

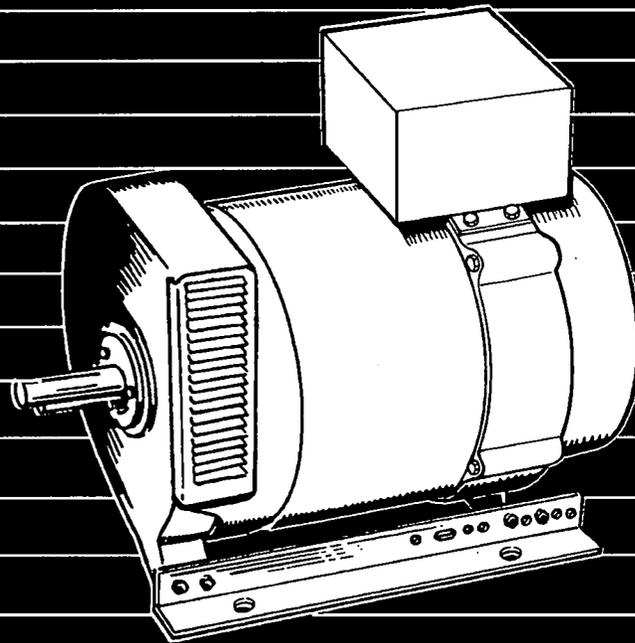
Onan

Generator Operator's Manual

YD PTO

PROTEC Series

Add Supplement
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Safety Precautions

Before operating the generator, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

GASOLINE AND LPG FUEL MAY BE ACCIDENTALLY IGNITED BY ELECTRICAL SPARKS, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

- Do not tie electrical wiring to fuel lines.
- Do not run electrical lines and fuel lines through the same compartment openings.
- Keep electrical and fuel lines as far apart as possible.
- Place a physical barrier between fuel lines and electrical lines wherever possible.
- If electrical and fuel lines must pass through the same compartment opening, make certain that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.
- **DO NOT SMOKE** while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

Safety Precautions

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator, disconnect batteries, negative (-) cable last. This will prevent accidental arcing.
- Keep your hands away from moving parts.
- Make sure that fasteners on the generator are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry while working on generators. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- **DO NOT CONNECT GENERATOR DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM.** Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Have a fire extinguisher nearby. Maintain extinguisher properly and become familiar with its use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and generator damage, which presents a potential fire hazard.
- **DO NOT** store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Section 1. Introduction

ABOUT THIS MANUAL

This manual covers the operation and maintenance of the Onan PROTEC YD AC PTO generator. For more information, see these publications:

- PROTEC AC PTO Installation Manual (publication # 929-0600)
- YD Generator Service Manual (publication # 900-0184)

Read this manual carefully, and follow all warnings and cautions. Using the generator properly and following a regular maintenance schedule can result in longer unit life, better performance, and safer operation. The generator must be installed properly to operate safely.

HOW TO OBTAIN SERVICE

When the unit needs service, call an authorized service center and give them the complete model number and serial number listed on the generator nameplate.

Factory-trained parts and service centers can handle your service needs. The Parts and Service Center Directory (publication F-118, included) lists the nearest center.

GENERATOR

The PROTEC AC PTO generator features the Onan YD generator. The YD series AC generators are two-bearing, 1800 rpm, 60 Hertz units designed for direct drive from a power takeoff unit connected to a vehicle engine.

A centrifugal blower, on the front end of the rotor shaft, circulates the generator cooling air which is drawn in through the end bell cover, over the rotor, and discharged through an outlet at the blower end. See Figure 1-1.

A ball bearing at each end of the generator supports the rotor shaft. The end bell and stator housing are attached by four through-studs which pass through the stator assembly. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the rotor shaft.

VOLTAGE REGULATOR

The voltage regulator assembly includes the following components:

- Printed circuit board
- Voltage reference transformer
- Commutating reactor assembly
- Field circuit breaker

The AC PTO voltage regulator is housed in a remote box which may be mounted in any convenient location within a short range of the generator.

METER/BREAKER BOX

The meter/breaker box contains the following components:

- Voltmeter
- Ammeters
- Line circuit breakers
- Marked output terminals
- Conduit connector and hardware
- Current transformers

These components are used to indicate alternator voltage, load current and voltage regulation with a varying load.

Figure 1-2 illustrates the control box and its faceplate.

OPERATION

Residual magnetism in the generator rotor and a permanent magnet embedded in one exciter field pole begin the voltage buildup process as the generator starts running. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference voltage for maintaining the generator output voltage. The AC reference voltage is converted to DC by a silicon controlled rectifier bridge on the voltage regulator printed circuit board and fed into the exciter field windings. The exciter armature produces three-phase AC voltage that is converted to DC by the rotating rectifier assembly. The resulting DC voltage excites the generator rotor winding to produce the stator output voltage for the AC load.

Figure 1-1 illustrates the YD AC PTO generator. Figure 1-2 illustrates the PTO generator meter/circuit breaker box.

Section 2. Specifications

Design: Revolving field: 4 pole. Drip-proof construction. Skewed stator minimizes field heating and voltage harmonics. Stator laminations welded in heavy steel frame. Dynamically balanced rotor. Windings epoxy impregnated and over-coated for environmental protection and improved cooling.

Bearings: 2, double sealed, prelubricated ball

Cooling: Direct-drive centrifugal blower. Single-opening air outlet, 250 ft³/m (7.08 m³/min), easily ducted

Output Box: Top mounted. Houses output terminals and conduit connectors.

Exciter System: Brushless, with 8-pole stator mounted in end bell. Rectifier assemblies encapsulated for environmental protection. Permanent magnet in stator field provides reliable voltage buildup.

Voltage Regulator: Components include printed circuit board, voltage reference transformer, commutating reactor, field circuit breaker, voltage adjust rheostat.

Insulation System: Class F, per NEMA MG1-1.65 definition. Insulating varnish conforms with MIL-I-24092, Grade CB, Class 155° C.

Electromagnetic Interference Attenuation: Meets requirements of most industrial and commercial applications.

Configuration: Platform-mounted or side-mounted.

<p>15 KW GENERATOR Voltage/Frequency: 120/240 VAC @ 60 Hz Phase: One Wires: Four Watts: 15 Kw kVA at PF: 15.0 @ 1.0 power factor Circuit breaker rating: 70 amps</p>	<p>Ampere meter rating: 0 - 100 amperes Height: 19.55 inches Width: 15.0 inches Length: 21.9 inches Weight: 306 pounds Meter/breaker box dimensions: 10-15/16" x 16-7/16" x 4-1/2"</p>
<p>20 KW GENERATOR Voltage/Frequency: 120/240 VAC @ 60 Hz Phase: One Wires: Four Watts: 20 Kw kVA at PF: 20.0 @ 1.0 power factor Circuit breaker rating (amps): 85</p>	<p>Ampere meter rating: 0 - 100 amperes Height: 19.55 inches Width: 15.0 inches Length: 23.34 inches Weight: 356 pounds Meter/breaker box dimensions: 15" x 16-1/2" x 10"</p>
<p>24 KW GENERATOR Voltage/Frequency: 120/240 VAC @ 60 Hz Phase: One Wires: Four Watts: 24 Kw kVA at PF: 24.0 @ 1.0 power factor Circuit breaker rating (amps): 100</p>	<p>Ampere meter rating: 0 - 150 amperes Height: 19.55 inches Width: 15.0 inches Length: 24.59 inches Weight: 398 pounds Meter/breaker box dimensions: 15" x 16-1/2" x 10"</p>
<p>30 KW GENERATOR Voltage/Frequency: 120/240 VAC @ 60 Hz Phase: One Wires: Four Watts: 30 Kw kVA at PF: 30.0 @ 1.0 power factor Circuit breaker rating: 150 amps</p>	<p>Ampere meter rating: 0 - 200 amperes Height: 19.55 inches Width: 15.0 inches Length: 26.21 inches Weight: 453 pounds Meter/breaker box dimensions: 15" x 16-1/2" x 10"</p>
<p>35 KW GENERATOR Voltage/Frequency: 120/240 VAC @ 60 Hz Phase: One Wires: Four Watts: 35 Kw kVA at PF: 35.0 @ 1.0 power factor Circuit breaker rating: 175 amps</p>	<p>Ampere meter rating: 0 - 200 amperes Height: 19.55 inches Width: 15.0 inches Length: 27.97 inches Weight: 512 pounds Meter/breaker box dimensions: 15" x 16-1/2" x 10"</p>
<p>Voltage Regulator Box Dimensions (all generators) 8" x 7.75" x 2.75"</p>	

Section 3. Operation

STARTUP CONSIDERATIONS

Components of the Onan YD AC PTO generator include:

- YD generator with mounting hardware
- Voltage regulator in box
- Meter/breaker box with ampere and voltmeters and circuit breakers

These components are not supplied by Onan:

- Driving source (normally the vehicle propulsion engine)
- External governor unit, dedicated to maintaining 1800 rpm from the driving source
- Dedicated power takeoff unit with clutch or transmission to engage the generator
- Remote control unit for the power takeoff unit
- Interlock systems to keep the PTO from being started in the wrong circumstances (vehicle in gear, brakes off, etc.).

TYPICAL STARTUP PROCEDURE

Although most installations vary, a typical startup procedure follows. These steps depend on the procedures recommended by the manufacturers of the non-Onan components of the system: the engine, governor, power takeoff unit and remote control unit. **Consult their instruction manuals before starting the PTO system.**

1. **Engage the vehicle emergency brake.** Most installations will have an interlock that keeps the PTO system from being started unless the brake is engaged and the vehicle is motionless.
2. **Verify that the vehicle transmission is in the NEUTRAL position.** Most installations will have an interlock that prevents the PTO system from being started unless the transmission is in neutral.
3. **Start the vehicle propulsion engine** (if not already running).
4. **Verify that the engine is running at low RPM.** On most installations, the PTO output will be geared up to provide the 1800 rpm (1500 rpm, 50 Hz units) and 30 horsepower or less that the YD AC generator requires. A typical engine/PTO output ratio might be 1:1.29. This means that the vehicle engine will be running at 1400 rpm to provide 1800 rpm to the generator. Most installations will have an interlock to keep the PTO from being started at high RPM.
5. **Actuate the governor/PTO system.** The engine governor and the geared PTO are actuated, beginning rotation of the Onan YD generator. The engine governor system maintains PTO output speed at 1800 rpm (1500 rpm for 50 Hz system), adjusting engine speed to compensate for the generator's electrical load.
6. **Verify the output voltage and frequency on the Onan switch/meter panel.** The Onan meter panel provides verification of output voltage and frequency: these should quickly stabilize at 120/240 VAC and 60 Hz (or other voltage/frequency, depending on model).
7. **Close the circuit breakers on the Onan panel (if not already closed).** The breakers on the Onan panel provide system protection from electrical shorts or overloads. Ampere rating of the breakers depends on the size of the generator.
8. **Apply power to the load.** External switches or plug connections may be used to apply power to the load, depending on the application. **Note: depending on the configuration, the load may be powered by closing the breakers on the Onan panel.**

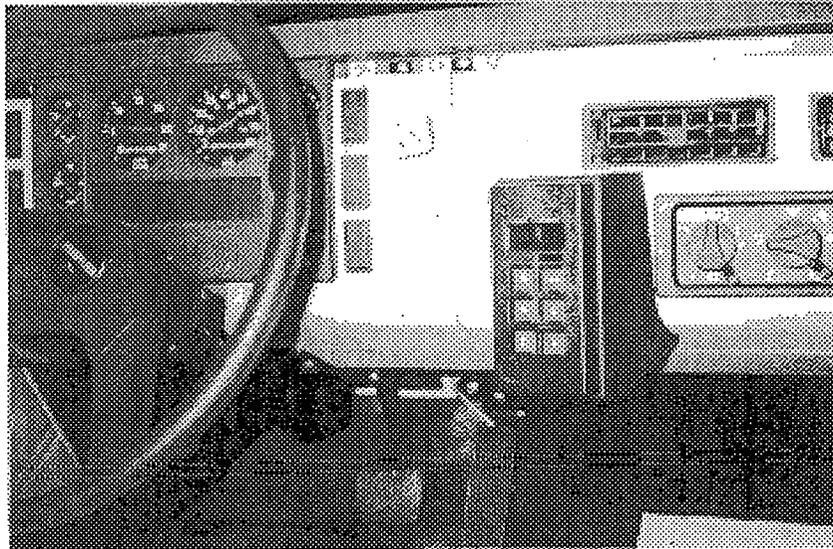
⚠ WARNING Exhaust gas presents the hazard of severe personal injury or death. Inspect the vehicle exhaust system audibly and visually before operating the PTO. Have any leaks repaired immediately.

APPLYING ELECTRICAL LOAD

- Allow the driving source to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. Although the generator can handle a 20% overload for ten minutes, the breakers supplied by Onan will not permit it. For normal operation, keep the load within nameplate rating.
- Connect the electrical load after the generator operates correctly at no load. When applying load to electric motors, connect one at a time,

allowing each to reach running speed before connecting the next one. Motors require much more current for starting than when running at normal speed. Therefore, if several motors were connected at the same time, the generator could be so overloaded that none of the motors would start.

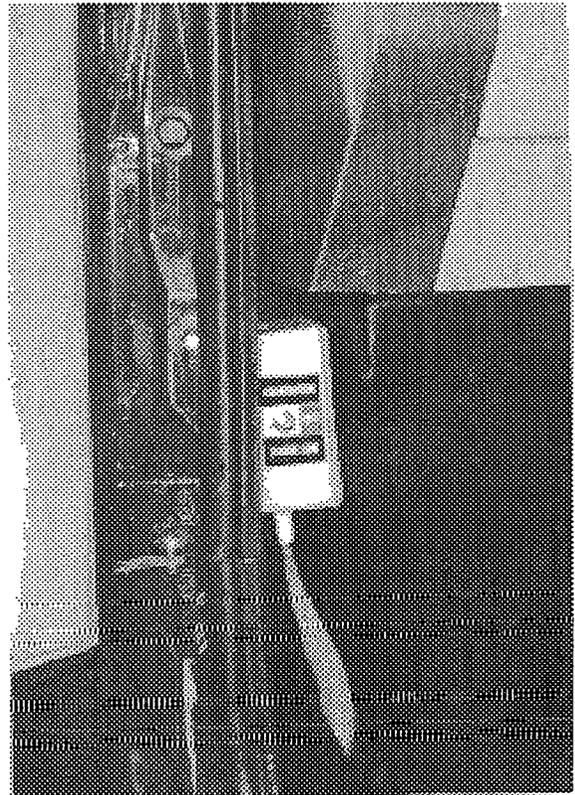
- If the engine governor does not provide effective regulation, or if the engine is operating at maximum capacity, it may be necessary to manually adjust the engine throttle control in accordance with changes in generator load.



TYPICAL IN-CAB PTO CONTROL



METER/BREAKER BOX MOUNTING



PTO ON-OFF SWITCH

FIGURE 3-1. EXAMPLES OF PTO CONTROL SYSTEMS

Section 4. Maintenance/Troubleshooting

MAINTENANCE

The Onan YD PTO AC generator is a low-maintenance unit: only a few principles need to be kept in mind to keep the generator running correctly:

- Keep the generator clean: remove dirt, oil, grease and other foreign substances on a regular basis
- Make certain that the air inlet and outlet to the generator are unobstructed, so that it may be cooled properly
- Inspect the generator regularly. Make a good visual check before, during, and after the generator is operating; look for loose or broken leads and bad connections.
- Check the torque on the generator holddown bolts and retighten if necessary (see Installation Manual for rating).

TROUBLESHOOTING

A few simple checks and a proper troubleshooting procedure can locate the probable source of trouble and cut down troubleshooting time.

- Check all modifications, repairs, and replacements performed since last satisfactory operation of the generator, to be sure that connection of the generator leads are correct. A loose wire

connection, overlooked when installing a replacement part, could cause problems. An incorrect connection, an opened circuit breaker, or a loose printed circuit board are all potential malfunction areas to be eliminated by a visual check.

- Unless absolutely sure that the panel instruments are accurate, use portable test meters for troubleshooting.
- Visually inspect components inside the voltage regulator box. Look for dirt, dust, moisture, burned resistors, arcing tracks and cracks in the printed circuit conductors.
- Coupling direct drive units have the driving unit and generator shafts in line with each other. If either the driving unit or the generator is loosened from the base, the loosened unit must be properly realigned when reinstalled.

CLEANING THE GENERATOR

Clean the generator every six months, or more often in severe conditions. Remove dust with a damp cloth. Use steam to remove tar or other residue (do not steam-clean the generator while it is running). Protect the generator, voltage regulator, and meter/breaker box from cleaning solutions. Do not clean with solvents; they may damage electrical connectors.

TROUBLESHOOTING GUIDE

⚠ WARNING *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electricity and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

	SYMPTOM	CORRECTION
Generator overheats	<ol style="list-style-type: none"> 1. Windings and parts covered with dirt and oil. 2. Air intake is restricted or incoming air is too hot. 3. Overloaded. 	<ol style="list-style-type: none"> 1. Disassemble generator and clean. 2. Take necessary steps to allow for proper cooling. 3. Check load.
Noisy generator	<ol style="list-style-type: none"> 1. Generator loose on mounting. 2. Defective bearing. 	<ol style="list-style-type: none"> 1. Tighten/replace mounting bolts. 2. Replace. Check alignment (call Onan service center).
No voltage output	<ol style="list-style-type: none"> 1. Voltage regulator trouble, or open, short or grounded circuit in generator. 2. Generator leads broken or loose. 3. PTO transmission failure. 	<ol style="list-style-type: none"> 1. Call Onan service center. 2. Tighten connections and replace broken leads. 3. Repair/replace PTO.
Low voltage output	<ol style="list-style-type: none"> 1. Speed low because of faulty PTO and/or governor. 2. External short circuit on line. 3. Open circuit to voltage regulator. 4. Short circuit of winding in field or armature. 	<ol style="list-style-type: none"> 1. Adjust/repair PTO/governor system as required. 2. Test generator with output leads disconnected. 3. Make proper connections. 4. Call Onan service center.

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