Decal, Explosion (relay causes, sparks...)	292469			
1	Sink, heat	292938			
1	Strip, terminal (4-terminal)	292940			
1	Ammeter, DC	292941			
1	Panel, silkscreen	292944			
1	Module, SCR	292946			
1	Resistor, power	292947			
1	Fuse, 7 Amp.	292948			
1	Voltmeter, DC	292957			
1	Harness, wiring	292958			
1	Marker, strip (1-6)	292961			
1	Marker, strip (sense/output)	292962			
1	Nameplate	292972			
1	Box, battery charger	292974			
1	Decal, U.L.	292975			
1	Retainer	295010			
1	Block, terminal (6-terminal)	295314			
4	Nut, 6-32 captive	298810			

X Not Sold Separately

# Series 189

## Accessories

### Battery Heater

Qty.	Description	Part No.	Qty.	Description	Part No.
	<b>BATTERY HEATER KIT</b>	<b>258885</b>		<b>BATTERY HEATER KIT</b>	<b>273564</b>
1	Box assembly, relay	A-272826	1	Box assembly, relay	A-272825
4	Washer, #6 split lock	X-18-1	4	Washer, #6 split lock	X-18-1
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
2	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
4	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9	8	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9
2	Screw, 6-32 x 3/8	X-49-2	8	Screw, 6-32 x 3/8	X-49-2
4	Screw, 6-32 x 1/2	X-49-26	4	Screw, 8-32 x 1/2	X-51-15
4	Screw, 8-32 x 1/2	X-49-26	4	Screw, 10-24 x 1/2	X-6216-1
4	Screw, 10-24 x 1/2	X-6216-1	8	Nut, 6-32	X-71-2
6	Nut, 6-32	X-71-2	4	Nut, 8-32	X-72-4
4	Nut, 8-32	X-72-4	2	Receptacle	238581
1	Receptacle	238581	1	Box, relay	272820
1	Box, relay	272820	1	Cover, silkscreen	272823
1	Plate, cover	272824	6	Adapter, tab	287571
3	Adapter, tab	287571	2	Resistor	292915
1	Resistor	292915	2	Relay	292916
1	Relay	292916	6	Nut, 1/4-20 elastic stop	X-101-8
4	Nut, 1/4-20 stop	X-101-8	2	Screw, 5/16-18 x 3/4, Gr. 5	X-125-3
2	Screw, 5/16-18 x 3/4, Gr. 5	X-125-3	2	Washer, 5/16 split lock	X-21-1
2	Washer, 5/16 split lock	X-21-1	6	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	2	Screw, 1/4-20 x 3/4, Gr. 5	X-465-16
2	Screw, 1/4-20 x 3/4, Gr. 5	X-465-16	2	Tie, cable	X-468-1
1	Tie, cable	X-468-1	2	Tie, cable (screw mount)	X-468-4
1	Tie, cable (screw mount)	X-468-4	4	Screw, 1/4-20 x 5/8	X-73-14
2	Screw, 1/2-20 5/8	X-73-14	2	Nut, 5/16-18	X-82-2
2	Nut, 5/16-18	X-82-2	2	Heater, battery (6 x 9)	255649
1	Heater, battery (6 x 9)	255649	2	Heater, battery (5-1/4 x 37)	258780
1	Heater, battery (5-1/4 x 37)	258780	1	Bracket, box	275451
1	Bracket, box	275451			
2	Bolt, angle	286316			

X Not Sold Separately



# Series 189

## Accessories

### Battery Rack and Cables

Qty.	Description	Part No.	Qty.	Description	Part No.
	BATTERY RACK KIT	273400		BATTERY RACK KIT	273642
2	Nut, 5/16-24 lock	X-101-4	2	Nut, 5/16-24 lock	X-101-4
2	Screw, 5/16-18 x 3/4	X-125-3	2	Screw, 5/16-18 x 3/4	X-125-3
1	Screw, 1/2-13 x 3/4	X-129-15	1	Screw, 1/2-13 x 3/4	X-129-15
2	Washer, 5/16 split lock	X-21-1	2	Washer, 5/16 split lock	X-21-1
1	Washer, 1/2 int./ext. tooth lock	X-22-26	1	Washer, 1/2 int./ext. tooth lock	X-22-26
2	Washer, 21/64 x 9/16 x 1/16 plain	X-25-44	2	Washer, 21/64 x 9/16 x 1/16 plain	X-25-44
1	Cable, battery 50 in. (red)	X-545-17	1	Cable, battery (black)	X-545-7
1	Cable, battery (black)	X-545-7	1	Cable, battery (red)	X-545-76
2	Nut, 5/16-18	X-82-2	2	Nut, 5/16-18	X-82-2
2	Bolt, angle	273689	2	Bolt, angle	273689
1	Rack, battery	273691	1	Decal, warning	273780
1	Decal, warning	273780	1	Rack, battery	288582
1	Clamp, battery	288614	1	Clamp, battery	288614
	BATTERY RACK	273401			
3	Nut, 5/16-24 lock	X-101-4			
3	Screw, 5/16-18 x 1	X-125-5			
3	Washer, 5/16 split lock	X-21-1			
1	Washer, #3 ext. tooth lock	X-22-43			
3	Washer, 21/64 x 9/16 x 1/16 plain	X-25-44			
1	Cable, battery (black)	X-545-70			
1	Cable, battery (red)	X-545-72			
1	Screw, 5/8-11 x 1	X-6021-3			
3	Nut, 5/16-18	X-82-2			
1	Clamp, battery	273446			
1	Tray, battery	273447			
1	Decal, warning	273780			
3	Bolt, angle	286316			
	BATTERY RACK KIT	273523			
3	Nut, 5/16-24 lock	X-101-4			
3	Screw, 5/16-18 x 1	X-125-5			
1	Screw, 1/2-13 x 3/4	X-129-15			
3	Washer, 5/16 split lock	X-21-1			
1	Washer, 1/2 int. tooth lock	X-22-4			
3	Washer, 21/64 x 9/16 x 1/16 plain	X-25-44			
1	Cable, battery (black)	X-545-69			
1	Cable, battery (red)	X-545-78			
3	Nut, 5/16-18	X-82-2			
2	Bolt, angle	254674			
1	Clamp, battery	272715			
1	Decal, warning	273780			
1	Rack, battery	273926			
1	Bolt, angle	286316			

X Not Sold Separately

# Series 189

## Accessories

### Block Heater

Qty.	Description	Part No.	Qty.	Description	Part No.
	BLOCK HEATER KIT (Discontinued)	273620		BLOCK HEATER KIT	275585
	Order service kit 276505 (20-60ROZJ) for replacement		4	Washer, 1/4 split lock	X-20-1
	Order service kit 276509 (80/100ROZJ) for replacement		1	Bushing, 1-7/16 x 3/4 reducer	X-202-1
			1	Nipple, pipe	X-206-6
			1	Elbow, 3/4 pipe	X-215-2
	BLOCK HEATER KIT (Discontinued)	273621	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
	Order service kit 276508 (20-60ROZJ) for replacement		1	Clamp, 1 in. hose	X-426-10
	Order service kit 276510 (80/100ROZJ) for replacement		4	Screw, 1/4-20 x 1	X-465-7
			1	Hose, 5/8 ID x 6 in.	X-577-10
			1	Hose, 5/8 ID x 37 in.	X-577-36
			1	Hose, 5/8 ID x 27 in.	X-577-44
	BLOCK HEATER KIT (Discontinued)	275530	1	Connector, adapter	X-582-3
	Order service kit 276511 (125/150ROZJ) for replacement		4	Nut, 1/4-20	X-81-1
	Order service kit 276513 (150ROZJ O/S, 180ROZJ) for replacement		2	Clamp, 3 in. hose	250081
			1	Bracket, mounting	275588
			1	Connector, hose	276205
			1	Heater, block	276209
	BLOCK HEATER KIT (Discontinued)	275531			
	Order service kit 276512 (125/150ROZJ) for replacement			BLOCK HEATER KIT	275586
	Order service kit 276514 (150ROZJ O/S, 180ROZJ) for replacement		1	Elbow, 3/4 NPTF	SA-472
			4	Washer, 1/4 split lock	X-20-1
			4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
			6	Clamp, 1 in. hose	X-426-10
			4	Screw, 1/4-20 x 1	X-465-7
	BLOCK HEATER KIT	275584	1	Hose, 5/8 ID x 6 in.	X-577-10
4	Washer, 1/4 split lock	X-20-1	1	Hose, 5/8 ID x 30 in.	X-577-35
1	Bushing, 1-7/16 x 3/4 reducer	X-202-1	1	Hose, 5/8 ID x 40 in.	X-577-42
1	Nipple, pipe	X-206-4	1	Connector, adapter	X-582-3
1	Elbow, 3/4 pipe	X-215-2	4	Nut, 1/4-20	X-81-1
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	2	Clamp, 3 in. hose	250081
1	Clamp, 1 in. hose	X-426-10	1	Connector, hose	275582
2	Clamp, 2-1/2 in. hose	X-426-6	1	Bracket, mounting	275583
4	Screw, 1/4-20 x 1	X-465-7	1	Heater, block	276209
1	Hose, 5/8 ID x 21 in.	X-577-24			
1	Hose, 5/8 ID x 30 in.	X-577-35		BLOCK HEATER KIT	275587
1	Hose, 5/8 ID x 4 in.	X-577-39			
1	Connector, adapter	X-582-3	1	Elbow, 3/4 NPTF	SA-472
4	Nut, 1/4-20	X-81-1	4	Washer, 1/4 split lock	X-20-1
1	Connector, hose	275581	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Bracket, mounting	275583	6	Clamp, 1 in. hose	X-426-10
1	Heater, block	276209	4	Screw, 1/4-20 x 1	X-465-7
			1	Hose, 5/8 ID x 6 in.	X-577-10
			1	Hose, 5/8 ID x 45 in.	X-577-40
			1	Hose, 5/8 ID x 33 in.	X-577-41
			1	Connector, adapter	X-582-3
			4	Nut, 1/4-20	X-81-1
			2	Clamp, 3 in. hose	250081
			1	Connector, hose	275582
			1	Bracket, mounting	275583
			1	Heater, block	276209

X Not Sold Separately

# Series 189

## Accessories

### Block Heater (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	BLOCK HEATER KIT	275589		BLOCK HEATER KIT	275592
4	Washer, 1/4 split lock	X-20-1	1	Elbow, 3/4 NPTF	SA-472
1	Bushing, 1-7/16 x 3/4 reducer	X-202-1	4	Washer, 1/4 split lock	X-20-1
1	Nipple, 3/4 NPTF x 2-1/2 in. pipe	X-206-4	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Elbow, 3/4 pipe	X-215-2	6	Clamp, 1 in. hose	X-426-10
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	4	Screw, 1/4-20 x 1	X-465-7
1	Clamp, 1 in. hose	X-426-10	1	Hose, 5/8 ID x 6 in.	X-577-10
2	Clamp, 2-1/2 in. hose	X-426-6	1	Hose, 5/8 ID x 45 in.	X-577-40
4	Screw, 1/4-20 x 1	X-465-7	1	Hose, 5/8 ID x 33 in.	X-577-41
1	Hose, 5/8 ID x 21 in.	X-577-24	1	Connector, adapter	X-582-3
1	Hose, 5/8 ID x 30 in.	X-577-35	4	Nut, 1/4-20	X-81-1
1	Hose, 5/8 ID x 4 in.	X-577-39	2	Clamp, 3 in. hose	250081
1	Connector, adapter	X-582-3	1	Connector, hose	275582
4	Nut, 1/4-20	X-81-1	1	Bracket, mounting	275583
1	Connector, hose	275581	1	Heater, block	276208
1	Bracket, mounting	275583			
1	Heater, block	276208		BLOCK HEATER KIT	276507
	BLOCK HEATER KIT	275590	4	Washer, 1/4 split lock	X-20-1
4	Washer, 1/4 split lock	X-20-1	1	Bushing, 1-7/16 x 3/4 reducer	X-202-1
1	Bushing, 1-7/16 x 3/4 reducer	X-202-1	1	Nipple, pipe	X-206-4
1	Nipple, 3/4 NPTF x 3-1/2 in. pipe	X-206-6	1	Elbow, 3/4 NPTF x 2-1/2 in. pipe	X-215-2
1	Elbow, 3/4 pipe	X-215-2	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	6	Clamp, 1 in. hose	X-426-10
1	Clamp, 1 in. hose	X-426-10	2	Clamp, 2-1/2 in. hose	X-426-6
4	Screw, 1/4-20 x 1	X-465-7	4	Screw, 1/4-20 x 1	X-465-7
1	Hose, 5/8 ID x 6 in.	X-577-10	1	Hose, 5/8 ID x 21 in.	X-577-24
1	Hose, 5/8 ID x 37 in.	X-577-36	1	Hose, 5/8 ID x 30 in.	X-577-35
1	Hose, 5/8 ID x 27 in.	X-577-44	1	Hose, 5/8 ID x 4 in.	X-577-39
1	Connector, adapter	X-582-3	1	Connector, adapter	X-582-3
4	Nut, 1/4-20	X-81-1	4	Plug, 1/2 NPT pipe	X-75-28
2	Clamp, 3 in. hose	250081	1	Nut, 1/4-20	X-81-1
1	Bracket, mounting	275588	1	Connector, hose	275581
1	Connector, hose	276205	1	Bracket, mounting	275583
1	Heater, block	276208	1	Heater, block	276209
	BLOCK HEATER KIT	275591		BLOCK HEATER KIT	276508
1	Elbow, 3/4 NPTF	SA-472	4	Washer, 1/4 split lock	X-20-1
4	Washer, 1/4 split lock	X-20-1	1	Bushing, 1-7/16 x 3/4 reducer	X-202-1
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	1	Nipple, 3/4 NPTF x 2-1/2 in. pipe	X-206-4
6	Clamp, 1 in. hose	X-426-10	1	Elbow, 3/4 pipe	X-215-2
4	Screw, 1/4-20 x 1	X-465-7	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Hose, 5/8 ID x 6 in.	X-577-10	6	Clamp, 1 in. hose	X-426-10
1	Hose, 5/8 ID x 30 in.	X-577-35	2	Clamp, 2-1/2 in. hose	X-426-6
1	Hose, 5/8 ID x 40 in.	X-577-42	4	Screw, 1/4-20 x 1	X-465-7
1	Connector, adapter	X-582-3	1	Hose, 5/8 ID x 21 in.	X-577-24
4	Nut, 1/4-20	X-81-1	1	Hose, 5/8 ID x 30 in.	X-577-35
2	Clamp, 3 in. hose	250081	1	Hose, 5/8 ID x 4 in.	X-577-39
1	Connector, hose	275582	1	Connector, adapter	X-582-3
1	Bracket, mounting	275583	1	Plug, 1/2 NPT pipe	X-75-28
1	Heater, block	276208	4	Nut, 1/4-20	X-81-1
			1	Connector, hose	275581
			1	Bracket, mounting	275583
			1	Heater, block	276208

X Not Sold Separately

# Series 189

## Accessories

### Block Heater (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	BLOCK HEATER KIT	276509		BLOCK HEATER KIT	276512
4	Washer, 1/4 split lock	X-20-1	1	Elbow, 3/4 NPTF	SA-472
1	Bushing, 1-7/16 x 3/4 reducer	X-202-1	4	Washer, 1/4 split lock	X-20-1
1	Nipple, 3/4 NPTF x 3-1/2 in. pipe	X-206-6	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Elbow, 3/4 pipe	X-215-2	6	Clamp, 1 in. hose	X-426-10
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	4	Screw, 1/4-20 x 1	X-465-7
6	Clamp, 1 in. hose	X-426-10	1	Hose, 5/8 ID x 6 in.	X-577-10
4	Screw, 1/4-20 x 1	X-465-7	1	Hose, 5/8 ID x 30 in.	X-577-35
1	Hose, 5/8 ID x 6 in.	X-577-10	1	Hose, 5/8 ID x 40 in.	X-577-42
1	Hose, 5/8 ID x 37 in.	X-577-36	1	Connector, adapter	X-582-3
1	Hose, 5/8 ID x 27 in.	X-577-44	1	Plug, 1 NPT pipe	X-75-22
1	Connector, adapter	X-582-3	4	Nut, 1/4-20	X-81-1
1	Plug, 1/2 NPT pipe	X-75-28	2	Clamp, 3 in. hose	250081
4	Nut, 1/4-20	X-81-1	1	Connector, hose	275582
2	Clamp, 3 in. hose	250081	1	Bracket, mounting	275583
1	Bracket, mounting	275588	1	Heater, block	276208
1	Connector, hose	276205		BLOCK HEATER KIT	276513
1	Heater, block	276209			
	BLOCK HEATER KIT	276510	1	Elbow, 3/4 NPTF	SA-472
4	Washer, 1/4 split lock	X-20-1	4	Washer, 1/4 split lock	X-20-1
1	Bushing, 1-7/16 x 3/4 reducer	X-202-1	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Nipple, 3/4 NPTF x 3-1/2 in. pipe	X-206-6	6	Clamp, 1 in. hose	X-426-10
1	Elbow, 3/4 pipe	X-215-2	4	Screw, 1/4-20 x 1	X-465-7
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	1	Hose, 5/8 ID x 6 in.	X-577-10
6	Clamp, 1 in. hose	X-426-10	1	Hose, 5/8 ID x 45 in.	X-577-40
4	Screw, 1/4-20 x 1	X-465-7	1	Hose, 5/8 ID x 33 in.	X-577-41
1	Hose, 5/8 ID x 6 in.	X-577-10	1	Connector, adapter	X-582-3
1	Hose, 5/8 ID x 37 in.	X-577-36	1	Plug, 1 NPT pipe	X-75-22
1	Hose, 5/8 ID x 27 in.	X-577-44	4	Nut, 1/4-20	X-81-1
1	Connector, adapter	X-582-3	2	Clamp, 3 in. hose	250081
1	Plug, 1/2 NPT pipe	X-75-28	1	Connector, hose	275582
4	Nut, 1/4-20	X-81-1	1	Bracket, mounting	275583
2	Clamp, 3 in. hose	250081	1	Heater, block	276209
1	Bracket, mounting	275588		BLOCK HEATER KIT	276514
1	Connector, hose	276205			
1	Heater, block	276208	1	Elbow, 3/4 NPTF	SA-472
	BLOCK HEATER KIT	276511	4	Washer, 1/4 split lock	X-20-1
1	Elbow, 3/4 NPTF	SA-472	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Washer, 1/4 split lock	X-20-1	6	Clamp, 1 in. hose	X-426-10
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	4	Screw, 1/4-20 x 1	X-465-7
6	Clamp, 1 in. hose	X-426-10	1	Hose, 5/8 ID x 6 in.	X-577-10
4	Screw, 1/4-20 x 1	X-465-7	1	Hose, 5/8 ID x 45 in.	X-577-40
1	Hose, 5/8 ID x 6 in.	X-577-10	1	Hose, 5/8 ID x 33 in.	X-577-41
1	Hose, 5/8 ID x 30 in.	X-577-35	1	Connector, adapter	X-582-3
1	Hose, 5/8 ID x 40 in.	X-577-42	1	Plug, 1 NPT pipe	X-75-22
1	Connector, adapter	X-582-3	4	Nut, 1/4-20	X-81-1
1	Plug, 1 NPT pipe	X-75-22	2	Clamp, 3 in. hose	250081
4	Nut, 1/4-20	X-81-1	1	Connector, hose	275582
2	Clamp, 3 in. hose	250081	1	Bracket, mounting	275583
1	Connector, hose	275582	1	Heater, block	276208
1	Bracket, mounting	275583			
1	Heater, block	276209			

X Not Sold Separately

# Series 189

## Accessories

### Common Fault Relay

Qty.	Description	Part No.	Qty.	Description	Part No.
	COMMON FAULT RELAY KIT	273914			
1	Board assembly, relay circuit	A-294301			
4	Washer, #8 split lock	X-18-2			
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48			
1	Tie, cable	X-468-1			
4	Screw, 8-32 x 1	X-51-3			
4	Spacer	X-712-9			
4	Nut, 8-32	X-72-4			
1	Harness, wiring	273772			

X Not Sold Separately

# Series 189

## Accessories

### Current Transformer

Qty.	Description	Part No.	Qty.	Description	Part No.
	CURRENT TRANSFORMER KIT	274832		CURRENT TRANSFORMER KIT	275505
12	Washer, #10 split lock	X-19-1	12	Washer, #10 split lock	X-19-1
12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36	12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36
2	Tie, cable	X-468-2	2	Tie, cable	X-468-2
12	Screw, 10-24 x 5/8	X-50-8	12	Screw, 10-24 x 5/8	X-50-8
1	Jumper, two-terminal	X-6076-2	1	Jumper, two-terminal	X-6076-2
12	Nut, 10-24	X-70-2	4	Screw, 10-24 x 1/2	X-6216-1
3	Transformer, current	272690	12	Nut, 10-24	X-70-2
			3	Transformer, current	253503
			1	Bracket, mounting	273967
	CURRENT TRANSFORMER KIT	275491		CURRENT TRANSFORMER KIT	275508
12	Washer, #10 split lock	X-19-1	12	Washer, #10 split lock	X-19-1
12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36	12	Washer, 7/32 x 1/2 x 3/64	X-25-36
2	Tie, cable	X-468-2	2	Tie, cable	X-468-2
12	Screw, 10-24 x 5/8	X-50-8	12	Screw, 10-24 x 1/2	X-50-8
1	Jumper, two-terminal	X-6076-2	1	Jumper, two-terminal	X-6076-2
4	Screw, 10-24 x 1/2	X-6216-1	4	Screw, 10-24 x 1/2	X-6216-1
12	Nut, 10-24	X-70-2	12	Nut, 10-24	X-70-2
3	Transformer, current	259359	3	Transformer, current	273257
1	Bracket, mounting	273967	1	Bracket, mounting	273967
	CURRENT TRANSFORMER KIT	275492		CURRENT TRANSFORMER KIT	275511
12	Washer, #10 split lock	X-19-1	12	Washer, #10 split lock	X-19-1
12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36	12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36
2	Tie, cable	X-468-2	2	Tie, cable	X-468-2
12	Screw, 10-24 x 5/8	X-50-8	12	Screw, 10-24 x 5/8	X-50-8
1	Jumper, two-terminal	X-6076-2	1	Jumper, two-terminal	X-6076-2
4	Screw, 10-24 x 1/2	X-6216-1	4	Screw, 10-24 x 1/2	X-6216-1
12	Nut, 10-24	X-70-2	12	Nut, 10-24	X-70-2
3	Transformer, current	259360	3	Transformer, current	253610
1	Bracket, mounting	273967	1	Bracket, mounting	273967
	CURRENT TRANSFORMER KIT	275496		CURRENT TRANSFORMER KIT	275515
12	Washer, #10 split lock	X-19-1	12	Washer, #10 split lock	X-19-1
12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36	12	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36
2	Tie, cable	X-468-2	2	Tie, cable	X-468-2
12	Screw, 10-24 x 5/8	X-50-8	12	Screw, 10-24 5/8	X-50-8
1	Jumper, two-terminal	X-6076-2	1	Jumper, two-terminal	X-6076-2
4	Screw, 10-24 x 1/2	X-6216-1	12	Nut, 10-24	X-70-2
12	Nut, 10-24	X-70-2	3	Transformer, current	272691
3	Transformer, current	259414	1	Bracket, mounting	273967
1	Bracket, mounting	273967			

X Not Sold Separately

# Series 189

## Accessories

### Customer Connection Terminal Strip Kit

### Dry Contact Kits

Qty.	Description	Part No.	Qty.	Description	Part No.
	CUSTOMER CONNECTION KIT	273915		DRY CONTACT KIT, SINGLE RELAY	PA-273912
4	Washer, #8 split lock	X-18-2	1	Contact assembly	A-273945
4	Screw, 8-32 x 3/4	X-51-11	1	Board assembly, relay circuit	A-294301
4	Nut, 8-32	X-72-4	4	Screw, 10-24 x 1/2	X-6216-1
1	Block, terminal	273769	4	Nut, 10-24	X-70-12
1	Strip, terminal	273770	4	Spacer	X-712-9
1	Harness, wiring	273771	1	Grommet	243319
			1	Box, dry contact	273942
			1	Cover, dry contact	273943
			1	Harness, wiring	273944
				DRY CONTACT KIT, 10 RELAY	PA-273913
			1	Contact assembly	A-273936
			1	Board assembly, relay circuit	A-294303
			6	Stud, locking	X-6205-3
			4	Screw, 10-24 x 1/2	X-6216-1
			6	Nut, 10-24	X-70-12
			6	Spacer	X-712-9
			1	Grommet	243319
			1	Box, dry contact	273933
			1	Cover, dry contact	273934
			1	Harness, wiring	273935

X Not Sold Separately

# Series 189

## Accessories

### Electronic Isochronous Governor Kit

Qty.	Description	Part No.	Qty.	Description	Part No.
	ISOCHRONOUS GOVERNOR KIT	273545		ISOCHRONOUS GOVERNOR KIT	273679
2	Nut, 1/4-20 elastic stop	X-101-8	2	Nut, 1/4-28 lock	X-101-7
5	Screw, 10-24 x 5/8	X-117-5	5	Screw, 10-24 x 5/8	X-117-5
5	Washer, #10 split lock	X-19-1	5	Washer, #10 split lock	X-19-1
1	Stud	X-352-72	4	Washer, 1/4 split lock	X-20-1
6	Screw, 1/4-20	X-465-7	2	Washer, 5/8 split lock	X-24-1
7	Tie, cable	X-468-1	1	Stud	X-352-49
1	Nut, M6-1	X-6053-1	4	Screw, 1/4-20 x 1-1/4	X-465-8
5	Nut, 10-24	X-70-2	7	Tie, cable	X-468-1
2	Nut, 1/4-28	X-81-2	2	Screw, 9/16-12 x 1	X-6244-1
1	Cable, shielded 40 in.	254210	5	Nut, 10-24	X-70-2
2	Ball-joint	254229	4	Nut, 1/4-20	X-81-1
1	Relay	259391	2	Nut, 1/4-28	X-81-2
1	Cable, shielded 53 in.	273710	1	Actuator, governor	255746
1	Actuator, linear	273748	1	Lever, actuator	255748
1	Control, Governor	273749	1	Pick-up, magnetic	255750
1	Bracket, actuator mounting	273750	1	Control, governor	255932
1	Yoke	273751	1	Relay	259391
1	Lever, shut-off	273452	2	Ball joint	271097
1	Pickup, RPM	273758	1	Lever assembly, shut	273687
1	Cable, shielded 80 in.	273765	1	Bracket, governor mounting	273694
	ISOCHRONOUS GOVERNOR KIT	273678	1	Cable, shielded 43 in.	273708
2	Nut, 1/4-28 lock	X-101-7	1	Cable, shielded 16 in.	273709
5	Screw, 10-24 x 5/8	X-117-5	1	Cable, shielded 53 in.	273710
2	Screw, 1/2-13 x 7/8	X-129-15		ISOCHRONOUS GOVERNOR KIT	275544
5	Washer, #10 split lock	X-19-1	2	Nut, 1/4-20 elastic stop	X-101-8
4	Washer, 1/4 split lock	X-20-1	5	Screw, 10-24 x 5/8	X-117-5
1	Washer, 5/8 split lock	X-24-1	5	Washer, #10 split lock	X-19-1
2	Washer, 1/2 split lock	X-24-6	1	Stud	X-352-72
1	Stud	X-352-50	6	Screw, 1/4-20 x 1	X-465-7
4	Screw, 1/4-20 x 1-1/4	X-465-8	7	Tie, cable	X-468-1
5	Tie, cable	X-468-1	1	Nut, M6-1	X-6053-1
1	Screw, 9/16-12 x 1	X-6244-1	5	Nut, 10-24	X-70-2
5	Nut, 10-24	X-70-2	2	Nut, 1/4-28	X-81-2
4	Nut, 1/4-20	X-81-1	1	Cable, shielded 40 in.	254210
2	Nut, 1/4-28	X-81-2	2	Ball joint	254229
1	Actuator, governor	255746	1	Relay	259391
1	Lever, actuator	255748	1	Cable, shielded 53 in.	273710
1	Pick-up, magnetic	255750	1	Actuator, linear	273748
1	Control, governor	255932	1	Control, governor	273749
1	Relay	259391	1	Bracket, actuator mounting	273750
2	Ball joint	271097	1	Yoke	273751
1	Bracket, governor	273686	1	Lever, shutoff	273752
1	Lever assembly, shut	273687	1	Pickup, RPM	273758
1	Cable, shielded 23 in.	273707	1	Cable, shielded 80 in.	273765
1	Cable, shielded 16 in.	273709			
1	Cable, shielded 53 in.	273710			
1	Insulator, blanket	275480			



# Series 189

## Accessories

### Electronic Isochronous Governor Kit (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	ISOCHRONOUS GOVERNOR KIT	276555		ISOCHRONOUS GOVERNOR KIT	276568
2	Nut, 1/4-20 stop nut	X-101-8	1	Controller, electronic	A-246045
5	Screw, 10-24 x 5/8	X-117-5	2	Nut, 10-32 lock nut	X-101-12
5	Washer, #10 split lock	X-19-1	4	Washer, #8 split lock	X-18-2
1	Stud	X-352-72	4	Washer, 1/4 split lock	X-20-1
4	Screw, 1/4-20 x 3/4	X-465-16	1	Washer, 1/4 int. tooth lock	X-22-11
6	Screw, 1/4-20 x 1	X-465-7	2	Washer, 5/8 split lock	X-24-2
7	Tie, cable	X-468-1	3	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36
1	Nut, M6 x 1	X-6053-1	1	Stud	X-352-83
5	Nut, 10-24	X-70-2	4	Screw, 1/4-20 x 7/8	X-465-18
2	Nut, 1/4-28	X-81-2	2	Screw, 10-32 x 1	X-50-56
1	Cable, shielded (pick-up)	254210	4	Screw 8-32 x 5/8	X-51-9
2	Ball-joint	254229	1	Nut, M6 x 1	X-6053-1
1	Relay	259391	2	Screw, 9/16-12 x 1	X-6244-1
1	Actuator, linear	273748	2	Nut, 10-32	X-70-3
1	Control, governor	273749	4	Nut, 8-32	X-72-4
1	Bracket, actuator mounting	273750	4	Nut, 1/4-20	X-81-1
1	Yoke	273751	1	Actuator, linear	249923
1	Lever, shot-off	273752	1	Pick-up, speed	249927
1	Cable, shielded	273753	2	Link, ball	272456
1	Cable, shielded	273754	1	Yoke	273751
1	Pickup, RPM	273758	1	Bracket, actuator	276569
	ISOCHRONOUS GOVERNOR KIT	276565			
1	Controller, electronic	A-246045			
2	Nut, 10-32 lock nut	X-101-12			
1	Screw, 5/16-18 x 7/8	X-125-31			
1	Screw, 5/16-18 x 1/2	X-125-33			
4	Washer, #8 split lock	X-18-2			
4	Washer, 1/4 split lock	X-20-1			
2	Washer, 5/16 split lock	X-21-1			
1	Washer, 1/4 int. tooth lock	X-22-11			
2	Washer, 5/8 split lock	X-24-2			
3	Washer, 7/32 x 1/2 x 3/64 plain	X-25-36			
1	Washer, 21/64 x 9/16 x 1/16 plain	X-25-44			
1	Washer, 21/32 x 1-1/8 x 3/32 plain	X-25-64			
1	Stud	X-352-80			
4	Screw, 1/4-20 x 7/8	X-465-18			
2	Screw, 10-32 x 1	X-50-56			
4	Screw 8-32 x 5/8	X-51-9			
1	Screw, 9/16-12 x 1	X-6244-1			
2	Nut, 10-32	X-70-3			
4	Nut, 8-32	X-72-4			
4	Nut, 1/4-20	X-81-1			
1	Nut, 5/16-18	X-82-2			
1	Actuator, linear	249923			
1	Pick-up, speed	249927			
2	Link, ball	272456			
1	Yoke	273751			
1	Bracket, actuator	276566			
1	Bracket, actuator	276567			

X Not Sold Separately

# Series 189

## Accessories

### Exhaust Manifold Insulation Kit

### Fast Check

Qty.	Description	Part No.	Qty.	Description	Part No.
	EXHAUST MANIFOLD INSULATION KIT	275477		FAST CHECK	PA-272766
1	Insulator, blanket	275480	1	Control assembly	B-291930
	EXHAUST MANIFOLD INSULATION KIT	275478	1	Harness, wiring	255915
1	Insulator, blanket	275482			
	EXHAUST MANIFOLD INSULATION KIT	275479			
1	Insulator, blanket	275479			
	EXHAUST MANIFOLD INSULATION KIT	275483			
1	Insulation, blanket	275481			
	EXHAUST MANIFOLD INSULATION KIT	276558			
1	Insulation, blanket	276564			

X Not Sold Separately

# Series 189

## Accessories

### Flexible Exhaust Connectors

Qty.	Description	Part No.		Qty.	Description	Part No.
	FLEXIBLE EXHAUST KIT	PA-273674				
1	Clamp, U	X-722-2				
1	Adapter, flexible exhaust	273671				
	FLEXIBLE EXHAUST KIT	PA-273675				
1	Adapter, flexible exhaust	273672				
1	Clamp, exhaust pipe	289372				
	FLEXIBLE EXHAUST KIT	PA-273676				
1	Adapter, flexible exhaust	273673				
1	Clamp, exhaust pipe	289372				

X Not Sold Separately

# Series 189

## Accessories

### Flexible Fuel Lines

Qty.	Description	Part No.	Qty.	Description	Part No.
	FLEXIBLE FUEL LINE KIT	273546		FLEXIBLE FUEL LINE KIT	273917
1	Screw, 1/2-13 x 3/4	X-129-15			
1	Washer, 1/4 split lock	X-20-1	1	Washer, 1/4 split lock	X-20-1
1	Washer, 1/2 split lock	X-24-6	1	Washer, 5/8 split lock	X-24-1
1	Cap, 1/4 NPT pipe	X-268-3	1	Cap, 1/4 NPT pipe	X-268-3
1	Cap, 1/8 NPT pipe	X-268-7	1	Cap, 1/8 NPT pipe	X-268-7
1	Connector, 7/16-20 x 1	X-296-1	1	Connector, 7/16-20 x 1	X-296-1
1	Elbow, 1/2-20 x 1/4	X-447-6	1	Elbow, 1/2-20 x 1/4	X-447-6
1	Screw, 1/4-20 x 1/2	X-465-6	1	Screw, 1/4-20 x 1/2	X-465-6
2	Tie, cable	x-468-2	2	Tie, cable	X-468-2
1	Clamp	X-672-10	1	Screw, 5/8-11 x 1	X-6021-3
1	Union	X-695-2	1	Clamp	X-672-10
1	Line, 7/16-20 F x 7/16-20 F x 37 in. flexible fuel	273629	1	Union	X-695-2
1	Line, 9/16-18 F x 1/2-20 F x 48 in. flexible fuel	273630	1	Line, 7/16-20 F x 7/16-20 F x 37 in. flexible fuel	273629
1	Line, .25 OD steel fuel	273631	1	Line, 9/16-18 F x 1/2-20 F x 48 in. flexible fuel	273630
1	Bracket, mounting	273643	1	Line, .25 OD steel fuel	273631
			1	Bracket, mounting	273916
	FLEXIBLE FUEL LINE KIT	273618			
1	Washer, 1/4 split lock	X-20-1			
1	Washer, 3/8 split lock	X-22-1			
2	Cap, 1/8 NPT pipe	X-268-7			
3	Elbow, 7/16-20 x 1/8	X-447-10			
1	Screw, 1/4-20 x 1/4	X-465-6			
2	Tie, cable	X-468-1			
1	Screw, 3/8-16 x 5/8	X-6238-2			
1	Clamp	X-672-10			
1	Union	X-695-2			
1	Line, 7/16-20 x F x 7/16-20 F x 29 in. flexible fuel	273614			
1	Line, 7/16-20 F x 7/16-20 F x 43 in. flexible fuel	273615			
1	Line, .25 OD steel fuel	273616			
1	Bracket, mounting	273617			
	FLEXIBLE FUEL LINE KIT	273628			
1	Screw, 1/2-13 x 3/4	X-129-15			
1	Washer, 1/4 split lock	X-20-1			
1	Washer, 1/2 split lock	X-24-6			
2	Cap, 1/8 NPT pipe	X-268-7			
1	Connector, 7/16-20 x 1	X-296-1			
2	Elbow, 7/16-20 x 1/8	X-447-10			
1	Screw, 1/4-20 x 1/2	X-465-6			
2	Tie, cable	X-468-1			
1	Clamp	X-672-10			
1	Union	X-695-2			
2	Line, 7/16-20 F x 7/16-20 F x 37 in. flexible fuel	273629			
1	Line, .25 OD steel fuel	273631			
1	Bracket, mounting	273643			

# Series 189

## Accessories

### Fuel Pressure Gauge

### Generator Heater

Qty.	Description	Part No.	Qty.	Description	Part No.
	FUEL PRESSURE GAUGE	275538		GENERATOR HEATER KIT	253213
1	Spacer	X-400-145	4	Nut, 1/4-20 elastic stop	X-101-8
1	Elbow, 2 OD x 2.2 in. street	X-555-2	8	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
1	Adapter	275539	4	Screw, 1/4-20 x 1	X-465-7
1	Gauge, pressure	275540	4	Nut, 1/4-20	X-81-1
			2	Heater, strip	291269
	FUEL PRESSURE GAUGE	275541			
1	Coupling, 1/8 NPSC x 13/16 in. pipe	X-216-24			
1	Gauge, pressure	275542			
1	Nipple, 1/8 NPTF x 1-1/2	289055			

X Not Sold Separately

# Series 189

## Accessories

### Housing, Weather

Qty.	Description	Part No.	Qty.	Description	Part No.
	HOUSING KIT, WEATHER	254479		HOUSING KIT, WEATHER	273547
8	Screw, 5/16-18 x 3/4	X-125-3	10	Nut, 5/16-18 elastic stop	X-101-16
8	Washer, 5/16 split lock	X-21-1	24	Nut, 1/4-20 elastic stop	X-101-8
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	14	Nut, 10-24 elastic stop	X-101-9
2	Decal, stripes	X-6232-2	10	Screw, 5/16-18 x 1	X-125-5
2	Decal, Kohler "Power Systems"	X-6246-1	44	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
12	Screw, 1/4-14 x 3/4 drill	X-794-1	28	Washer, 17/64 x 9/16 x 1/16 plain	X-25-72
1	Plug	253268	20	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
7	Latch	253373	24	Screw, 1/4-20 x 3/4	X-465-16
28	Plug, plastic	253723	14	Screw, #10-24 x 1	X-50-7
2	Bracket, mounting	253950	2	Decal "stripes"	X-6232-2
1	Shroud, rear housing	254474	2	Decal, Kohler "Power Systems"	X-6246-2
2	Door, housing	254475	14	Screw, 1/4-14 x 3/4 drill	X-794-1
1	Door, rear housing	254476	10	Screw, 8-18 x 1/2 drill	X-794-2
1	Roof, weather housing	273554	1	Plug	253268
4	Door, weather housing	273558	28	Plug, plastic	253723
2	Decal	273739	1	Bracket, right mounting	258439
			1	Bracket, left mounting	258823
			7	Latch	259890
			1	Roof	273509
	HOUSING KIT, WEATHER	254480	5	Stiffener, roof	273585
8	Screw, 5/16-18 x 3/4	X-125-3	4	Door	273633
8	Washer, 5/16 split lock	X-21-1	2	Door, side (center)	273635
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	1	Door, back (end)	273636
1	Plug, cap	X-519-15	1	Rail, end	273637
2	Decal, stripes	X-6232-2	1	Support, left rear housing	273638
2	Decal, Kohler "Power Systems"	X-6246-1	1	Support, right rear housing	273639
12	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Support, rear housing (center)	273640
1	Plug	253268	2	Rail, side	273641
7	Latch	253373	2	Decal	273740
28	Plug, plastic	253723			
2	Bracket, mounting	253950		HOUSING KIT, WEATHER	273982
1	Shroud, rear housing	254474	10	Nut, elastic stop 5/16-18	X-101-16
2	Door, housing	254475	24	Nut, elastic stop 1/4-20	X-101-8
1	Door, rear housing	254476	10	Screw, 5/16-18 x 1	X-125-5
1	Roof, weather housing	273555	4	Washer, 1/4 split lock	X-20-1
4	Door, weather housing	273558	44	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
2	Decal	273739	20	Washer, 11/32 x 11/16 x 1/16	X-25-85
			20	Screw, 1/4-20 x 3/4	X-465-16
			4	Screw, 1/4-20 x 1	X-465-7
	HOUSING KIT, WEATHER	254481	2	Decal "stripes"	X-6232-2
8	Screw, 5/16-18 x 3/4	X-125-3	2	Decal Kohler "Power Systems"	X-6246-2
8	Washer, 5/16 split lock	X-21-1	14	Screw, 1/4-14 x 3/4 drill	X-794-1
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	7	Latch	253373
2	Decal, stripes	X-6232-2	28	Plug, plastic	253723
2	Decal, Kohler "Power Systems"	X-6246-2	4	Door, housing	255427-BLK
12	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Roof, housing	273450
1	Plug	253268	2	Rail, side	273619
7	Latch	253373	2	Decal	273740
28	Plug, plastic	253723	1	Support, right rear housing	273974
2	Bracket, mounting	253950	1	Support, left rear housing	273975
1	Shroud, rear housing	254472	1	Bracket, left housing support	273976
2	Door, housing	254473	1	Bracket, right housing support	273977
1	Door, rear housing	254476	1	Bracket, center housing support	273978
1	Roof, weather housing	273553	1	Rail, end	273979
4	Door, weather housing	273557	1	Door, rear housing (end)	273980
2	Decal	273740	2	Door, rear housing (center)	273981

# Series 189

## Accessories

### Line Circuit Breakers

Qty.	Description	Part No.	Qty.	Description	Part No.
	LINE CIRCUIT BREAKER KIT	273524		LINE CIRCUIT BREAKER KIT	273528
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-38	1	Breaker, circuit	X-786-35
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273530	1	Cover, side	273530
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	LINE CIRCUIT BREAKER KIT	273525		LINE CIRCUIT BREAKER KIT	273529
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-20-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
8	Washer, 11/32 x 11/16 x 3/64 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 1/4-20 x 2	X-73-11
4	Nut, 8-32	X-72-4	1	Breaker, circuit	X-786-23
1	Breaker, circuit	X-786-49	4	Nut, 1/4-20	X-81-1
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273530	1	Cover, side	273530
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	LINE CIRCUIT BREAKER KIT	273526		LINE CIRCUIT BREAKER KIT	273533
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 1	X-125-5
4	Washer, #8 split lock	X-18-2	4	Washer, #10 split lock	X-19-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 13/64 x 3/4 x 1/16 plain	X-25-45
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	1	Tag, L1	X-452-2
4	Nut, 8-32	X-72-4	1	Tag, L2	X-452-3
1	Breaker, circuit	X-786-16	1	Tag, L3	X-452-4
4	Nut, 5/16-18	X-82-2	4	Screw, 10-24 x 4	X-50-46
1	Bracket, circuit breaker	255026	4	Nut, 10-24	X-70-2
1	Cover, side	273530	1	Breaker, circuit	X-786-38
2	Insulator, breaker	290020	4	Nut, 1/4-20	X-82-2
			2	Insulator, breaker	290020
			1	Bracket, circuit breaker	291833
	LINE CIRCUIT BREAKER KIT	273527			
4	Screw, 5/16-18 x 3/4	X-125-3			
4	Washer, 1/4 split lock	X-20-1			
4	Washer, 5/16 split lock	X-21-1			
4	Washer, 9/32 x 5/5 x 1/16 plain	X-25-40			
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85			
4	Screw, 1/4-20 x 2	X-73-11			
1	Breaker, circuit	X-786-22			
4	Nut, 1/4-20	X-81-1			
4	Nut, 5/16-18	X-82-2			
1	Bracket, circuit breaker	255026			
1	Cover, side	273530			
2	Insulator, breaker	290020			

X Not Sold Separately

# Series 189

## Accessories

### Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	LINE CIRCUIT BREAKER KIT	273534		LINE CIRCUIT BREAKER KIT	273537
4	Screw, 5/16-18 x 1	X-125-5	4	Washer, 1/4 split lock	X-20-1
4	Washer, #10 split lock	X-19-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 1/4 split lock	X-20-1	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Washer, 5/16 split lock	X-21-1	4	Spacer	X-400-98
4	Washer, 17/64 x 5/8 x 1/16 plain	X-25-53	4	Screw, 1/4-20 x 2	X-73-11
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	1	Marker, wire L1	X-750-14
1	Tag, wire L1	X-452-2	1	Marker, wire L2	X-750-15
1	Tag, wire L2	X-452-3	1	Marker, wire L3	X-750-16
1	Tag, wire L3	X-452-4	1	Breaker, circuit	X-786-24
4	Screw, 1/4-20 x 2	X-73-11	4	Nut, 1/4-20	X-81-1
1	Breaker, circuit	X-786-49	4	Nut, 5/16-18	X-82-2
4	Nut, 1/4-20	X-81-1	4	Screw, 5/16-18 x 2-1/4	230578
4	Nut, 5/16-18	X-82-2	1	Cover, side	273532
1	Cover, side	273531	2	Insulator, breaker	290020
2	Insulator, breaker	290020	1	Bracket, circuit breaker	291834
1	Bracket, circuit breaker	291833		LINE CIRCUIT BREAKER KIT	273569
	LINE CIRCUIT BREAKER KIT	273535	4	Washer, #6 split lock	X-18-1
4	Screw, 5/16-18 x 1	X-125-5	4	Screw, 6-32 x 3/8	X-49-2
4	Washer, 1/4 split lock	X-20-1	1	Breaker, circuit	269252
4	Washer, 5/16 split lock	X-21-1	1	Cover, side	273551
4	Washer, 17/64 x 5/8 x 1/16 plain	X-25-53		LINE CIRCUIT BREAKER KIT	273570
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Washer, #6 split lock	X-18-1
4	Screw, 1/4-20 x 2	X-73-11	4	Screw, 6-32 x 3/8	X-49-2
1	Marker, wire L1	X-750-14	1	Breaker, circuit	269252
1	Marker, wire L2	X-750-15	1	Cover, side	273551
1	Marker, wire L3	X-750-16		LINE CIRCUIT BREAKER KIT	273571
1	Breaker, circuit	X-786-22	4	Washer, #6 split lock	X-18-1
4	Nut, 1/4-20	X-81-1	4	Screw, 6-32 x 3/8	X-49-2
4	Nut, 5/16-18	X-82-2	1	Breaker, circuit	269252
1	Cover, side	273531	1	Cover, side	273551
2	Insulator, breaker	290090		LINE CIRCUIT BREAKER KIT	273572
1	Bracket, circuit breaker	291833	4	Washer, #6 split lock	X-18-1
	LINE CIRCUIT BREAKER KIT	273536	4	Screw, 6-32 x 3/8	X-49-2
4	Screw, 5/16-18 x 1	X-125-5	1	Breaker, circuit	269252
4	Washer, 1/4 split lock	X-20-1	1	Cover, side	273551
4	Washer, 5/16 split lock	X-21-1		LINE CIRCUIT BREAKER KIT	273571
4	Washer, 17/64 x 5/8 x 1/16 plain	X-25-53	4	Washer, #6 split lock	X-18-1
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Screw, 6-32 x 3/8	X-49-2
4	Screw, 1/4-20 x 2	X-73-11	1	Breaker, circuit	269252
1	Marker, wire L1	X-750-14	1	Cover, side	273551
1	Marker, wire L2	X-750-15		LINE CIRCUIT BREAKER KIT	273572
1	Marker, wire L3	X-750-16	4	Washer, #6 split lock	X-18-1
1	Breaker, circuit	X-786-23	4	Screw, 6-32 x 3/8	X-49-2
4	Nut, 1/4-20	X-81-1	1	Breaker, circuit	269252
4	Nut, 5/16-18	X-82-2	1	Cover, side	273551
1	Cover, side	273531		LINE CIRCUIT BREAKER KIT	273572
2	Insulator, breaker	290020	4	Washer, #6 split lock	X-18-1
1	Bracket, circuit breaker	291833	4	Screw, 6-32 x 3/8	X-49-2

X Not Sold Separately



# Series 189

## Accessories

### Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	LINE CIRCUIT BREAKER KIT	273573		LINE CIRCUIT BREAKER KIT	273577
4	Screw, 5/16-18 x 3/4	X-125-3	4	Washer, #8 split lock	X-18-2
4	Washer, #8 split lock	X-18-2	4	Washer, 5/16 split lock	X-21-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Screw, 8-32 x 3-1/2	X-51-47
4	Screw, 8-32 x 3-1/2	X-51-47	4	Nut, 8-32	X-72-4
4	Nut, 8-32	X-72-4	1	Breaker, circuit	X-786-15
1	Breaker, circuit	X-786-28	4	Nut, 5/16-18	X-82-2
4	Nut, 5/16-18	X-82-2	1	Bracket, circuit breaker	255026
1	Bracket, circuit breaker	255026	1	Cover, side	273552
1	Cover, side	273552	2	Insulator, breaker	290020
2	Insulator, breaker	290020		LINE CIRCUIT BREAKER KIT	273579
	LINE CIRCUIT BREAKER KIT	273574		LINE CIRCUIT BREAKER KIT	273579
4	Screw, 5/16-18 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-40	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-13	1	Breaker, circuit	X-786-29
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273552	1	Cover, side	273552
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	LINE CIRCUIT BREAKER KIT	273575		LINE CIRCUIT BREAKER KIT	273580
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-40	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-36	1	Breaker, circuit	X-786-34
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273578	1	Cover, side	273530
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	LINE CIRCUIT BREAKER KIT	273576		LINE CIRCUIT BREAKER KIT	273581
4	Washer, #6 split lock	X-18-1	4	Screw, 5/16-18 x 3/4	X-125-3
4	Screw, 6-32 x 3/8	X-49-2	4	Washer, #8 split lock	X-18-2
1	Breaker, circuit	258928	4	Washer, 5/16 split lock	X-21-1
1	Cover, side	273551	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
			8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
			4	Screw, 8-32 x 3-1/2	X-51-47
			4	Nut, 8-32	X-72-4
			1	Breaker, circuit	X-786-15
			4	Nut, 5/16-18	X-82-2
			1	Bracket, circuit breaker	255026
			1	Cover, side	273578
			2	Insulator, breaker	290020

X Not Sold Separately

# Series 189

## Accessories

### Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	LINE CIRCUIT BREAKER KIT	273582		LINE CIRCUIT BREAKER KIT	273842
4	Washer, #6 split lock	X-18-1	4	Screw, 5/16-18 x 1	X-125-5
4	Screw, 6-32 x 3/8	X-49-2	4	Washer, #10 split lock	X-19-1
1	Breaker, circuit	269250	4	Washer, 1/4 split lock	X-20-1
1	Cover, side	273551	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
	LINE CIRCUIT BREAKER KIT	273625	4	Washer, 11/32 x 11/16 x 1/16 plain	x-25-85
4	Screw, 5/16-18 x 3/4	X-125-3	1	Tag, L1	X-452-2
4	Washer, #8 split lock	X-18-2	1	Tag, L2	X-452-3
4	Washer, 5/16 split lock	X-21-1	1	Tag, L3	X-452-4
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Nut, 8-32	X-73-11
4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	1	Breaker, circuit	X-786-20
8	Screw, 8-32 x 3-1/2	X-51-47	4	Nut, 1/4-20	X-81-1
4	Nut, 8-32	X-72-4	4	Nut, 5/16-18	X-82-2
1	Breaker, circuit	X-786-18	1	Cover, side	273531
4	Nut, 5/16-18	X-82-2	2	Insulator, breaker	290020
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	291833
1	Cover, side	273530		LINE CIRCUIT BREAKER KIT	275566
2	Insulator, breaker	290020	4	Screw, 5/16-18 x 1	X-125-5
	LINE CIRCUIT BREAKER KIT	273627	4	Washer, #10 split lock	X-19-1
4	Screw, 5/16-18 x 3/4	X-125-3	4	Washer, 5/16 split lock	X-21-1
4	Washer, #8 split lock	X-18-2	4	Washer, 13/64 x plain	X-25-45
4	Washer, 5/16 split lock	X-21-1	4	Washer, 11/32 x 11/16 x 1/16 plain	x-25-85
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	1	Tag, L1	X-452-2
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	1	Tag, L2	X-452-3
4	Screw, 8-32 x 3-1/2	X-51-47	1	Tag, L3	X-452-4
4	Nut, 8-32	X-72-4	4	Screw, 10-24 x 4	X-50-46
1	Breaker, circuit	X-786-55	4	Nut, 10-24	X-70-2
4	Nut, 5/16-18	X-82-2	1	Breaker, circuit	X-786-18
1	Bracket, circuit breaker	255026	4	Nut, 5/16-18	X-82-2
1	Cover, side	273530	1	Cover, side	273531
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	LINE CIRCUIT BREAKER KIT	273698	1	Bracket, circuit breaker	291833
4	Screw, 5/16-18 x 3/4	X-125-3		LINE CIRCUIT BREAKER KIT	275567
4	Washer, #8 split lock	X-18-2	4	Screw, 5/16-18 x 1	X-125-5
4	Washer, 5/16 split lock	X-21-1	4	Washer, #10 split lock	X-19-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 1/4 split lock	X-20-1
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
4	Screw, 8-32 x 3-1/2	X-51-47	4	Washer, 11/32 x 11/16 x 1/16 plain	x-25-85
4	Nut, 8-32	X-72-4	1	Tag, L1	X-452-2
1	Breaker, circuit	X-786-31	1	Tag, L2	X-452-3
4	Nut, 5/16-18	X-82-2	1	Tag, L3	X-452-4
1	Bracket, circuit breaker	255026	4	Nut, 8-32	X-73-11
1	Cover, side	273552	1	Breaker, circuit	X-786-5
2	Insulator, breaker	290020	4	Nut, 1/4-20	X-81-1
			4	Nut, 5/16-18	X-82-2
			1	Cover, side	273531
			2	Insulator, breaker	290020
			1	Bracket, circuit breaker	291833

# Series 189

## Accessories

### Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	LINE CIRCUIT BREAKER KIT	275568			
4	Screw, 5/16-18 x 1	X-125-5			
4	Washer, 1/4 split lock	X-20-1			
4	Washer, 5/16 split lock	X-21-1			
4	Washer, 17/64 x 5/8 x 1/16 plain	X-25-53			
4	Washer, 11/32 x 11/16 x 1/16 plain	x-25-85			
1	Tag, L1	X-452-2			
1	Tag, L2	X-452-3			
1	Tag, L3	X-452-4			
4	Nut, 8-32	X-73-11			
1	Breaker, circuit	X-786-35			
4	Nut, 1/4-20	X-81-1			
4	Nut, 5/16-18	X-82-2			
1	Cover, side	273531			
2	Insulator, breaker	290020			
1	Bracket, circuit breaker	291833			

X Not Sold Separately

# Series 189

## Accessories

### Load (Bus) Connection Kit

Qty.	Description	Part No.	Qty.	Description	Part No.
	LOAD BUS KIT	274689		LOAD BUS KIT	274691
4	Screw, 5/16-18 x 7/8	X-125-31	4	Screw, 5/16-18 x 7/8	X-125-31
8	Screw, 5/16-18 x 1	X-125-5	8	Screw, 5/16-18 x 1	X-125-5
8	Washer, 1/4 split lock	X-20-1	8	Washer, 1/4 split lock	X-20-1
12	Washer, 5/16 split lock	X-21-1	12	Washer, 5/16 split lock	X-21-1
8	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	24	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
12	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	16	Washer, 9/32 x 5/8 x 1/8 plain	X-25-68
8	Screw, 1/4-20 x 1-1/2	X-465-9	12	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Tie, cable	X-468-2	8	Screw, 1/4-20 x 7/8	X-465-18
4	Rivet, 3/16 dia. x 3/8 aluminum/steel pop	X-781-9	32	Screw, 1/4-20 x 1/2	X-465-6
8	Nut, 1/4-20	X-81-1	4	Tie, cable	X-468-2
12	Nut, 5/16-18	X-82-2	4	Rivet, nylon	X-6264-1
1	Bracket, left support	275457	4	Rivet, 6/16 dia. x 3/8 aluminum/steel pop	X-781-9
1	Bracket, right support	275458	2	Screw, 8-18 x 1/2 drill	X-794-2
4	Bus	275459	8	Nut, 1/4-20	X-81-1
2	Bracket, upper support	275468	12	Nut, 5/16-18	X-82-2
	LOAD BUS KIT	274690	16	Insulator, panel	233269
4	Screw, 5/16-18 x 7/18	X-125-31	1	Bracket, support	275432
8	Screw, 5/16-18 x 1	X-125-5	2	Bracket, upper support	274433
12	Washer, 5/16 split lock	X-21-1	4	Channel, insulating	274434
16	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	1	Bracket, right support	274741
12	Washer, 9/32 x 5/8 x 1/8 plain	X-25-68	1	Bracket, lower support	275452
12	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Bus	275453
2	Terminal, 5/16 dia. x No. 000 eyelet	X-251-52		LOAD BUS KIT	274692
32	Screw, 1/4-20	X-465-6	4	Bus assembly	A-274670
4	Tie, cable	X-468-2	2	Nut, 1/4-20 PEM	X-6263-1
4	Rivet, 3/16 dia. x 3/8 aluminum/steel pop	X-781-9	1	Bus	274658
8	Nut, 1/4-20	X-81-1	2	Nut, 1/4-20 elastic stop	X-101-8
12	Nut, 5/16-18	X-82-2	24	Screw, 5/16-18 x 1-3/4	X-125-25
16	Insulator, panel	233269	24	Washer, 5/16 split lock	X-21-1
2	Bracket, upper support	274433	4	Washer, 3/8 split lock	X-22-1
1	Bracket, left support	275454	4	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18
1	Bracket, right support	275455	10	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Bus	275456	24	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
			2	Terminal, 3/8 dia. x No. 0000 eyelet	X-251-53
			8	Screw, 1/4-20 x 7/8	X-465-18
			4	Tie, cable	X-468-2
			4	Screw, 3/8-16 x 2	X-6238-6
			2	Screw, 10-16 x 3/8	X-67-107
			5	Screw, 8-18 x 1/2 drill	X-794-2
			24	Nut, 5/16-18	X-82-2
			4	Nut, 3/8-16	X-83-2
			2	Bracket, support	274657
			2	Support, main bus	274659
			1	Bracket, upper support	274660
			1	Bracket, lower support	274661
			2	Channel, insulating	274662

X Not Sold Separately

# Series 189

## Accessories

**Load (Bus)  
Connection Kit  
(cont'd.)**

**Load Share Module,  
Electronic Governor**

Qty.	Description	Part No.	Qty.	Description	Part No.
	LOAD BUS KIT	274996		LOAD SHARE MODULE KIT, ELECTRONIC. GOV.	273775
4	Bus assembly	A-272870			
4	Screw, 5/16-18 x 7/8	X-125-25			
8	Screw, 5/16-18 x 1	X-125-5			
10	Washer, 1/4 split lock	X-20-1			
28	Washer, 5/16 split lock	X-21-1			
9	Washer, 3/8 split lock	X-22-1			
18	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18			
18	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40			
52	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85			
4	Washer, 3/16 x 1/2 x 1/32 plain	X-25-92			
2	Screw, 1/4-20 x 1-1/2	X-465-16			
8	Screw, 1/4-20 x 1	X-465-7			
4	Tie, cable	X-468-2			
9	Screw, 3/8-16 x 1-1/4	X-6238-4			
2	Screw, 10-16 x 3/8	X-67-107			
4	Rivet, 3/16 dia. x 1/8 L aluminum/steel	X-781-11			
5	Screw, 8-18 x 1/2 drill	X-794-2			
10	Nut, 1/4-20	X-81-1			
28	Nut, 5/16-18	X-82-2			
9	Nut, 3/8-16	X-83-7			
1	Tab, identification (L1)	201620-83			
1	Tab, identification (L2)	201620-84			
1	Tab, identification (L0)	201620-94			
1	Tab, identification (L3)	201620-95			
1	Bracket, lower support	272871			
1	Bracket, upper support	272872			
1	Insulator, lug	272874			
2	Bracket, support	274657			
2	Support, main bus	274659			
2	Channel, insulating	274662			

X Not Sold Separately

# Series 189

## Accessories

### Meterbox Relocation Box

### NFPA-110 Literature

Qty.	Description	Part No.	Qty.	Description	Part No.
	METERBOX RELOCATION BOX KIT	PAB-258849		NFPA-110 LITERATURE	PA-273685
1	Box assembly, connection	B-258849	2	Manual, installation	ES-420
6	Washer, #8 split lock	X-18-2	2	Chart, maintenance	ES-527
1	Tie, cable	X-468-7	2	Notification, start-up	K-3322
2	Screw, 8-32 x 3/4	X-51-11	2	Manual, generator operation	TP-5352
2	Screw, 8-32 x 3/8	X-51-12	2	Manual, generator service	TP-5353
4	Screw, 8-32 x 5/8	X-51-9	2	Catalog, generator parts	TP-5408
6	Nut, 8-32	X-72-4	2	Manual, engine operation	TP-5361
4	Terminal, 1/4 push-on x .142 dia. hole	238898	2	Manual, engine service	TP-5362
1	Block, terminal (two-terminal)	243845	2	Catalog, engine parts	TP-5369
1	Block, terminal (8-terminal)	246115			
1	Harness, wiring	258277			
1	Box, remote connection	258845		NFPA-110 LITERATURE	PA-273715
1	Bracket, mounting	258846			
1	Strip, marker (5,7C)	258848	2	Manual, installation	ES-420
1	Strip, marker (V7, V8, V8,...)	282824	2	Chart, maintenance	ES-527
			2	Notification, start-up	K-3322
			2	Manual, generator operation	TP-5352
			2	Manual, generator service	TP-5353
			2	Catalog, generator parts	TP-5408
			2	Manual, engine operation	TP-5355
			2	Manual, engine service	TP-5356
			2	Catalog, engine parts	TP-5370
				NFPA-110 LITERATURE	PA-276554
			2	Manual, installation	ES-420
			2	Chart, maintenance	ES-527
			2	Notification, start-up	K-3322
			2	Manual, generator operation	TP-5352
			2	Manual, generator service	TP-5353
			2	Catalog, generator parts	TP-5408
			2	Manual, engine operation	TP-5430
			2	Manual, engine service	TP-5419
			2	Catalog, engine parts	TP-5434

X Not Sold Separately

# Series 189

## Accessories

### Oil Drain Kit

### Overvoltage Protection

Qty.	Description	Part No.	Qty.	Description	Part No.
	OIL DRAIN KIT	273726		OVERVOLTAGE PROTECTION KIT	291746
2	Clamp, 1 in. hose	X-426-10	1	Board assembly, overvoltage circuit	F-291739
1	Hose, 5/8 ID x 17 in.	X-577-28	2	Washer, #10 split lock	X-19-1
1	Nut, flex jam 1-14	X-80-1	4	Washer, 13/64 x 1/2 x .040 brass	X-25-11
1	Plug, drain	241062	2	Nut, 10-32	X-70-3
1	Gasket, drain plug	241063	2	Spacer	292372
1	Valve, oil drain	272701			
1	Adapter, hose	273729			
	OIL DRAIN KIT	273727			
2	Clamp, 1 in. hose	X-426-10			
1	Hose, 5/8 ID x 17 in.	X-577-8			
1	Nut, flex jam 1-14	X-80-1			
1	Plug, drain	241062			
1	Gasket, drain plug	241063			
1	Valve, oil drain	272725			
1	Adapter, hose	273729			
	OIL DRAIN KIT	273728			
2	Clamp, 1 in. hose	X-426-10			
1	Hose, 5/8 ID x 17 in.	X-577-32			
1	Nut, flex jam 1-14	X-80-1			
1	Plug, drain	241062			
1	Gasket, drain plug	241063			
1	Valve, oil drain	272701			
1	Adapter, hose	273729			
	OIL DRAIN KIT	273846			
1	Elbow, street 1/2 NPT	X-211-1			
2	Clamp, 1 in. hose	X-426-10			
1	Hose, 5/8 x 17 in.	X-577-28			
1	Nut, 1-14 jam	X-80-1			
1	Plug, drain	241062			
1	Gasket, drain plug	241063			
1	Valve, oil drain	272701			
1	Adapter, hose	273729			
1	Adapter, oil drain	273857			
1	O-ring	273918			
	OIL DRAIN KIT	273847			
1	Elbow, street 1/2 NPT	X-211-1			
2	Clamp, 1 in. hose	X-426-10			
1	Hose, 5/8 x 17 in.	X-577-18			
1	Nut, 1-14 jam	X-80-1			
1	Plug, drain	241062			
1	Gasket, drain plug	241063			
1	Valve, oil drain	272701			
1	Adapter, hose	273729			
1	Adapter, oil drain	273857			
1	O-ring	273918			

X Not Sold Separately

# Series 189

## Accessories

### Radiator Duct Flange (with Radiator Shroud)

### Reactive Droop Compensator

Qty.	Description	Part No.	Qty.	Description	Part No.
	RADIATOR DUCT FLANGE KIT	273402		REACTIVE DROOP COMPENSATOR KIT	290939
8	Rivet, 3/16 dia. x 1/8 aluminum/steel pop	X-781-11	1	Rheostat 10 Ohm, 50 Watt	X-270-1
10	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Nameplate	283869
2	Frame, air duct (top and bottom)	292985	1	Transformer	283916
2	Frame, air duct (left and right)	292988			
	RADIATOR DUCT FLANGE KIT	273467		REACTIVE DROOP COMPENSATOR KIT	290940
8	Rivet, 3/16 dia. x 1/8 aluminum/steel pop	X-781-11	1	Rheostat 10 Ohm, 50 Watt	X-270-1
6	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Nameplate	283869
4	Screw, 1/4-14 x 3/4 drill	X-794-2	1	Transformer	283917
2	Frame, air duct (left and right)	273466			
2	Frame, air duct (top and bottom)	292989			
	RADIATOR DUCT FLANGE KIT	273932		REACTIVE DROOP COMPENSATOR KIT	290941
8	Rivet, 3/16 dia. x 1/8 aluminum/steel pop	X-781-11	1	Rheostat 10 Ohm, 50 Watt	X-270-1
6	Screw, 1/4-14 x 3/4 drill	X-794-1	1	Nameplate	283869
4	Screw, 8-18 x 1/2 drill	X-794-2	1	Transformer	283918
2	Frame, air duct (left and right)	273931			
2	Frame, air duct (top and bottom)	292989			
	RADIATOR DUCT FLANGE KIT	279645		REACTIVE DROOP COMPENSATOR KIT	290942
8	Rivet, pop	X-781-11	1	Rheostat 10 Ohm, 50 Watt	X-270-1
6	Screw, drill	X-791-1	1	Nameplate	283869
4	Screw, drill	X-794-2	1	Transformer	283919
2	Frame, air duct	279642			
2	Frame, air duct	279644			
				REACTIVE DROOP COMPENSATOR KIT	290943
			3	Washer, #8 split lock	X-18-2
			1	Rheostat, 5 Ohm, 100 Watt	X-467-3
			3	Screw, 8-32 x 7/16	X-51-5
			3	Nut, 8-32	X-72-4
			1	Nameplate	283869
			1	Transformer	283919

X Not Sold Separately



# Series 189

## Accessories

**Remote Annunciator,  
16 Lite**

**Remote Audio/Visual  
Alarm**

Qty.	Description	Part No.	Qty.	Description	Part No.
	REMOTE ANNUNCIATOR KIT, 16 LITE (SURFACE MOUNT)	PA-256471		REMOTE AUDIO/VISUAL ALARM KIT	A-292856
1	Panel assembly	A-256472	1	Panel assembly	A-292887
1	Board assembly, circuit	C-294303	1	Board assembly, 1 lite circuit	A-292883
4	Screw, 10-24 x 1/2	X-6216-1	4	Washer, #8 split lock	X-18-2
6	Nut, 8-32	X-70-12	4	Stud, self-clinching	X-6205-3
6	Spacer	X-712-9	4	Spacer	X-712-9
1	Grommet	243319	4	Nut, 8-32	X-72-4
1	Harness, wiring	256473	1	Lens, red	253241
1	Box, dry contact	273933	4	Screw, mounting	292828
1	Cover, dry contact	273934	1	Panel, silkscreen	292936
1	Panel assembly, annunciator	A-258782			
1	Board assembly, 16 lite annunciator circuit	A-292885			
2	Washer, #6 split lock	X-18-1			
1	Grommet, 1-3/8	X-284-3			
2	Screw, 6-32 x 1/2	X-49-26			
4	Screw, 8-32 x 3/8	X-67-43			
6	Screw, 8-18 x 1/2 drill	X-794-2			
1	Bracket, wall mounting	253346			
1	Panel, front	253350			
1	Decal, marker	258832			
1	Nameplate	258834			
1	Harness, wiring	258890			
1	Block, terminal	258891			
2	Panel, side	287798			
	REMOTE ANNUNCIATOR KIT, 16 LITE (FLUSH MOUNT)	PA-256484			
1	Panel assembly, annunciator	A-256452			
1	Board assembly, circuit	A-292885			
4	Washer, #6 split lock	X-18-1			
2	Washer, #8 split lock	X-18-2			
2	Screw, 8-32 x 5/8	X-51-9			
4	Nut, 6-32	X-71-2			
4	Spacer	X-712-8			
2	Nut, 8-32	X-72-4			
1	Panel	256453			
1	Decal, marker	258832			
1	Nameplate	258834			
1	Harness, wiring	258890			
1	Block, terminal	258891			
1	Panel assembly	A-256472			
1	Board assembly, circuit	C-294303			
4	Screw, 10-24 x 1/2	X-6216-1			
6	Nut, 8-32	X-70-12			
6	Spacer	X-712-9			
1	Grommet	243319			
1	Harness, wiring	256473			
1	Box, dry contact	273933			
1	Cover, dry contact	273934			
	REMOTE ANNUNCIATOR KIT, 16 LITE (Discontinued, reference PA-256471)	PA-258782			

X Not Sold Separately

# Series 189

## Accessories

**Remote Emergency  
Stop**

**Rodent Proofing  
Kit**

Qty.	Description	Part No.	Qty.	Description	Part No.
	REMOTE EMERGENCY STOP KIT	PA-292366		RODENT PROOFING KIT	273968
1	Switch, emergency stop	A-292785	4	Washer, 3/8 int. tooth lock	X-22-10
1	Panel, silkscreen	292786	6	Tie, cable	X-468-2
1	Switch, emergency	292796	4	Nut, 3/8-16	X-83-2
			1	Guard, generator	273733
			4	Screw, 3/8-16 x 2-1/2	273736
			1	Screen, fan	273971
				RODENT PROOFING KIT	273969
			4	Washer, 3/8 int. tooth lock	X-22-10
			6	Tie, cable	X-468-2
			4	Nut, 3/8-16	X-83-2
			1	Guard, generator	273734
			4	Screw, 3/8-16 x 3-1/2	273737
			1	Screen, fan	273972
				RODENT PROOFING KIT	273970
			4	Washer, 3/8 int. tooth lock	X-22-4
			12	Tie, cable	X-468-2
			4	Nut, 1/2-13	X-89-8
			1	Guard, generator	273735
			4	Screw, 1/2-13 x 4	273738
			2	Screen, fan	273973
				RODENT PROOFING KIT	274599
			6	Tie, cable	X-468-2
			1	Screen, fan	273971
				RODENT PROOFING KIT	274600
			6	Tie, cable	X-468-2
			1	Screen, fan	273972
				RODENT PROOFING KIT	274601
			6	Tie, cable	X-468-2
			1	Screen, fan	273973

X Not Sold Separately

# Series 189

## Accessories

### Run Relay

### Safeguard Circuit Breakers

Qty.	Description	Part No.	Qty.	Description	Part No.
	RUN RELAY	273743		SAFEGUARD CIRCUIT BREAKER KIT	255127
2	Washer, #6 split lock	X-18-1	4	Washer, #6 split lock	X-18-1
2	Washer, 5/32 x 3/8 x 3/64 plain	X-25-9	4	Screw, 6-32 x 3/8	X-49-2
2	Screw, 6-32 x 1/2	X-49-26	1	Breaker, circuit	X-796-1
2	Nut, 6-32	X-71-2			
1	Relay assembly	273705		SAFEGUARD CIRCUIT BREAKER KIT	255128
2	Terminal	X-431-43			
1	Tubing, shrink	X-748-29	4	Washer, #6 split lock	X-18-1
1	Diode	233712	4	Screw, 6-32 x 3/8	X-49-2
1	Relay	248362	1	Breaker, circuit	X-796-4
				SAFEGUARD CIRCUIT BREAKER KIT	255129
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x 3/8	X-49-2
			1	Breaker, circuit	X-796-6
				SAFEGUARD CIRCUIT BREAKER KIT	255130
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x 3/8	X-49-2
			1	Breaker, circuit	X-796-2
				SAFEGUARD CIRCUIT BREAKER KIT	255131
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x 3/8	X-49-2
			1	Breaker, circuit	X-796-3
				SAFEGUARD CIRCUIT BREAKER KIT	272746
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x 3/8	X-49-2
			1	Breaker, circuit	X-796-3
				SAFEGUARD CIRCUIT BREAKER KIT	272747
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x 3/8	X-49-26
			1	Breaker, circuit	X-796-1
				SAFEGUARD CIRCUIT BREAKER KIT	275595
			4	Washer, #6 split lock	X-18-1
			4	Screw, 6-32 x	X-49-2
			1	Breaker, circuit	X-796-2

X Not Sold Separately

# Series 189

## Accessories

### Shunt Trip Line Circuit Breakers

Qty.	Description	Part No.	Qty.	Description	Part No.
	SHUNT TRIP LINE CIRCUIT BREAKER	273961		SHUNT TRIP LINE CIRCUIT BREAKER	273965
4	Screw, 5/16-18 x 1	X-125-5	4	Washer, 1/4 split lock	X-20-1
4	Washer, #10 split lock	X-19-1	4	Washer, /516 split lock	X-21-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
4	Washer, 1/8 x 1/4 x .022 plain	X-25-45	4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Spacer	X-400-98
1	Tag, L1	X-452-2	4	Screw, 1/4-20 x 2	X-73-11
1	Tag, L2	X-452-3	1	Marker, wire L1	X-750-14
1	Tag, L3	X-452-4	1	Marker, wire L2	X-750-15
4	Screw, 10-24 x 4	X-50-46	1	Marker, wire L3	X-750-16
4	Nut, 10-24	X-70-2	1	Breaker, circuit	X-786-85
1	Breaker, circuit	X-786-70	4	Nut, 1/4-20	X-81-1
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Cover, side	273531	4	Screw, 5/16-18 x 2-1/4	230578
2	Insulator, breaker	290020	1	Cover, side	273532
1	Bracket, circuit breaker	291833	2	Insulator, breaker	290020
			1	Bracket, circuit breaker	291834
	SHUNT TRIP LINE CIRCUIT BREAKER	273962		SHUNT TRIP LINE CIRCUIT BREAKER	273966
4	Screw, 5/16-18 x 1, Gr. 5	X-125-5	4	Screw, 5/16-18 x 1, Gr. 5	X-125-5
4	Washer, #10 split lock	X-19-1	4	Washer, #10 split lock	X-19-1
4	Washer, 1/4 split lock	X-20-1	4	Washer, 1/4 split lock	X-20-1
4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
1	Tag, L1	X-452-2	1	Tag, L1	X-452-2
1	Tag, L2	X-452-3	1	Tag, L2	X-452-3
1	Tag, L3	X-452-4	1	Tag, L3	X-452-4
4	Screw, 1/4-20 x 2	X-73-11	4	Screw, 1/4-20 x 2	X-73-11
1	Breaker, circuit	X-786-71	1	Breaker, circuit	X-786-86
4	Nut, 1/4-20	X-81-1	4	Nut, 1/4-20	X-81-1
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Cover, side	273531	1	Cover, side	273531
2	Insulator, breaker	290020	2	Insulator, breaker	290020
1	Bracket, circuit breaker	291833	1	Bracket, circuit breaker	291833
	SHUNT TRIP LINE CIRCUIT BREAKER	273964		SHUNT TRIP LINE CIRCUIT BREAKER	274460
4	Screw, 5/16-18 x 1	X-125-5	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, 1/4 split lock	X-20-1	4	Washer, 1/4 split lock	X-20-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 1/4-20 x 2	X-73-11	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
1	Marker, wire L1	X-750-14	4	Screw, 1/4-20 x 2	X-73-11
1	Marker, wire L2	X-750-15	1	Breaker, circuit	X-786-84
1	Marker, wire L3	X-750-16	4	Nut, 1/4-20	X-81-1
1	Breaker, circuit	X-786-84	4	Nut, 5/16-18	X-82-2
4	Nut, 1/4-20	X-81-1	1	Bracket, circuit breaker	255026
4	Nut, 5/16-18	X-82-2	1	Cover, side	273530
1	Cover, side	273531	2	Insulator, breaker	290020
2	Insulator, breaker	290020			
1	Bracket, circuit breaker	291833			

X Not Sold Separately

# Series 189

## Accessories

### Shunt Trip Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	SHUNT TRIP LINE CIRCUIT BREAKER	274467		SHUNT TRIP LINE CIRCUIT BREAKER	274470
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, 1/4 split lock	X-20-1
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 1/4-20 x 2	X-73-11
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-70	1	Breaker, circuit	X-786-73
4	Nut, 5/16-18	X-82-2	4	Nut, 1/4-20	X-81-1
1	Bracket, circuit breaker	255026	4	Nut, 5/16-18	X-82-2
1	Cover, side	273530	1	Bracket, circuit breaker	255026
2	Insulator, breaker	290020	1	Cover, side	273530
			2	Insulator, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274468		SHUNT TRIP LINE CIRCUIT BREAKER	274471
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-71	1	Breaker, circuit	X-786-74
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273530	1	Cover, side	273530
2	Insulator, breaker	290020	2	Insulation, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274469		SHUNT TRIP LINE CIRCUIT BREAKER	274472
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-72	1	Breaker, circuit	X-786-75
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273530	1	Cover, side	273552
2	Insulation, breaker	290020	2	Insulation, breaker	290020
				SHUNT TRIP LINE CIRCUIT BREAKER	274473
			4	Screw, 5/16-18	X-125-3
			4	Washer, #8 split lock	X-18-2
			4	Washer, 5/16 split lock	X-21-1
			4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
			8	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
			4	Screw, 8-32 x 3-1/2	X-51-47
			4	Nut, 8-32	X-72-4
			1	Breaker, circuit	X-786-76
			4	Nut, 5/16-18	X-82-2
			1	Bracket, circuit breaker	255026
			1	Cover, side	273552
			1	Cover, side	273552

X Not Sold Separately

# Series 189

## Accessories

### Shunt Trip Line Circuit Breakers (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	SHUNT TRIP LINE CIRCUIT BREAKER	274474		SHUNT TRIP LINE CIRCUIT BREAKER	274478
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 3/64 plain	X-25-85	8	Washer, 11/32 x 11/16 x 3/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-77	1	Breaker, circuit	X-786-81
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273578	1	Cover, side	273578
			2	Insulator, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274475		SHUNT TRIP LINE CIRCUIT BREAKER	274479
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 3/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 3/16	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-78	1	Breaker, circuit	X-786-82
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273578	1	Cover, side	273578
2	Insulator, breaker	290020	2	Insulator, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274476		SHUNT TRIP LINE CIRCUIT BREAKER	274480
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 3/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 3/16 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-79	1	Breaker, circuit	X-786-83
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Cover, side	273552
1	Cover, side	273578	2	Insulator, breaker	290020
2	Insulator, breaker	290020			
	SHUNT TRIP LINE CIRCUIT BREAKER	274477		SHUNT TRIP LINE CIRCUIT BREAKER	274481
4	Screw, 5/16-18 x 3/4	X-125-3	4	Screw, 5/16-18 x 3/4	X-125-3
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
4	Washer, 5/16 split lock	X-21-1	4	Washer, 5/16 split lock	X-21-1
4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48	4	Washer, 3/16 x 7/16 x 3/64 plain	X-25-48
8	Washer, 11/32 x 11/16 x 3/16 plain	X-25-85	8	Washer, 11/32 x 11/16 x 3/64 plain	X-25-85
4	Screw, 8-32 x 3-1/2	X-51-47	4	Screw, 8-32 x 3-1/2	X-51-47
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
1	Breaker, circuit	X-786-80	1	Breaker, circuit	X-786-80
4	Nut, 5/16-18	X-82-2	4	Nut, 5/16-18	X-82-2
1	Bracket, circuit breaker	255026	1	Bracket, circuit breaker	255026
1	Cover, side	273578	1	Cover, side	273552
2	Insulator, breaker	290020			

X Not Sold Separately

# Series 189

## Accessories

### Shunt Trip Line Circuit Breaker (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	SHUNT TRIP LINE CIRCUIT BREAKER	274482		SHUNT TRIP LINE CIRCUIT BREAKER	275569
4	Washer, #6 split lock	X-18-1	4	Screw, 5/16-18 x 1	X-125-5
4	Screw, 6-32 x 3/8	X-49-2	4	Washer, 1/4 split lock	X-20-1
1	Breaker, circuit	X-6250-2	4	Washer, 5/16 split lock	X-21-1
1	Cover, side	274512	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
	SHUNT TRIP LINE CIRCUIT BREAKER	274483	4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Washer, #6 split lock	X-18-1	1	Tag, L1	X-452-2
4	Screw, 6-32 x 3/8	X-49-2	1	Tag, L2	X-452-3
1	Breaker, circuit	X-6250-3	1	Tag, L3	X-452-4
1	Cover, side	274512	4	Screw, 1/4-20 x 2	X-73-11
	SHUNT TRIP LINE CIRCUIT BREAKER	274484	1	Breaker, circuit	X-786-73
4	Washer, #6 split lock	X-18-1	4	Nut, 1/4-20	X-81-1
4	Screw, 6-32 x 3/8	X-49-2	4	Nut, 5/16-18	X-82-2
1	Breaker, circuit	X-6250-4	1	Cover, side	273531
1	Cover, side	274512	2	Insulator, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274485	1	Bracket, circuit breaker	291833
4	Washer, #6 split lock	X-18-1		SHUNT TRIP LINE CIRCUIT BREAKER	275570
4	Screw, 6-32 x 3/8	X-49-2	4	Screw, 5/16-18 x	X-125-5
1	Breaker, circuit	X-6250-5	4	Washer, #10 split lock	X-19-1
1	Cover, side	274512	4	Washer, 1/4 split lock	X-20-1
	SHUNT TRIP LINE CIRCUIT BREAKER	274486	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
4	Washer, #6 split lock	X-18-1	1	Tag, L1	X-452-2
4	Screw, 6-32 x 3/8	X-49-2	1	Tag, L2	X-452-3
1	Breaker, circuit	X-6250-6	1	Tag, L3	X-452-4
1	Cover, side	274512	4	Screw, 1/4-20 x 2	X-73-11
	SHUNT TRIP LINE CIRCUIT BREAKER	274487	1	Breaker, circuit	X-786-82
4	Washer, #6 split lock	X-18-1	4	Nut, 1/4-20	X-81-1
4	Screw, 6-32 x 3/8	X-49-2	4	Nut, 5/16-18	X-82-2
1	Breaker, circuit	X-6250-1	1	Cover, side	273531
1	Cover, side	274512	2	Insulator, breaker	290020
	SHUNT TRIP LINE CIRCUIT BREAKER	274488	1	Bracket, circuit breaker	291833
4	Washer, #6 split lock	X-18-1		SHUNT TRIP LINE CIRCUIT BREAKER	275571
4	Screw, 6-32 x 3/8	X-49-2	4	Screw, 5/16-18 x	X-125-5
1	Breaker, circuit	X-6250-2	4	Washer, 1/4 split lock	X-20-1
1	Cover, side	274512	4	Washer, 5/16 split lock	X-21-1
	SHUNT TRIP LINE CIRCUIT BREAKER	274489	4	Washer, 17/64 x 3/4 x 1/16 plain	X-25-52
4	Washer, #6 split lock	X-18-1	4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
4	Screw, 6-32 x 3/8	X-49-2	1	Tag, L1	X-452-2
1	Breaker, circuit	X-6250-1	1	Tag, L2	X-452-3
1	Cover, side	274512	1	Tag, L3	X-452-4
	SHUNT TRIP LINE CIRCUIT BREAKER	274490	4	Screw, 1/4-20 x 2	X-73-11
4	Washer, #6 split lock	X-18-1	1	Breaker, circuit	X-786-74
4	Screw, 6-32 x 3/8	X-49-2	4	Nut, 1/4-20	X-81-1
1	Breaker, circuit	X-6250-1	4	Nut, 5/16-18	X-82-2
1	Cover, side	274512	1	Cover, side	273531
	SHUNT TRIP LINE CIRCUIT BREAKER	274491	2	Insulator, breaker	290020
4	Washer, #6 split lock	X-18-1	1	Bracket, circuit breaker	291833
4	Screw, 6-32 x 3/8	X-49-2			
1	Breaker, circuit	X-6250-1			
1	Cover, side	274512			

X Not Sold Separately

# Series 189

## Accessories

### Shunt Trip Line Circuit Breaker (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	SHUT TRIP LINE CIRCUIT BREAKER	275572			
4	Screw, 5/16-18 x 1	X-125-5			
4	Washer, #10 split lock	X-19-1			
4	Washer, 5/16 split lock	X-21-1			
4	Washer, 13/64 x 3/4 x 1/16 plain	X-25-45			
4	Washer, 11/32 x 11/16 x 1/16 plain	X-25-85			
1	Tag, L1	X-452-2			
1	Tag, L2	X-452-3			
1	Tag, L3	X-452-4			
4	Screw, 10-24 x 4	X-50-46			
4	Nut, 10-24	X-70-2			
1	Breaker, circuit	X-786-81			
4	Nut, 5/16-18	X-82-2			
1	Cover, side	273531			
2	Insulator, breaker	290020			
1	Bracket, circuit breaker	291833			

X Not Sold Separately



# Series 189

## Accessories

### Silencer Mounting Kit

Qty.	Description	Part No.	Qty.	Description	Part No.
	SILENCER MOUNTING KIT	273548		SILENCER MOUNTING KIT	273604
1	Connector	273649	2	Nut, 1/4-20 stop	X-101-8
2	Clamp, exhaust pipe	289372	4	Washer, 1/4 split lock	X-20-1
	SILENCER MOUNTING KIT	273601	3	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
2	Nut, 1/4-20 elastic stop	X-101-8	2	Screw, 1/4-20 x 1/2	X-465-6
4	Washer, 1/4 split lock	X-20-1	2	Nut, 1/4-20	X-81-1
3	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	2	Bolt, angle	253307
2	Screw, 1/4-20 x 1/2	X-465-6	2	Bumper	259632
1	U-Clamp	X-722-2	1	Bracket, mounting	273587
2	Nut, 1/4-20	X-81-1	1	Adapter, exhaust	273599
2	Bolt, angle	253307	1	Clamp, exhaust pipe	286283
2	Bumper	259632	1	Strap, muffler	290864
1	Bracket, mounting	273587		SILENCER MOUNTING KIT	273605
1	Adapter, exhaust	273599	2	Nut, 1/4-20 stop	X-101-8
1	Clamp, exhaust pipe	286283	4	Washer, 1/4 split lock	X-20-1
1	Strap, muffler	290864	3	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
	SILENCER MOUNTING KIT	273602	2	Screw, 1/4-20 x 1/2	X-465-6
2	Nut, 1/4-20 elastic stop	X-101-8	2	Nut, 1/4-20	X-81-1
4	Washer, 1/4 split lock	X-20-1	2	Bolt, angle	253307
3	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	2	Bumper	255443
2	Screw, 1/4-20 x 1/2	X-465-6	1	Bracket, mounting	273587
1	U-Clamp	X-722-2	1	Adapter, exhaust	273596
2	Nut, 1/4-20	X-81-1	1	Clamp, exhaust pipe	289372
2	Bolt, angle	253307	1	Strap, muffler	290865
2	Bumper	259632			
1	Bracket, mounting	273587			
1	Adapter, exhaust	273600			
1	Strap, muffler	290864			
	SILENCER MOUNTING KIT	273603			
2	Nut, 1/4-20 elastic stop	X-101-8			
4	Washer, 1/4 split lock	X-20-1			
3	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40			
2	Screw, 1/4-20 x 1/2	X-465-6			
2	Nut, 1/4-20	X-81-1			
2	Bolt, angle	253307			
2	Bumper	259632			
1	Bracket, mounting	273587			
1	Adapter, exhaust	273594			
1	Clamp, 3 in. exhaust pipe	286283			
1	Clamp, 4 in. exhaust pipe	289372			
1	Strap, muffler	290864			

X Not Sold Separately

# Series 189

## Accessories

### Silencer Kits

### Skid End Cap Kit

Qty.	Description	Part No.	Qty.	Description	Part No.
	SILENCER KIT, INDUSTRIAL	253143		SKID END CAP KIT	275463
1	Silencer, industrial	253237	12	Washer, 1/4 split lock	X-20-1
			12	Screw, 1/4-20 x 5/8	X-465-2
			2	Enclosure, skid	275460
	SILENCER KIT, CRITICAL	253236			
	SILENCER KIT, CRITICAL	253305		SKID END CAP KIT	275464
1	Silencer, critical	253236	12	Washer, 1/4 split lock	X-20-1
			12	Screw, 1/4-20 x 5/8	X-465-2
			2	Enclosure, skid	275461
	SILENCER KIT, CRITICAL	253615			
	SILENCER KIT, INDUSTRIAL	253616		SKID END CAP KIT	275465
1	Silencer, industrial	253614	12	Washer, 1/4 split lock	X-20-1
			12	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40
			12	Screw, 1/4-20 x 5/8	X-465-2
			2	Enclosure, skid	275462
	SILENCER KIT, CRITICAL	273652			
1	Silencer, critical	273774			
	SILENCER KIT, RESIDENTIAL	273653			
	SILENCER KIT, INDUSTRIAL	273669			
	SILENCER KIT, INDUSTRIAL	273670			
	SILENCER KIT, INDUSTRIAL	273718			
	SILENCER KIT, INDUSTRIAL	273719			
	SILENCER KIT, CRITICAL	273720			
	SILENCER KIT, RESIDENTIAL	273843			
	SILENCER KIT, CRITICAL	273844			
	SILENCER KIT, RESIDENTIAL	290488			
	SILENCER KIT, CRITICAL	290490			
	SILENCER KIT, CRITICAL	290493			
	SILENCER KIT, CRITICAL	290496			

X Not Sold Separately

# Series 189

## Accessories

**Speed Potentiometer  
Kit, Electronic Governor**

**Subbase Fuel  
Tank Kits**

Qty.	Description	Part No.	Qty.	Description	Part No.
	<b>SPEED POTENTIOMETER KIT</b>	<b>273768</b>		<b>SUBBASE FUEL TANK KIT</b>	<b>273372</b>
2	Washer, #4 split lock	X-18-4	4	Screw, 1/2-13 x 1-1/2	X-129-19
1	Tie, cable	X-468-1	1	Bushing, reducer 1/4 x 1/2	X-202-12
2	Screw, 4-40 x 3/8	X-49-40	2	Bushing, reducer 1/8 x 1/2	X-202-29
1	Nameplate, speed adjustment	X-6133-28	4	Washer, 1/2 split lock	X-24-6
2	Nut, 4-40	X-74-6	4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
1	Potentiometer	273767	4	Nut, 1/2-13	X-89-8
			1	Tank, sub-base fuel	273865
				<b>SUBBASE FUEL TANK KIT</b>	<b>273986</b>
			4	Screw, 1/2-13 x 1-1/2	X-129-19
			2	Bushing, reducer 1/8 x 1/2	X-202-29
			4	Washer, 1/2 split lock	X-24-6
			4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
			4	Nut, 1/2-13	X-89-8
			1	Tank, sub-base fuel	273946
				<b>SUBBASE FUEL TANK KIT</b>	<b>273987</b>
			4	Screw, 1/2-13 x 1-1/2	X-129-19
			2	Bushing, reducer 1/8 x 1/2	X-202-29
			4	Washer, 1/2 split lock	X-24-6
			4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
			4	Nut, 1/2-13	X-89-8
			1	Tank, sub-base fuel	273947
				<b>SUBBASE FUEL TANK KIT</b>	<b>273988</b>
			4	Screw, 1/2-13 x 1-1/2	X-129-19
			2	Bushing, reducer 1/8 x 1/2	X-202-29
			4	Washer, 1/2 split lock	X-24-6
			4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
			4	Nut, 1/2-13	X-89-8
			1	Tank, subbase fuel	273948
				<b>SUBBASE FUEL TANK KIT</b>	<b>273989</b>
			4	Screw, 1/2-13 x 1-1/2	X-129-19
			1	Bushing, reducer 1/4 x 1/2	X-202-12
			1	Bushing, reducer 1/8 x 1/2	X-202-29
			4	Washer, 1/2 split lock	X-24-6
			4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
			4	Nut, 1/2-13	X-89-8
			1	Tank, subbase fuel	273949
				<b>SUBBASE FUEL TANK KIT</b>	<b>273990</b>
			4	Screw, 1/2-13 x 1-1/2	X-129-19
			1	Bushing, reducer 1/4 x 1/2	X-202-12
			1	Bushing, reducer 1/8 x 1/2	X-202-29
			4	Washer, 1/2 split lock	X-24-6
			4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
			4	Nut, 1/2-13	X-89-8
			1	Tank, subbase fuel	273950

X Not Sold Separately

# Series 189

## Accessories

### Subbase Fuel Tank Kits (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	SUBBASE FUEL TANK KIT	273991		SUBBASE FUEL TANK KIT	273996
4	Screw, 1/2-13 x 1-1/2	X-129-19	4	Screw, 1/2-13 x 1-1/2	X-129-19
1	Bushing, reducer 1/4 x 1/2	X-202-12	1	Bushing, reducer 1/4 x 1/2	X-202-12
1	Bushing, reducer 1/8 x 1/2	X-202-29	1	Bushing, reducer 1/8 x 1/2	X-202-29
4	Washer, 1/2 split lock	X-24-6	4	Washer, 1/2 split lock	X-24-6
4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26	4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
4	Nut, 1/2-13	X-89-8	4	Nut, 1/2-13	X-89-8
1	Tank, subbase fuel	273951	1	Tank, subbase fuel	273956
	SUBBASE FUEL TANK KIT	273992		SUBBASE FUEL TANK KIT	273997
4	Screw, 1/2-13 x 1-1/2	X-129-19	4	Screw, 1/2-13 x 1-1/2	X-129-19
1	Bushing, reducer 1/4 x 1/2	X-202-12	1	Bushing, reducer 1/4 x 1/2	X-202-12
1	Bushing, reducer 1/8 x 1/2	X-202-29	1	Bushing, reducer 1/8 x 1/2	X-202-29
4	Washer, 1/2 split lock	X-24-6	4	Washer, 1/2 split lock	X-24-6
4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26	4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
4	Nut, 1/2-13	X-89-8	4	Nut, 1/2-13	X-89-8
1	Tank, subbase fuel	273952	1	Tank, subbase fuel	273957
	SUBBASE FUEL TANK KIT	273993		SUBBASE FUEL TANK KIT	273998
4	Screw, 1/2-13 x 1-1/2	X-129-19	4	Screw, 1/2-13 x 1-1/2	X-129-19
1	Bushing, reducer 1/4 x 1/2	X-202-12	1	Bushing, reducer 1/4 x 1/2	X-202-12
1	Bushing, reducer 1/8 x 1/2	X-202-29	1	Bushing, reducer 1/8 x 1/2	X-202-29
4	Washer, 1/2 split lock	X-24-6	4	Washer, 1/2 split lock	X-24-6
4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26	4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
4	Nut, 1/2-13	X-89-8	4	Nut, 1/2-13	X-89-8
1	Tank, subbase fuel	273953	1	Tank, subbase fuel	273958
	SUBBASE FUEL TANK KIT	273994		SUBBASE FUEL TANK KIT	273999
4	Screw, 1/2-13 x 1-1/2	X-129-19	4	Screw, 1/2-13 x 1-1/2	X-129-19
1	Bushing, reducer 1/4 x 1/2	X-202-12	1	Bushing, reducer 1/4 x 1/2	X-202-12
1	Bushing, reducer 1/8 x 1/2	X-202-29	1	Bushing, reducer 1/8 x 1/2	X-202-29
4	Washer, 1/2 split lock	X-24-6	4	Washer, 1/2 split lock	X-24-6
4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26	4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26
4	Nut, 1/2-13	X-89-8	4	Nut, 1/2-13	X-89-8
1	Tank, subbase fuel	273954	1	Tank, subbase fuel	273959
	SUBBASE FUEL TANK KIT	273995			
4	Screw, 1/2-13 x 1-1/2	X-129-19			
1	Bushing, reducer 1/4 x 1/2	X-202-12			
1	Bushing, reducer 1/8 x 1/2	X-202-29			
4	Washer, 1/2 split lock	X-24-6			
4	Washer, 17/32 x 1-1/16 x 3/32 plain	X-25-26			
4	Nut, 1/2-13	X-89-8			
1	Tank, subbase fuel	273955			

X Not Sold Separately

# Series 189

## Accessories

**Subbase Tank  
Fuel Gage**

**Subbase Tank  
Low Fuel Switch**

Qty.	Description	Part No.	Qty.	Description	Part No.
	SUBBASE TANK FUEL GAGE	292265		SUBBASE TANK LOW FUEL SWITCH	292271
	SUBBASE TANK FUEL GAGE	292266		SUBBASE TANK LOW FUEL SWITCH	292282
	SUBBASE TANK FUEL GAGE	292267	1	Sleeve, insulating	X-415-9
			1	Switch, low fuel level	292269
	SUBBASE TANK FUEL GAGE	292268		SUBBASE TANK LOW FUEL SWITCH	292283
			1	Sleeve, insulating	X-415-9
			1	Switch, low fuel level	292270
				SUBBASE TANK LOW FUEL SWITCH	292284
			1	Sleeve, insulating	X-415-9
			1	Switch, low fuel level	292271
				SUBBASE TANK LOW FUEL SWITCH	292285
			1	Sleeve, insulating	X-415-9
			1	Switch, low fuel level	292272

X Not Sold Separately

# Series 189

## Accessories

**Subbase Tank  
Float Switch**

**Subbase Tank  
Transfer Pump**

Qty. Description	Part No.	Qty. Description	Part No.
SUBBASE TANK FLOAT SWITCH	274797	SUBBASE TANK TRANSFER PUMP	274781
SUBBASE TANK FLOAT SWITCH	274798	1 Box assembly, control	A-274818
		1 Pump assembly, motor	A-290024
		1 Bushing, 1/4 x 1 reducer	D-2159
		4 Screw, 5/16-18 x 1, Gr. 5	X-125-5
		4 Washer, 5/16 split lock	X-21-1
		4 Washer, 11/32 x 11/16 x 1/16 plain	X-25-85
		1 Line, flexible fuel	X-386-81
		2 Connector, hose elbow	X-391-20
		2 Clamp, 1 in. hose	X-426-10
		4 Nut, 5/16-18	X-82-2
		1 Connector, conduit	156327

X Not Sold Separately

# Series 189

## Accessories

### Tachometer

### Tail Pipe Kit

Qty.	Description	Part No.	Qty.	Description	Part No.
	TACHOMETER KIT	274888		TAIL PIPE KIT	273919
1	Tubing, shrinkable	X-748-22	1	Cap, rain	253191
1	Terminal	237661	1	Tube, exhaust	273922
1	Tachometer	254204	1	Clamp, exhaust pipe	286283
				TAIL PIPE KIT	273920
			1	Nut, 3/8 NPT lock	X-6038-2
			1	Cap, rain	253191
			1	Adapter, exhaust	273925
				TAIL PIPE KIT	273921
			1	Cap, rain	253990
			1	Tube, exhaust	273924
			1	Clamp, exhaust pipe	289372
				TAIL PIPE KIT	273928
			1	Cap, rain	253990

X Not Sold Separately

# Series 189

## Accessories

### Terminal Lug Kit

Qty.	Description	Part No.	Qty.	Description	Part No.	
	TERMINAL LUG KIT	274693		TERMINAL LUG KIT	274698	
4	Washer, 1/4 split lock	X-20-1	8	Washer, 3/8 split lock	X-22-1	
4	Washer, 9/32 x 5/8 x 1/16 plain	X-25-40	8	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	
4	Screw, 1/4-20 x 1-1/2	X-465-9	8	Screw, 3/8-16 x 1-3/4	X-6238-1	
4	Lug	X-6207-7	8	Nut, 3/8-16	X-83-2	
4	Nut, 1/4-20	X-81-14	4	Bracket, lug retaining	297981	
4	Bracket, lug retaining	275473				
	TERMINAL LUG KIT	274694		TERMINAL LUG KIT	274699	
4	Washer, 3/8 split lock	X-22-1	8	Washer, 3/8 split lock	X-22-1	
4	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	8	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	
4	Lug	X-6207-8	8	Screw, 3/8-16 x 1-3/4	X-6238-1	
4	Screw, 3/8-16 x 1-1/4	X-6238-4	8	Nut, 3/8-16	X-83-2	
4	Nut, 3/8-16	X-83-2	4	Lug, terminal	297983	
4	Bracket, lug retaining	275471				
	TERMINAL LUG KIT	274695		TERMINAL LUG KIT	274700	
4	Washer, 3/8 split lock	X-22-1	8	Washer, 3/8 split lock	X-22-1	
4	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	8	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	
4	Lug	X-6207-5	8	Screw, 3/8-16 x 1-3/4	X-6238-1	
4	Screw, 3/8-16 x 1-1/4	X-6238-4	8	Nut, 3/8-16	X-83-2	
4	Nut, 3/8-16	X-83-2	4	Bracket, lug retaining	297582	
4	Bracket, lug retaining	275474				
	TERMINAL LUG KIT	274696		TERMINAL LUG KIT	274778	
8	Washer, 3/8 split lock	X-22-1	8	Washer, 3/8 split lock	X-22-1	
8	Washer, 25/64 x 7/8 x 1/16 plain	X-25-18	8	Stud, self-clinching	X-6205-11	
8	Lug	X-6207-8	8	Nut, 3/8-16	X-83-2	
4	Screw, 3/8-16 x 1-1/4	X-6238-4	4	Terminal	297981	
4	Nut, 3/8-16	X-83-2				
4	Bracket, lug retaining	275469		TERMINAL LUG KIT	274779	
	TERMINAL LUG KIT	274697		8	Washer, 3/8 split lock	X-22-1
4	Washer, 3/8 split lock	X-22-1	8	Stud, self-clinching	X-6205-11	
4	Stud, self-clinching	X-6205-11	8	Nut, 3/8-16	X-83-2	
4	Lug	X-6207-9	4	Terminal	297983	
8	Nut, 3/8-16	X-83-2				
4	Bracket, lug retaining	275470				

X Not Sold Separately



# Series 189

## Accessories

### Voltage Regulator Kit, Remote Mounting

### Wattmeter Kits

Qty.	Description	Part No.	Qty.	Description	Part No.
	VOLTAGE REGULATOR KIT	273611		WATTMETER KIT	274358
1	Regulator assembly	A-263266	2	Washer, #10 split lock	X-19-1
2	Washer, #8 split lock	X-18-2	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
2	Screw, 8-32 x 3/4	X-51-11	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
2	Nut, 8-32	X-72-4	2	Insulink, 22-18 Ga.	X-367-6
1	Strip, marker	263268	2	Screw, 10-24 x 5/8	X-50-8
1	Harness, wiring	273941	2	Nut, 10-24	X-70-2
			3	Transformer, current	246885
			1	Wattmeter	274329
			1	Transducer, watt	274340
				WATTMETER KIT	274359
			2	Washer, #10 split lock	X-19-1
			2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
			16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
			2	Insulink, 22-18 Ga.	X-367-6
			2	Screw, 10-24 x 5/8	X-50-8
			2	Nut, 10-24	X-70-2
			3	Transformer, current	246886
			1	Wattmeter	274330
			1	Transducer, watt	274341
				WATTMETER KIT	274360
			2	Washer, #10 split lock	X-19-1
			2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
			16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
			2	Insulink, 22-18 Ga.	X-367-6
			2	Screw, 10-24 x 5/8	X-50-8
			2	Nut, 10-24	X-70-2
			3	Transformer, current	246887
			1	Wattmeter	274331
			1	Transducer, watt	274342
				WATTMETER KIT	274361
			2	Washer, #10 split lock	X-19-1
			2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
			16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
			2	Insulink, 22-18 Ga.	X-367-6
			2	Screw, 10-24 x 5/8	X-50-8
			2	Nut, 10-24	X-70-2
			3	Transformer, current	246889
			1	Wattmeter	274332
			1	Transducer, watt	274343

X Not Sold Separately

# Series 189

## Accessories

### Wattmeter Kits (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	WATTMETER KIT	274362		WATTMETER KIT	274367
2	Washer, #10 split lock	X-19-1	2	Washer, #8 split lock	X-18-2
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Washer, #10 split lock	X-19-1
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	2	Terminal, 1/4 eyelet 16-14 Ga.	X-283-4
2	Insulink, 22-18 Ga.	X-367-6	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
2	Screw, 10-24 x 5/8	X-50-8	2	Insulink, 22-18 Ga.	X-367-6
2	Nut, 10-24	X-70-2	4	Terminal, 1/4 F push-on fully insulated	X-431-30
3	Transformer, current	248875	2	Screw, 10-24 x 5/8	X-50-8
1	Wattmeter	274333	2	Screw, 8-32 x 3/8	X-51-12
1	Transducer, watt	274344	2	Nut, 10-24	X-70-2
	WATTMETER KIT	274363	2	Nut, 8-32	X-72-4
2	Washer, #10 split lock	X-19-1	3	Transformer, current	246887
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	1	Wattmeter	274331
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	1	Transducer, watt	274349
2	Insulink, 22-18 Ga.	X-367-6	2	Transformer	283619
2	Screw, 10-24 x 5/8	X-50-8		WATTMETER	274368
2	Nut, 10-24	X-70-2	2	Washer, #8 split lock	X-18-2
3	Transformer, current	246877	2	Washer, #10 split lock	X-19-1
1	Wattmeter	274334	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
1	Transducer, watt	274345	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
	WATTMETER KIT	274365	2	Insulink, 22-18 Ga.	X-367-6
2	Washer, #8 split lock	X-18-2	4	Terminal, 1/4 F push-on fully insulated	X-431-30
2	Washer, #10 split lock	X-19-1	2	Screw, 10-24 x 5/8	X-50-8
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Screw, 8-32 x 3/8	X-51-12
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	2	Nut, 10-24	X-70-2
2	Insulink, 22-18 Ga.	X-367-6	2	Nut, 8-32	X-72-4
4	Terminal, 1/4 F push-on fully insulated	X-431-30	3	Transformer, current	246889
2	Screw, 10-24 x 5/8	X-50-8	1	Wattmeter	274332
2	Screw, 8-32 3/8	X-51-12	1	Transducer, watt	274350
2	Nut, 10-24	X-70-2	2	Transformer	283619
2	Nut, 8-32	X-72-4		WATTMETER	274369
3	Transformer, current	246885	2	Washer, #8 split lock	X-18-2
1	Wattmeter	274329	2	Washer, #10 split lock	X-19-1
1	Transducer, watt	274347	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
2	Transformer	283619	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
	WATTMETER KIT	274366	2	Insulink, 22-18 Ga.	X-367-6
2	Washer, #8 split lock	X-18-2	4	Terminal, 1/4 F push-on fully insulated	X-431-30
2	Washer, #10 split lock	X-19-1	2	Screw, 10-24 x 5/8	X-50-8
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Screw, 8-32 x 3/8	X-51-12
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	2	Nut, 10-24	X-70-2
2	Insulink, 22-18 Ga.	X-367-6	2	Nut, 8-32	X-72-4
4	Terminal, 1/4 F push-on fully insulated	X-431-30	3	Transformer, current	248874
2	Screw, 10-24 x 5/8	X-50-8	1	Wattmeter	274333
2	Screw, 8-32 x 3/8	X-51-12	1	Transducer, watt	274351
2	Nut, 10-24	X-70-2	2	Transformer	283619
2	Nut, 8-32	X-72-4			
3	Transformer, current	246886			
1	Wattmeter	274330			
1	Transducer, watt	274348			
2	Transformer	283619			

X Not Sold Separately

# Series 189

## Accessories

### Wattmeter Kits (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	WATTMETER	274370		WATTMETER	274373
4	Washer, #8 split lock	X-18-2	4	Washer #8 split lock	X-18-2
2	Washer, #10 split lock	X-19-1	2	Washer, #10 split lock	X-19-1
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
2	Insulink, 22-18 Ga.	X-367-6	2	Insulink, 22-18 Ga.	X-367-6
8	Terminal, 1/4 F push-on fully insulated	X-431-30	8	Terminal, 1/4 F push-on fully insulated	X-431-30
2	Screw, 10-24 x 5/8	X-50-8	2	Screw, 10-24 x 5/8	X-50-8
4	Screw, 8-32 x 3/8	X-51-12	4	Screw, 8-32 x 3/8	X-51-12
2	Nut, 10-24	X-70-2	2	Nut, 10-24	X-70-2
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
3	Transformer, current	248878	3	Transformer, current	246885
1	Wattmeter	274334	1	Wattmeter	274331
1	Transducer, watt	274352	1	Transducer, watt	274349
2	Transformer	283619	2	Transformer	289809
	WATTMETER	274371		WATTMETER	274374
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
2	Washer, #10 split lock	X-19-1	2	Washer, #10 split lock	X-19-1
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
2	Insulink, 22-18 Ga.	X-367-6	2	Insulink, 22-18 Ga.	X-367-6
8	Terminal, 1/4 push-on fully insulated	X-431-30	8	Terminal, 1/4 F push-on insulated	X-431-30
2	Screw, 10-24 x 5/8	X-50-8	2	Screw, 10-24 x 5/8	X-50-8
4	Screw, 8-32 x 3/8	X-51-12	4	Screw, 8-32 x 3/8	X-51-12
2	Nut, 10-24	X-70-2	2	Nut, 10-24	X-70-2
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
3	Transformer, current	255278	3	Transformer, current	246886
1	Wattmeter	274329	1	Wattmeter	274332
1	Transducer, watt	274347	1	Transducer, watt	274350
2	Transformer	289809	2	Transformer	289809
	WATTMETER	274372		WATTMETER	274375
4	Washer, #8 split lock	X-18-2	4	Washer, #8 split lock	X-18-2
2	Washer, #10 split lock	X-19-1	2	Washer, #10 split lock	X-19-1
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4	2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9	16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9
2	Insulink, 22-18 Ga.	X-367-6	2	Insulink, 22-18 Ga.	X-367-6
8	Terminal, 1/4 F push-on fully insulated	X-431-30	8	Terminal, 1/4 F push-on fully insulated	X-431-30
2	Screw, 10-24 x 5/8	X-50-8	2	Screw, 10-24 x 5/8	X-50-8
4	Screw, 8-32 x 3/8	X-51-12	4	Screw, 8-32 x 3/8	X-51-12
2	Nut, 10-24	X-70-2	2	Nut, 10-24	X-70-2
4	Nut, 8-32	X-72-4	4	Nut, 8-32	X-72-4
3	Transformer, current	246884	3	Transformer, current	246887
1	Wattmeter	274330	1	Wattmeter	274333
1	Transducer, watt	274348	1	Transducer, watt	274351
2	Transformer	289809	2	Transformer	289809

X Not Sold Separately

# Series 189

## Accessories

### Wattmeter Kits (cont'd.)

Qty.	Description	Part No.	Qty.	Description	Part No.
	WATTMETER	274376			
4	Washer, #8 split lock	X-18-2			
2	Washer, #10 split lock	X-19-1			
2	Terminal, 1/4 eyelet, 16-14 Ga.	X-283-4			
16	Terminal, 1/4 eyelet, 22-16 Ga.	X-285-9			
2	Insulink, 22-18 Ga.	X-367-6			
8	Terminal, 1/4 F push-on fully insulated	X-431-30			
2	Screw, 10-24 x 5/8	X-50-8			
4	Screw, 8-32 x 3/8	X-51-12			
2	Nut, 10-24	X-70-2			
4	Nut, 8-32	X-72-4			
3	Transformer, current	246884			
1	Wattmeter	274334			
1	Transducer, watt	274352			
2	Transformer	289809			

X Not Sold Separately

# Series 189

## Group 701-184- Literature

Variation No.	Spec. Sheet	Installation Manual	Prestart Checklist	GENERATOR			ENGINE		
				Operation Manual	Service Manual	Parts Catalog	Operation Manual	Service Manual	Parts Catalog
1 *	G05-080	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5434
	G05-080	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5368
2 **	G05-084	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5386
	G05-084	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5370
3	G05-086	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5361	TP-5362	TP-5369
4	G05-088	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5361	TP-5362	TP-5369
5	G05-082	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5368
6	G05-081	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5368
7 *	G05-079	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5434
	G05-079	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5368
8	G05-083	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5355	TP-5356	TP-5368
9	G05-085	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5386
10	G05-087	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5361	TP-5362	TP-5369
11	G05-081	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5434
12	G05-082	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5434
13	G05-083	ES-420	ES-527	TP-5352	TP-5353	TP-5408	TP-5430	TP-5419	TP-5434

\* Use first row of manual numbers for generator set serial nos. 257821 and above. Use second row of manual numbers for generator set serial nos. below 257821.

\*\* Use first row of manual numbers for generator sets using engine models TO6059T/6059TL. Use second row of manual numbers for generator sets using engine model 6359TL.

X Not Sold Separately

# COMMON HARDWARE IDENTIFICATION

The common hardware has many different head, drive, and grade (hardness) styles. Some of the more common types are shown below. Use this as a guide for identification purposes. Not all generator hardware used is shown.

## SCREWS/BOLTS/STUDS

### HEAD STYLES



Hex. Head or Machine Head



Hex. Head or Machine Head



Hex. Head or Machine Head with Washer



Flat Head



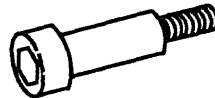
Round Head



Pan Head



Socket Head Cap or Allen Head Cap



Socket Head or Allen Head Shoulder Bolt



Sheet Metal Screw



Stud

### DRIVE STYLES



Hex.



Hex. and Slotted



Phillips



Slotted



Hex. Socket

### GRADE (HARDNESS)

#### American Standard



Grade 2



Grade 5

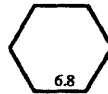


Grade 8

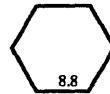


Grade 8/9

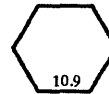
#### Metric



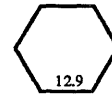
6.8



8.8



10.9



12.9

### SAMPLE DIMENSIONS

#### American Standard

Major thread diameter in fractional inches or screw number size  $\frac{1}{4}$ -20 x  $\frac{1}{2}$  Length in inches  
Threads per inch

#### Metric

Major thread diameter in millimeters  $M8-1.25$  x 20 Length in millimeters  
Distance between threads in millimeters

## NUTS

### STYLES



Hex. Head



Lock Nut or  
Nylock Nut



Square  
Nut



Cap Nut or  
Acorn Nut



Wing Nut

### GRADE (HARDNESS)

#### American Standard

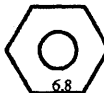


Grade 2

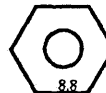


Grade 5

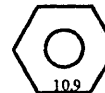
#### Metric



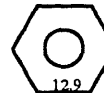
6.8



8.8



10.9



12.9

### SAMPLE DIMENSIONS

#### American Standard

Major thread diameter in fractional inches or screw number size  $\frac{1}{4}-20$  Threads per inch

#### Metric

Major thread diameter in millimeters  $M8-1.25$  Distance between threads in millimeters

## WASHERS

### STYLES



Plain  
Washer



Split Lock  
Washer or  
Spring Washer



Spring Washer  
or Wave Washer



External  
Tooth Lock  
Washer



Internal Tooth  
Lock Washer



Internal-External  
Tooth Lock Washer

### GRADE (HARDNESS)

There is no marking to identify hardness. Usually hardened washers have a black oxide or black phosphate finish rather than a zinc (siler-colored) finish.

### SAMPLE DIMENSIONS

#### Plain Washers

Internal Dimension  $\frac{9}{32} \times \frac{5}{8} \times \frac{1}{16}$  Thickness  
External Dimension

#### Lock Washers

$\frac{5}{8}$   
Internal Dimension

