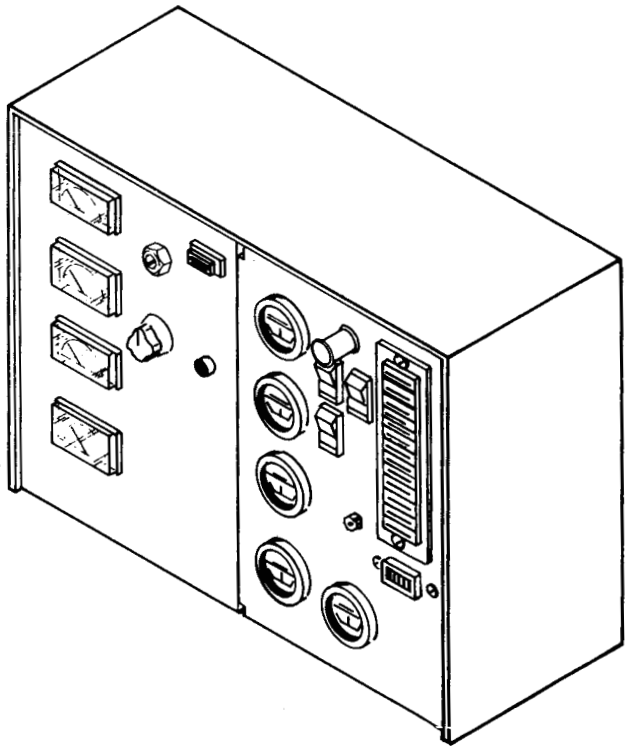
Caution: This document contains mixed page sizes (8.5 x 11 or 11 x 17), which may affect printing. Please adjust your printer settings according to the size of each page you wish to print.

Onan

Service Manual

Detector

GenSet Control



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Printed in U.S.A.

Safety Precautions

The following symbols in this manual highlight conditions potentially dangerous to service personnel, or equipment. Read this manual carefully. Know when these conditions can exist. Then take necessary steps to protect personnel as well as equipment.

⚠DANGER ***This symbol if used 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.***

PROTECT AGAINST MOVING PARTS

Avoid moving parts of the unit. Avoid use of loose jackets, shirts or sleeves due to danger of becoming caught in moving parts.

Make sure all nuts and bolts are secure. Keep power shields and guards in position.

If you must make adjustments while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

Do not work on this equipment when mentally or physically fatigued.

GUARD AGAINST ELECTRIC SHOCK

Disconnect electric power 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.

Disconnect batteries to prevent accidental engine start. Jewelry is a good conductor of electricity and should be removed before working on electrical equipment.

Use extreme caution when working on electrical components. High voltages cause injury or death.

Follow all state and local codes. To avoid possible personal injury or equipment damage, a qualified electrician or an authorized service representative must perform installation and all service.

⚠WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas formed during the combustion of hydrocarbon fuels. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning are the following:

- ***Inability to Think Coherently***
- ***Vomiting***
- ***Muscular Twitching***
- ***Throbbing in Temples***
- ***Dizziness***
- ***Headache***
- ***Weakness and Sleepiness***

If you or anyone else experience any of these symptoms, shut down the unit and get out into the fresh air immediately. If symptoms persist, seek medical attention. DO NOT OPERATE THE UNIT UNTIL IT HAS BEEN INSPECTED AND REPAIRED.

The best protection against carbon monoxide inhalation is proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

Table of Contents

Section 1. Introduction

ABOUT THIS MANUAL

This manual provides basic information regarding your Onan GenSet AC/DC control options, internal component descriptions, and DC control troubleshooting. For the AC control troubleshooting, refer to specific generator service manual. For more DC servicing/troubleshooting refer to specific engine service manual.

Study all manuals carefully and observe all warnings and cautions. Knowing your generator set, using it properly, and following a regular maintenance schedule can result in longer unit life, better performance, and safer operation.

Information for printed circuit board repair is not extensive because solid state printed circuit boards lend themselves more to replacement than repair. Application of meters or hot soldering irons to printed circuit boards by other than qualified personnel can cause unnecessary and expensive damage. Repair of the printed circuit boards is not recommended.

⚠CAUTION ***High voltage testing or high potential (or Megger) testing of generator windings can cause damage to solid state components. Isolate these components before testing.***

TEST EQUIPMENT

Most of the test procedures in this manual can be performed with an AC-DC multimeter such as a Simpson Model 260 VOM or a digital VOM. Some other instruments to have available are:

- Onan Multitester
- Jumper Loads
- Onan Load Test Panel
- AC Voltmeter
- DC Voltmeter

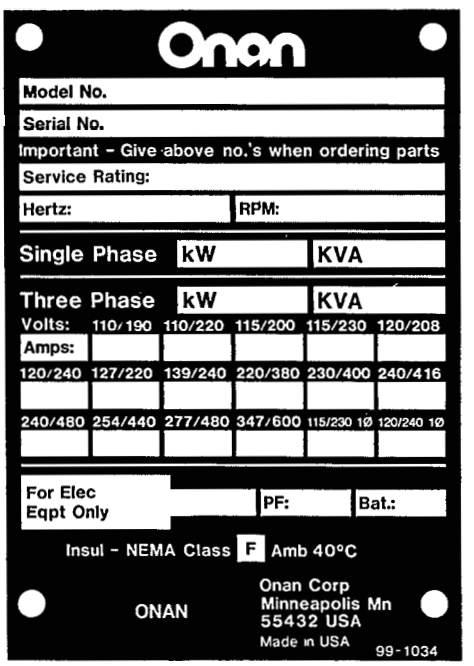
See Tool Catalog 900-0019

HOW TO OBTAIN SERVICE

If the generator set/controls requires servicing beyond the scope of information given in this manual, contact an Onan Distributor for assistance. Onan factory trained Parts and Service representatives are ready to handle all your service needs.

When contacting an Onan Distributor, always supply the complete model number and serial number as shown on the Onan nameplate. The Onan nameplate is located on the side of the generator control box (Figure 1-1).

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury and/or equipment damage. Service personnel must be qualified to perform electrical and/or mechanical service.***



M-1641

FIGURE 1-1. ONAN NAMEPLATE

CONTROLLER DESCRIPTIONS

The control configurations have been designed to accommodate both the vertical and horizontal style control compartments. Although the controls on the exterior of the cabinets are similar, the interior component locations differ somewhat. Refer to the Figure 3-2 for exact component locations of your control cabinet.

The control cabinet is separated into a DC panel for engine-related components on the right side, and an AC panel for generator-related components on the left side.

Depending on options ordered, the control groups can consist of the standard model Detector 2 DC control panel or with options as a Detector 12 control panel (can also include Detector AC meter control panel). The following briefly describes each.

Detector 2 Group

This is the standard model DC control, which offers the minimum features required to operate and monitor the generator set. Its name refers to the two DC operating indicator lamps:

- The green RUN lamp, which lights when unit is operating.
- The red FAULT lamp which lights in the event of shutdown for a low oil pressure, high engine temperature, overcranking, or overspeed condition.

Detector 12 Group

This model DC control group includes options to more effectively monitor the generator set during operation and identify the cause of a shutdown. It also includes pre-alarm monitoring to inform the operator that a shutdown circumstance might occur if attention is not given to an aspect of engine operation soon.

Detector AC Group

This AC control group enables generator monitoring and control at the genset and consists of meters, phase selector, and voltage adjustment.

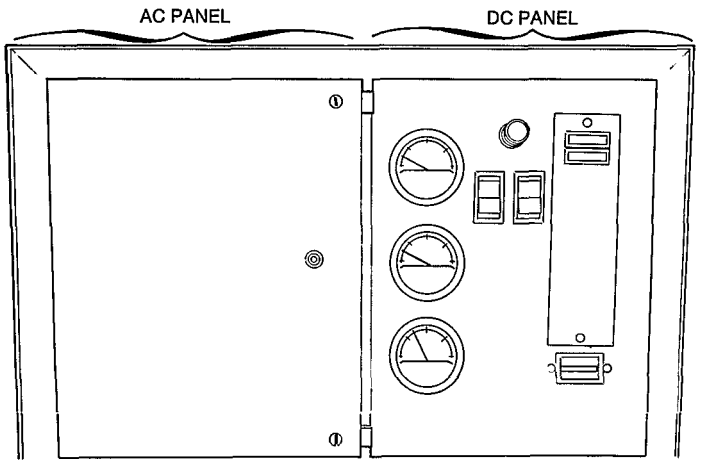


FIGURE 1-2. STANDARD MODEL DETECTOR 2 WITH NO OPTIONS

M-1590-2

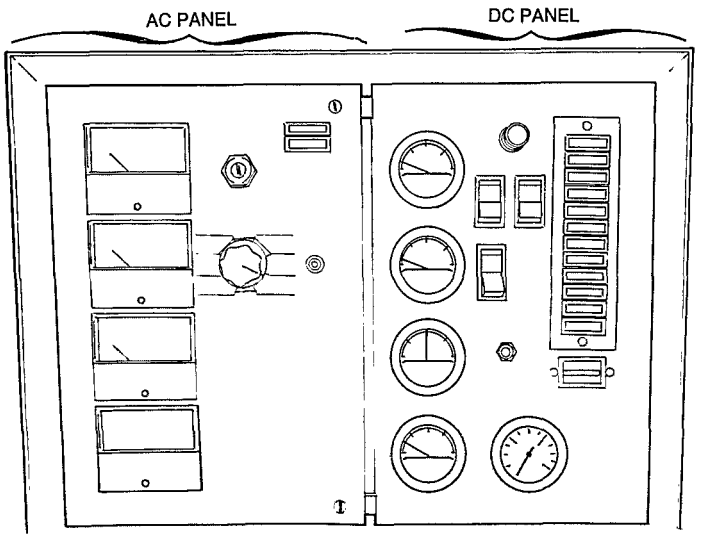


FIGURE 1-3. VERTICAL CONTROL, COMPLETE WITH DETECTOR 12 AND DETECTOR AC OPTIONS

M-1590-1

Section 2. AC Control

CONTROL DESCRIPTIONS

The following describes the optional Detector AC meter package for on-set control and monitoring of the generator.

AC Voltmeter: Dual range instrument indicating generator AC voltage. Measurement range in use shown on indicator light.

AC Ammeter: Dual range instrument indicating generator AC voltage. Measurement range in use shown on indicator light.

Frequency Meter: Indicates generator output frequency in hertz. It can be used to check engine speed (Each hertz equals 30 r/min for 1800 r/min generator sets, 60 r/min for 3600 r/min generator sets.)

Wattmeter: Continuously gives reading of the generator output in kilowatts.

Voltage Adjust: Rheostat providing approximately plus or minus five percent adjustment of the rated output voltage.

Field Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of generator, exciter and voltage regulator.

Phase Selector Switch: Selects phases of generator output to be measured by AC voltmeter and AC ammeter.

Upper and Lower Scale Indicator Lights: Indicates which scale to use on the AC voltmeter and ammeter.

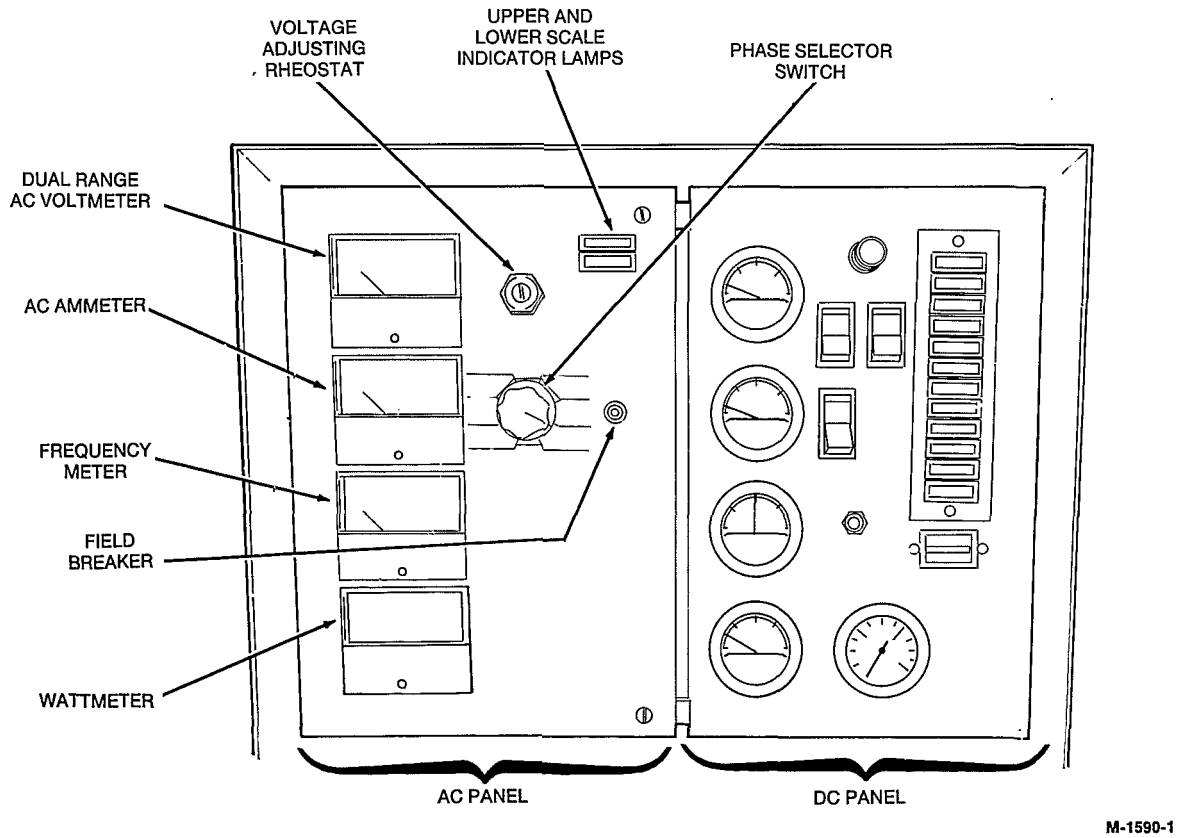


FIGURE 2-1. AC CONTROLS

CONTROL PANEL INTERIOR

The following describes the internal components and their function.

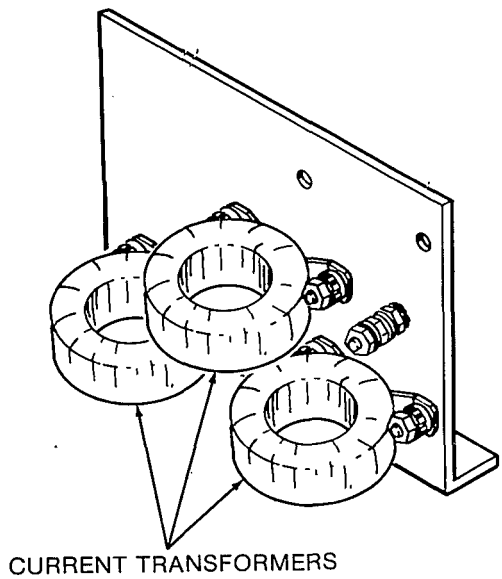
Voltage Regulator

Because the voltage regulator circuit is directly connected to the AC generator, and because it does regulate excitation in response to generator output, this service information is covered with generator service. See the generator service manual for the voltage regulator information.

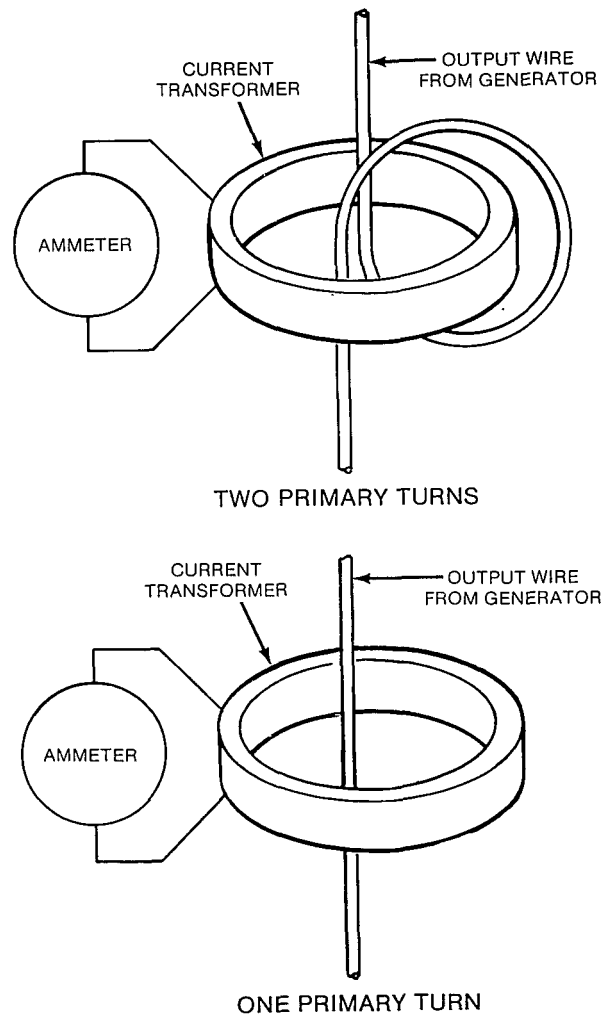
Current Transformers

For generator sets equipped with the optional ammeter, the generator output leads must be routed through the current transformers for proper meter operation. See Figure 2-2. The current transformers are identified as CT21, CT22, etc. on the AC wiring diagrams and electrical schematics.

Refer to the appropriate generator connection diagram to identify the output leads that must be routed through each current transformer. Depending on model of generator set, it may be required to route the generator output leads through the current transformers a second or third winding to accomplish proper amplification for accurate meter movement readings. An output wire passing through a current transformer is considered one primary turn. If passed through again, that would be two primary turns.



CURRENT TRANSFORMERS



ES-1556

FIGURE 2-2. CURRENT TRANSFORMERS

Control Heater

A control heater provides a means of humidity/temperature control of the control box interior to protect the components and ensure their effectiveness when the generator set is subjected to varying ambient air conditions during extended periods of non-use (Figure 2-3). The element is controlled by an adjustable thermostat.

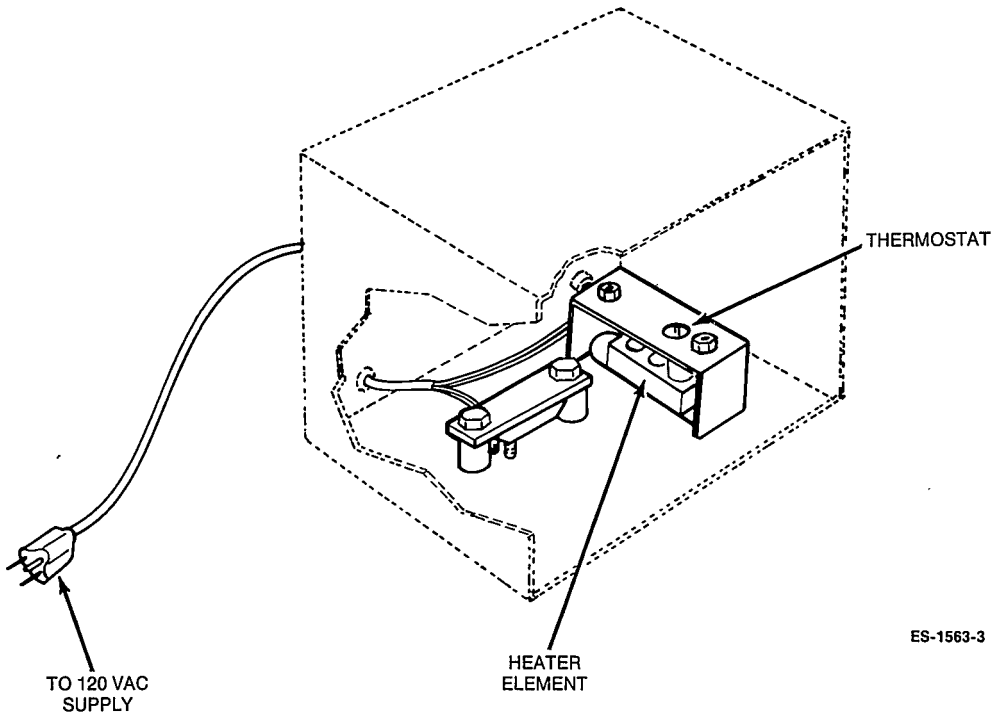


FIGURE 2-3. CONTROL HEATER

Section 3. DC Control

CONTROL DESCRIPTIONS

The following function and operation descriptions includes options. Refer to those applicable to your specific control group. See Figure 3-1.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine (wired to a sensor unit located on the engine.

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Oil Temperature Gauge: Indicates temperature of lubricating oil in engine (wired to a sensor unit located on the engine).

Tachometer: Provides constant monitoring of engine r/min.

Speed Adjust Potentiometer: Operator control for adjusting engine r/min (used with electronic governor only).

Run-Stop-Remote Switch: Starts and stops the unit locally, or from a remote location wired to the control engine monitor board.

Reset, Lamp Test, Panel Lamp Switch: Resets the fault circuit only when the Run-Stop-Remote switch is in the Stop (Reset) position. Tests fault lamps (except 2 light control) and turns on the control panel lamp.

Preheat Switch: Used with diesel engines to provide momentary warm-up of glow plugs.

Running Time Meter: Registers the total number of hours that the unit has run. Use it to keep a record for periodic servicing. Time is cumulative; meter cannot be reset.

Control Panel Lamp: Convenience light for operator.

Indicator Lamps: Refer to the following control group descriptions.

Detector 2 Control

The standard control panel has two monitor system indicator lamps.

- RUN (green)
- FAULT (red)

The green RUN lamp comes on as soon as both primary and secondary starter disconnect circuits are opened after unit starting. The red FAULT lamp will come on when an emergency shutdown of the generator set occurs from one of the following conditions:

- Low oil pressure during unit operation
- High engine temperature during unit operation
- Overspeed of engine during unit operation
- Overcrank condition during starting

Detector 12 Control

The twelve monitor system option features indicator lamps for the following:

- RUN (green) lamp comes on when both starter disconnect circuits are opened after unit starting.
- PRE LO OIL PRES (yellow) indicates engine oil pressure is marginally low.
- PRE HI ENG TEMP (yellow) indicates engine temperature is marginally high.
- LO OIL PRES (red) indicates engine has shut down because of critically low oil pressure.
- HI ENG TEMP (red) indicates engine has shut down because of critically high temperature.
- OVERSPEED (red) indicates engine has shut down because of excessive speed.
- OVERCRANK (red) indicates the starter has been locked out because of excessive cranking time.
- FAULT 1 (red) an undedicated fault. Might be factory programmed as a shutdown or non-shutdown, and as a timed or non-timed fault. (Normally set for timed shutdown.)
- FAULT 2 (red) same features as Fault 1. (Normally set for immediate shutdown.)
- LO ENG TEMP (yellow) engine temperature is marginally low for starting. Indicates inoperative coolant heater.
- LO FUEL (yellow) indicates fuel supply is marginally low.
- SWITCH OFF (flashing red) indicates generator set is not in automatic start operation mode.

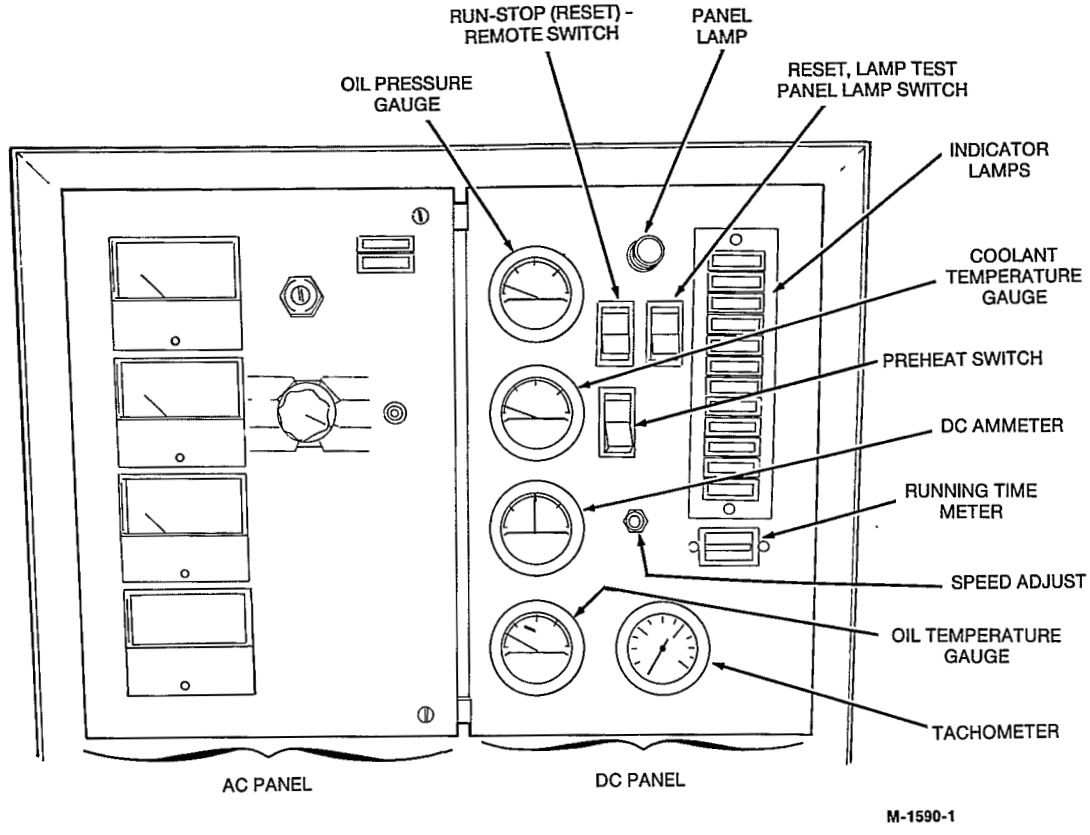
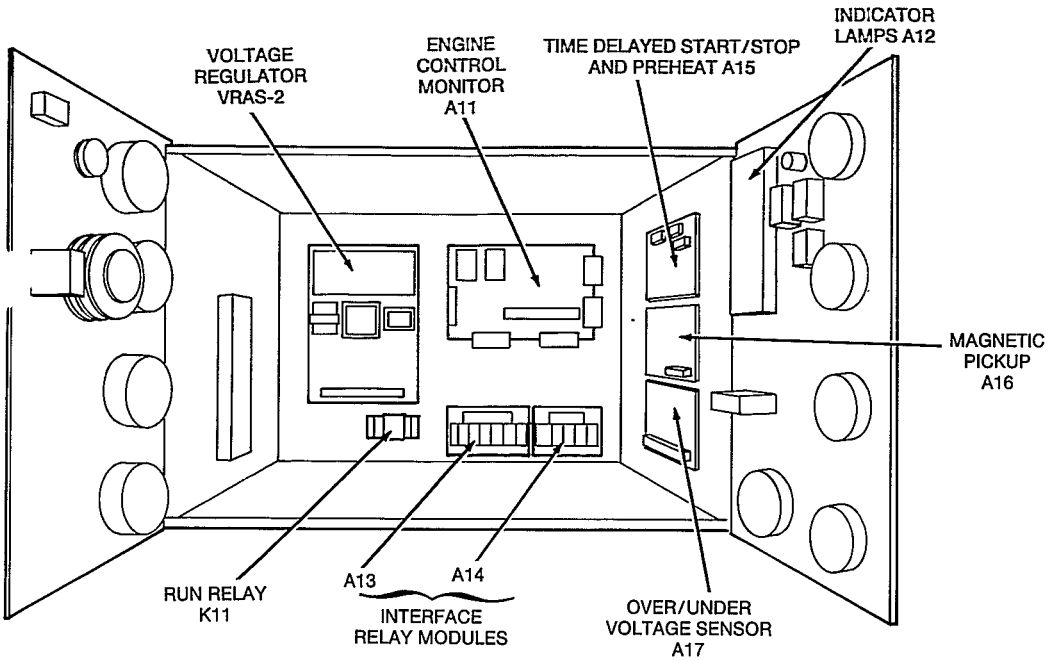
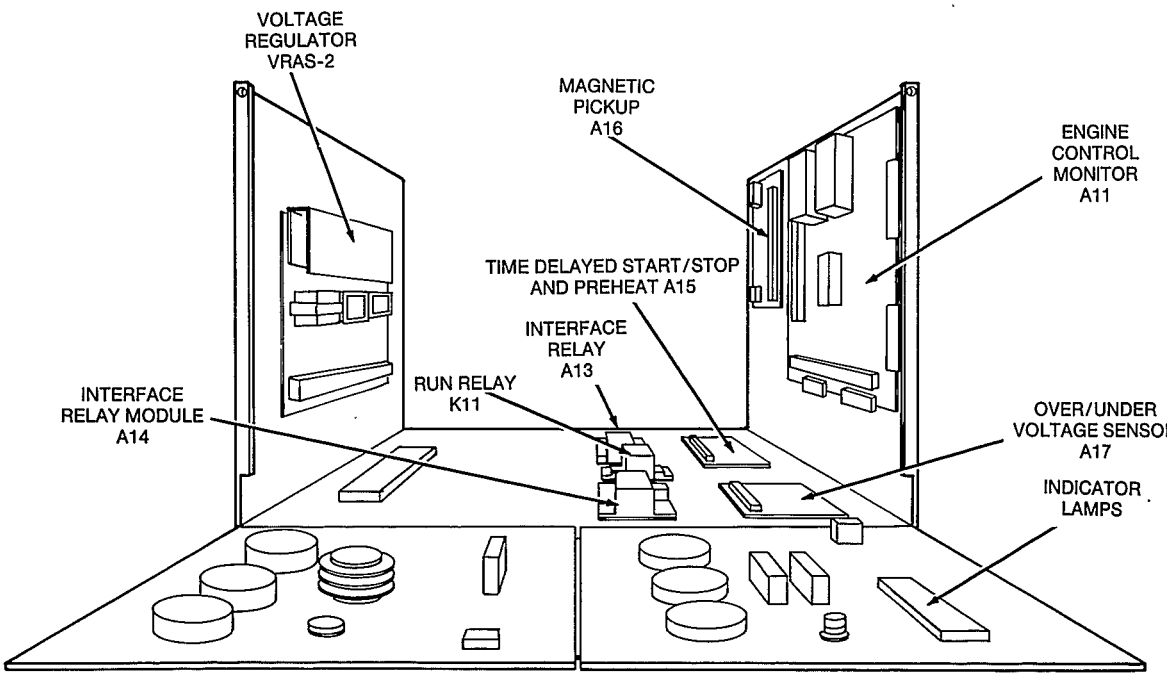


FIGURE 3-1. DC CONTROL



VERTICAL CONTROLLER

XES-1561



HORIZONTAL CONTROLLER

XES-1562

FIGURE 3-2. CONTROL INTERIOR

CONTROL PANEL INTERIOR

The following describes the engine control components and how they function (Figure 3-3). Depending on options included on your control system, some of the following might not apply.

Engine Control Monitor (ECM) (A11)

This solid state printed circuit board monitors basic engine control system functions (Figure 3-3). This includes starting, stopping, and fault system operation. Terminal blocks are included for making remote connections and adding further control options.

The ECM provides the following functions or unit protection:

- Overcrank - limits engine cranking to 75 seconds. If engine fails to start, the module lights a fault lamp and opens the cranking circuit. The cycle cranking option allows three 15-second cranking cycles with two 15-second rest periods on 12-lamp controls.

- Overspeed - shuts down the engine immediately if overspeed occurs and lights a fault lamp. The sensor switch is mounted in the end bell on the generator shaft. It is factory adjusted to shut down 1800 r/min units at 2200 ± 100 r/min, 1500 r/min units at 1900 ± 100 r/min, and 3000 and 3600 r/min units at 4000 ± 90 r/min.

- Low Oil Pressure - shuts down the engine immediately if oil pressure drops below 14 psi (97 kPa) and lights a fault lamp. The fault is time delayed about 10 seconds following starter disconnect and inhibited during cranking. The delay allows oil pressure to rise to normal before the electronic control module monitors this system.

  A pre-low oil pressure sensor and lamp (used with optional 12-lamp systems) provides an alarm that oil pressure is marginally low (20 psi/138 kPa or less). The cause should be found and corrected as soon as possible. This fault is delayed with low oil pressure function.

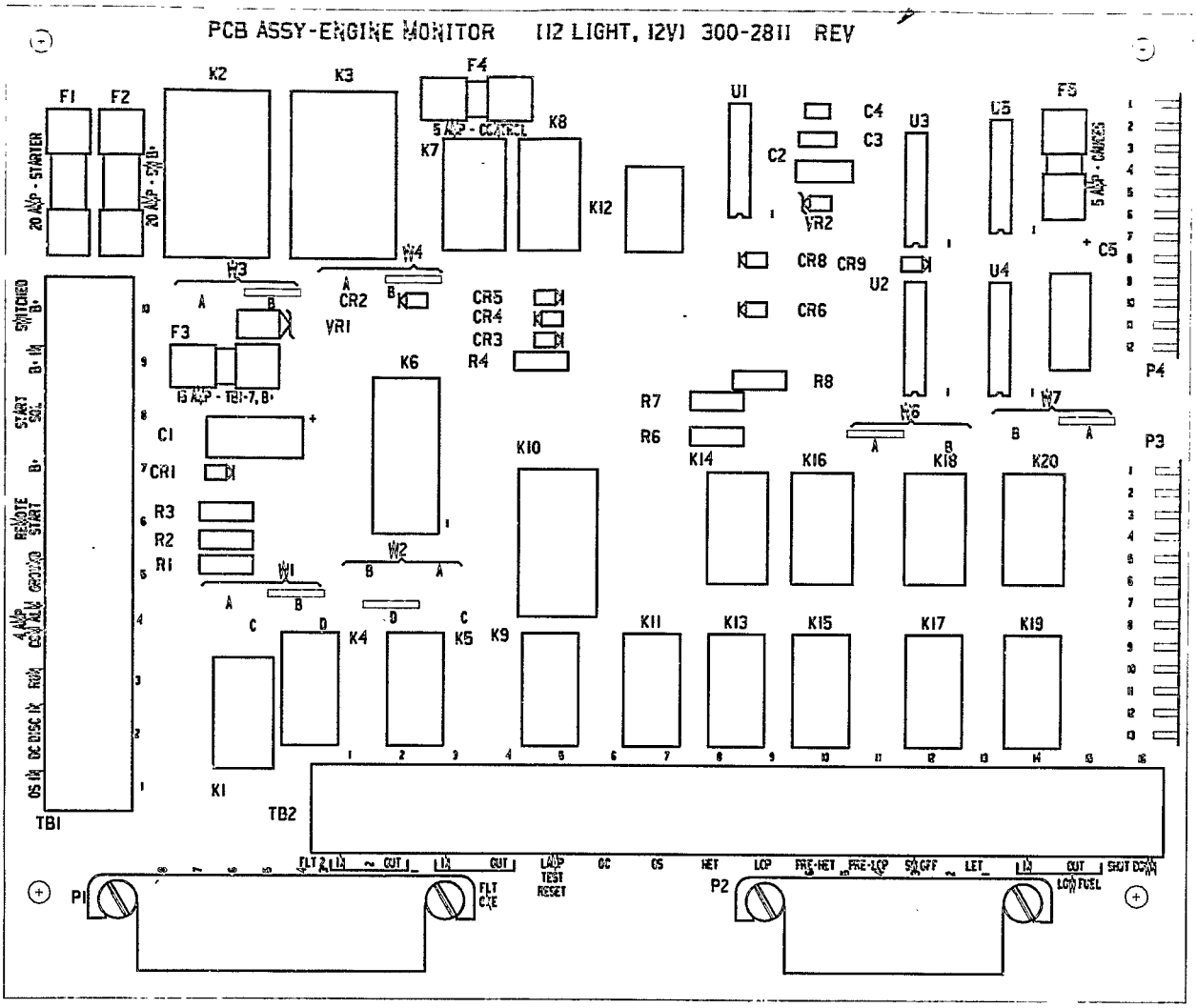
- High Engine Temperature - shuts down the engine immediately if coolant temperature rises above 227°F or 108°C (above 222°F or 106° C for Onan TechStar generator sets) and lights a fault lamp. The fault is time delayed about 10 seconds following starter disconnect and inhibited during cranking. This delay allows coolant in a hot engine time to circulate and return the water jacket to normal before the electronic control module monitors this system.

  A pre-high engine temperature sensor and lamp used with optional 12-lamp systems, provides an alarm that engine temperature is marginally high (216°F/102°C). The cause should be found and corrected as soon as possible. This fault is delayed with high engine temperature function.

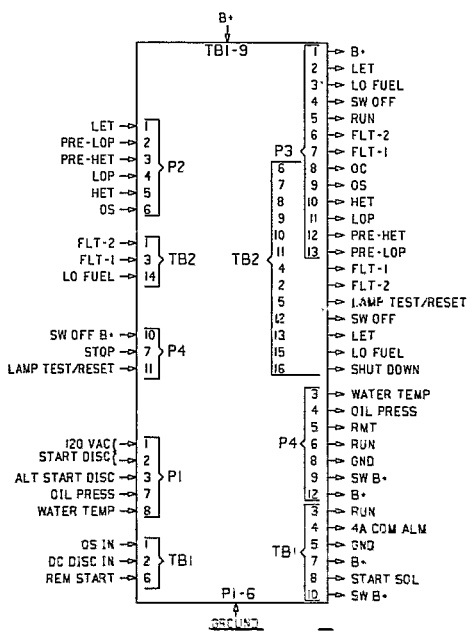
⚠CAUTION ***The high engine temperature shutdown will shut down engine in an overheat condition only if coolant level is sufficiently high to physically contact shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, resulting in severe damage to the engine. Therefore, maintain adequate engine coolant levels to ensure operational integrity of cooling system and engine coolant overheat shutdown protection.***

A low engine temperature lamp lights when engine water jacket temperature is 70°F (21°C) or lower. Lighting of the lamp should be no cause for alarm, even during initial generator set operation, since the lamp goes out after the engine warms up.

If the generator set is in an application where it must accept load immediately after starting (such as emergency power standby operation) or when temperatures are so low that starting problems are encountered, Onan recommends the use of engine coolant heaters to ensure starting and proper response.



BLOCK DIAGRAM



TB1-6 IS SIGNAL MODE SELECTABLE AS FOLLOWS:

W3 & W4 POSITION	REMOTE START SIGNAL
A	GND TO START
B	B+ TO START

P2-2&3 ARE FUNCTION MODE SELECTABLE AS FOLLOWS:

P2-2:W7	P2-3:W6	POSITION	FUNCTION MODE
		A	NON-SHUTDOWN
		B	SHUTDOWN

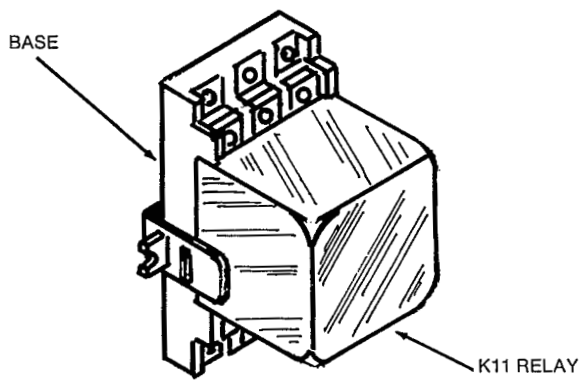
TB2-1&3 ARE FUNCTION MODE SELECTABLE AS FOLLOWS:

TB2-1:W1	TB2-3:W2	POSITION	FUNCTION MODE
		A	NON-SHUTDOWN,NON-TIMED
		B	SHUTDOWN,NON-TIMED
		C	NON-SHUTDOWN,TIMED
		D	SHUTDOWN,TIMED

FIGURE 3-3. ENGINE CONTROL MONITOR

Run Relay (K11)

This relay, Figure 3-4, provides wiring connections for external functions of the site installation that are to be controlled by the starting and/or stopping of the generator set such as ventilation air louvres, blowers, etc. The sets of contacts in the relay base provide for either closing a circuit or opening a circuit upon energizing and de-energizing the K11 relay (depending on the desired function wires to the base connections.) Run Relay K11 is energized when the generator set starts when connected to the ECM at TB1-10 (switched B+ connection).



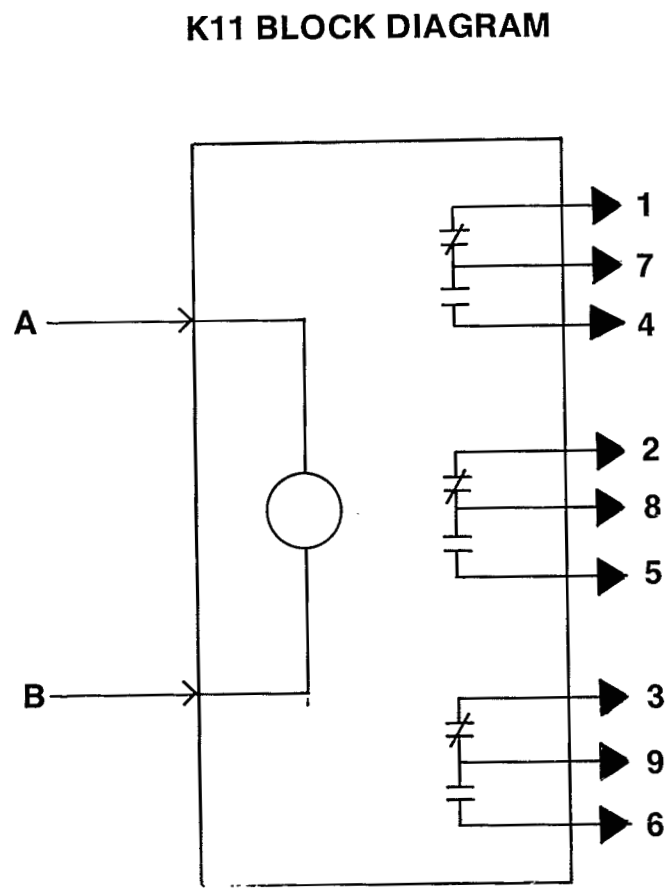
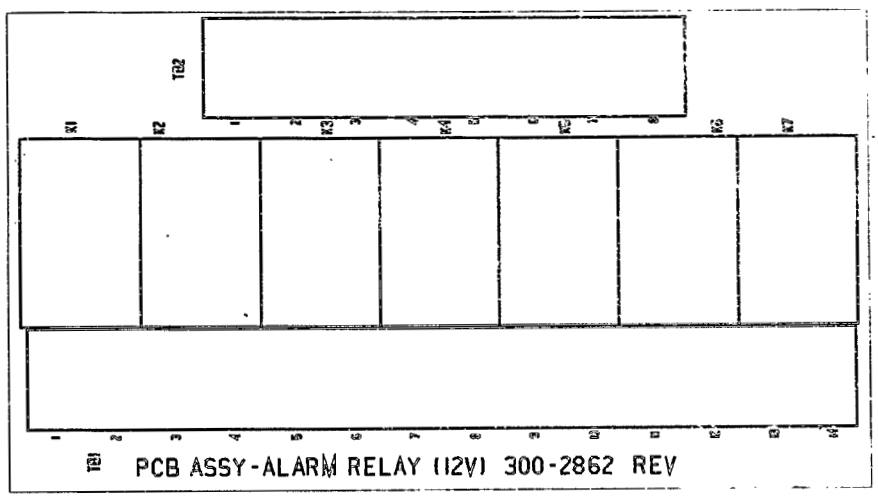


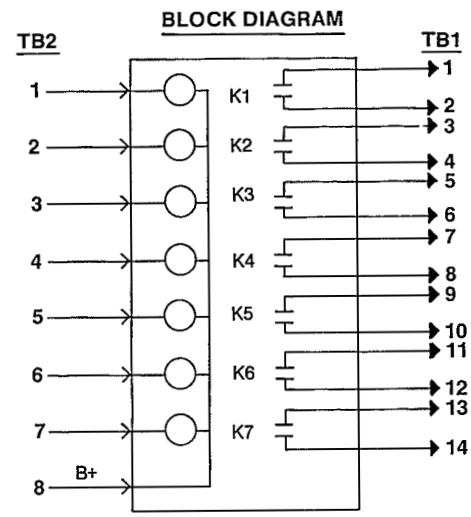
FIGURE 3-4. RUN RELAY

Interface Relay Modules (A13, A14)

These relay modules are used in conjunction with the "Detector 12" engine control monitor to provide external monitoring of the engine-generator at customers control panel (Figure 3-5). As add-on circuit boards, they interface with the remote annunciator signals from the engine control monitor and allow the use of either AC or DC for alarm drives. The relays are configured for low side switching by the control and supply sets of contacts for external alarm connections.



A13



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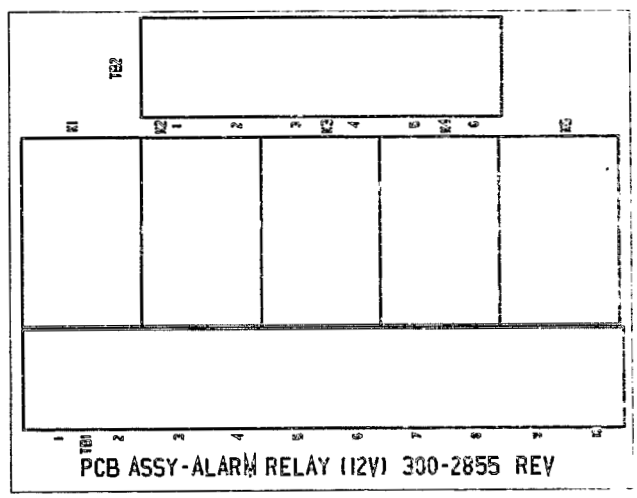

A14

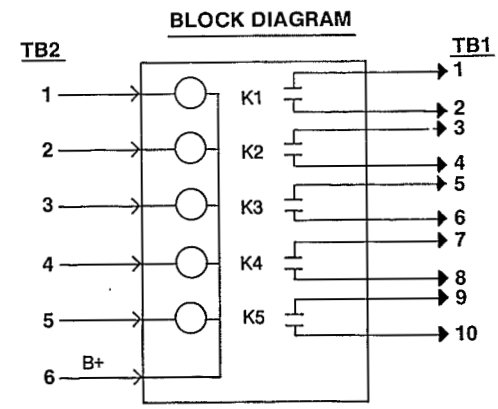

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FIGURE 3-5. INTERFACE RELAY MODULES

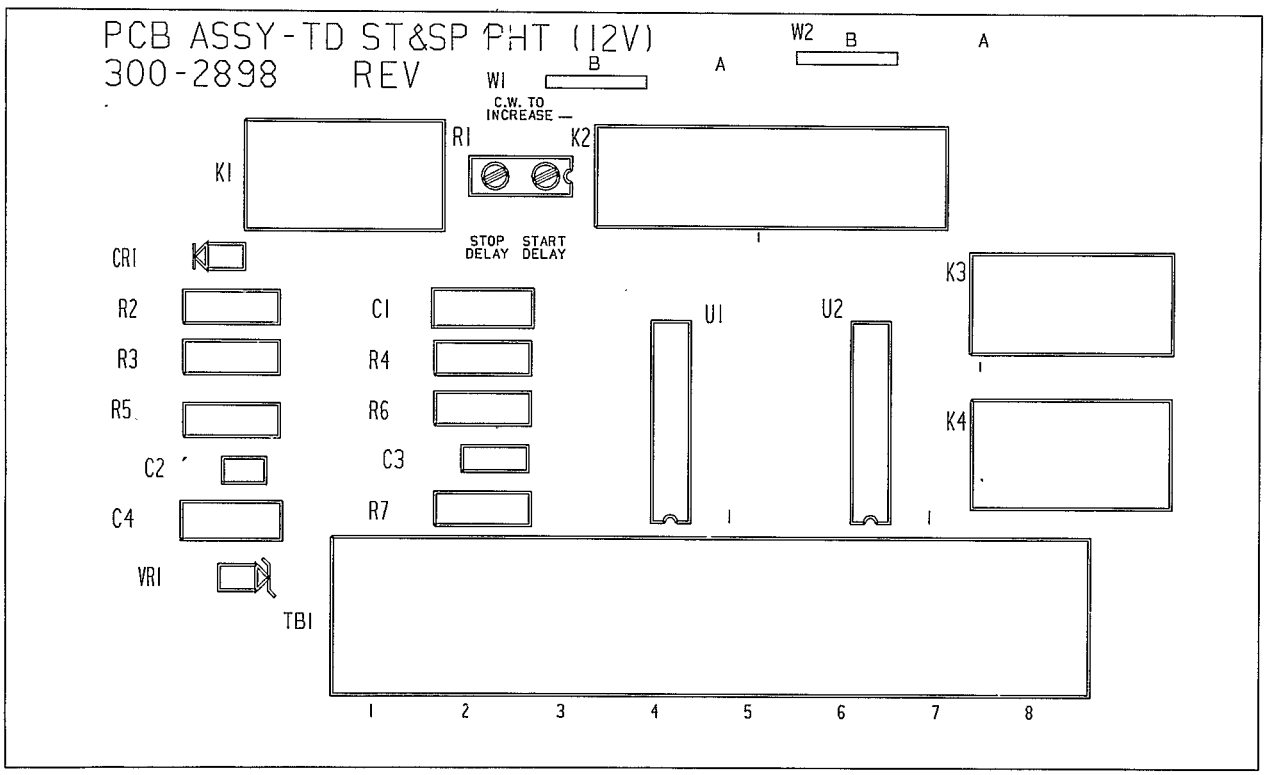
Time Delayed Start/Stop, and Preheat Module (A15)

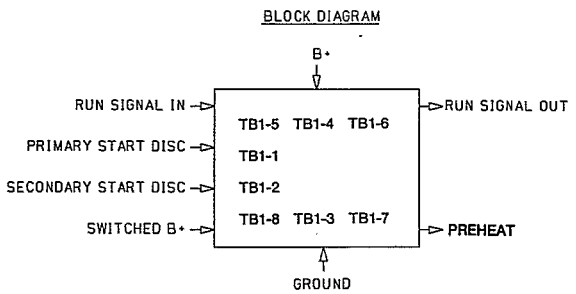
This module provides time delays for starting and stopping the generator set. See Figure 3-6.

Delayed Starting: The time delay start function is to preclude automatic start-up of the generator set for a determined amount of time (adjustable from 1 to 15 seconds) for installations that might experience power interruptions of short duration, and therefore not want the generator set starting.

Delayed Stopping: The time delay stop function adjustable from 1 to 15 minutes, is to provide for automatic cool-down running of the engine for prescribed amount of time (approximately 3 to 5 minutes is recommended).

Preheat: This function is included on the time delayed start/stop modules used on indirect injected diesel engine generator sets. It provides a signal during the time delay start period and during cranking to activate the engine glow plugs.





TERMINAL #5 IS SIGNAL MODE SELECTABLE AS FOLLOWS

W1 & W2 POSITION	RUN SIGNAL IN MODE
A	GND TO RUN
B	B+ TO RUN

FIGURE 3-6. TIME DELAYED START/STOP AND PREHEAT MODULE

Magnetic Pickup Interface Module (A16)

The magnetic pick-up module, Figure 3-7, senses engine speed and provides a starter disconnect signal and an engine overspeed signal. Engine speed is sensed using a magnetic pick-up and a toothed wheel mounted on the engine/generator. A signal LED (DS1) is provided to indicate that a usable input signal is being received from the magnetic pick-up. There are two configurations of the magnetic pick-up interface module, a fixed setpoint or an adjustable setpoint.

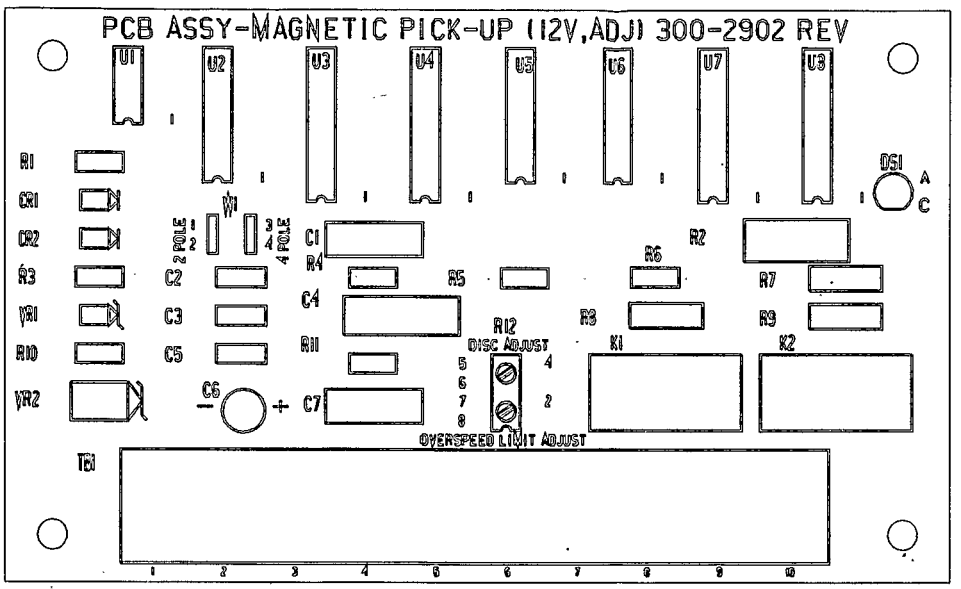
The fixed setpoint version is designed to operate at the following output values:

- Start Disconnect - 510 ± 60 r/min
- Overspeed Trip Point
  - 2200 r/min ± 8% for 4-pole, 50/60 Hz
  - 4400 r/min ± 8% for 2-pole, 50/60 Hz

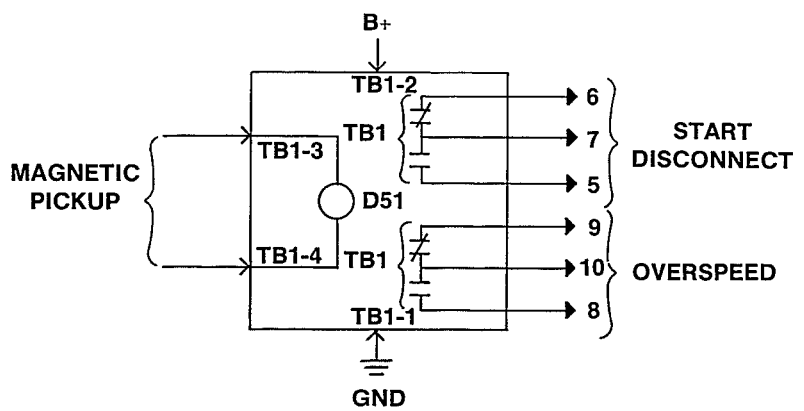
The adjustable setpoint version has the following ranges of setpoint actuation: (clockwise adjustment increases values):

- Start Disconnect - 250 to 1000 r/min
- Overspeed Trip Point
  - 1000 to 2800 r/min on 4-pole, 50/60 Hz
  - 2000 to 5600 r/min on 2-pole, 50/60 Hz

On all versions, the starter reconnect value is from 0 to 30 r/min and the overspeed reconnect is 50 percent of the trip point.



BLOCK DIAGRAM



ES-1578

FIGURE 3-7. MAGNETIC PICKUP INTERFACE MODULE

Over/Under Voltage Sensor Module (A17)

This module senses the applied generator voltage being controlled by the voltage regulator VRAS-2 and provides two outputs for separate indication of over and under voltage conditions (Figure 3-8). If the AC inputs to the Over/Under Voltage Sensor (A17) received from the voltage regulator VRAS-2 indicate generator output is outside the limits of module A17, a shutdown signal is initiated to the ECM. Fault 1 on the 12-light ECM is tied to undervoltage and Fault 2 is tied to overvoltage.

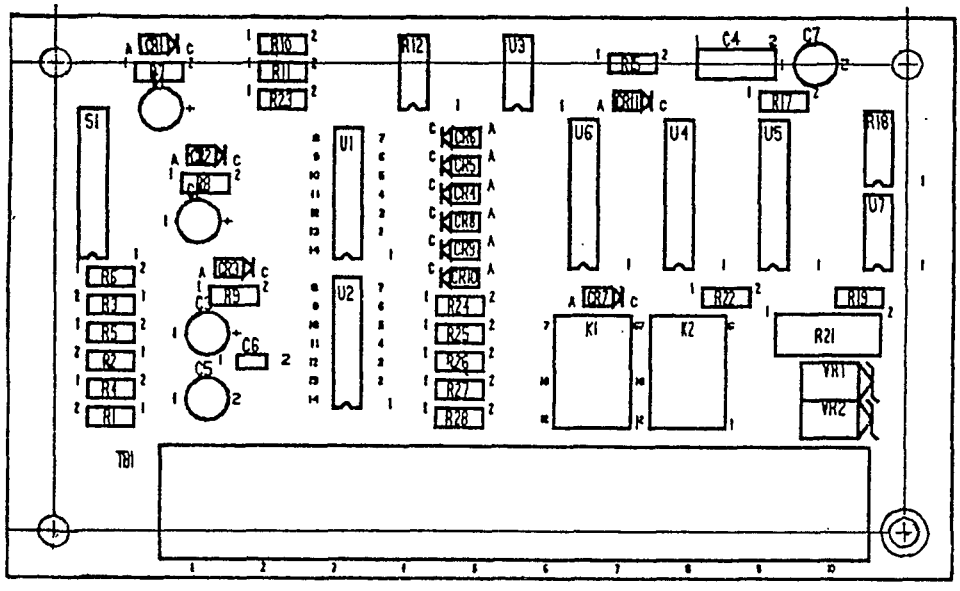
A shutdown fault occuring through this module, might first indicate a failure of voltage regulator VRAS-2.

The adjustments available on this module are as follows:

- Undervoltage
  - —Dropout Range
    (R12) 50 to 139 VAC
  - —Time Delay
    (R18) 0.5 to 30 seconds

- Overvoltage
  - —Limit Range
    (R12) 100 to 200 VAC
    Time Delay - A
    Function of the
    amount of overvoltage.

Overvoltage (% of Limit Setting)	Time Delay (Seconds)
135 or above	0.5 maximum
120	2
110	5
100 or below	8 to infinity



BLOCK DIAGRAM

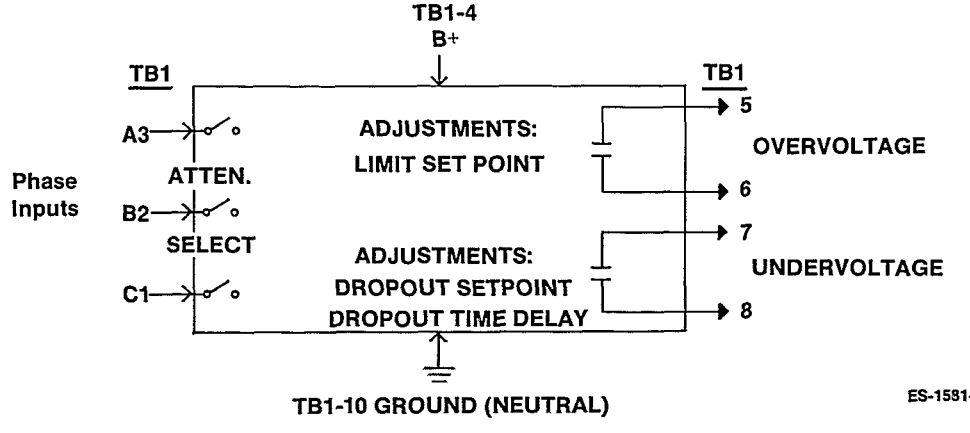


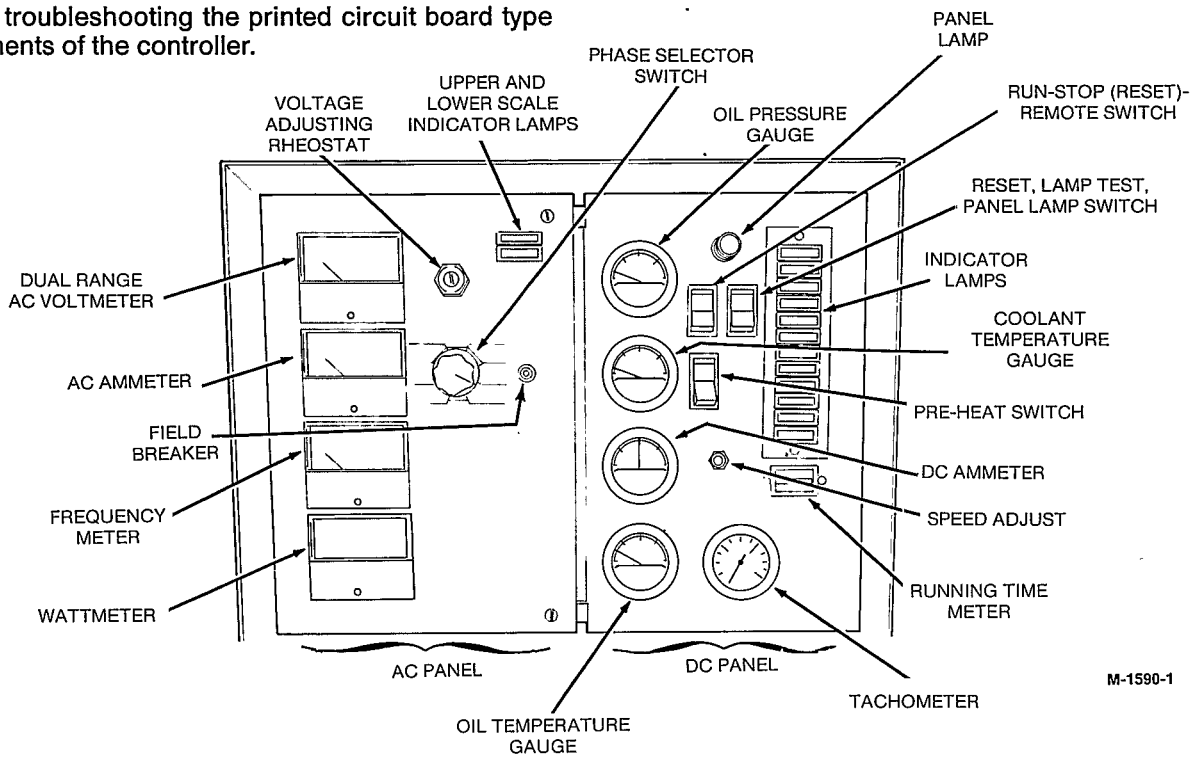
FIGURE 3-8. OVER/UNDER VOLTAGE SENSOR MODULE

OPERATION

Because of varying control option combinations, the following operating descriptions will encompass a "Detector 12" controller with full options (Figure 3-9). Read the information through to Emergency Shutdown to gain a full understanding of the options and how they interact with the engine control monitor.

If you are reviewing this operation information for troubleshooting purposes, ensure that you have eliminated all other malfunction checks external of the controls prior to troubleshooting the printed circuit board type components of the controller.

Regardless of the controller model you have, the engine control monitor includes the shutdown fault commands. Controllers with options provide delineation and pre-alarm of the shutdown faults, time delayed starting and stopping, and additional monitoring/control, but all engine operation commands through these options are still controlled through the engine control monitor (ECM).



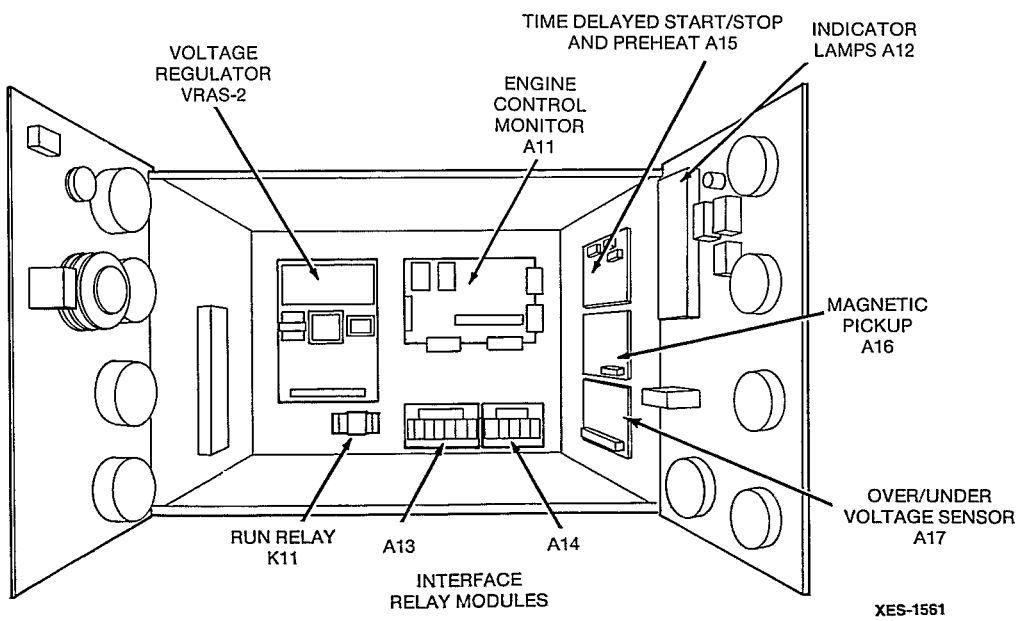


FIGURE 3-9. CONTROLLER

Starting Sequence

Manual: For cold weather starting of diesel driven gensets, the Preheat switch (S13) is held in the preheat position for the necessary period of time (usually about 10 seconds). This energizes the glow plug solenoid. The starting sequence is initiated by placing the Run/Stop/Remote switch (S12) in the Run position.

Placing switch S12 in the Run position energizes the ECM Run Relay (K7). By energizing K7, B+ is supplied through the electrical circuits of the ECM to energize the engine run circuits (i.e. fuel solenoid) and front panel gauges and to the starter solenoid (through K3).

The engine cranking period is determined by the Overcrank Timer and Cycle Crank Driver (U1), and the Cycle Crank Relay (K12), which control energizing and de-energizing the Power Relays K2 and K3 that supply current to the on-set starter and fuel solenoids.

Automatic: With the Run/Stop/Remote switch (S12) in Remote position, a start command to the genset controller activates the Time Delayed Start/Stop and Preheat Module (A15), which initializes its time delay start period and the Preheat output.

Upon completion of the time delay start/preheat period of glow plugs, the ECM commenses the cranking and start-up by energizing Run Relay (K7) as described in manual start-up.

When engine successfully cranks and starter disconnects, inputs signals from either start disconnect system of the ECM will activate the Start Disconnect Relay of module A15 (K1) which deactivates the preheat output and programs the module for Time Delayed Stop mode.

During generator set operation, all safety systems function to protect and monitor set operation. At end of the generator set duty cycle, when generator output is disconnected from load and the remote run signal is discontinued, the time delayed stop function of module A15 will continue the engine-generator run time for the prescribed engine cool-down period of 5 minutes before deactivating the run circuits of the ECM.

Starter-Disconnect Parameters

This type of control requires two means of starter-disconnect in order to protect the starter in the case one means should fail. The first uses a DC relay (K14). A B+ signal taken from the battery charging alternator in most cases energizes this relay to disconnect the starter. The second method uses an AC relay (K10). In this case, voltage from the generator energizes this relay to provide a back-up to the DC relay. The control uses this method to ensure uninterrupted generator set operation even if only one means of start disconnect is operational. However, the local Run lamp does not light unless both start disconnect relays operate. If the generator set is equipped with a remote Run lamp, the operator can then determine which means of start disconnect has failed for such an occurence. If the remote Run lamp lights (and the local Run lamp does not), the DC relay is not functioning.

All power paths leaving the ECM are protected by fuses so that the circuit board paths cannot be destroyed by excessive current.

F1 - Starter circuit fuse (20 ampere) to protect circuit board paths, K3 and associated wiring.

F2 - Switched B+ fuse (20 ampere) to protect circuit board paths, K2 and associated wiring.

F3 - B+ out fuse (15 ampere) to protect circuit board paths.

F4 - Main ECM circuit fuse (5 ampere) to protect circuit board paths and components on the ECM.

F5 - Gauge fuse (5 ampere) to protect circuit board paths, gauges on the front panel and all associated wiring.

High Engine Temperature (HET) and Low Oil Pressure (LOP) faults are time delayed about 10 seconds following starter disconnect and inhibited during cranking. This allows the coolant in a hot engine some time to circulate and return the water jacket to normal temperature before the ECM begins to monitor this parameter. It also allows the oil pressure to build to normal before monitoring this system. Following this delay, these faults become immediate shutdowns for engine protection.

If conditions are correct, the engine will start and the starter will disconnect. If not, an overcrank fault occurs by U1 having cycled/timed out through drive transistor U4 (pin 6 to 11) to energize Fault Relay K6, which opens the start circuit of the ECM. The Reset switch (S11) must be pushed to clear the fault before attempting a restart.

Start-Disconnect Sequence

When the generator set starts, output voltage from the DC alternator, or from the Magnetic Pickup Module energizes Start-Disconnect relay K14. Energizing K14 then closes its normally-open contacts which illuminates the control panel RUN lamp. Also, when the generator set starts, output voltage from the generator stator energizes Starter-Disconnect relay K10. Energizing K10 relay closes its normally-open contacts and illuminates a Remote Run lamp (if equipped).

After the starter disconnects, the LOP and HET fault shutdowns will remain inhibited for another 10 seconds to allow oil pressure and engine temperature to stabilize within the operating range.

Normal Operating Parameters

After a sucessful engine start-up, with all conditions satisfied, the engine will gain in r/min to governor controlled operation. Should the engine go into an overspeed condition, the Magnetic Pickup Module (A16) will reach the trip point and ground the overspeed input circuit to the ECM to cause a shutdown.

If the genset is not equipped with the Magnetic Pickup Module/toothed wheel speed sensing, the overspeed switch is a mechanical switch that grounds the overspeed circuit on the ECM if an overspeed condition exists. Either means of controlling overspeed activates the overspeed fault lamp. After the problem is corrected, starting will not occur until the Reset switch is pressed.

Continuous operation of the genset also depends on the proper oil pressure and engine temperature being maintained, and also any customer required fault conditions connected to the ECM.

Stopping Sequence

Placing the Run/Stop/Remote switch to the Stop position de-energizes Run Relay (K7) which opens the current supply through the ECM (K2) to de-energize the generator set mounted fuel solenoid (stops fuel flow which stops the engine).

Emergency Shutdown

The K6 fault relay is energized when fault sensors respond to one of the following fault conditions: overcrank, low oil pressure, high engine temperature, overspeed, over/under voltage output. Energizing the K6 fault relay opens its contacts and closes its normally-open contacts. Opening the normally-closed contacts disconnects B+ from the Power Relays K3 and K2. This stops cranking if the engine is being cranked and shuts off the fuel flow. Closing one of the contacts of K6, activates the K8 relay which breaks power to the fault interface relays so that only the indicator associated with the fault will activate. Closing the other normally-open contacts of K6 contacts connects B+ to the remote alarm terminal.

Section 4. Engine Control Service

TROUBLESHOOTING

Regardless of the controller model a generator set has, the basics of problem analysis are fundamentally the same.

A. Engine does not crank.
B. Engine cranks, but does not start.
C. Engine starts, but stops after running several seconds.
D. Engine-generator is in operation, then a fault shutdown occurs.

Because the troubleshooting tables in this section include information about various control options, read through this section before a fault occurs to identify what is or is not applicable to your genset. This will save troubleshooting time when the actual need arises. Before starting a troubleshooting procedure, make a few simple checks that might expose the problem.

- Review troubleshooting information as outlined in operator's manual before performing the procedures in this section.

- Check all modifications, repairs, or parts replacements performed since the last satisfactory operation of the generator set. A loose or otherwise incorrect wire connection, an opened switch or circuit breaker, or a loose plug-in are all potential problems that can be eliminated by a visual check.

- Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.

When troubleshooting, remember to keep your problem solving a factual, methodical, and most of all a safe process. Hasty decisions can be costly and also harmful to your health.

The Detector 2 controller indicates a fault condition by illuminating only one FAULT lamp. To aid in identifying which of the four basic shutdown faults (LOP, HET, Overcrank, or Overspeed) caused the shutdown, your initial problem analysis before reviewing the following tables should be as follows:

1. Was unit in operation?
   Delete Overcrank condition.
2. Did shutdown occur within one minute after starter disconnect?
   Possible Low Oil Pressure condition.
3. Was engine operation noticeably erratic with high r/min conditions.
   Possible overspeed condition.
4. Perform start-up procedures and observe the following:
   - Oil pressure gauge reads within proper operating range soon after starting.
   - Engine temperature gauge reads 175 to 212°F (80 to 100° C) and stabilizes.
   - Engine starts, builds in speed, and stabilizes at proper r/min.

TABLE 4-1. ENGINE DOES NOT CRANK

SYMPTOM	CAUSE	CORRECTIVE ACTION
1. SWITCH OFF indicator lamp flashing.	Run/Stop/Remote switch in Stop position.	Press to desired, Run or Remote position.
2. Other fault indicator lamps illuminated, but no fault exists.	Lamp Reset switch not actuated after a previous fault was remedied.	Press Lamp Reset switch to de-energize fault lamp relays of ECM, after Run/Stop/Remote switch is pressed to Stop position.
3. No indication.	Fuses blown on ECM board A11.	Check fuses F1 and F4. Replace if necesary with proper fuse: F1 - 20 Ampere F4 - 5 Ampere
	Starter solenoid will not energize.	Inspect starter solenoid per proper test procedure.
	Possible defective ECM board A11.	Check A11 board TB1-9 for B+ voltage in. With S12 switch in Run position, check for voltage out to starter solenoid at TB1-8 of board A11.
	Broken wiring or poor connections between board A11 TB1-8 and starter solenoid.	Check and repair as necessary.
4. Time delay start is initiated, but starter solenoid does not energize after desired time delay period.	Possible defective Time Delayed Start/ Stop Module A15.	Check A15 board TB1-4 for constant B+ voltage in. Check A15 board TB1-5 for Run Signal In voltage. Voltage at A15 board TB1-6 should be at B+ at end of start delay period. Check wiring and connections from A15 TB1-6 to ECM TB1-6.

TABLE 4-2. ENGINE CRANKS BUT DOES NOT START

SYMPTOM	CAUSE	CORRECTIVE ACTION
1. Overcrank Fault shutdown lamp illuminated.		
A. Low Fuel lamp also illuminated.	Insufficient fuel supply in tank.	Fill with correct fuel.
B. Fuel solenoid does not energize.	Fuse blown on ECM board A11.	Check fuse F2. Replace if necessary with proper fuse. F2-20 Ampere.
	Possible defective ECM board A11.	Check for voltage out at A11 TB1-10 when engine is cranking.
	Broken wiring or poor connections between board A11 TB1-10 and fuel solenoid.	Check and rectify as necessary.
C. Fuel solenoid energizes, but no fuel flows.	Blockage of fuel supply system.	Check fuel supply system, fuel tank shutoff valves, fuel lines and connections, fuel filters and transfer pump.
D. Engine hard to start due to cold ambient air temperature.	Heater system not keeping engine warm.	Check heater system power supply, controls, etc., and correct as necessary.
	Engine glow plugs not being energized.	Improper start-up procedures used. Depress Preheat switch S13 to energize glow plugs.
	Time delayed Start/ Stop and Preheat module A15 not energizing Preheat solenoid for glow plugs.	Initiate a restart and check for voltage at A15 TB1-7 to Preheat solenoid.
		Depress Preheat switch S13 to bypass A15. Check if Preheat solenoid energized.
		Check Preheat solenoid per proper test procedure.

TABLE 4-2. ENGINE CRANKS BUT DOES NOT START (Continued)

SYMPTOM	CAUSE	CORRECTIVE ACTION
(Continued)		
D. Engine hard to start due to cold ambient air temperature.		Check wiring and connections from switch S13 and module A15 to Preheat solenoid.
	Fuel supply line freeze to engine.	Refer to Symptom 1.C of this table.
2. Fault shutdown occurs, but no fault lamp indication.	Lamp burned out.	Depress Lamp Test switch S11 to check fault lamps.
	Possible defective ECM board A11.	Refer to Symptom 3.
3. Short cranking period.		
A. Controller ECM (A11 is equipped to perform cycle cranking, but stops cranking before 15 ± 3 seconds.	Defective ECM board A11	Replace ECM (A11).
B. Controller ECM (A11) is equipped to provide constant cranking to fault limit, but stops cranking before 75 ± 15 seconds.	Defective ECM board A11	Replace ECM (A11).

TABLE 4-3. ENGINE STARTS BUT STOPS AFTER RUNNING SEVERAL SECONDS.		
SYMPTOM	**CAUSE**	**CORRECTIVE ACTION**
1. Fault lamp illuminated: A. Overspeed	Mechanical Switch, or Magnetic Pickup overspeed sensing faulty or out of adjustment.	Refer to Generator Service Manual for adjustment specifications.
	Magnetic Pickup Module A16 initialized shutdown.	Review functional description of Mag Pickup Module A16, and limits of fixed setpoint or adjustable setpoint. Perform start-up and monitor engine speed to overspeed shutdown. Fixed Setpoint If shutdown occurs before limit, replace A16 module. Adjustable Setpoint If shutdown occurs before desired setpoint, readjust module A16. If adjustment does not correct fault conditions, replace module A16.
	Engine governor faulty or out of adjustment.	If shutdown occurs within module A16 limits, refer to governor operation in engine/generator service manual, or contact an Onan representative.
B. Low Oil Pressure	Low oil level in engine.	Replenish as necessary.
	LOP switch S1 faulty.	Check oil level, perform restart, and monitor oil pressure gauge M11. If gauge reading is within normal range, switch S1 is faulty. Replace.

TABLE 4-3. ENGINE STARTS BUT STOPS RUNNING AFTER SEVERAL SECONDS. (Continued)

SYMPTOM	CAUSE	CORRECTIVE ACTION
C. High Engine Temperature.	Low coolant level in engine.	Replenish as necessary.
	HET switch S2 faulty.	Check coolant level, perform restart, and monitor engine temperature gauge M12. If gauge reading is within normal range, switch S2 is faulty. Replace.
	Thermostat defective.	Replace thermostat.
	Fan belt slipping.	Tighten fan belt.
2. No fault condition.	Intermittent control wiring connections.	Check condition of all control wiring to ensure correct and secure terminal connections.

TABLE 4-4. ENGINE GENERATOR IS IN OPERATION, THEN A FAULT SHUTDOWN OCCURS		
SYMPTOM	**CAUSE**	**CORRECTIVE ACTION**
1. Fault indicator lamp illuminated.		
A. LOP, HET, Overspeed	As indicated.	Refer to Table 4.
B. Auxiliary lamp illuminated.	As dedicated by customer.	As required.
2. No fault lamp indication.	Possible defective ECM board A11.	Check fuses F4 and F2 of ECM board A11. F4-(Main) - 5 Ampere F2- (Fuel solenoid or ignition) - 20 ampere Perform restart and check for B+ voltage in at TB1-9 and voltage out at TB1-10 to fuel solenoid. If there is voltage out at TB1-10, check fuel supply solenoid, shutoff valves, etc. If there is no voltage out at TB1-10, ECM board A11 is defective. Replace.
	Other customer required shutdown command.	Refer to installation reference material, or contact an Onan representative.

TESTS

Refer to the following checkout tests when isolating circuit problems caused by faulty engine control components. Follow the instructions closely to protect test instruments and components from permanent damage.

All external engine control components such as leads, switches, relays, indicator lights, senders, and gauges, plug into the engine monitor board. When testing external components, disconnect the corresponding jack (J1, J2, J3, or J4) from the board. Refer to the appropriate wiring diagram to determine the jack number.

Battery Checkout

Check charge condition of the battery with a hydrometer. The electrolyte specific gravity should be about 1.260 for a fully charged battery at 80°F (27°C). If not, add approved water to keep electrolyte at proper level and recharge the battery. If battery will not recharge, replace it.

⚠CAUTION ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke while servicing batteries.***

If the battery loses excess water, the alternator charge may be too high. Likewise, if battery state of charge is not maintained, the charge rate may be too low. Refer to Alternator Checkout.

Battery Cable Checkout

With the starter motor operating, check the voltage drops (1) from the battery negative post (not the cable clamp) to the cylinder block, (2) from the battery positive post to the battery terminal stud on the solenoid. Normally, each of these should be less than 0.3 volt. If extra long battery cables are used, slightly higher voltage drops may result. Thoroughly clean all connections in any part of the circuit showing excessive voltage drop.

Alternator Checkout

With the engine running, check the battery charge rate DC ammeter. If the alternator is operating properly, the ammeter should show a slight charge, gradually tapering to zero as the battery becomes fully charged. If the ammeter shows a constant discharge or a constant high rate of charge, stop the generator set and check for a loose or slipping drive belt, poor terminal connections, or broken lead wires. Repair or replace as required.

If everything checks out, use a voltmeter to determine the alternator output voltage. Connect the positive (+) lead to the output terminal and connect the negative (-) lead to ground. Start the generator set and run for a few minutes to allow the voltage to stabilize. A proper operating system will have a nominal output voltage of between 13.8 and 14.8 volts.

If the output voltage is high (over 15 volts), check for loose or corroded voltage regulator leads. If this does not correct the problem, the regulator is probably shorted and should be replaced.

If the output voltage is low (equals battery voltage), the problem could be worn or broken brushes, an open regulator, or an open field diode. Refer to appropriate engine/generator service manual for more detailed test and service procedures.

Solenoid Checkout

1. Apply battery positive (B+) to the terminal marked S.
2. Jumper a ground wire to the solenoid mounting bracket. Solenoid should activate.
3. If the contacts are good, 12 volts should be read between terminal I and ground. The voltage drop measured across the contacts should never exceed one volt in circuit application.

Relay Checkout

1. Connect 12 volts across relay coil terminals. Relay should activate if coil is okay.
2. Connect a 12-volt source to one side of relay contacts.
3. Connect a voltmeter to other side of relay contact and 12-volt source. If 12 volts appear when relay is energized, contact is okay. The 12-volt reading appears in reverse order when checking normally closed contacts.

Fuel Solenoid Checkout (Diesel Only)

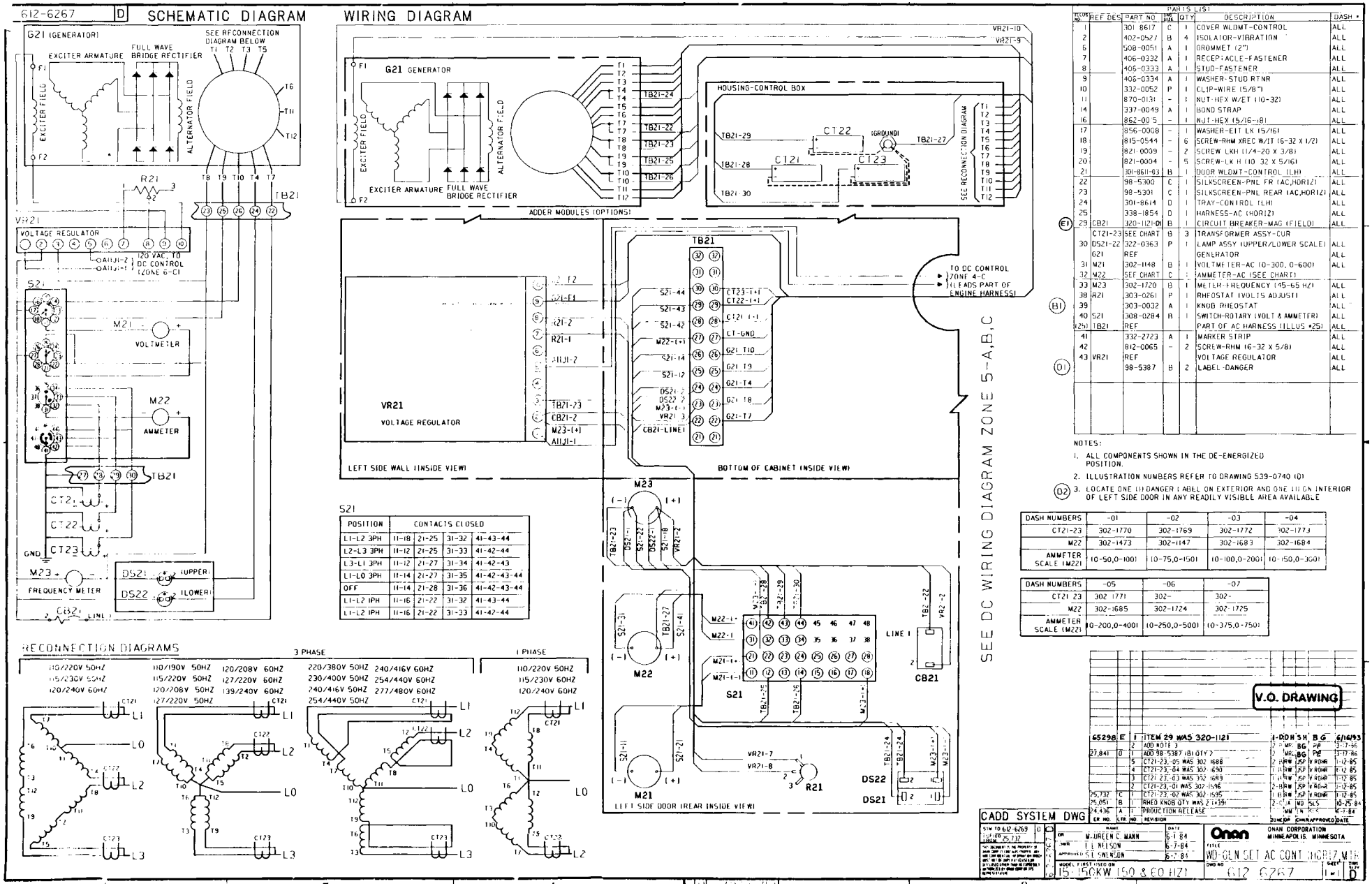
If there is fuel to the injection pump, but no fuel at injection nozzle, the fuel solenoid might be defective.

To check fuel solenoid operation, remove the B+ lead connection from the solenoid, and jumper a separate B+ connection to this terminal. The injection pump should click. If no click is heard, the fuel solenoid must be replaced.

Control Switch Checkout

1. Remove battery B+ cable.
2. Place ohmmeter leads across switch.
3. Open and close switch while observing the ohmmeter. A normally open switch should indicate infinite resistance when open and continuity when closed. A normally closed switch should indicate continuity when closed and infinite resistance when open.
4. Replace switch if defective.

Wiring Diagrams



S21

POSITION	CONTACTS CLOSED			
L1-L2 3PH	11-18	21-25	31-32	41-43-44
L2-L3 3PH	11-12	21-25	31-33	41-42-44
L3-L1 3PH	11-12	21-27	31-34	41-42-43
L1-L0 3PH	11-14	21-27	31-35	41-42-43-44
OFF	11-14	21-28	31-36	41-42-43-44
L1-L2 1PH	11-16	21-22	31-32	41-43-44
L1-L2 1PH	11-16	21-22	31-33	41-42-44

PARTS LIST

RECOM NO	REF DES	PART NO	SMV MFR	QTY	DESCRIPTION	DASH *
1		301-8617	C	1	COVER WLDMT-CONTROL	ALL
2		402-0527	B	4	ISOLATOR-VIBRATION	ALL
6		508-0051	A	1	GROMMET (2")	ALL
7		406-0332	A	1	RECEPTACLE-FASTENER	ALL
8		406-0333	A	1	STUD-FASTENER	ALL
9		406-0334	A	1	WASHER-STUD RTNR	ALL
10		332-0052	P	1	CLIP-WIRE (5/8")	ALL
11		870-0131	-	1	NUT-HEX W/ET (10-32)	ALL
14		337-0049	A	1	BOND STRAP	ALL
16		862-0015	-	1	NUT-HEX (5/16-18)	ALL
17		856-0008	-	1	WASHER-EIT LK (5/16)	ALL
18		815-0544	-	6	SCREW-RHM XREC W/IT (6-32 X 1/2)	ALL
19		821-0009	-	2	SCREW LKH (1/4-20 X 3/8)	ALL
20		821-0004	-	5	SCREW-LK H (10-32 X 5/16)	ALL
21		301-8611-03	B	1	DOOR WLDMT-CONTROL (LH)	ALL
22		98-5300	C	1	SILKSCREEN-PNL FR (AC,HORIZ)	ALL
23		98-5301	C	1	SILKSCREEN-PNL REAR (AC,HORIZ)	ALL
24		301-8614	D	1	TRAY-CONTROL (LH)	ALL
25		338-1854	D	1	HARNESS-AC (HORIZ)	ALL
E1	CB21	320-1121-01	B	1	CIRCUIT BREAKER-MAG (FIELD)	ALL
	CT21-23	SEE CHART	B	3	TRANSFORMER ASSY-CUR	
30	DS21-22	322-0363	P	1	LAMP ASSY (UPPER/LOWER SCALE)	ALL
	G21	REF			GENERATOR	ALL
31	M21	302-1148	B	1	VOLTMETER-AC (0-300, 0-600)	ALL
32	M22	SEE CHART	C	1	AMMETER-AC (SEE CHART)	
33	M23	302-1720	B	1	METER-FREQUENCY (45-65 HZ)	ALL
38	R21	303-0261	P	1	RHEOSTAT (VOLTS ADJUST)	ALL
39		303-0032	A	1	KNOB RHEOSTAT	ALL
40	S21	308-0284	B	1	SWITCH-ROTARY (VOLT & AMMETER)	ALL
(24)	TB21	REF			PART OF AC HARNESS (ILLUS #25)	ALL
41		332-2723	A	1	MARKER STRIP	ALL
42		812-0065	-	2	SCREW-RHM (6-32 X 5/8)	ALL
43	VR21	REF			VOLTAGE REGULATOR	ALL
D1		98-5387	B	2	LABEL-DANGER	ALL

NOTES:
1. ALL COMPONENTS SHOWN IN THE DE-ENERGIZED POSITION.
2. ILLUSTRATION NUMBERS REFER TO DRAWING 539-0740 (D)
D2 3. LOCATE ONE (1) DANGER LABEL ON EXTERIOR AND ONE (1) ON INTERIOR OF LEFT SIDE DOOR IN ANY READILY VISIBLE AREA AVAILABLE

DASH NUMBERS	-01	-02	-03	-04
CT21-23	302-1770	302-1769	302-1772	302-1773
M22	302-1473	302-1147	302-1683	302-1684
AMMETER SCALE (M221	10-50,0-100)	10-75,0-150)	10-100,0-200)	10-150,0-300)

DASH NUMBERS	-05	-06	-07
CT21-23	302-1771	302-	302-
M22	302-1685	302-1724	302-1725
AMMETER SCALE (M221	10-200,0-400)	10-250,0-500)	10-375,0-750)

V.O. DRAWING

65298	E	1	ITEM 29 WAS 320-1121	J-DDH SH	BG		6/16/93
		2	ADD NOTE 3		BG	PE	3-17-86
27,841	D	1	ADD 98-5387 (B) QTY 2		BG	PE	3-17-86
		5	CT21-23,-05 WAS 302-1688		RW	JSP	V ROHR 1-12-85
		4	CT21-23,-04 WAS 302-1690		RW	JSP	V ROHR 1-12-85
		3	CT21-23,-03 WAS 302-1689		RW	JSP	V ROHR 1-12-85
		2	CT21-23,-01 WAS 302-1546		RW	JSP	V ROHR 1-12-85
25,732	C	1	CT21-23,-02 WAS 302-1695		RW	JSP	V ROHR 1-12-85
25,051	B	1	RHEO KNOB QTY WAS 2 (+39)		WD	SLS	10-25-84
24,436	A	1	PRODUCTION RELEASE		MN	JN	6-7-84
ER NO.	ER NO		REVISION	ZONE OP	CHKR	APPROVED	DATE

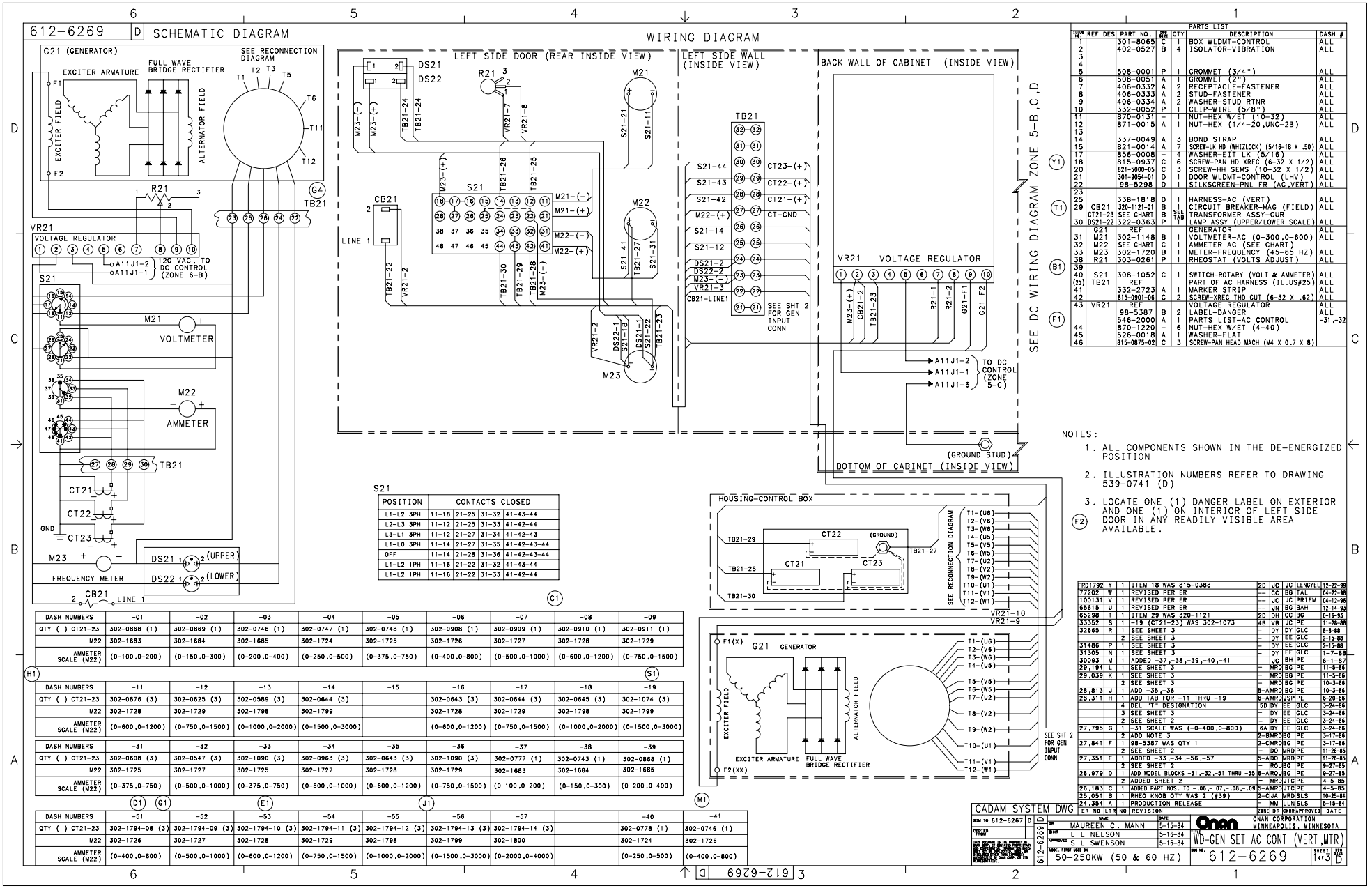
CADD SYSTEM DWG
SIM TO 612-6269 D
LEVEL 25,732

	NAME	DATE
DR	M. DREEN C. MANN	6-1-84
CHKR	E. L. NELSON	6-7-84
APPROVED	S. E. SWENSON	6-7-84

MODEL FIRST USED ON 15-150KW (50 & 60 HZ)

Onan ONAN CORPORATION MINNEAPOLIS, MINNESOTA
TITLE WD GEN SET AC CONT HORIZ MTR
DWG NO 612-6267 SHEET 1 of 1 DASH D

AC Control Wire Diagram (Horizontal, w/Detector AC)



PARTS LIST						
ITEM NO.	REF DES	PART NO.	SYM RFR	QTY	DESCRIPTION	DASH #
1		301-8065	C	1	BOX WLDMT-CONTROL	ALL
2		402-0527	B	4	ISOLATOR-VIBRATION	ALL
3						
4						
5		508-0001	P	1	GROMMET (3/4")	ALL
6		508-0051	A	1	GROMMET (2")	ALL
7		406-0332	A	2	RECEPTACLE-FASTENER	ALL
8		406-0333	A	2	STUD-FASTENER	ALL
9		406-0334	A	2	WASHER-STUD RTNR	ALL
10		332-0052	P	1	CLIP-WIRE (5/8")	ALL
11		870-0131	–	1	NUT-HEX W/ET (10-32)	ALL
12		871-0015	A	1	NUT-HEX (1/4-20,UNC-2B)	ALL
13						
14		337-0049	A	3	BOND STRAP	ALL
15		821-0014	A	7	SCREW-LK HD (WHIZLOCK) (5/16-18 X .50)	ALL
17		856-0008	–	4	WASHER-EIT LK (5/16)	ALL
18		815-0937	C	6	SCREW-PAN HD XREC (6-32 X 1/2)	ALL
20		821-5000-05	C	3	SCREW-HH SEMS (10-32 X 1/2)	ALL
21		301-9054-01	D	1	DOOR WLDMT-CONTROL (LHV)	ALL
22		98-5298	D	1	SILKSCREEN-PNL FR (AC,VERT)	ALL
23						
25		338-1818	D	1	HARNESS-AC (VERT)	ALL
29	CB21	320-1121-01	B	1	CIRCUIT BREAKER-MAG (FIELD)	ALL
	CT21-23	SEE CHART	B	SEE TAB	TRANSFORMER ASSY-CUR	
30	DS21-22	322-0363	P	1	LAMP ASSY (UPPER/LOWER SCALE)	ALL
	G21	REF			GENERATOR	ALL
31	M21	302-1148	B	1	VOLTMETER-AC (0-300,0-600)	ALL
32	M22	SEE CHART	C	1	AMMETER-AC (SEE CHART)	
33	M23	302-1720	B	1	METER-FREQUENCY (45-65 HZ)	ALL
38	R21	303-0261	P	1	RHEOSTAT (VOLTS ADJUST)	ALL
39						
40	S21	308-1052	C	1	SWITCH-ROTARY (VOLT & AMMETER)	ALL
(25)	TB21	REF			PART OF AC HARNESS (ILLUS #25)	ALL
41		332-2723	A	1	MARKER STRIP	ALL
42		815-0901-06	C	2	SCREW-XREC THD CUT (6-32 X .62)	ALL
43	VR21	REF			VOLTAGE REGULATOR	ALL
		98-5387	B	2	LABEL-DANGER	ALL
		546-2000	A	1	PARTS LIST-AC CONTROL	-31,-32
44		870-1220	–	6	NUT-HEX W/ET (4-40)	
45		526-0018	A	1	WASHER-FLAT	
46		815-0875-02	C	3	SCREW-PAN HEAD MACH (M4 X 0.7 X 8)	

NOTES:

1. ALL COMPONENTS SHOWN IN THE DE-ENERGIZED POSITION
2. ILLUSTRATION NUMBERS REFER TO DRAWING 539-0741 (D)
3. LOCATE ONE (1) DANGER LABEL ON EXTERIOR AND ONE (1) ON INTERIOR OF LEFT SIDE DOOR IN ANY READILY VISIBLE AREA AVAILABLE.

S21

POSITION	CONTACTS CLOSED			
L1-L2 3PH	11-18	21-25	31-32	41-43-44
L2-L3 3PH	11-12	21-25	31-33	41-42-44
L3-L1 3PH	11-12	21-27	31-34	41-42-43
L1-L0 3PH	11-14	21-27	31-35	41-42-43-44
OFF	11-14	21-28	31-36	41-42-43-44
L1-L2 1PH	11-16	21-22	31-32	41-43-44
L1-L2 1PH	11-16	21-22	31-33	41-42-44

DASH NUMBERS	-01	-02	-03	-04	-05	-06	-07	-08	-09
QTY ( ) CT21-23	302-0868 (1)	302-0869 (1)	302-0746 (1)	302-0747 (1)	302-0748 (1)	302-0908 (1)	302-0909 (1)	302-0910 (1)	302-0911 (1)
M22	302-1683	302-1684	302-1685	302-1724	302-1725	302-1726	302-1727	302-1728	302-1729
AMMETER SCALE (M22)	(0-100,0-200)	(0-150,0-300)	(0-200,0-400)	(0-250,0-500)	(0-375,0-750)	(0-400,0-800)	(0-500,0-1000)	(0-600,0-1200)	(0-750,0-1500)

DASH NUMBERS	-11	-12	-13	-14	-15	-16	-17	-18	-19
QTY ( ) CT21-23	302-0876 (3)	302-0625 (3)	302-0589 (3)	302-0644 (3)		302-0643 (3)	302-0644 (3)	302-0645 (3)	302-1074 (3)
M22	302-1728	302-1729	302-1798	302-1799		302-1728	302-1729	302-1798	302-1799
AMMETER SCALE (M22)	(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)		(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)

DASH NUMBERS	-31	-32	-33	-34	-35	-36	-37	-38	-39
QTY ( ) CT21-23	302-0608 (3)	302-0547 (3)	302-1090 (3)	302-0963 (3)	302-0643 (3)	302-1090 (3)	302-0777 (1)	302-0743 (1)	302-0868 (1)
M22	302-1725	302-1727	302-1725	302-1727	302-1728	302-1729	302-1683	302-1684	302-1685
AMMETER SCALE (M22)	(0-375,0-750)	(0-500,0-1000)	(0-375,0-750)	(0-500,0-1000)	(0-600,0-1200)	(0-750,0-1500)	(0-100,0-200)	(0-150,0-300)	(0-200,0-400)

DASH NUMBERS	-51	-52	-53	-54	-55	-56	-57		-40	-41
QTY ( ) CT21-23	302-1794-08 (3)	302-1794-09 (3)	302-1794-10 (3)	302-1794-11 (3)	302-1794-12 (3)	302-1794-13 (3)	302-1794-14 (3)		302-0778 (1)	302-0746 (1)
M22	302-1726	302-1727	302-1728	302-1729	302-1798	302-1799	302-1800		302-1724	302-1726
AMMETER SCALE (M22)	(0-400,0-800)	(0-500,0-1000)	(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)	(0-2000,0-4000)		(0-250,0-500)	(0-400,0-800)

FR01792	Y	1	ITEM 18 WAS 815-0388	2D	JC	JC LENGYEL 12-22-98
77202	W	1	REVISED PER ER	---	CC	BG TAL 04-22-98
100131	V	1	REVISED PER ER	---	JC	JC PRIEW 04-12-96
65615	U	1	REVISED PER ER	---	JN	BG BAH 12-14-93
65298	T	1	ITEM 29 WAS 320-1121	2D	DH	CC BG 6-16-93
33352	S	1	-19 (CT21-23) WAS 302-1073	4B	VB	JC PE 11-26-88
32665	R	1	SEE SHEET 3	–	DY	DY GLC 8-8-88
		2	SEE SHEET 3	–	DY	EE GLC 2-15-88
31486	P	1	SEE SHEET 3	–	DY	EE GLC 2-15-88
31305	N	1	SEE SHEET 3	–	DY	EE GLC 1-7-88
30093	M	1	ADDED -37,-38,-39,-40,-41	–	JC	BH PE 6-1-87
29,194	L	1	SEE SHEET 3	–	MRD	BG PE 11-5-86
29,039	K	1	SEE SHEET 3	–	MRD	BG PE 11-5-86
		2	SEE SHEET 3	–	MRD	BG PE 10-3-86
28,813	J	1	ADD -35,-36	5-A	MRD	BG PE 10-3-86
28,311	H	1	ADD TAB FOR -11 THRU -19	6-A	MRD	JSP PE 8-20-86
		4	DEL "T" DESIGNATION	5D	DY	EE GLC 3-24-86
		3	SEE SHEET 3	–	DY	EE GLC 3-24-86
		2	SEE SHEET 3	–	DY	EE GLC 3-24-86
27,795	G	1	-31 SCALE WAS (0-400,0-800)	6A	DY	EE GLC 3-24-86
		2	ADD NOTE 3	2-B	MRD	BG PE 3-17-86
27,841	F	1	98-5387 WAS QTY 1	2-C	MRD	BG PE 3-17-86
		2	SEE SHEET 2	–	DO	MRD PE 11-26-85
27,351	E	1	ADDED -33,-34,-56,-57	5-A	DO	MRD PE 11-26-85
		2	SEE SHEET 2	–	ROU	BG PE 9-27-85
26,979	D	1	ADD MODEL BLOCKS -31,-32,-51 THRU -55	6-A	ROU	BG PE 9-27-85
		2	ADDED SHEET 2	–	MRD	JTC PE 4-5-85
26,183	C	1	ADDED PART NOS. TO -.06,-.07,-.08,-.09	5-A	MRD	JTC PE 4-5-85
25,051	B	1	RHEO KNOB QTY WAS 2 (#39)	2-C	JA	MRD SLS 10-25-84
24,354	A	1	PRODUCTION RELEASE	–	MM	LLN SLS 5-15-84

ER NO	LTR	NO	REVISION	ZONE	DR	CHK	APPROVED	DATE

CADAM SYSTEM DWG 612-6269 D

SIM TO 612-6267 D

DRAWN: MAUREEN C. MANN 5-15-84
CHKD: L L NELSON 5-16-84
APPROVED: S L SWENSON 5-16-84

MANUFACTURED BY ONAN CORPORATION MINNEAPOLIS, MINNESOTA

TITLE: WD-GEN SET AC CONT (VERT,MTR)

50-250KW (50 & 60 HZ)

DWG NO. 612-6269 SHEET 1 of 3 REV D

AC Control Wire Diagram (Vertical, w/Detector AC) Sheet 1 of 3

612-6269 D

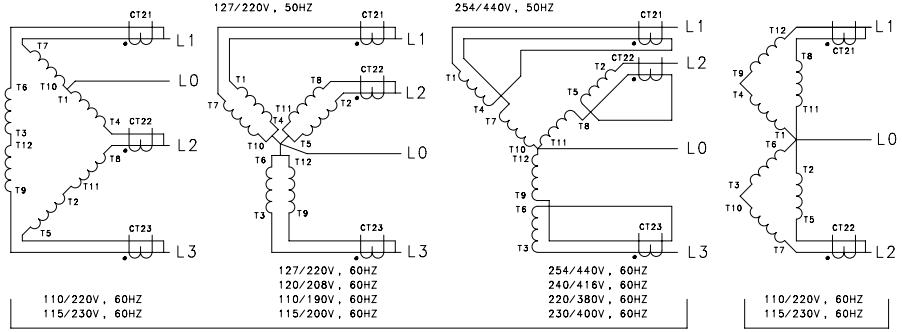
UR GENERATORS

15/515
3 PHASE

110/220V, 50HZ
115/230V, 50HZ
120/240V, 60HZ

110/190V, 50HZ 120/208V, 60HZ
115/220V, 50HZ 127/220V, 60HZ
120/208V, 50HZ 139/240V, 60HZ
127/220V, 50HZ

220/380V, 50HZ 240/416V, 60HZ
230/400V, 50HZ 254/440V, 60HZ
240/416V, 50HZ 277/480V, 60HZ
254/440V, 50HZ



110/220V, 60HZ
115/230V, 60HZ

127/220V, 60HZ
120/208V, 60HZ
110/190V, 60HZ
115/200V, 60HZ

254/440V, 60HZ
240/416V, 60HZ
220/380V, 60HZ
230/400V, 60HZ

3 PHASE
32

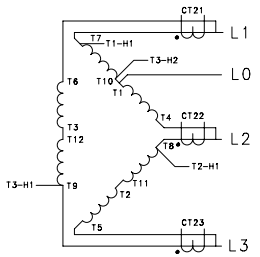
1 PHASE

110/220V, 50HZ
115/230V, 60HZ
120/240V, 60HZ

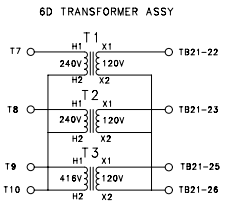
110/220V, 60HZ
115/230V, 60HZ

1 PHASE

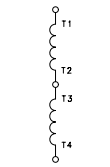
6D: 240/480V 60HZ



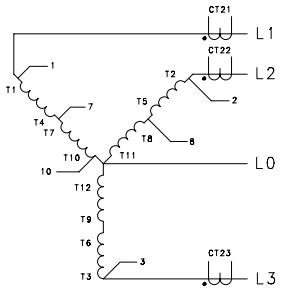
6D TRANSFORMER ASSY



1 PHASE, 3R
120/240V 60HZ



7:220/380V 60HZ



VOLTAGE CODE					
CONT INPUT TB21	15/515	6D	7·	3R	32
22	T7	T1-X1	T7	T1	T7
23	T8	T2-X1	T8	T2	T8
24	T4	–	–	–	T4
25	T9	T3-X1	T9	–	T9
26	T10	T1,2,3-X2	T10	–	T10
JUMPER	–	22-24	–	23-24	

ER NO	LTR	NO	REVISION	ZONE	DR	CHK	APPROVED	DATE
FRD10790	Z	—						
FRD17921	Y	—						
77202	W	—						
100131	V	—						
65615	U	—						
65298	T	—						
27795	G	2	SHEET 2 REDRAWN WITH CHANGES	–	DY	EE	GLC	3-24-86

CADAM SYSTEM DWG
NEW TO 612-6267 D

	NAME	DATE
DR	D. YOUNG	3-21-86
CHKR	E. ENGLE	4-1-86
APPROVED	G.L. CARLSON	4-1-86

612-6269 D

MODEL FIRST USED ON: 50KW (60 HZ)

ONAN CORPORATION
MINNEAPOLIS, MINNESOTA

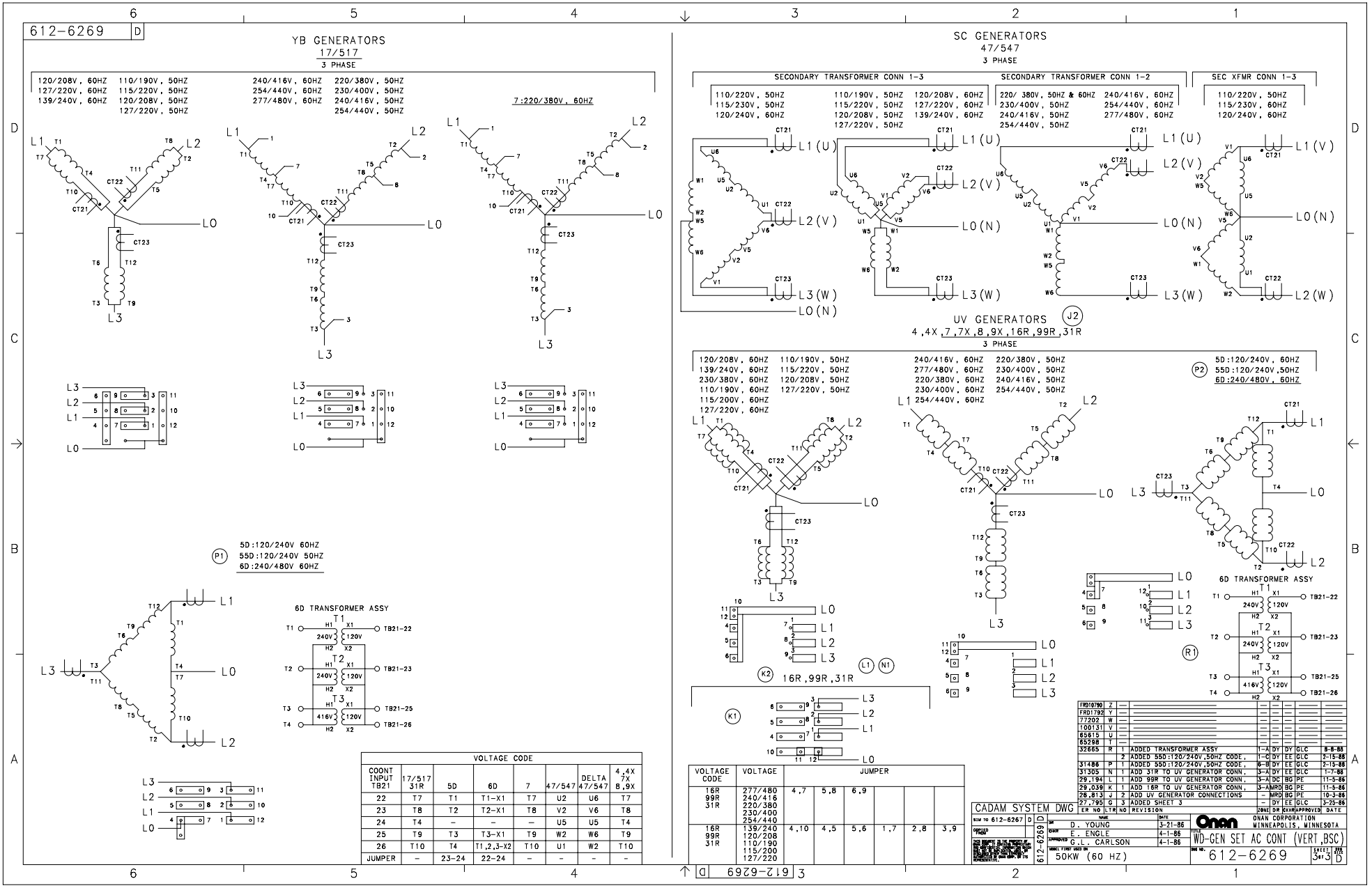
TITLE: WD-GEN SET AC CONT (VERT,BSC)

DWG NO. 612-6269

SHEET 2 of 3 REV D

612-6269 D 3

AC Control Wire Diagram (Vertical, w/Detector AC) Sheet 2 of 3



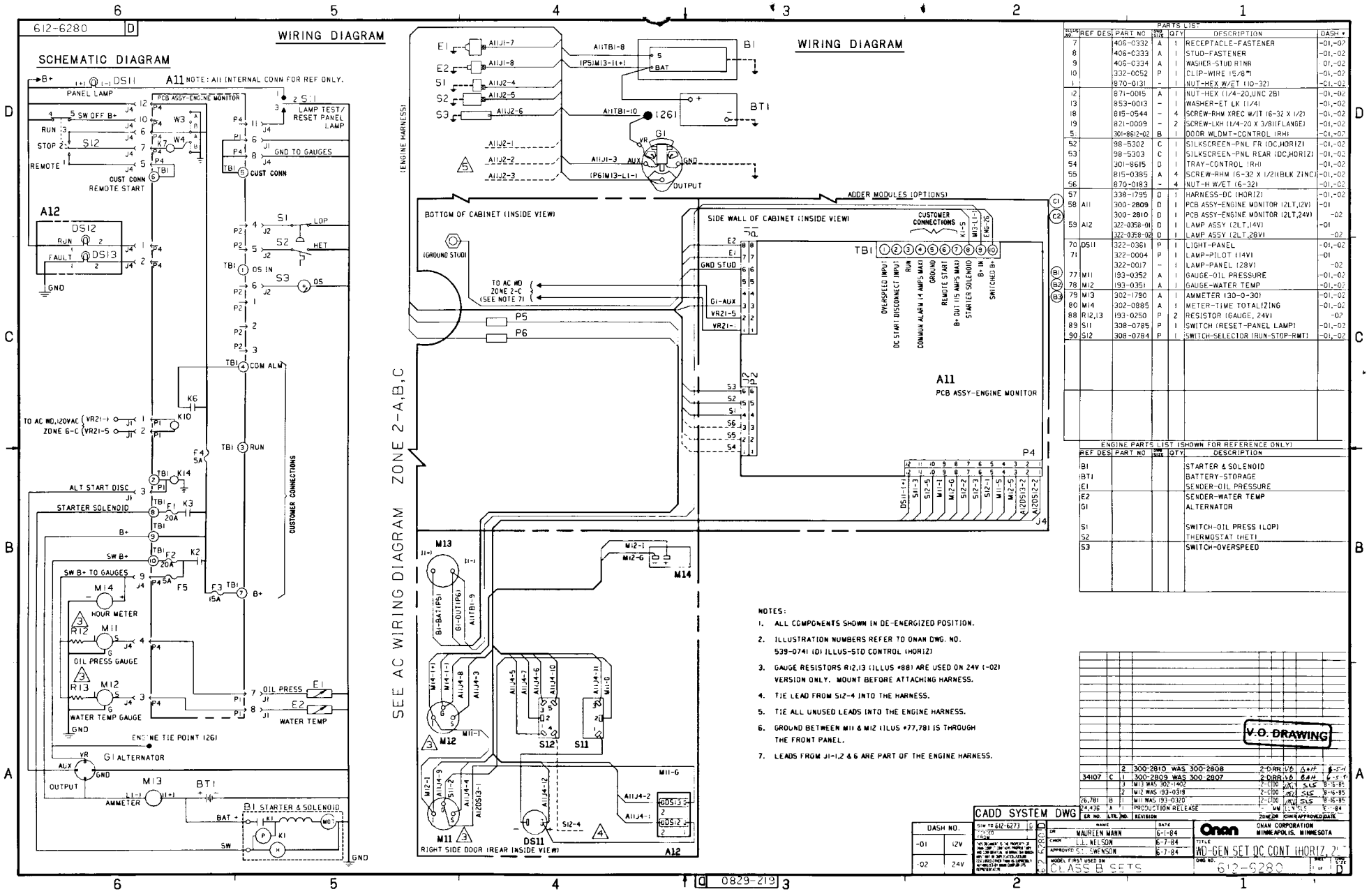
VOLTAGE CODE								
COONT INPUT TB21	17/517 31R	5D	6D	7	47/547	DELTA 47/547	4,4X 7X 8,9X
22	T7	T1	T1-X1	T7	U2	U6	T7
23	T8	T2	T2-X1	T8	V2	V6	T8
24	T4	–	–	–	U5	U5	T4
25	T9	T3	T3-X1	T9	W2	W6	T9
26	T10	T4	T1,2,3-X2	T10	U1	W2	T10
JUMPER	–	23-24	22-24	–	–	–	–

VOLTAGE CODE	VOLTAGE	JUMPER					
16R 99R 31R	277/480 240/416 220/380 230/400 254/440	4,7	5,8	6,9			
16R 99R 31R	139/240 120/208 110/190 115/200 127/220	4,10	4,5	5,6	1,7	2,8	3,9

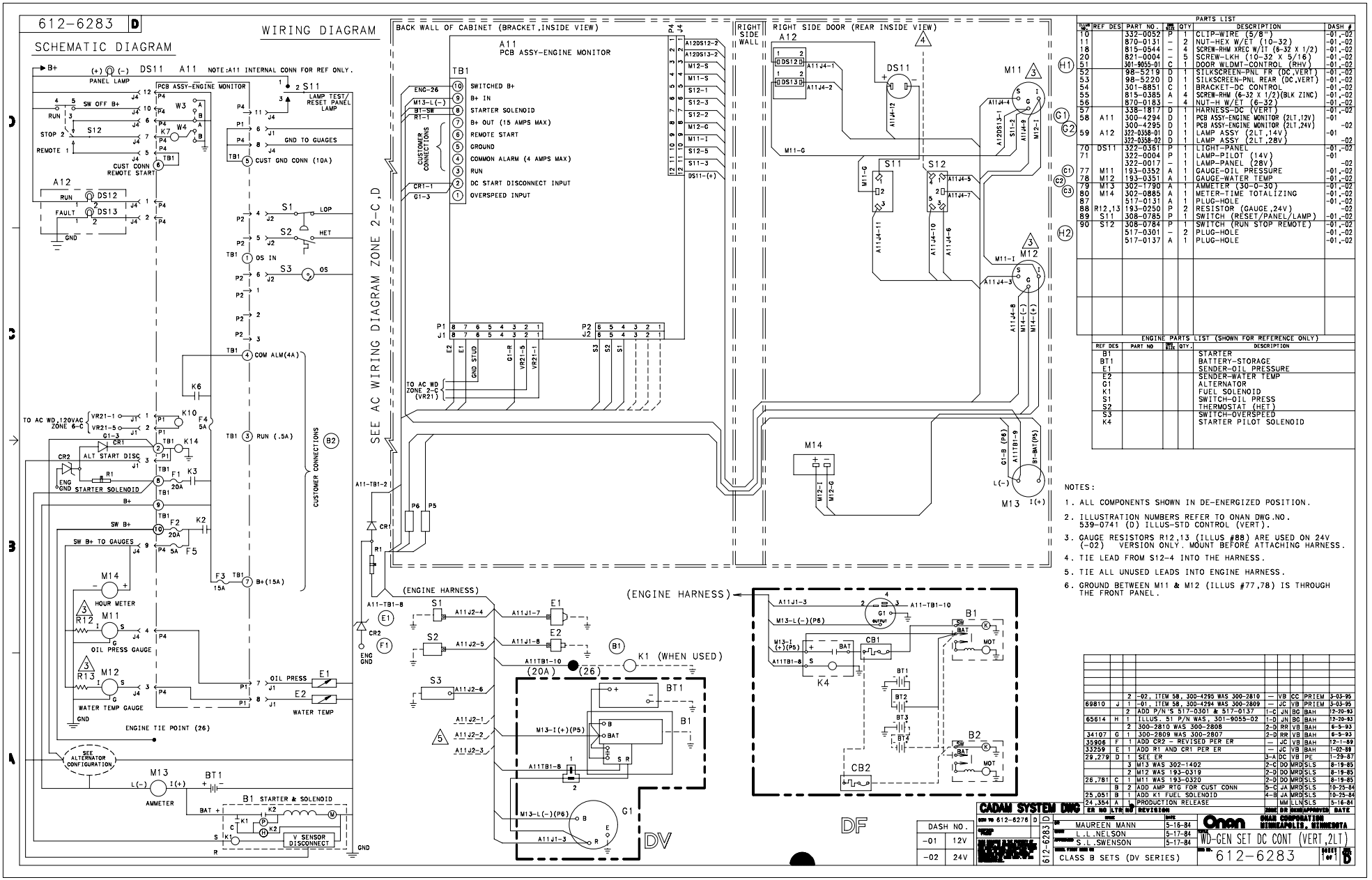
FRD10790	Z	–				
FRD1792	Y	–				
77202	W	–				
100131	V	–				
65615	U	–				
65298	T	–				
32665	R	1	ADDED TRANSFORMER ASSY	1-A DY	DY GLC	8-8-88
		2	ADDED 55D:120/240V,50HZ CODE,	1-C DY	EE GLC	2-15-88
31486	P	1	ADDED 55D:120/240V,50HZ CODE,	8-B DY	EE GLC	2-15-88
31305	N	1	ADD 31R TO UV GENERATOR CONN,	3-A DY	EE GLC	1-7-88
29,194	L	1	ADD 99R TO UV GENERATOR CONN,	3-A DC	BG PE	11-5-86
29,039	K	1	ADD 16R TO UV GENERATOR CONN,	3-A MRD	BG PE	11-5-86
28,813	J	2	ADD UV GENERATOR CONNECTIONS	– MRD	BG PE	10-3-86
27,795	G	3	ADDED SHEET 3	– DY	EE GLC	3-25-86
ER NO	LTR	NO	REVISION	ZONE	DR CKR	APPROVED DATE

CADAM SYSTEM DWG SIM TO 612-6267 D
612-6269 D
DR D. YOUNG 3-21-86
CKR E. ENGLE 4-1-86
APPROVED G. L. CARLSON 4-1-86
MODEL FIRST USED ON 50KW (60 HZ)
ONAN CORPORATION MINNEAPOLIS, MINNESOTA
TITLE WD-GEN SET AC CONT (VERT,BSC)
DWG NO. 612-6269
SHEET 3 of 3 REV D

AC Control Wire Diagram (Vertical, w/Detector AC) Sheet 3 of 3



DC Control Wire Diagram (Horizontal, w/Detector 2)



PARTS LIST

ITEM NO.	REF DES	PART NO.	REV LTR	QTY	DESCRIPTION	DASH #
10		332-0052	P	1	CLIP-WIRE (5/8")	-01,-02
11		870-0131	–	2	NUT-HEX W/ET (10-32)	-01,-02
18		815-0544	–	4	SCREW-RHM XREC W/IT (6-32 X 1/2)	-01,-02
20		821-0004	–	5	SCREW-LKH (10-32 X 5/16)	-01,-02
51		301-9055-01	C	1	DOOR WLDMT-CONTROL (RHV)	-01,-02
52		98-5219	D	1	SILKSCREEN-PNL FR (DC,VERT)	-01,-02
53		98-5220	D	1	SILKSCREEN-PNL REAR (DC,VERT)	-01,-02
54		301-8851	C	1	BRACKET-DC CONTROL	-01,-02
55		815-0385	A	4	SCREW-RHM (6-32 X 1/2)(BLK ZINC)	-01,-02
56		870-0183	–	4	NUT-H W/ET (6-32)	-01,-02
57		338-1817	D	1	HARNESS-DC (VERT)	-01,-02
58	A11	300-4294	D	1	PCB ASSY-ENGINE MONITOR (2LT,12V)	-01
		300-4295	D	1	PCB ASSY-ENGINE MONITOR (2LT,24V)	-02
59	A12	322-0358-01	D	1	LAMP ASSY (2LT,14V)	-01
		322-0358-02	D	1	LAMP ASSY (2LT,28V)	
70	DS11	322-0381	P	1	LIGHT-PANEL	-01,-02
71		322-0004	P	1	LAMP-PILOT (14V)	-01
		322-0017	–	1	LAMP-PANEL (28V)	-02
77	M11	193-0352	A	1	GAUGE-OIL PRESSURE	-01,-02
78	M12	193-0351	A	1	GAUGE-WATER TEMP	-01,-02
79	M13	302-1790	A	1	AMMETER (30-0-30)	-01,-02
80	M14	302-0885	A	1	METER-TIME TOTALIZING	-01,-02
87		517-0131	A	1	PLUG-HOLE	-01,-02
88	R12,13	193-0250	P	2	RESISTOR (GAUGE,24V)	-02
89	S11	308-0785	P	1	SWITCH (RESET/PANEL/LAMP)	-01,-02
90	S12	308-0784	P	1	SWITCH (RUN STOP REMOTE)	-01,-02
		517-0301	–	2	PLUG-HOLE	-01,-02
		517-0137	A	1	PLUG-HOLE	-01,-02

ENGINE PARTS LIST (SHOWN FOR REFERENCE ONLY)

REF DES	PART NO	REV LTR	QTY.	DESCRIPTION
B1				STARTER
BT1				BATTERY-STORAGE
E1				SENDER-OIL PRESSURE
E2				SENDER-WATER TEMP
G1				ALTERNATOR
K1				FUEL SOLENOID
S1				SWITCH-OIL PRESS
S2				THERMOSTAT (HET)
S3				SWITCH-OVERSPEED
K4				STARTER PILOT SOLENOID

NOTES:

1. ALL COMPONENTS SHOWN IN DE-ENERGIZED POSITION.
2. ILLUSTRATION NUMBERS REFER TO ONAN DWG.NO. 539-0741 (D) ILLUS-STD CONTROL (VERT).
3. GAUGE RESISTORS R12,13 (ILLUS #88) ARE USED ON 24V (-02) VERSION ONLY. MOUNT BEFORE ATTACHING HARNESS.
4. TIE LEAD FROM S12-4 INTO THE HARNESS.
5. TIE ALL UNUSED LEADS INTO ENGINE HARNESS.
6. GROUND BETWEEN M11 & M12 (ILLUS #77,78) IS THROUGH THE FRONT PANEL.

		2	-02, ITEM 58, 300-4295 WAS 300-2810	–	VB	CC	PRIEM 3-03-95
69810	J	1	-01, ITEM 58, 300-4294 WAS 300-2809	–	JC	VB	PRIEM 3-03-95
		2	ADD P/N'S 517-0301 & 517-0137	1-C	JN	BG	BAH 12-20-93
65614	H	1	ILLUS. 51 P/N WAS, 301-9055-02	1-D	JN	BG	BAH 12-20-93
		2	300-2810 WAS 300-2808	2-D	RR	VB	BAH 6-5-93
34107	G	1	300-2809 WAS 300-2807	2-D	RR	VB	BAH 6-5-93
35906	F	1	ADD CR2 – REVISED PER ER	–	JC	VB	BAH 12-1-89
33259	E	1	ADD R1 AND CR1 PER ER	–	JC	VB	BAH 1-02-89
29,279	D	1	SEE ER	3-A	DC	VB	PE 1-20-87
		3	M13 WAS 302-1402	2-C	DO	MRD	SLS 8-19-85
		2	M12 WAS 193-0319	2-D	DO	MRD	SLS 8-19-85
26,781	C	1	M11 WAS 193-0320	2-D	DO	MRD	SLS 8-19-85
	B	2	ADD AMP RTG FOR CUST CONN	5-C	JA	MRD	SLS 10-25-84
25,051	B	1	ADD K1 FUEL SOLENOID	4-B	JA	MRD	SLS 10-25-84
24,354	A	1	PRODUCTION RELEASE			WM	LLN SLS 5-16-84

ZONE	LTR	REVISIONS	DATE	BY	CHK'D	APPROVED	DATE

CADAM SYSTEM DWG DWN TO 612-6276 D

DRAWN	MAUREEN MANN	5-16-84
CHECKED	L.L.NELSON	5-17-84
APPROVED	S.L.SWENSON	5-17-84

ONAN CORPORATION MINNEAPOLIS, MINNESOTA

TITLE: WD-GEN SET DC CONT (VERT,2LT)

CLASS B SETS (DV SERIES)

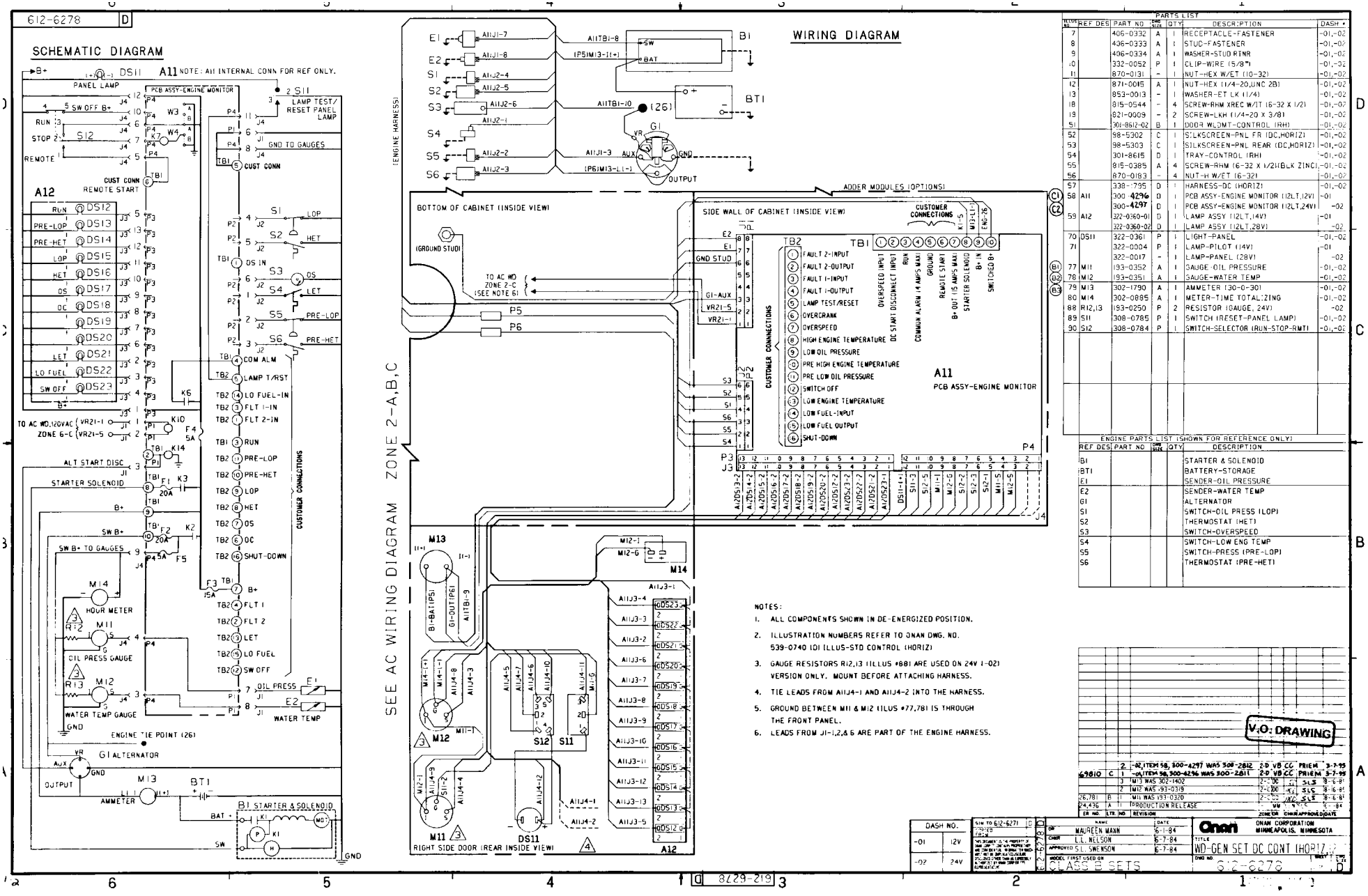
DWG NO. 612-6283 REV D

SHEET 1 OF 1

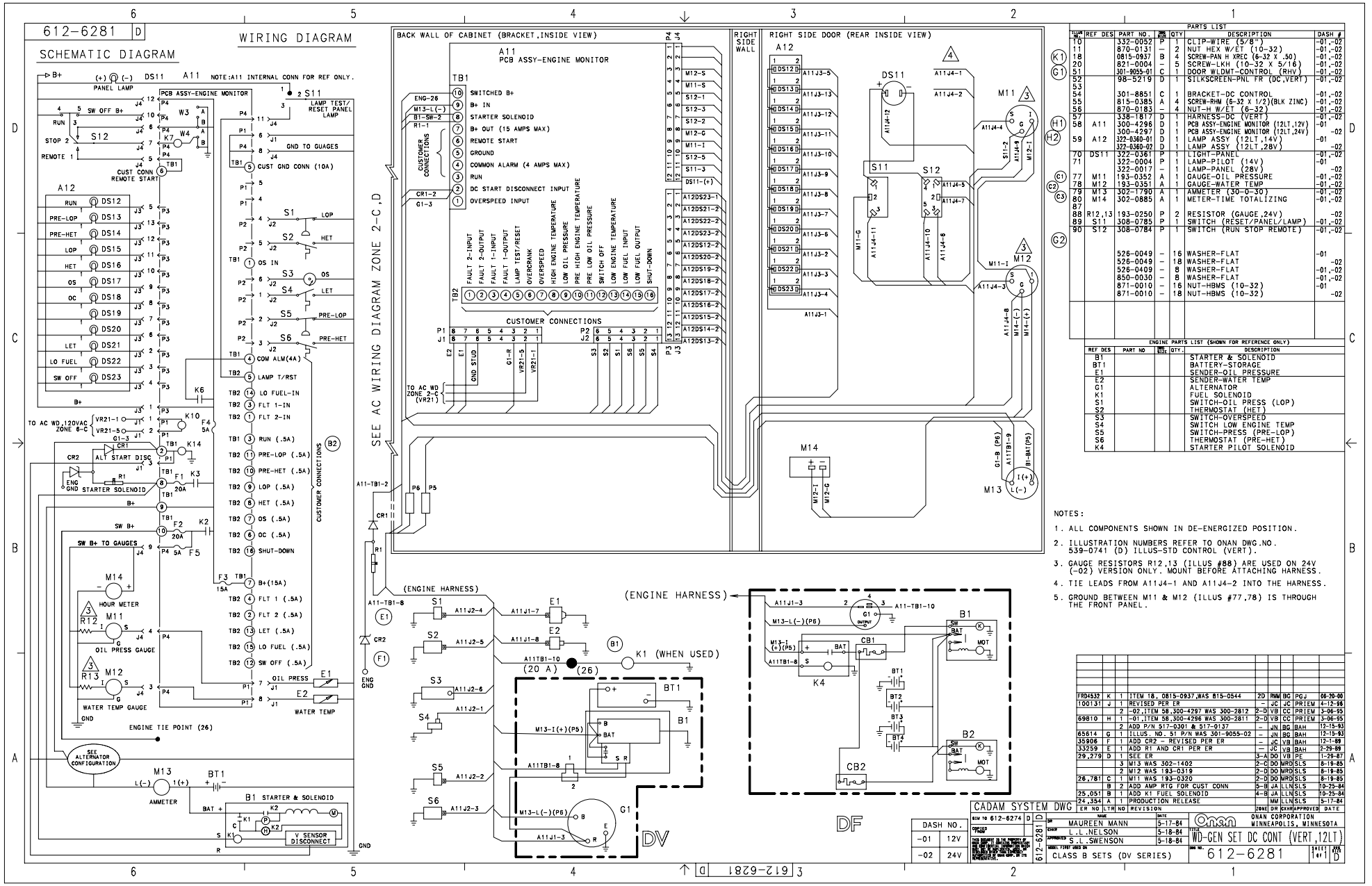
DASH NO.	
-01	12V
-02	24V

612-6283 D

DC Control Wire Diagram (Vertical, w/Detector 2)



DC Control Wire Diagram (Horizontal, Detector 12)



PARTS LIST						
ITEM NO.	REF DES	PART NO.	SMV SIZE	QTY	DESCRIPTION	DASH #
10		339-0097	P	1	CLIP-WIRE (5/8")	-01,-02
11		870-0131	–	2	NUT HEX W/ET (10-32)	-01,-02
18		0815-0937	B	4	SCREW-PAN H XREC (6-32 X .50)	-01,-02
20		821-0004	–	5	SCREW-LKH (10-32 X 5/16)	-01,-02
51		301-9055-01	C	1	DOOR W\DMT-CONTROL (RHV	-01,-02
52		98-5219	D	1	SILKSCREEN-PNL FR (DC,VERT)	-01,-02
53						
54		301-8851	C	1	BRACKET-DC CONTROL	-01,-02
55		815-0385	A	4	SCREW-RHM (6-32 X 1/2)(BLK ZINC)	-01,-02
56		870-0183	–	4	NUT-H W/ET (6-32)	-01,-02
57		338-1817	D	1	HARNESS-DC (VERT)	-01,-02
58	A11	300-4296	D	1	PCB ASSY-ENGINE MONITOR (12LT,12V)	-01
		300-4297	D	1	PCB ASSY-ENGINE MONITOR (12LT,24V)	-02
59	A12	322-0360-01	D	1	LAMP ASSY (12LT,14V)	-01
		322-0360-02	D	1	LAMP ASSY (12LT,28V)	-02
70	DS11	322-0361	P	1	LIGHT-PANEL	-01,-02
71		322-0004	P	1	LAMP-PILOT (14V)	-01
		322-0017	–	1	LAMP-PANEL (28V)	-02
77	M11	193-0352	A	1	GAUGE-OIL PRESSURE	-01,-02
78	M12	193-0351	A	1	GAUGE-WATER TEMP	-01,-02
79	M13	302-1790	A	1	AMMETER (30-0-30)	-01,-02
80	M14	302-0885	A	1	METER-TIME TOTALIZING	-01,-02
87						
88	R12,13	193-0250	P	2	RESISTOR (GAUGE,24V)	-02
89	S11	308-0785	P	1	SWITCH (RESET/PANEL/LAMP)	-01,-02
90	S12	308-0784	P	1	SWITCH (RUN STOP REMOTE)	-01,-02
		526-0049	–	16	WASHER-FLAT	-01
		526-0049	–	18	WASHER-FLAT	-02
		526-0409	–	8	WASHER-FLAT	-01,-02
		850-0030	–	8	WASHER-FLAT	-01,-02
		871-0010	–	16	NUT-HBMS (10-32)	-01
		871-0010	–	18	NUT-HBMS (10-32)	-02

ENGINE PARTS LIST (SHOWN FOR REFERENCE ONLY)			
REF DES	PART NO	SMV SIZE	QTY.	DESCRIPTION
B1				STARTER & SOLENOID
BT1				BATTERY-STORAGE
E1				SENDER-OIL PRESSURE
E2				SENDER-WATER TEMP
G1				ALTERNATOR
K1				FUEL SOLENOID
S1				SWITCH-OIL PRESS (LOP)
S2				THERMOSTAT (HET)
S3				SWITCH-OVERSPEED
S4				SWITCH LOW ENGINE TEMP
S5				SWITCH-PRESS (PRE-LOP)
S6				THERMOSTAT (PRE-HET)
K4				STARTER PILOT SOLENOID

NOTES:

1. ALL COMPONENTS SHOWN IN DE-ENERGIZED POSITION.
2. ILLUSTRATION NUMBERS REFER TO ONAN DWG.NO. 539-0741 (D) ILLUS-STD CONTROL (VERT).
3. GAUGE RESISTORS R12,13 (ILLUS #88) ARE USED ON 24V (-02) VERSION ONLY. MOUNT BEFORE ATTACHING HARNESS.
4. TIE LEADS FROM A11J4-1 AND A11J4-2 INTO THE HARNESS.
5. GROUND BETWEEN M11 & M12 (ILLUS #77,78) IS THROUGH THE FRONT PANEL.

REVISION HISTORY									
FRD4532	K	1	ITEM 18, 0815-0937,WAS 815-0544	2D	RMW	BG	PGJ	06-20-00
T001311	J	1	REVISED PER ER	–	JC	JC	PRIEM	4-12-96
		2	-02,ITEM 58,300-4297 WAS 300-2812	2-D	VB	CC	PRIEM	3-06-95
69810	H	1	-01,ITEM 58,300-4296 WAS 300-2811	2-D	VB	CC	PRIEM	3-06-95
		2	ADD P/N 517-0301 & 517-0137	–	JN	BG	BAH	12-15-93
65614	G	1	ILLUS. NO. 51 P/N WAS 301-9055-02	–	JN	BG	BAH	12-15-93
35906	F	1	ADD CR2 – REVISED PER ER	–	JC	VB	BAH	12-1-89
33259	E	1	ADD R1 AND CR1 PER ER	–	JC	VB	BAH	2-28-89
29,279	D	1	SEE ER	3-A	DO	VB	PE	1-28-87
		3	M13 WAS 302-1402	2-C	DO	MRD	SLS	8-19-85
		2	M12 WAS 193-0319	2-D	DO	MRD	SLS	8-19-85
26,781	C	1	M11 WAS 193-0320	2-D	DO	MRD	SLS	8-19-85
	B	2	ADD AMP RTG FOR CUST CONN	5-B	JA	LLN	SLS	10-25-84
25,051	B	1	ADD K1 FUEL SOLENOID	4-B	JA	LLN	SLS	10-25-84
24,354	A	1	PRODUCTION RELEASE	–	MM	LLN	SLS	5-17-84
		ER NO	LTR NO	REVISION			ZONE	BY	APPROVED	DATE

CADAM SYSTEM DWG REV TO 612-6274 D

DASH NO.	
-01	12V
-02	24V

612-6281 D

	NAME	DATE
DR	MAUREEN MANN	5-17-84
CHKR	L.L.NELSON	5-18-84
APPROVED	S.L.SWENSON	5-18-84

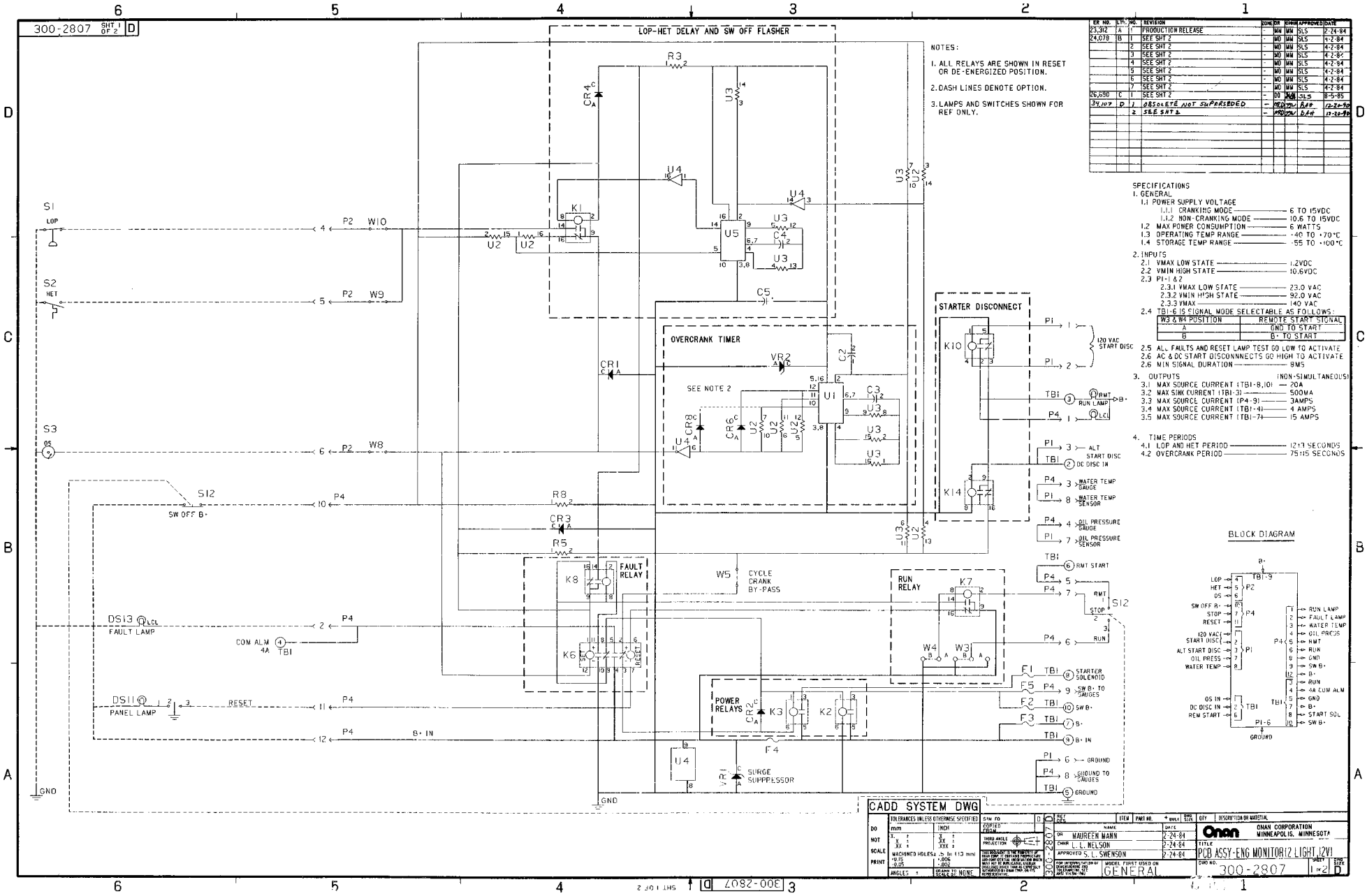
MODEL FIRST USED ON: CLASS B SETS (DV SERIES)

ONAN CORPORATION MINNEAPOLIS, MINNESOTA

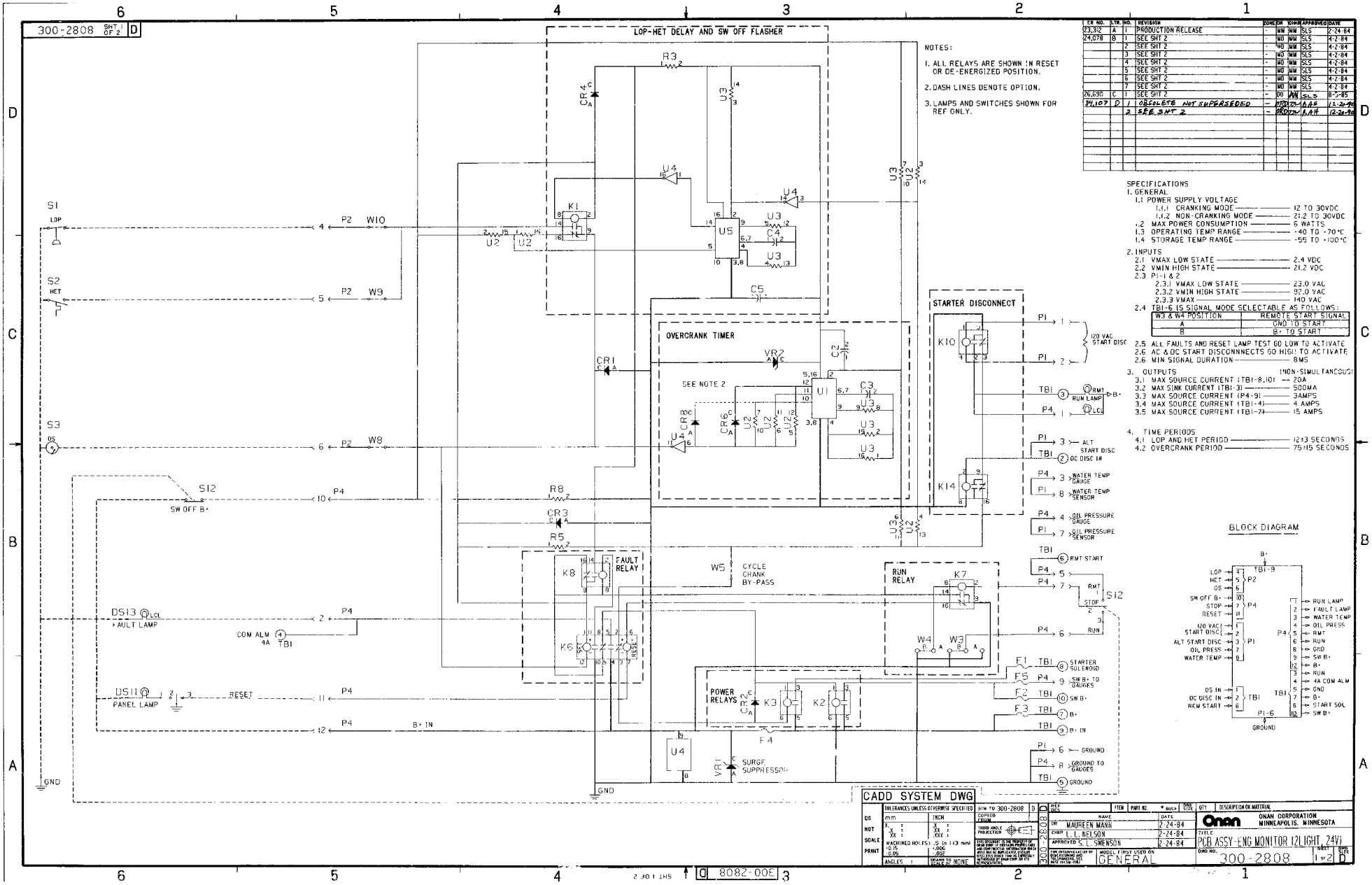
TITLE: WD-GEN SET DC CONT (VERT,12LT)

DWG NO. 612-6281 SHEET 1 OF 1 REV D

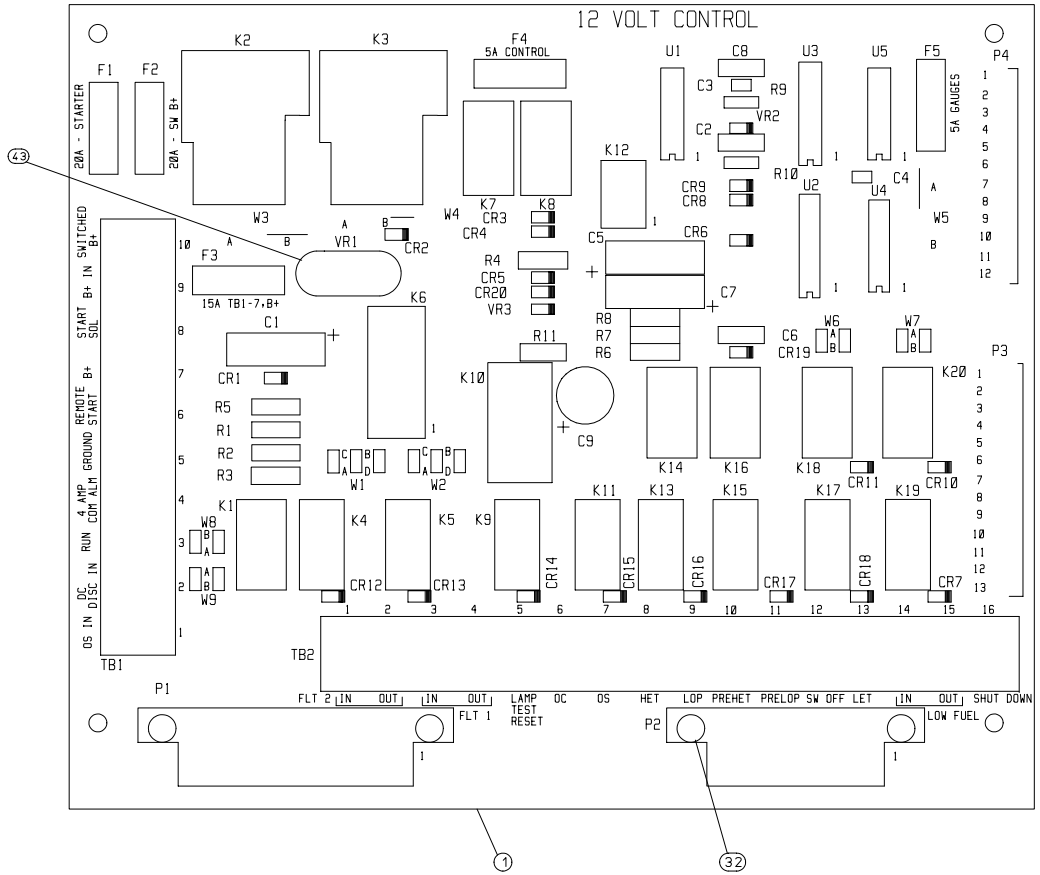
DC Control Wire Diagram (Vertical, Detector 12)



EMC P.C.B. Assembly - A11 (Detector 2, 12V)



EMC P.C.B. Assembly - A11 (Detector 2, 24V)



ER No.	Ltr	No	Revision	Zone	Dr.	Chkr	Approved	Date
34,107	F	1	REDRAWN WITH CHANGES PER ER	-	MRD	TW	BAH	02-19-91
62,300	G	1	REVISED PER ER	-	MRD	TW	PRO	08-01-92
72,330	H	1	OBS, SUPSD BY 300-4296(D)	-	MRD	BG	CPH	04-23-96

NOTES:

1. CIRCUIT BOARD SHALL BE SOLDERED WITH ITEM #2 AT MAX SOLDER TEMP OF 500°F AND MAX TIME OF 6 SECONDS.
2. SOLDER JOINTS AND/OR COMPONENT LEADS SHALL NOT PROJECT MORE THAN 1/8" BEYOND BOARD SURFACE. (EXCEPT TERMINAL BLOCK LEADS)
3. CONFORMAL COAT BOTH SIDES OF COMPLETED BOARD WITH ITEM #3 EXCEPT ITEM 15-18,28-32,37,38,46,47. COATING BUILDUP SHALL NOT BE LESS THAN .002" OR GREATER THAN .1".
4. TEST PRINTED CIRCUIT BOARD PER ITEMS #4-6.
5. DESIGN OF THIS ASSY IS CONTROLLED BY ITEM #7.
6. CLEAN BOARD WITH SUITABLE CLEANER BEFORE CONFORMAL COATING.
7. IF POSSIBLE, PLACE LABEL (ITEM #9) ON PRIMARY SIDE OF BOARD BEFORE CONFORMAL COATING. OTHERWISE PLACE ANYWHERE SPACE PERMITS (PRIMARY OR SECONDARY SIDE).

Item	Part No. *Bulk	Dwg Size	Qty	Description or Material
50	350-0347		1	RESISTOR (22,1/2W,5%)
49	356-0159		1	CAPACITOR-ELEC(470µF,35V)
48	337-0341		3	JUMPER-PCB
47	332-2417		6	JUMPER-PCB
46	323-1096		14	CONNECTOR-HEADER (2 PIN)
45	359-0032		1	DIODE-ZENER (8.2V)
44	359-0036		1	DIODE-ZENER (5.6V)
43	319-1891		1	COVER-VARISTOR
42	304-0800		1	VARISTOR-METALOXIDE (36V)
41	367-0064		1	IC-DRIVER ARRAY (2003)
40	367-0189		2	IC-RESISTOR(10K,2%)
39	367-0160		2	IC-24 STAG FREQ DIV(4521)
38	332-2551		1	TERMINAL BLK (16PL)
37	332-2706		1	TERMINAL BLK (10PL)
36	350-0103		2	RESISTOR (4.7K,1/4W,5%)
35	350-0387		3	RESISTOR (1.0K,1/2W,5%)
34	350-0355		1	RESISTOR (47,1/2W,5%)
33	350-0370		4	RESISTOR (200,1/2W,5%)
32	818-0209		4	RIVET-OVAL HD R-3311x7/32
31	323-1307		1	CONNECTOR-HEADER (12 PIN)
30	323-1309		1	CONNECTOR-HEADER (13 PIN)
29	323-1303		1	CONNECTOR-SOCKET (6 PIN)
28	323-1305		1	CONNECTOR-SOCKET (8 PIN)
27	307-2341		1	RELAY (SPDT,6V)
26	307-2329		1	RELAY (SPST,115VAC)
25	307-2127		2	RELAY (SPDT,12V)
24	307-2332		1	RELAY-LATCHING (6V)
23				
22	307-2330		8	RELAY-LATCHING(DPDT,6V)
21	307-2688		2	RELAY-POWER (SPDT,12V)
20				
19	307-2130		5	RELAY-12VDC (DPDT)
18	321-0324		5	CLIP-FUSE
17	321-0307-03		2	FUSE (5A,32V)
16	321-0307-06		1	FUSE (15A,32V)
15	321-0307-07		2	FUSE (20A,32V)
14	357-0004		20	RECTIFIER (1A,800V)
13	355-0183		1	CAPACITOR (220pF,100V)
12	355-0118		1	CAPACITOR (.01µF,100V)
11	355-0122		3	CAPACITOR (1µF,50V)
10	356-0115		3	CAPACITOR (22µF,35V)
9	98-5926		1	LABEL-BARCODE
8				
7	DS98009		-	PRODUCT DESIGN SPEC
6	TS98155		-	STRESS SCREEN TEST
5	TS98071		-	FINAL TEST SPEC
4	TS98024		-	ATE TEST SPEC
3	*524-0678	.01		RESIN-URETHANE (IN GALS)
2	*880-0003	1		SOLDER-BAR (IN OUNCES)
1	332-3215-01	1		PCB-ENGINE MON (12V)

HP SYSTEM DWG

Do Not Scale Print

Tolerances unless otherwise specified: mm X ± .5, XX ± .25, XXX ± .127; Inch X ± .02, XX ± .01, XXX ± .005; Angle Tol ±

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	Name	Date
Dr	MARK R DALSKE	02-19-91
Chkr / Mfg	THOMAS J. WIELAND	05-08-91
Approved	B. HAMPEL	05-08-91

For interpretation of dimensioning and tolerancing, see ANSI Y14.5M-1982

Model first used on: CLASS B SETS

Onan

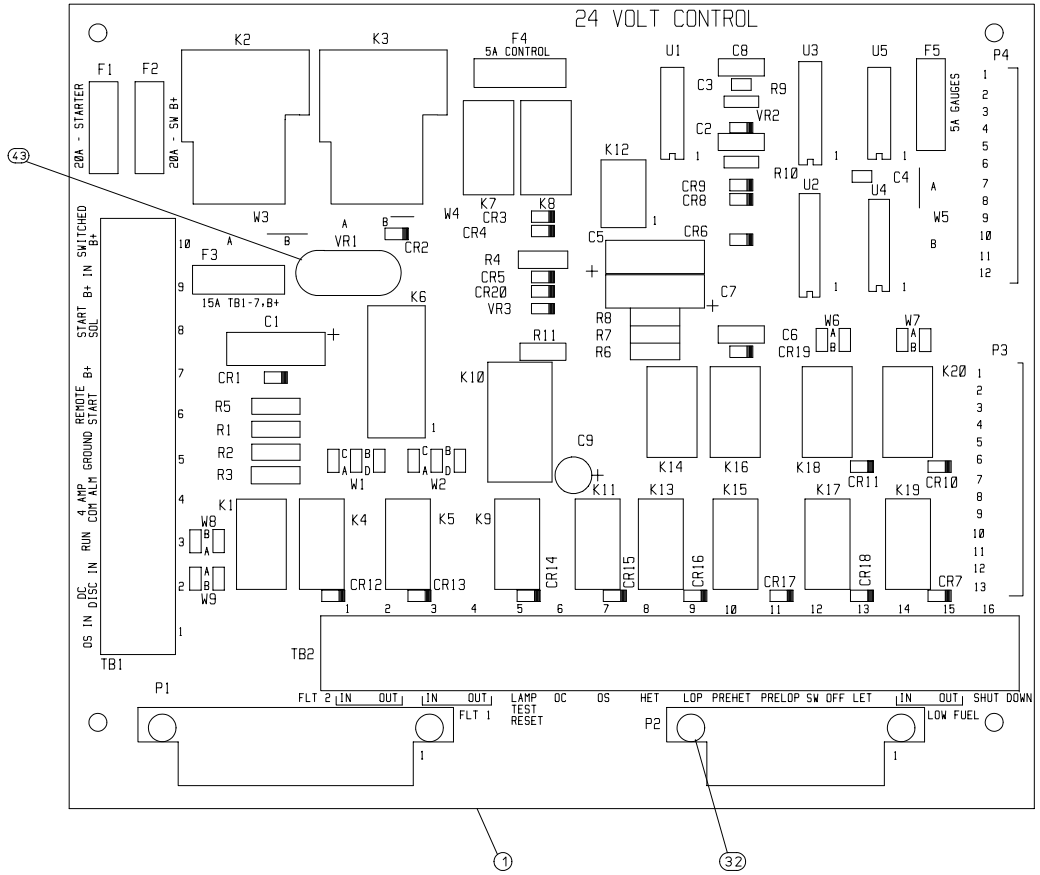
Minneapolis, Minnesota 55432

Title: PCB ASSY-ENG MON(12LIGHT,12V)

Dwg No. 300-2811 Sheet 2 of 2 Dwg Size D

EMC P.C.B. Assembly - A11 (Detector 12, 12V)

300-2812 D



ER No.	Ltr.	No	Revision	Zone	Dr.	Chkr	Approved	Date
34,107	E	1	REDRAWN WITH CHANGES PER ER	-	MRD	TW/BAH		02-19-91
62,300	F	1	REVISE PER ER	-	MRD	TW	PRD	08-01-92
72,330	G	1	OBS, SUPSD BY 300-4297(D)	-	MRD	BG	CPH	04-23-96

NOTES:

1. CIRCUIT BOARD SHALL BE SOLDERED WITH ITEM #2 AT MAX SOLDER TEMP OF 500°F AND MAX TIME OF 6 SECONDS.
2. SOLDER JOINTS AND/OR COMPONENT LEADS SHALL NOT PROJECT MORE THAN 1/8" BEYOND BOARD SURFACE. (EXCEPT TERMINAL BLOCK LEADS)
3. CONFORMAL COAT BOTH SIDES OF COMPLETED BOARD WITH ITEM #3 EXCEPT ITEM 15-18,28-32,37,38,46,47. COATING BUILDUP SHALL NOT BE LESS THAN .002" OR GREATER THAN .1".
4. TEST PRINTED CIRCUIT BOARD PER ITEMS #4-6.
5. DESIGN OF THIS ASSY IS CONTROLLED BY ITEM #7.
6. CLEAN BOARD WITH SUITABLE CLEANER BEFORE CONFORMAL COATING.
7. IF POSSIBLE, PLACE LABEL (ITEM #9) ON PRIMARY SIDE OF BOARD BEFORE CONFORMAL COATING. OTHERWISE PLACE ANYWHERE SPACE PERMITS (PRIMARY OR SECONDARY SIDE).

Ref Des	Item	Part No. *Bulk	Dwg Size	Qty	Description or Material
R11	50	350-0347		1	RESISTOR (22,1/2W,5%)
C9	49	356-0184		1	CAPACITOR-ELEC(100µF,50V)
W3,4,5	48	337-0341		3	JUMPER-PCB
	47	332-2417		6	JUMPER-PCB
W1,2,6-9	46	323-1096		14	CONNECTOR-HEADER (2 PIN)
VR3	45	359-0052		1	DIODE-ZENER (18V)
VR2	44	359-0036		1	DIODE-ZENER (5.6V)
	43	319-1891		1	COVER-VARISTOR
VR1	42	304-0800		1	VARISTOR-METALOXIDE (36V)
U4	41	367-0064		1	IC-DRIVER ARRAY (2003)
U2,3	40	367-0189		2	IC-RESISTOR(10K,2%)
U1,5	39	367-0160		2	IC-24 STAG FREQ DIV(4521)
TB2	38	332-2551		1	TERMINAL BLK (16PL)
TB1	37	332-2706		1	TERMINAL BLK (10PL)
R9,10	36	350-0111		2	RESISTOR (10K,1/4W,5%)
R4,6,8	35	350-0394		3	RESISTOR (2.0K,1/2W,5%)
R3	34	350-0363		1	RESISTOR (100,1/2W,5%)
R1,2,5,7	33	350-0384		4	RESISTOR (750,1/2W,5%)
	32	818-0209		4	RIVET-OVAL HD R-3311x7/32
P4	31	323-1307		1	CONNECTOR-HEADER (12 PIN)
P3	30	323-1309		1	CONNECTOR-HEADER (13 PIN)
P2	29	323-1303		1	CONNECTOR-SOCKET (6 PIN)
P1	28	323-1305		1	CONNECTOR-SOCKET (8 PIN)
K12	27	307-2342		1	RELAY (SPDT,12V)
K10	26	307-2329		1	RELAY (SPST,115VAC)
K7,8	25	307-2128		2	RELAY (SPDT,24V)
K6	24	307-2103		1	RELAY-LATCHING (12V)
K15,17,19	23				
K4,5,9,11,13	22	307-2339		8	RELAY-LATCHING(DPDT,12V)
K2,3	21	307-2689		2	RELAY-POWER (SPDT,24V)
K20	20				
K1,14,16,18,	19	307-2131		5	RELAY-24VDC (DPDT)
	18	321-0324		5	CLIP-FUSE
F4,5	17	321-0307-03		2	FUSE (5A,32V)
F3	16	321-0307-06		1	FUSE (15A,32V)
F1,2	15	321-0307-07		2	FUSE (20A,32V)
CR1-20	14	357-0004		20	RECTIFIER (1A,800V)
C4	13	355-0183		1	CAPACITOR (220pF,100V)
C3	12	355-0118		1	CAPACITOR (.01µF,100V)
C2,6,8	11	355-0122		3	CAPACITOR (1µF,50V)
C1,5,7	10	356-0115		3	CAPACITOR (22µF,35V)
SEE NOTE 7	9	98-5926		1	LABEL-BARCODE
	8				
	7	DS98009		-	PRODUCT DESIGN SPEC
	6	TS98155		-	STRESS SCREEN TEST
	5	TS98071		-	FINAL TEST SPEC
	4	TS98024		-	ATE TEST SPEC
	3	*524-0678		01	RESIN-URETHANE (IN GALS)
	2	*880-0003		1	SOLDER-BAR (IN OUNCES)
	1	332-3215-02		1	PCB-ENGINE MON (24V)

HP SYSTEM DWG

Do Not Scale Print

Tolerances unless otherwise specified: mm X ± .5, XX ± .25, XXX ± .127; Inch X ± .02, XX ± .01, XXX ± .005

Angle Tol ±

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Third Angle Projection

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Drawn to scale of 2 to 1

	Name	Date
Dr	MARK R. DALSKE	02-19-91
Chkr Mfg	THOMAS J. WIELAND	05-08-91
Approved	B. HAMPEL	05-08-91

For interpretation of dimensioning and tolerancing, see ANSI Y14.5M-1982

Model first used on: CLASS B SETS

Onan

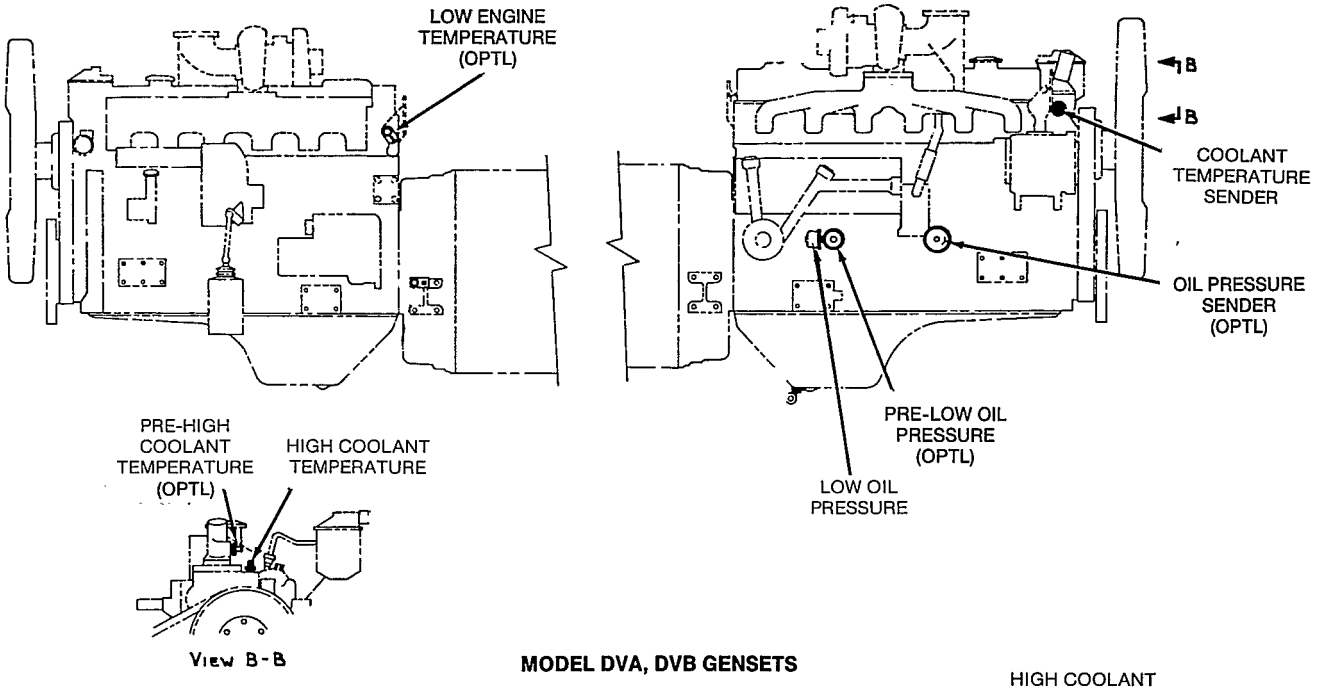
Minneapolis, Minnesota 55432

Title: PCB ASSY-ENG MON(12LIGHT,24V)

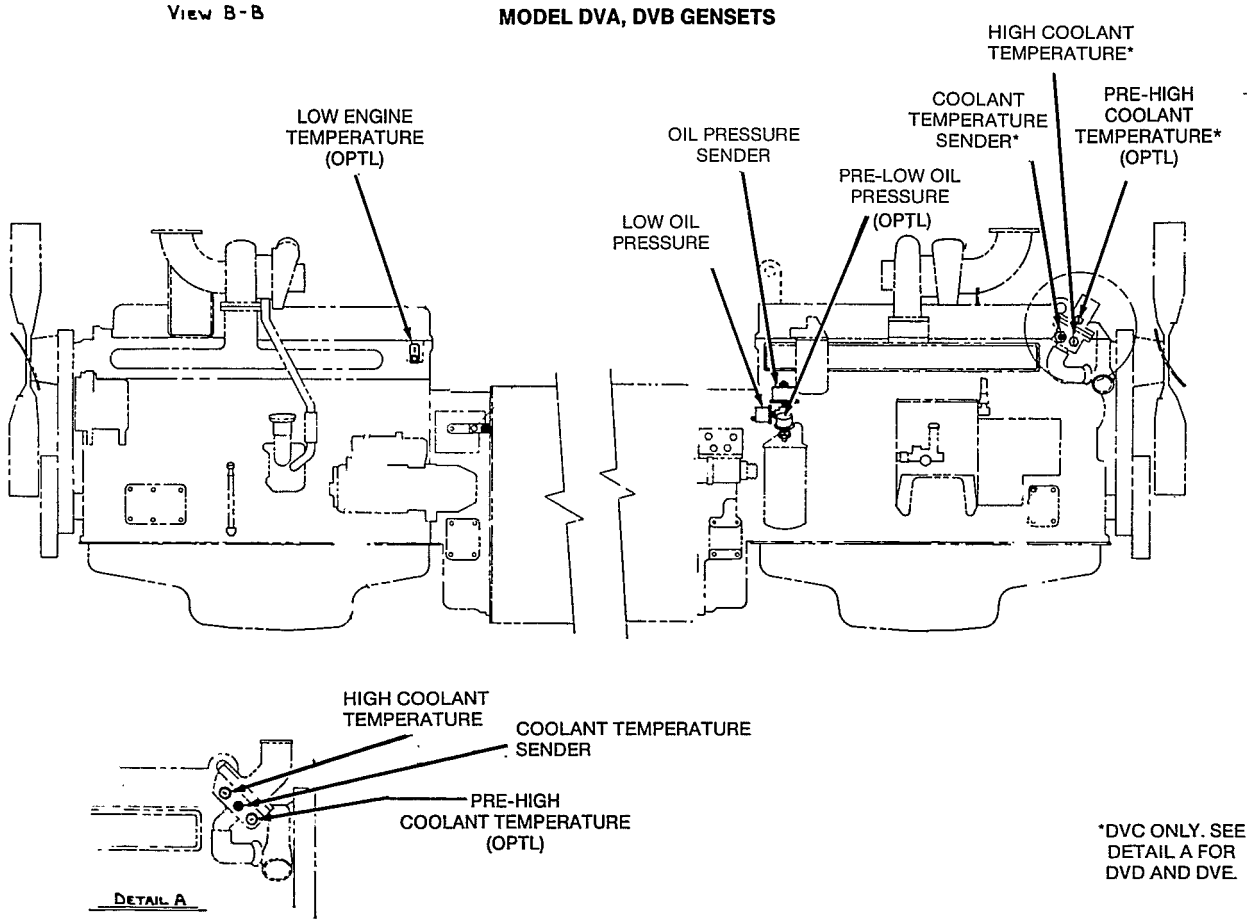
Dwg No. 300-2812 Sheet 2 of 2 Dwg Size D

EMC P.C.B. Assembly - A11 (Detector 12, 24V)

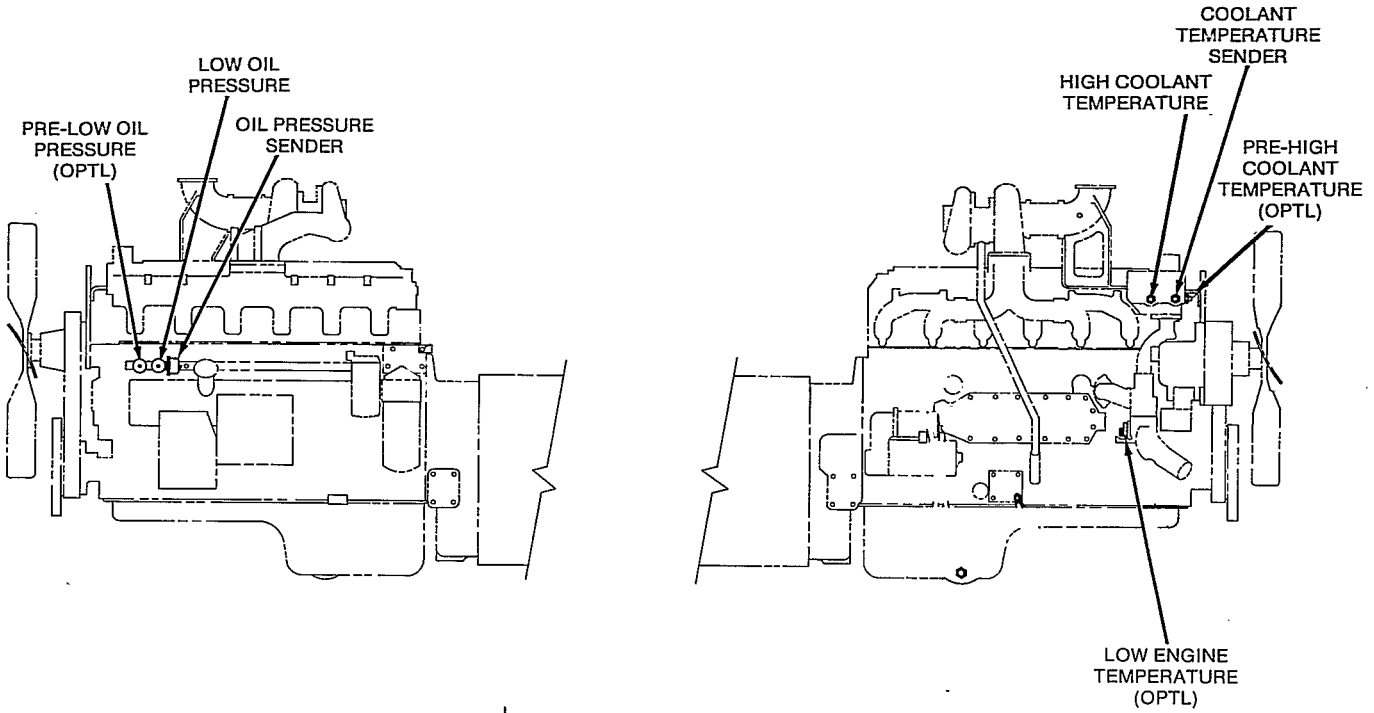
Section 6. Engine Sensor Location



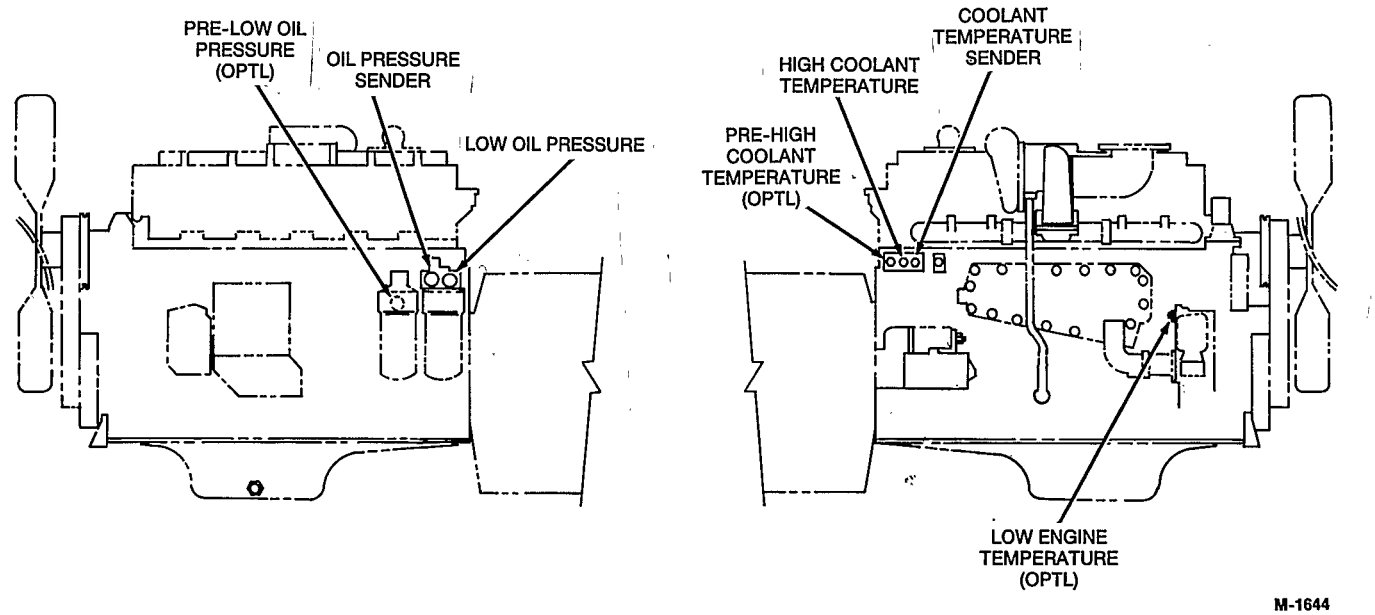
MODEL DVA, DVB GENSETS



MODEL DVC, DVD, DVE GENSETS



MODEL DVF, DVG GENSETS



MODEL DVH, DVJ GENSETS

Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
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Fax: 612-574-8087