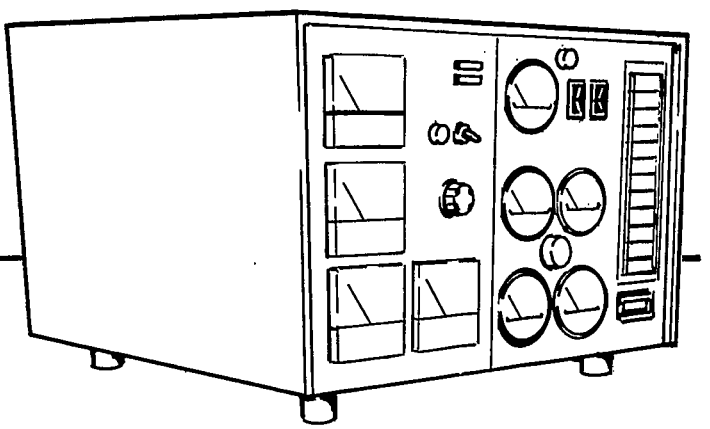
Onan

Service Manual

Detector

GenSet Control Module

With Torque Match-2™ Voltage Regulator And Detector Engine Control



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7-88
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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 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. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

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

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

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Section 1. Introduction

ABOUT THIS MANUAL

This manual describes the Onan Detector genset control module. It includes a guide for troubleshooting engine shutdowns and faulty starts. Refer to the appropriate engine and generator service manuals for more information about genset troubleshooting.

Study the genset manuals carefully and observe all the warnings and cautions. Know the genset. Proper use and regular maintenance of the genset can result in better performance, safer operation and longer life.

⚠WARNING ***Faulty repair or replacement of parts can lead to severe injury or death or damage to the equipment. Service must be done by qualified persons only.***

Note that this manual does not prescribe tests or procedures for repairing or replacing components on printed circuit boards (except fuses). Always replace faulty printed circuit board assemblies. Attempted repairs could lead to costly damage and unnecessary downtime.

TEST EQUIPMENT

Most of the tests in this manual can be performed with an AC-DC multimeter, such as a Simpson Model 260 VOM. Other instruments to have available are:

Battery Hydrometer
Tachometer or Frequency Meter

See Onan Tool Catalog 900-0019.

HOW TO OBTAIN SERVICE

Onan has factory-trained representatives ready to help you. Call an Onan Distributor if you have questions, or if the extent of service required is beyond the scope of this manual. When you call, the Distributor will need to know the genset serial and model numbers. These are found on the genset nameplate on the side of the output box. Figure 1-1 illustrates the nameplate.

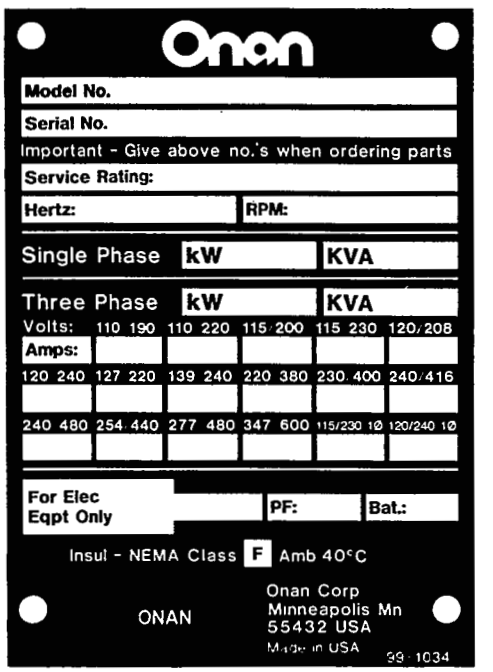

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FIGURE 1-1. ONAN NAMEPLATE

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GENERAL DESCRIPTION

The Detector genset control module performs two basic functions:

1. By means of the Torque Match-2 (VRAS-2) voltage regulator, it regulates the AC output voltage within plus or minus two percent of nominal voltage under normal load conditions; and under transient load conditions, such as when a large motor starts-up, provides a stable response by decreasing the output voltage just enough so that the engine can match the increasing generator load (torque).

2. By means of the Detector engine control monitor, it starts and stops the engine on command (panel switch or remote control) and shuts down the engine if there is a fault (low oil pressure, high engine temperature, overspeed or a failure to start).

There are two styles of the control module: horizontal and vertical, differing mainly in the arrangement of the components inside and on the front panels. Also, on horizontal style control modules used on Model SJB and SKB gensets, the front panels are hinged to swing down rather than to the sides. Figures 1-2 and 1-3 illustrate the arrangement of components for the two styles.

The control module is secured by four vibration isolators. The horizontal style sits on top of the generator housing, facing the front (opposite radiator end) or side. The vertical style faces front from inside the upper portion of the generator housing. The module is connected to the engine and generator by wiring to perform its control and monitoring functions, and may also be connected to remote control stations by the customer.

Components related to AC output monitoring are grouped on the left control panel, and those related to engine control on the right.

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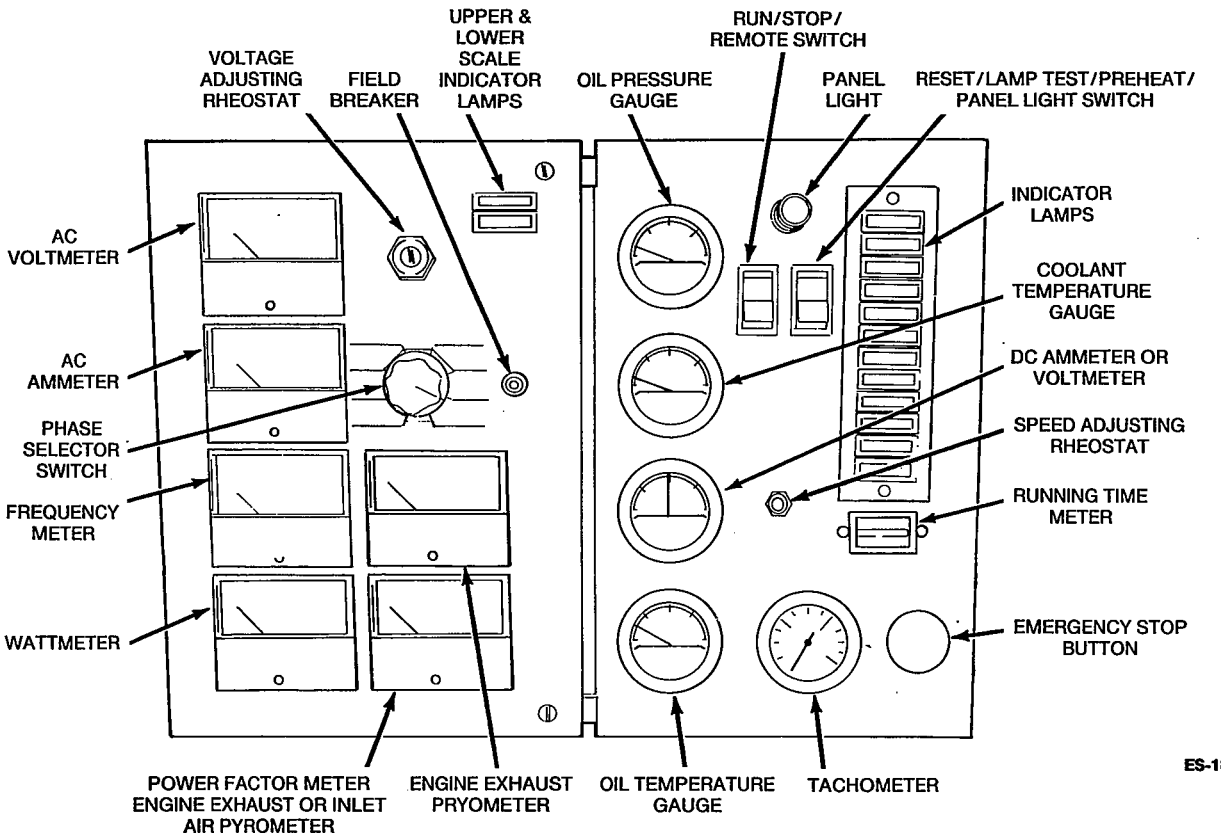

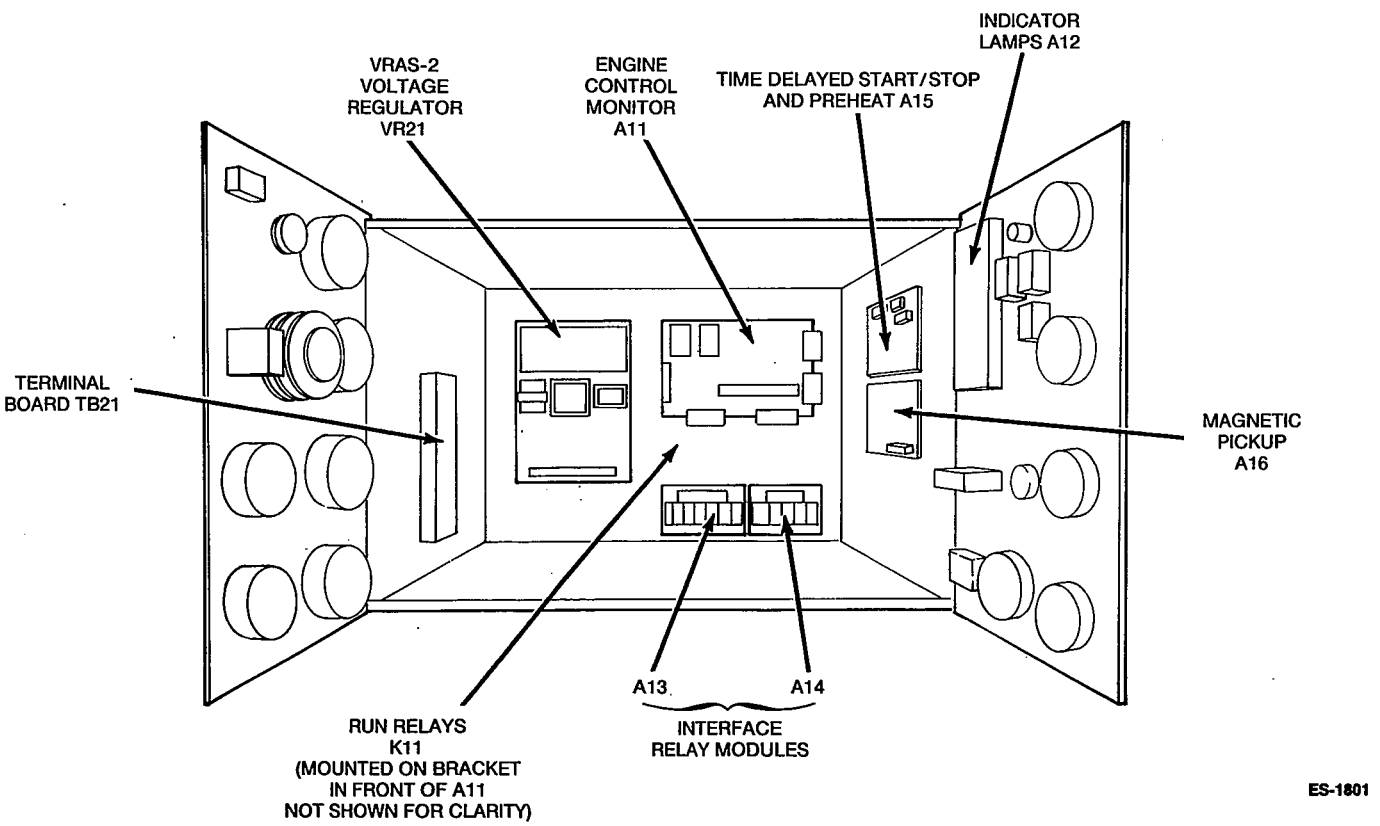

FIGURE 1-2. VERTICAL CONTROL PANELS AND INTERIOR

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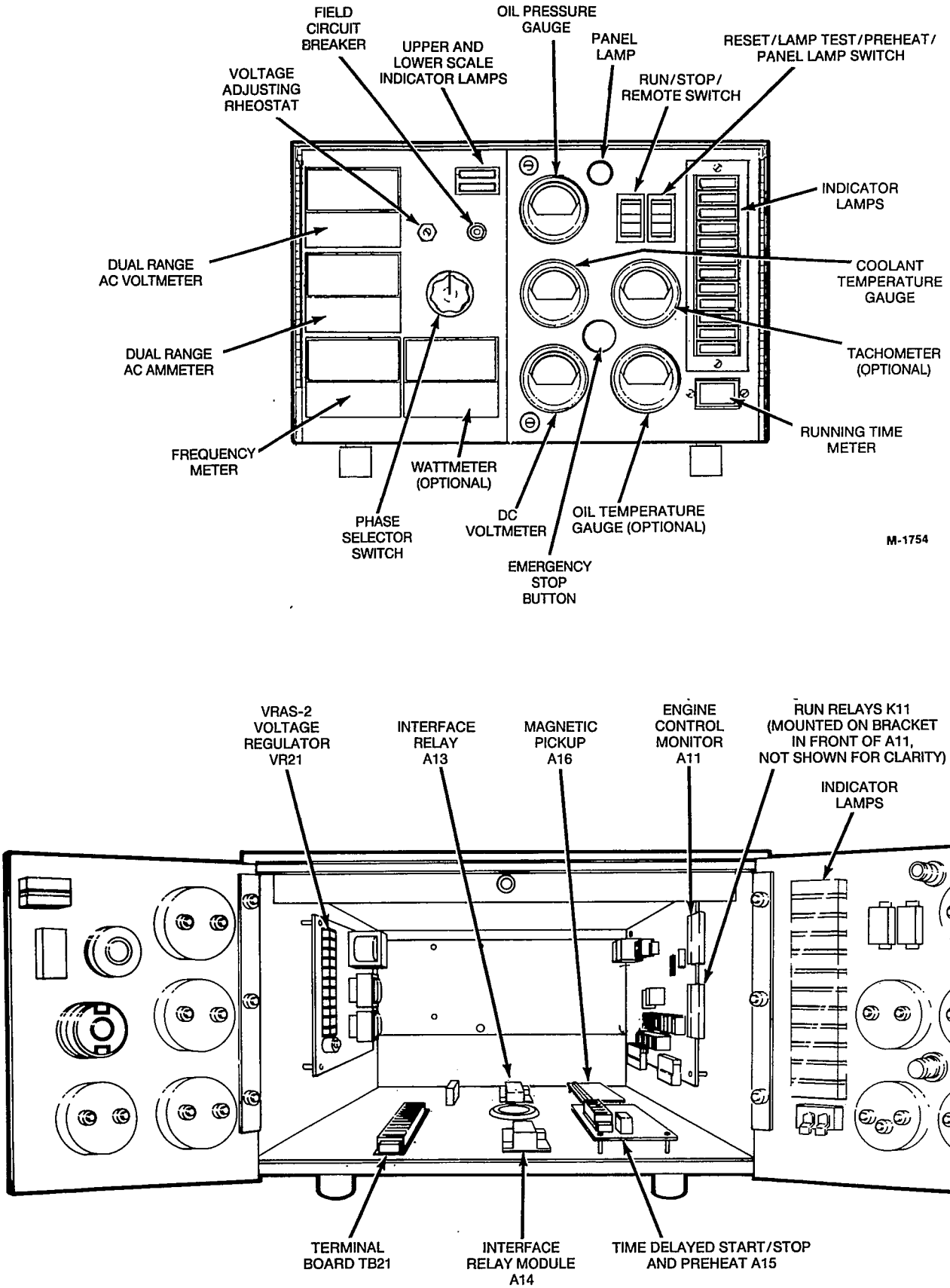

FIGURE 1-3. HORIZONTAL CONTROL PANELS AND INTERIOR

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Section 2. AC Control

AC CONTROL COMPONENTS

The Torque Match-2 (VRAS-2) voltage regulator (VR21) is the basic generator AC output controller. It is a printed circuit board assembly. It is described below under "Basic Operation". Optional meters and associated components may be provided for convenience in monitoring the AC output. Figures 1-2 and 1-3 illustrate the arrangement of components. Figure 2-1 is a typical wiring schematic. The components are as follows:

1. AC Voltmeter (M21): The dual scale meter is connected through the phase selector switch to the generator output leads. The scale indicator lamp indicates the scale to read.

2. AC Ammeter (M22): The dual scale meter is connected through the phase selector switch to current transformers (CT21, 22 and 23) located in the output box through which the generator output leads are routed. The scale indicator lamp indicates the scale to read.

3. Frequency Meter (M23): The meter is connected to the generator output leads to indicate AC frequency in Hertz (Hz). Note that engine RPM is 30 times Hz, except on 3000 and 3600 RPM gensets, when it is 60 times Hz.

4. Wattmeter (M24, not shown): The meter is connected to a wattmeter transducer (A21) in the generator output box to indicate output power in kilowatts.

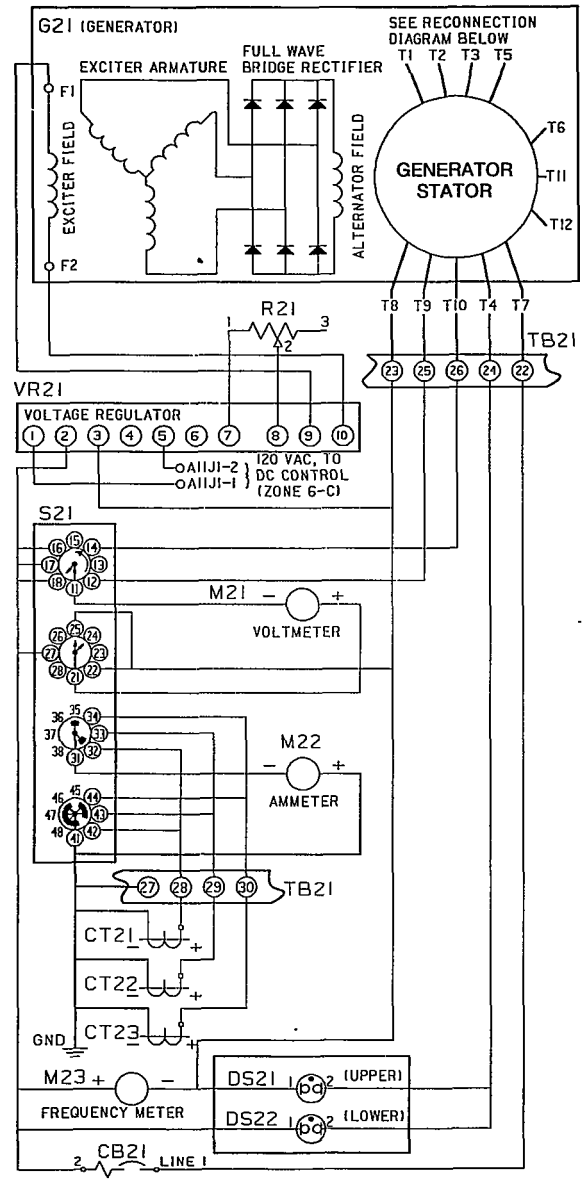
5. Powerfactor Meter (M25, not shown): The meter is connected to a transducer (A21) in the generator output box to indicate the percentage value of powerfactor.

6. Phase Selector Switch (S21): Connections to the switch are such that volts and amps of each phase can be read in turn by rotating the knob.

7. Upper and Lower Scale Indicator Lamps (DS21 and DS22): The lamp that lights indicates the meter scales to read.

8. Voltage Adjusting Rheostat (R21): The rheostat is connected to Terminals 7 and 8 of the voltage regulator to provide output voltage adjustments of plus or minus five percent.

9. Field Breaker (CB21): Resettable circuit breaker to protect against excessive field current. This component is always provided and may be the only component mounted on the left control panel.



For reference only. Refer to wiring diagram on the genset for service.

FIGURE 2-1. AC CONTROL SCHEMATIC

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BASIC OPERATION

See the appropriate generator service manual for specifications on the Torque Match-2 (VRAS-2) voltage regulator and for service and voltage adjustment procedures. Referring to Figure 2-1, basic operation is as follows:

1. Residual magnetism in the iron core (laminations) of the main rotor field magnets (Generator Field) induces voltage in the generator stator windings when the rotor starts rotating.

2. AC flows through terminals 2 and 3 of the voltage regulator because of the induced voltage.

3. The voltage regulator rectifies the AC and sends DC to the exciter field magnet windings.

4. The DC builds up the magnetic field in the exciter which induces a voltage in the exciter armature rotating inside the exciter field (stator) magnets.

5. The exciter armature 3 phase AC output is converted to DC by the 6 diode full wave bridge rectifier mounted on the generator rotor.

6. The DC from the rectifier increases the strength of the generator field when it flows through the main rotor field magnet windings.

7. The strengthened generator field induces greater voltage in the generator stator windings.

8. The generator stator builds up to nominal voltage as the voltage regulator keeps increasing the exciter field winding current, while the directly coupled engine and rotor accelerate to running speed.

9. Rotor speed and generator voltage stabilize in a matter of seconds, at which time the generator may be connected to the load.

10. During operation, the voltage regulator continues to monitor generator voltage and maintain it within plus or minus two percent by varying the exciter field winding current to match the generator load.

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Section 3. Engine Control

BASIC ENGINE CONTROL COMPONENTS

Figures 3-1 and 3-2 illustrate the arrangement of components for both styles of control. Section 6 illustrates the locations of the engine sensors. The components are as follows:

1. Detector Engine Control Monitor (ECM) (A11). This is the basic engine controller. It is a printed circuit board assembly. The variations include Detector-2, -7 and -12; each in a 12VDC or 24VDC version. The suffix number refers to the number of indicator lamps (A12).

   The ECM has five replaceable cartridge type fuses to protect it from overload or ground faults. They are:

   F1 - Starter solenoid circuit, 20 Amp.
   F2 - Fuel solenoid circuit, 20 Amp.
   F3 - B+ out to remote circuits, 15 Amp.
   F4 - ECM circuits, 5 Amp.
   F5 - Gauge circuits, 5 Amp.

   The ECM also provides soldered links that can be repositioned to adapt for a negative input signal and select timed or non-timed, shutdown or non-shutdown functions for various engine or auxiliary equipment fault signals. Figure 3-3 illustrates the Detector-12 ECM, showing the fuses, repositionable links, and terminal functions. Detector-2 and -7 ECMs are the same except for fewer components on the board.

2. Low Oil Pressure Switch (S1). The switch is calibrated to close when the oil pressure drops to the critical pressure determined for the particular engine. This signals the ECM to shut down the engine.

3. High Engine Temperature Switch (S2). The switch is calibrated to close when the engine coolant temperature rises to the critical temperature determined for the particular engine. This signals the ECM to shut down the engine.

4. Overspeed Switch (S3). The switch is calibrated to close at 1800-2000 RPM for 1500 RPM gensets, at 2100-2300 RPM for 1800 RPM gensets and at 3910-4090 RPM for 3000 and 3600 RPM gensets. This signals the ECM to shut down the engine. It is a centrifugal switch mounted on the end of the generator rotor. Alternately, a toothed wheel and magnetic pickup assembly may be provided. For details refer to Section 4.

5. Oil Pressure Gauge (M11). Connected through the ECM to an engine oil pressure sensing unit.

6. Coolant Temperature Gauge (M12). Connected through the ECM to an engine coolant temperature sensing unit.

7. DC Voltmeter or Ammeter (M13). Indicates the engine alternator charging voltage; or if an ammeter, the battery charging rate.

8. Running Time Meter (M14). Indicates the accumulated number of hours the genset has run. The meter is not resettable. Use the meter to keep a record for periodic maintenance.

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9. Run/Stop/Remote Switch (S12). Provided to start and stop the genset and permit automatic starting and stopping from a remote controller. The switch must be in the "Stop" position to reset the ECM with the reset switch, Item 10 below.

10. Reset/Lamp Test/Preheat/Panel Light Switch (S11). Provided to reset the ECM following an engine shutdown (Item 9 must be in the "Stop" position), test for burned-out indicator lamps and turn on the panel light, Item 13. Also, when the diesel engine is equipped with glow plugs, the switch is connected so that the glow plug solenoid can be manually activated while the starter is cranking the engine.

11. Run Indicator Lamp (Green). Lights up when the starter is disconnected, and stays lit while the engine is running. See Items 8 and 9 under "Basic Operation" for further details.

12. Fault Indicator Lamp (Red). Lights when the ECM shuts down the engine due to a fault condition.

13. Panel Light (DS11). Illuminates the control panel. It is turned on by the panel switch, Item 10.

DETECTOR-2 CONTROLS

All of the basic control components above are part of the Detector-2 Control, which is distinguished by the two indicator lamps: Run and Fault. The single fault lamp is lit following any of the four engine shutdown conditions.

DETECTOR-7 CONTROLS

The Detector-7 Control includes all of the basic control components and is distinguished by seven indicator lamps and associated sensors, as follows:

1. Run Indicator Lamp (Green).

2. Pre Low Oil Pressure Indicator Lamp (Yellow) and Pre Low Oil Pressure Switch (S-5). Provides a caution that engine oil pressure is marginal.

3. Low Oil Pressure Indicator Lamp (Red). Indicates that the fault shutdown is due to low oil pressure.

4. Pre High Engine Temperature Indicator Lamp (Yellow) and Pre High Coolant Temperature Switch. Provides a caution that the engine coolant temperature is marginal.

5. High Engine Temperature Indicator Lamp (Red). Indicates that the fault shutdown is due to high engine temperature.

6. Overspeed Indicator Lamp (Red). Indicates that the fault shutdown is due to engine overspeed.

7. Overcrank Indicator Lamp (Red). Indicates that the fault shutdown is due to a failure of the engine to start.

DETECTOR-12 CONTROLS

The Detector-12 Control includes all of the control components of Detector-7 and five more indicator lamps and associated circuits, as follows:

1. Low Engine Temperature Indicator Lamp (Yellow) and Low Engine Temperature Switch (S-4). Indicates that the engine temperature is less than 70°F, and possible failure of the engine block coolant heater.

2. Low Fuel Indicator Lamp (Yellow). Indicates that the fuel supply is low. The customer supplies the fuel level switch.

3. Fault 1 Indicator Lamp (Red). Indicates an over or under voltage fault (See Section 4 for details) or functioning of a customer installed auxiliary equipment fault switch. The lamp is part of a factory-set timed (10 second) shutdown circuit.

4. Fault 2 Indicator Lamp (Red). Indicates an over or under Hz (frequency) fault (See Section 4 for details) or functioning of a customer installed auxiliary equipment fault switch. The lamp is part of a factory-set non-time delayed shutdown circuit.

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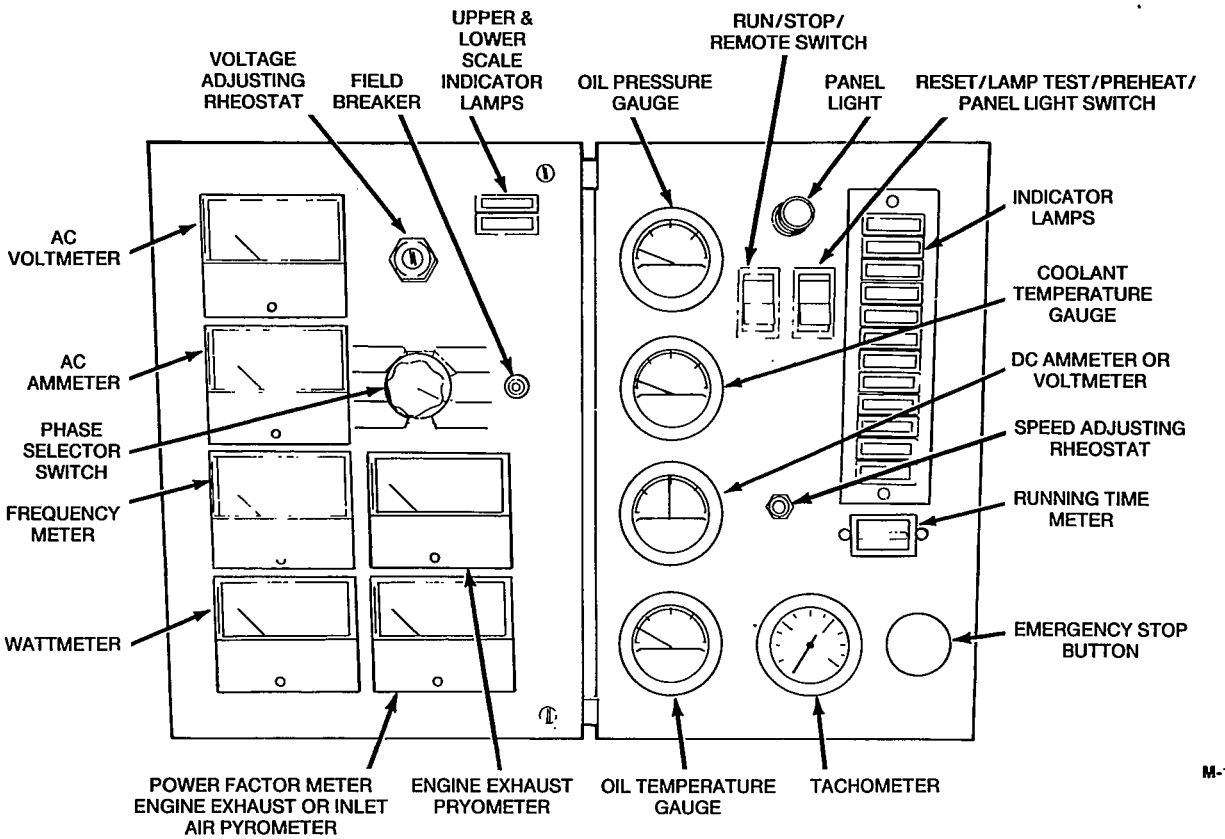

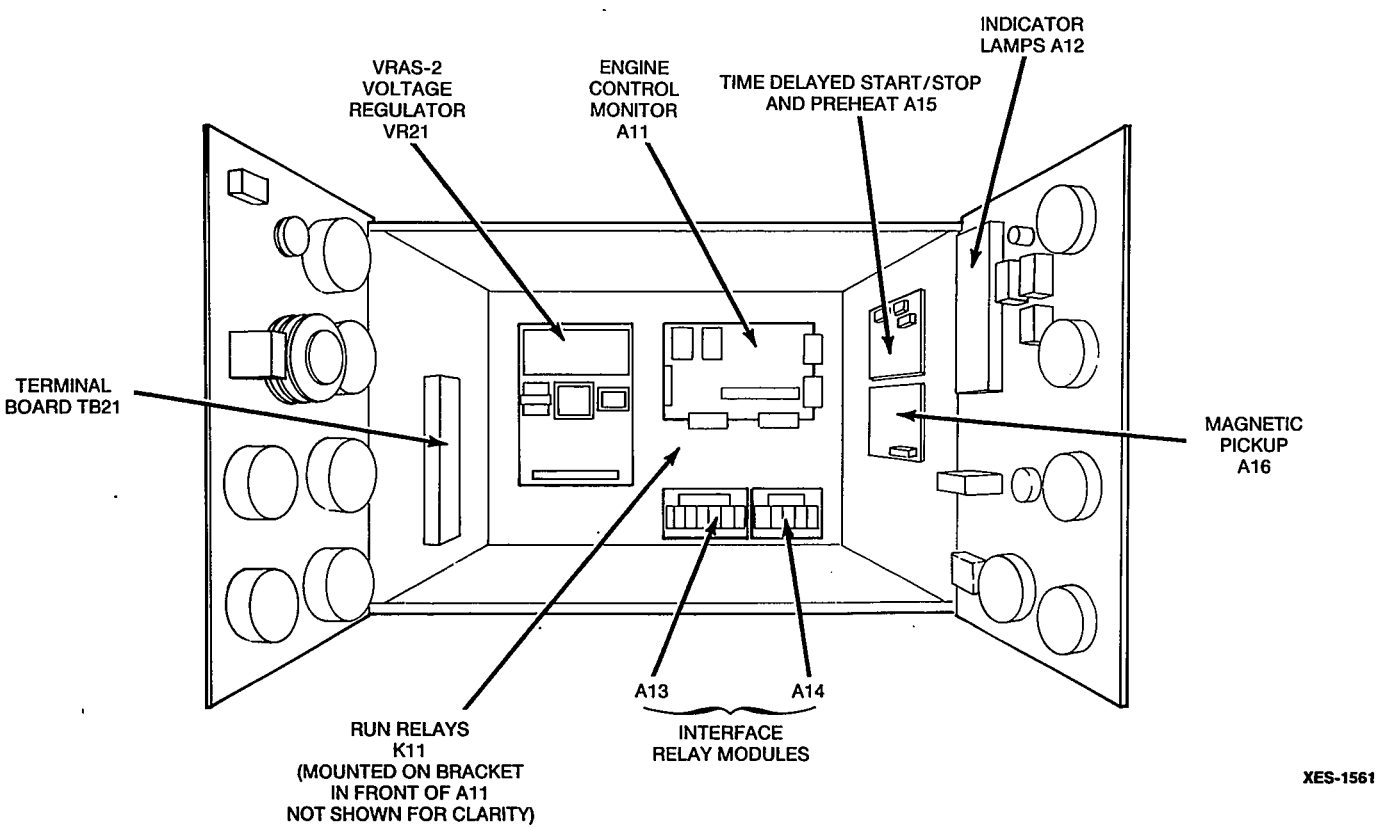

FIGURE 3-1. VERTICAL CONTROL PANELS AND INTERIOR

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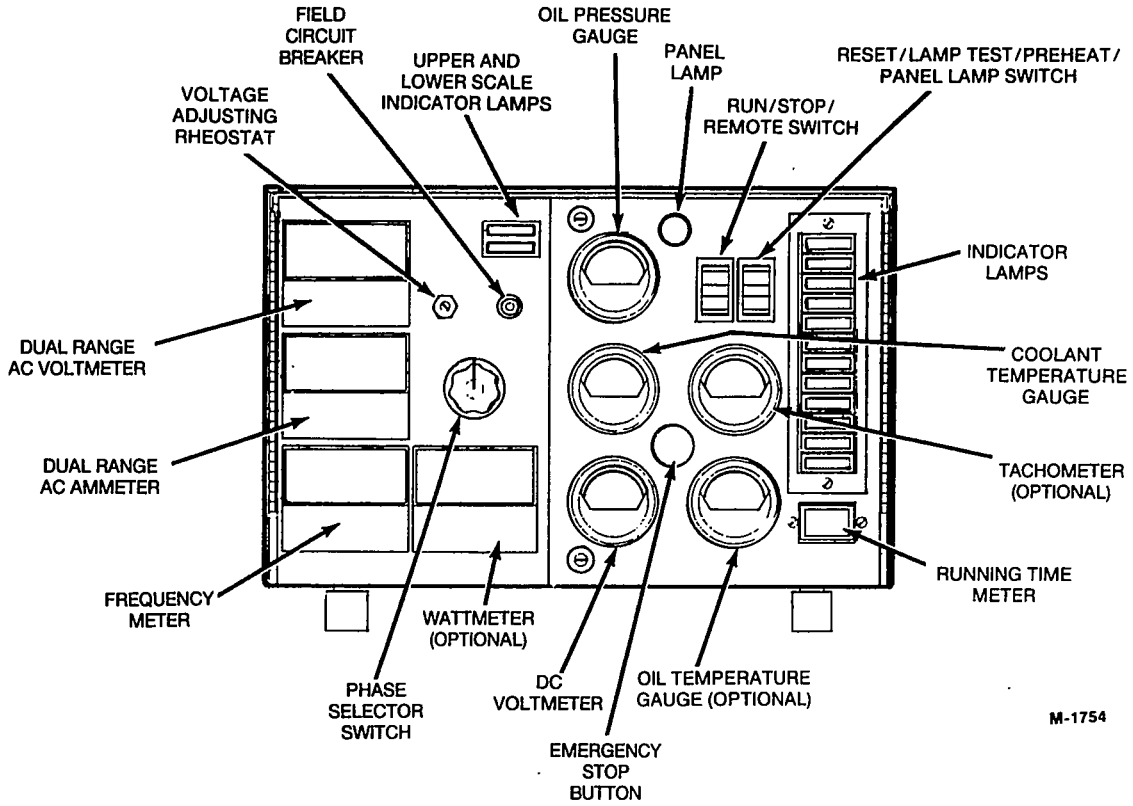

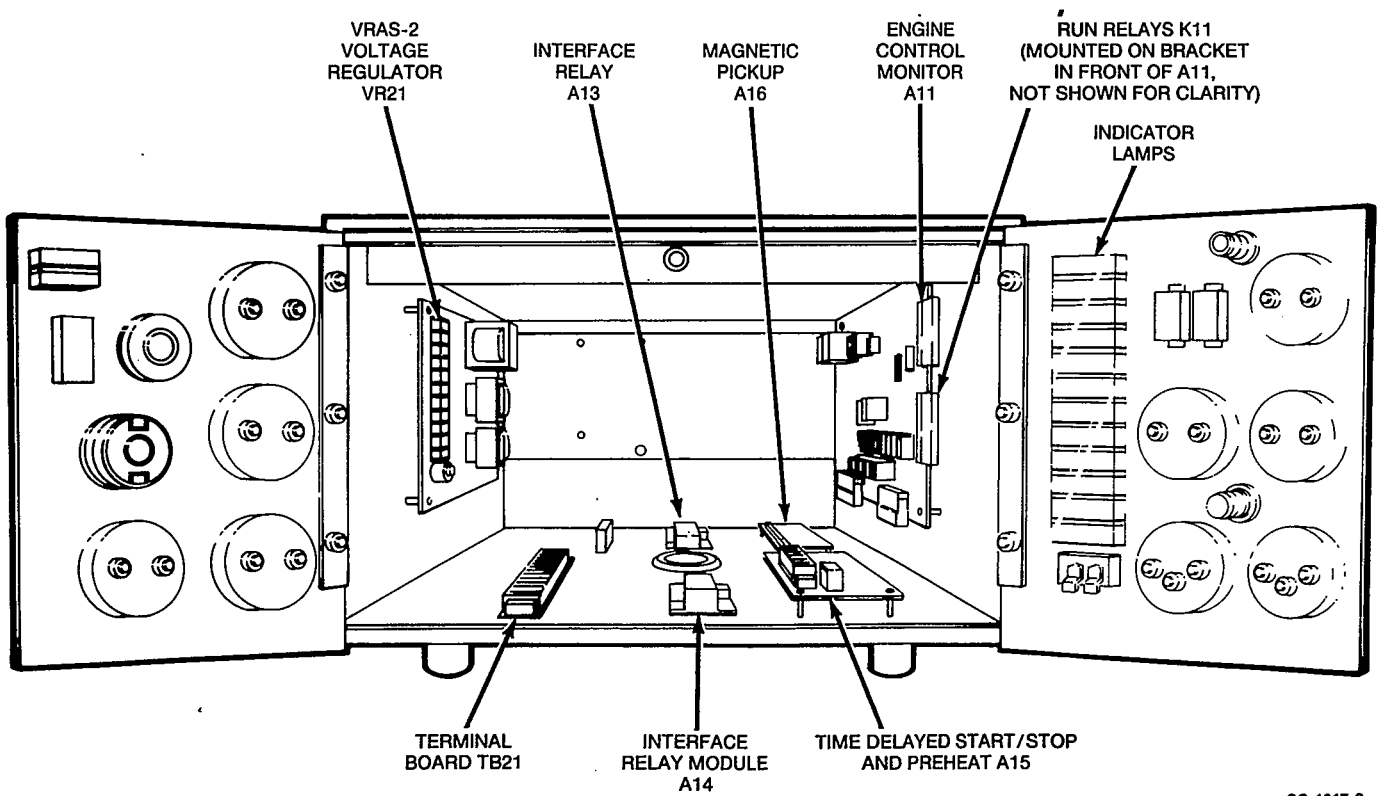

FIGURE 3-2. HORIZONTAL CONTROL PANELS AND INTERIOR

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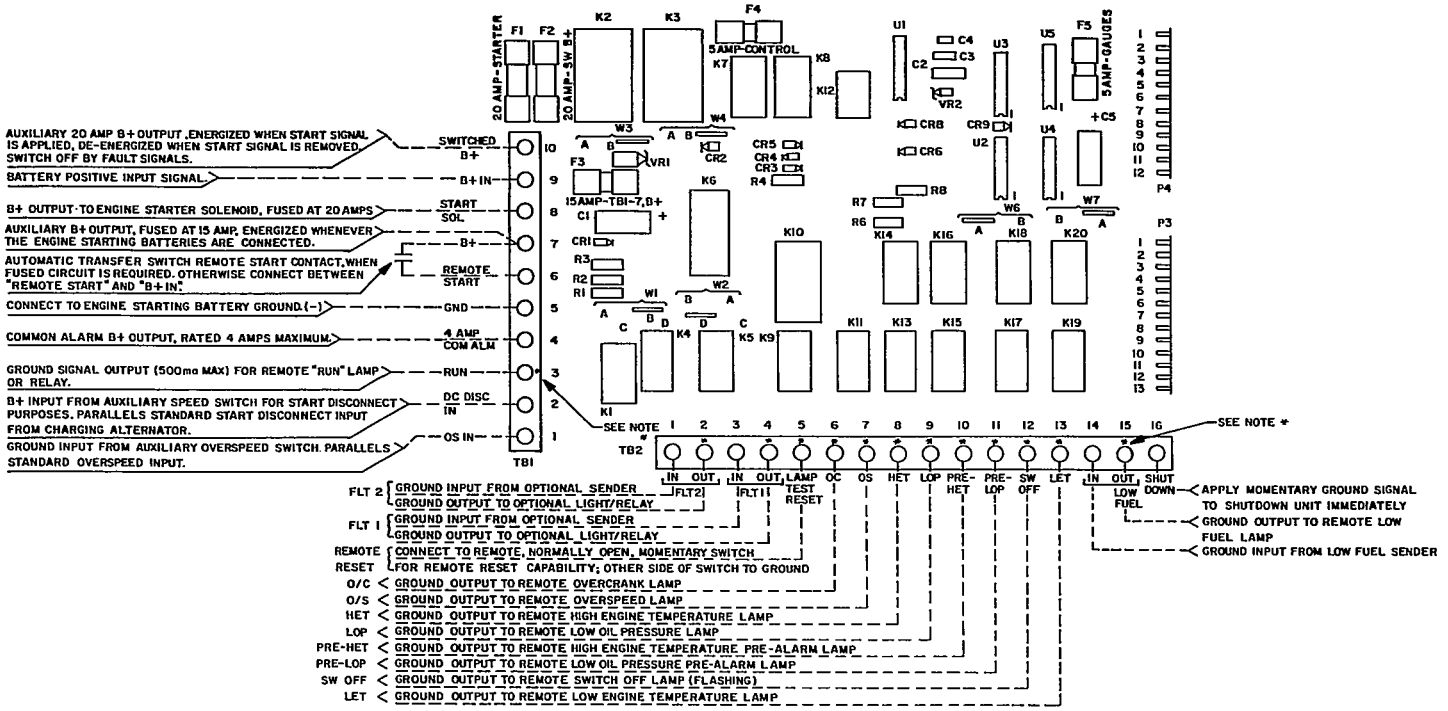

TB1-6 IS SIGNAL MODE SELECTABLE AS FOLLOWS:

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

NOTES:

* THESE CIRCUITS RATED 500ma MAX AND ARE FOR REMOTE ANNUNCIATOR USE.

1. ALL GROUND INPUTS OTHER THAN BATTERY GROUND ARE OF THE SWITCHING TYPE, (i.e. SENDER OR RELAY CONTACT BETWEEN THE INPUT AND GROUND).

2. ALL GROUND OUTPUTS ARE SWITCHING TYPE, (i.e. THE OUTPUT SWITCHES ON THE GROUND SIDE OF REMOTE LAMP OR RELAY).

FIGURE 3-3 ENGINE CONTROL MONITOR

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5. Switch Off Indicator Lamp (Flashing Red). By flashing on and off, indicates that the panel switch, Item 9 above, is not in the "Remote" position for automatic operation.

ADDITIONAL COMPONENTS

These components are optional, providing additional control or monitoring of the engine.

1. Low Coolant Level Switch (S7). This is a submerged sensor in the top portion of the radiator with a switch that closes when the coolant level falls below the level of the sensor. It is connected in parallel with the high engine temperature switch and acts to shut down the engine and turn on the Hi Engine Temp fault lamp.

2. Emergency Stop Button (Red) (S14). This is a push-in switch for emergency shut down of the engine. The button lights up red when pushed in. To restart the engine, pull out the switch and reset the ECM with the control reset switch.

3. Oil Temperature Gauge (M15). Connected to an engine oil temperature sensing unit.

4. Speed Adjusting Rheostat. May be used in conjunction with an optional electronic governor to adjust the engine speed.

5. Engine Pyrometers (M25 and M26). One or two pyrometers may be mounted on the left control panel. They are connected to sensors to indicate engine exhaust and inlet air temperatures, or on engines with dual exhaust, the temperature of each exhaust.

6. Tachometer (M16). Provided to monitor engine RPM.

BASIC OPERATION

Basic operation is as follows. Refer to Figure 3-4.

1. The ECM is powered by the engine starting battery. Terminal TB1-9 is connected to the positive (+) post of the battery. The ECM is grounded (negative [-] post) through plug-in connector P1-6.

2. The command to start, by means of the control panel switch or by a remote controller connected at TB1-6, powers relay K7.

3. Relay K7 powers relays K2 and K3.

4. Relay K2 powers terminal TB1-10 and the panel mounted engine gauges. The fuel solenoid (diesel engines) or engine module (gas engines) is connected to TB1-10 so that fuel and ignition spark (gas engines) are available as soon as the starter motor starts cranking the engine.

5. Relay K3 powers terminal TB1-8 to which the starter motor solenoid is connected, to begin cranking.

6. The engine should start and run-up to the nominal running speed in a matter of seconds. The mechanical or electronic engine governor will maintain the nominal engine speed by increasing or decreasing fuel to match the load.

7. The starter is disconnected when engine speed gets to about 500 RPM. This is accomplished by relay K10 or K14, whichever acts first to open the circuit powering relay K3.

8. Relay K10 is powered by the generator (plug-in connectors P1-1 and -2 are connected to terminals 1 and 5 on the voltage regulator, Figure 2-1). As generator voltage increases, relay K10 pulls in (120 VAC relay coil), to open the relay K3 circuit. Relay K10 also grounds terminal TB1-3, lighting the remote Run lamp. On Detector-2 Controls only, the control panel and remote Run lamps will also be lit.

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9. Relay K14 is powered by the auxiliary terminal (see specific engine wiring diagram to identify terminal) on the engine battery charging alternator through plug-in connector P1-3. As alternator voltage increases, relay K14 pulls in (12 or 24 VDC relay coil), to open the relay K3 circuit. On Detector-7 and -12 Controls relay K14 also lights the control panel Run lamp.

   Alternately, relay K14 may be powered by the battery through the optional magnetic pick-up module connected at terminal TB1-2. See Section 4 for details.

   It should be noted that relays K10 and K14 are redundant. As a result, the starter will be disconnected if either independent circuit fails. On Detector-7 and -12 Controls, if the engine starts, and the starter is disconnected; failure of the remote Run lamp to light indicates a failure of the relay K10 circuit, and a failure of the control panel lamp to light, a failure of the relay K14 circuit.

10. If the engine does not start right away, there is a timing circuit in the ECM that discontinues cranking after 75 seconds. There may be an optional cycle crank circuit that cranks for three 15 second periods with two 15 second rest periods.

11. If the engine does not start during the 75 second cranking period, relay K6 is powered. Relay K6 opens the K2 and K3 relay circuits, thereby disconnecting the starter and shutting off fuel and ignition spark. The Overcrank fault lamp is lit, and relay K6 latches in position and has to be manually reset by means of the panel reset switch. Relay K6 also powers terminal TB1-4 to which the customer may connect an alarm.

12. If a fault condition occurs during operation, or if the optional emergency stop button is pushed in, the circuit to ground is completed by the fault sensor or switch, powering relay K6, to shut down the engine. The low oil pressure and high engine temperature sensors are connected to a timing circuit in the ECM that delays shutdown for 10 seconds following starter disconnect. The delay prevents nuisance shutdowns by allowing oil pressure and engine temperature to stabilize. The appropriate fault lamp lights and relay K6 has to be reset as in item 11 above to restart the engine.

13. The command to stop, by means of the panel switch or remote controller, drops out relay K7, which drops out relay K2, thus shutting off fuel and ignition spark.

14. After a command to stop, the genset stands ready for the next command to start, unless shutdown by a fault condition.

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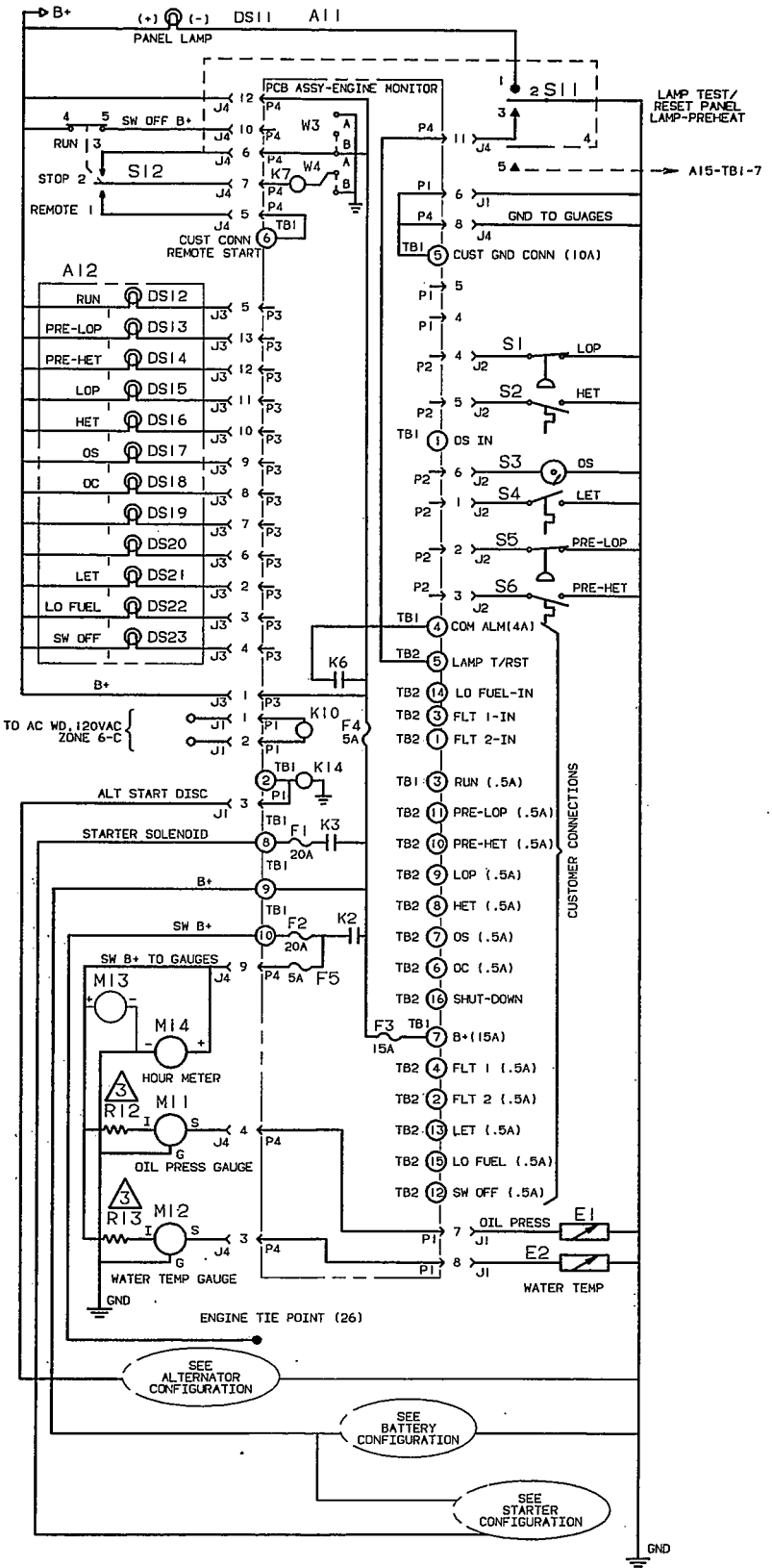

For reference only. Refer to the wiring diagram on the genset for service.

FIGURE 3-4. ECM WIRING SCHEMATIC

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Section 4. Auxiliary Components

The following components are available to perform auxiliary functions.

RUN RELAYS (K11)

One to three relays may be provided to activate auxiliary equipment provided by the customer; such as fans, pumps and air intake louver motors. The relays are mounted on a stand-off bracket in front of the ECM (A11 in Figures 3-1 and 3-2). Figure 4-1 is a typical wiring schematic.

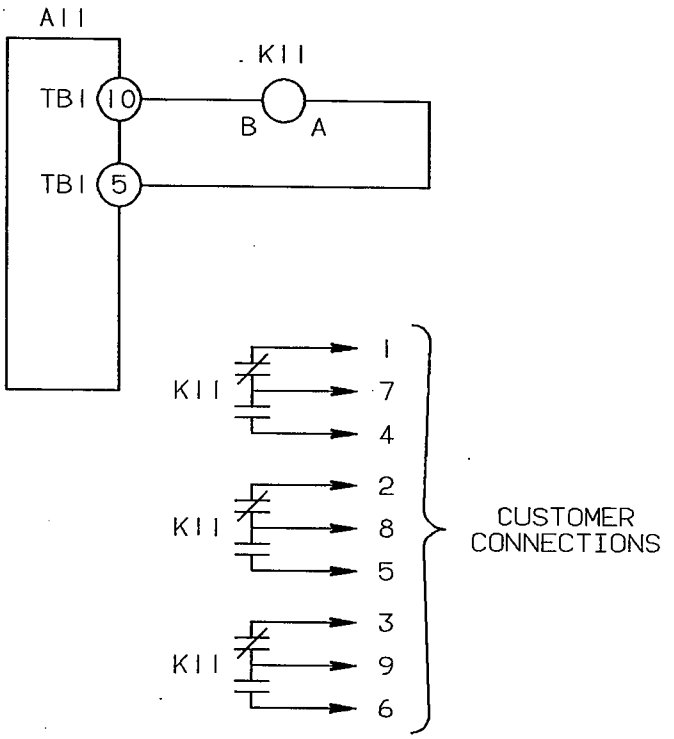

FIGURE 4-1. K11 WIRING SCHEMATIC

ALARM RELAY MODULES (A13 AND A14)

When the customer provides a remote control panel having alarm circuits powered by a separate AC or DC source, Module A13 with 7 relays and Module 14 with 5 relays may be provided to interface with the ECM (A11) circuits. The modules are mounted by screws on pedestals inside the control cabinet as shown by Figures 3-1 and 3-2. Figure 4-2 shows typical wiring schematics.

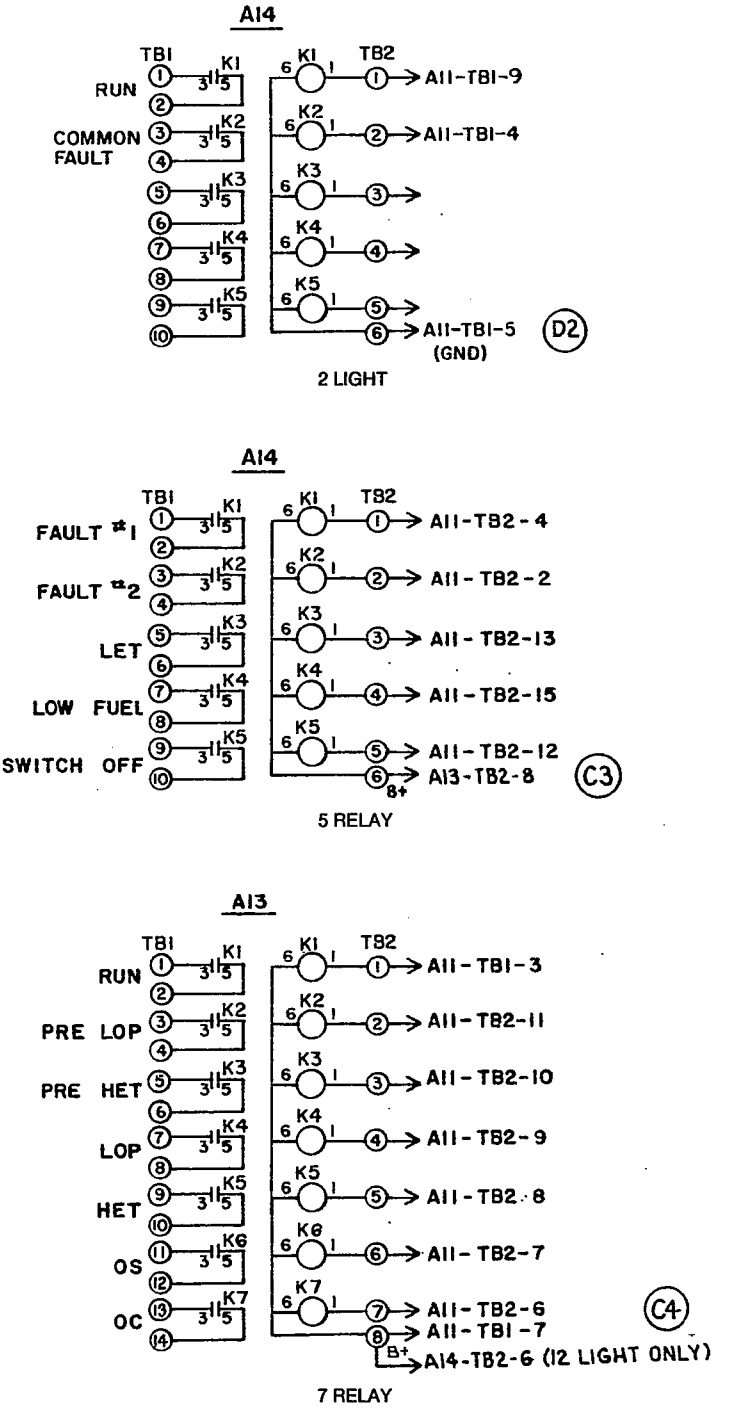

FIGURE 4-2. A13 AND A14 WIRING SCHEMATICS

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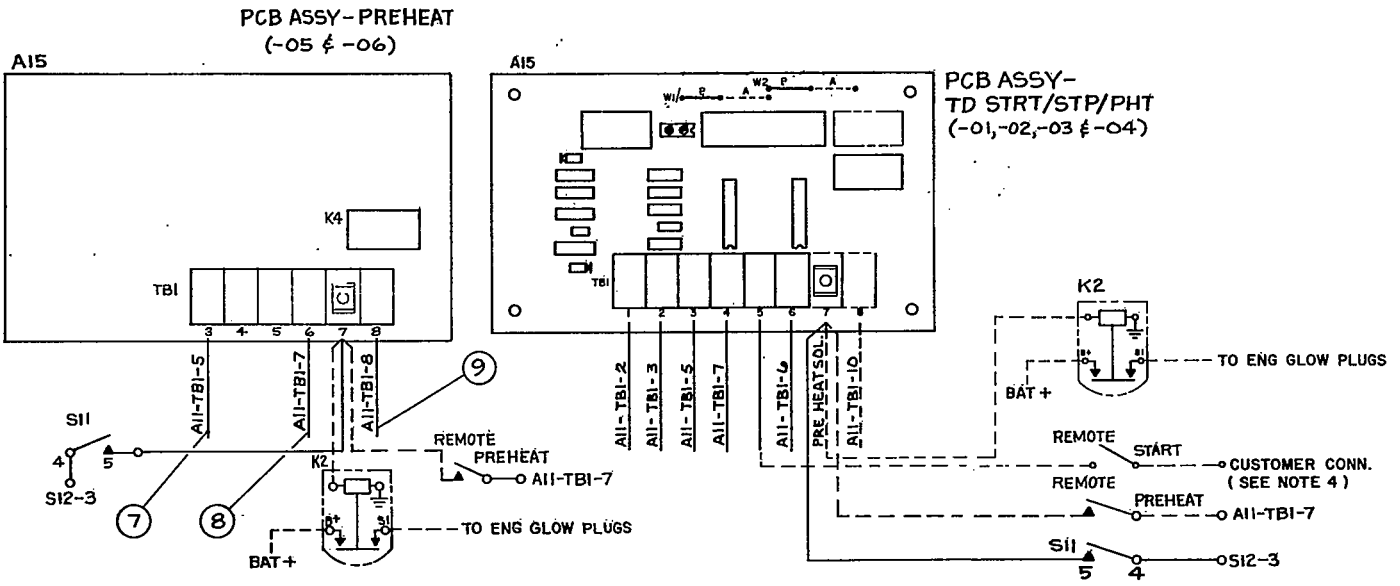
TIME DELAYED START/STOP AND PREHEAT MODULES (A15)

1. Preheat Module. This is a printed circuit board assembly mounted on pedestals by screws inside the control cabinet as shown by Figures 3-1 and 3-2. It is for remote, automatic control applications of diesel gensets equipped with glow plugs. The module powers the glow plug solenoid, which powers the glow plugs during the start delay period, during engine cranking and during rest periods if the cycle crank feature is provided. Figure 4-3 is a typical wiring schematic.

2. Delayed Start/Stop Module. This is a printed circuit board assembly mounted on pedestals by screws inside the control cabinet as shown by Figures 3-1 and 3-2. It is for remote, automatic control applications where it may be desirable to delay starts because the installation is subject to frequent power interruptions of short duration. The module is adjustable to delay starts from 1 to 15 seconds. It is also desirable to allow the engine to cool down by running for 3 to 5 minutes without load before stopping. The module is adjustable to delay stops from 1 to 30 minutes. Figure 4-3 shows typical wiring schematics.

3. Combination Module. The preheat and delayed start/stop modules are available as a combined module.



TERMINAL #5 IS SIGNAL MODE SELECTABLE AS FOLLOWS

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

FIGURE 4-3. TIME DELAYED START/STOP AND PREHEAT MODULES

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MAGNETIC PICK-UP MODULE (A16)

The magnetic pick-up module is used in conjunction with a toothed wheel mounted on the end of the generator rotor and a magnetic pick-up head to provide starter disconnect and rotor overspeed signals to the ECM. Figure 4-4 shows the toothed wheel and magnetic pick-up head installation and Figure 4-5 a typical wiring schematic.

The magnetic pick-up module is a printed circuit board assembly mounted on pedestals by screws inside the control cabinet as shown by Figures 3-1 and 3-2. There are fixed setpoint and adjustable setpoint versions.

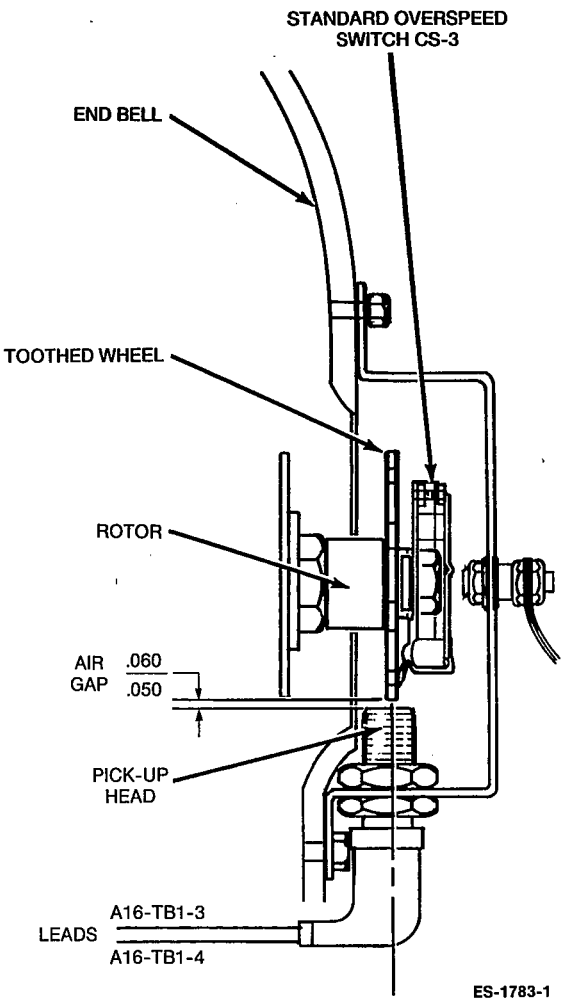

FIGURE 4-4. MAGNETIC PICK-UP HEAD DETAIL

The fixed setpoint version has the following setpoints:

Start Disconnect — 450-570 RPM

Overspeed — 2024-2376 RPM for 1500 and 1800 RPM gensets.

4048-4752 RPM for 3000 and 3600 RPM gensets.

The adjustable setpoint version has the following adjustment ranges:

Start Disconnect — 250-1000 RPM

Overspeed — 1000-2800 RPM for 1500 and 1800 RPM gensets.

2000-5600 RPM for 3000 and 3600 RPM gensets.

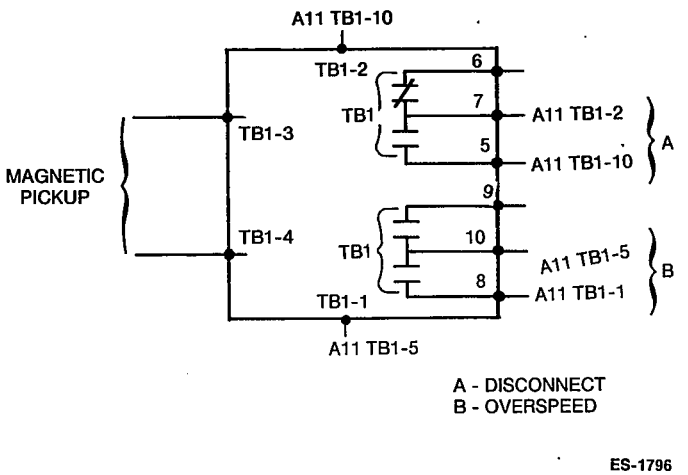

FIGURE 4-5. WIRING SCHEMATIC

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OVER/UNDER VOLTAGE MODULE (A17)

This is an adjustable voltage-sensitive relay typically connected to the ECM (A11) Fault 1 circuit to shut down the genset when the output voltage is over or under the nominal voltage by the preselected amount (typically 10 percent). The module includes an adjustable time delay relay (K17) to prevent nuisance tripping (typically set at 25 percent, or approximately 2.5 seconds). The module is mounted on a bracket in the generator power outlet box. Figure 4-6 is a wiring schematic.

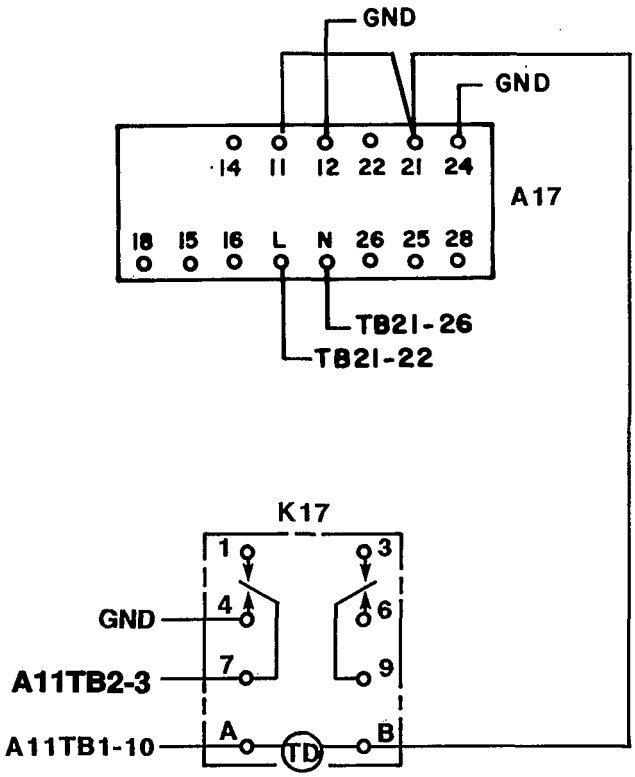

FIGURE 4-6. WIRING SCHEMATIC

OVER/UNDER HZ (FREQUENCY) MODULE (A18)

This is an adjustable frequency-sensitive relay typically connected to the ECM (A11) Fault 2 circuit if the over/-undervoltage module (A17) is also installed, or Fault 1 for over Hz and Fault 2 for under Hz if installed alone, to shut down the genset when the output frequency is over or under the nominal frequency by the preselected amount. Also, Fault 2 must be converted for timed shutdown. The recommended settings are:

Nominal Hz	50	60
Under Hz Set	45	55
Reset	47	57
Over Hz Set	55	65
Reset	57	63

The module is mounted on a bracket in the power outlet box. Figure 4-7 is a typical wiring schematic.

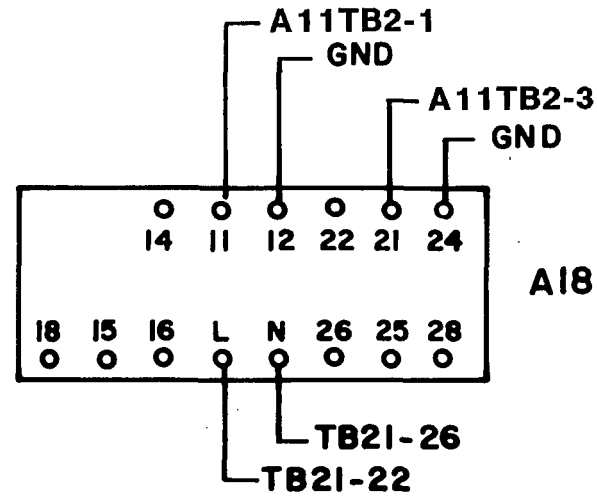

FIGURE 4-7. WIRING SCHEMATIC

CONTROL CABINET HEATER

A heater is available for temperature and humidity control inside the control cabinet to protect the components during standby periods. See Figure 4-8.

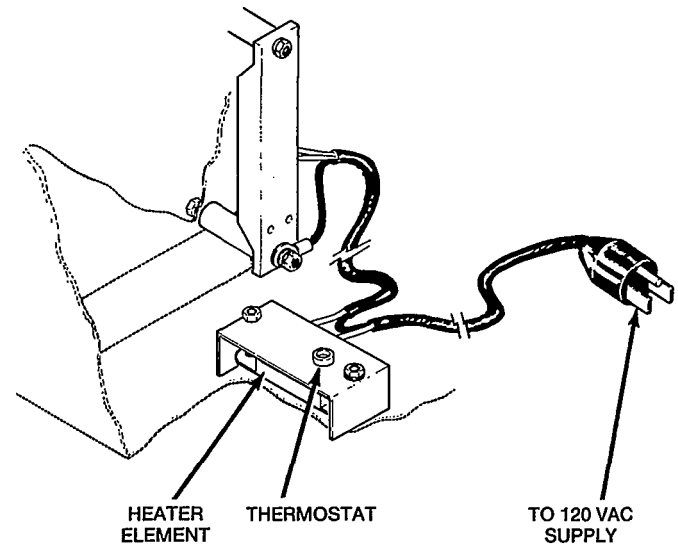

FIGURE 4-8. CONTROL CABINET HEATER

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Section 5. Troubleshooting

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

This is a guide for troubleshooting engine shutdowns and failures to start. Refer to the appropriate engine and generator service manuals for additional information. Call an Onan Distributor if you have questions or if the extent of service required is beyond the scope of this manual.

You can save time when you are troubleshooting by reading this manual ahead of time so that you understand the basic operation and know what control options the genset has.

Also, the trouble may be a result of the last modification, repair or replacement of parts. Go over what was done. It may involve only tightening a loose connection, replacing a blown fuse on the ECM or correcting some other obvious fault.

Try to think through the problem. Hasty decisions can be costly and not solve the problem.

The following guide is arranged to help you troubleshoot if you find the engine does not crank, the engine cranks but does not start or if the engine shuts down due to a fault condition. Get to know the sequence of items to check in each section, to help you think through the problem.

For gensets with the Detector-2 control the fault lamp does not indicate which fault occurred. Time can be saved by asking the following questions.

1. Was the engine running when it shut down? If it was, shutdown is not due to overcrank.
2. Did shutdown occur within one minute after start? If it did, the shutdown is probably due to low oil pressure.
3. Was engine operation noticeably erratic or faster than usual? If it was, the shutdown was probably due to overspeed.
4. If the engine starts and runs, observe the oil pressure, engine temperature and frequency meter or tachometer until shutdown occurs, to determine the cause.

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ENGINE DOES NOT CRANK

POSSIBLE CAUSE	REMEDY
1. Control panel switch "Off", preventing start by remote control. Switch-off lamp flashing, if provided.	1. Push switch to "Remote" position.
2. Control module was not reset following last shutdown. A fault lamp will be on.	2. Push Run/Stop/Remote switch to "Stop" and then push Reset switch to "Reset".
3. Discharged or worn-out battery.	3. Charge the battery if the electrolyte specific gravity is less than 1.260, or replace.
4. Loose or corroded battery terminals.	4. Remove the battery cables (negative [-] first), clean the connectors and battery posts and re-tighten the connectors. Replace damaged cables or connectors.
5. Fuse C blown on the ECM.	5. Replace with an appropriate cartridge fuse of the same amp rating.
6. Loose connections or damaged wiring in the engine wiring harness.	6. Check for battery voltage (12 VDC or 24 VDC) between ECM terminal TB1-9 (B+ in) and the control cabinet grounding stud. If there is no voltage, tighten connections and replace any damaged wiring.
7. Faulty Run/Stop/Remote switch (S 12)	7. Check for electrical continuity (Zero Ohms) between terminals 2 and 3 with the switch in the "Run" position and between terminals 1 and 2 with the switch in the "Remote" position. Replace the switch if it is faulty in either position.
8. Faulty remote control circuit.	8. Push panel switch to "Remote" and jumper ECM terminals TB1-9 and TB1-6. If the engine cranks, repair the faulty remote circuit.
9. Faulty starter, starter solenoid, loose connections or damaged wiring.	9. Push panel switch to "Run" and check voltage between ECM terminal TB1-8 and ground. If the wiring and connections are good, and there is voltage, the starter and/or starter solenoid should be serviced in accordance with the engine service manual.
10. Faulty ECM. (Check again for blown fuses)	10. If there is no voltage between TB1-8 and the ground stud when the panel switch is in the "Run" position, replace the faulty ECM.

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ENGINE CRANKS BUT DOES NOT START

POSSIBLE CAUSE	REMEDY
1. Fuel tank empty or manual gas shut-off valve "Off". Low fuel lamp on, if provided.	1. Fill the tank with the appropriate grade of fuel or open the gas shut-off valve.
2. Fuse F2 blown on the ECM.	2. Replace with an appropriate 20 Amp cartridge fuse.
3. Faulty ECM.	3. While cranking, check for battery voltage (12 VDC or 24 VDC) between ECM terminal TB1-10 and the control cabinet ground stud. If there is no voltage replace the faulty ECM.
4. Faulty fuel solenoid (diesel engines), or engine module (gas engines).	4. If wiring connections and wiring are good, and there is voltage at terminal TB1-10, the fuel solenoid should be replaced, or the engine module serviced.
5. Low engine temperature. Low engine temperature lamp on, if provided.	5. Plug in, repair or install the appropriate engine block coolant heater. Check that engine oil of recommended viscosity is being used. On gasoline engines, service and adjust the electric choke in accordance with the operator's manual. On diesel engines with glow plugs, listen for the preheat solenoid to "Click" on the command to start. If it does, service the glow plugs in accordance with the engine service manual. If it does not, check for loose wiring connections and damaged wire, and bypass the module by pressing the panel preheat switch. Replace the module if the glow plugs are activated by the panel switch.
6. Discharged battery (slow cranking speed).	6. Service battery and connectors as indicated in "Engine Does Not Crank".
7. Fuel line plugged or frozen, fuel filter plugged, air filter plugged, contaminated fuel, lift or transfer pump not working.	7. Investigate thoroughly and rectify the problem.
8. Fault in engine fuel, mechanical or electrical system.	8. Investigate thoroughly and service in accordance with the engine service manual.

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ENGINE RUNS UNTIL FAULT SHUTDOWN

POSSIBLE CAUSE	REMEDY
1. Engine overspeed. Fault lamp on.	1. Service and adjust faulty engine governor in accordance with the appropriate instructions. Readjust engine overspeed switch in accordance with the generator service manual.
2. Low oil pressure. Fault lamp on.	2. Check and refill engine oil as necessary, and repair any leaks immediately. Start engine and monitor oil pressure with the panel gauge. If the engine still shuts down and the oil pressure reading is normal (30-60 PSIG) replace the low oil pressure switch. If the oil pressure is low, service the engine lubricating oil system in accordance with the engine service manual.
3. High engine temperature. Fault lamp on.	3. Check and refill engine coolant as necessary, and repair any leaks immediately, remove any obstructions to cooling air flow and check for slipping fan belts and repair. Start engine and monitor engine temperature with the panel gauge. If engine temperature is 205°F or less, replace the high engine temperature switch. If the engine temperature is high, service the engine cooling system in accordance with the engine service manual.
4. Fault 1 or Fault 2 Lamp on.	4. Correct fault. If shutdown is due to over- or under-voltage, the voltage regulator may be faulty. Service in accordance with the generator service manual.

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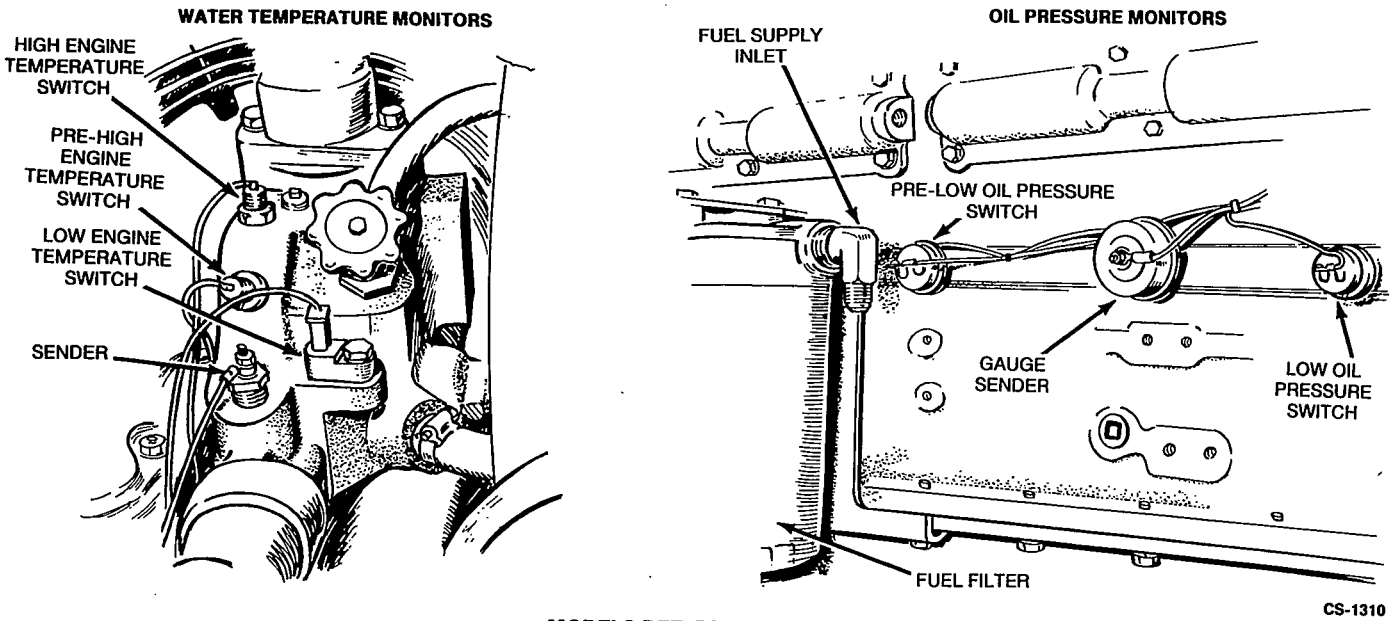
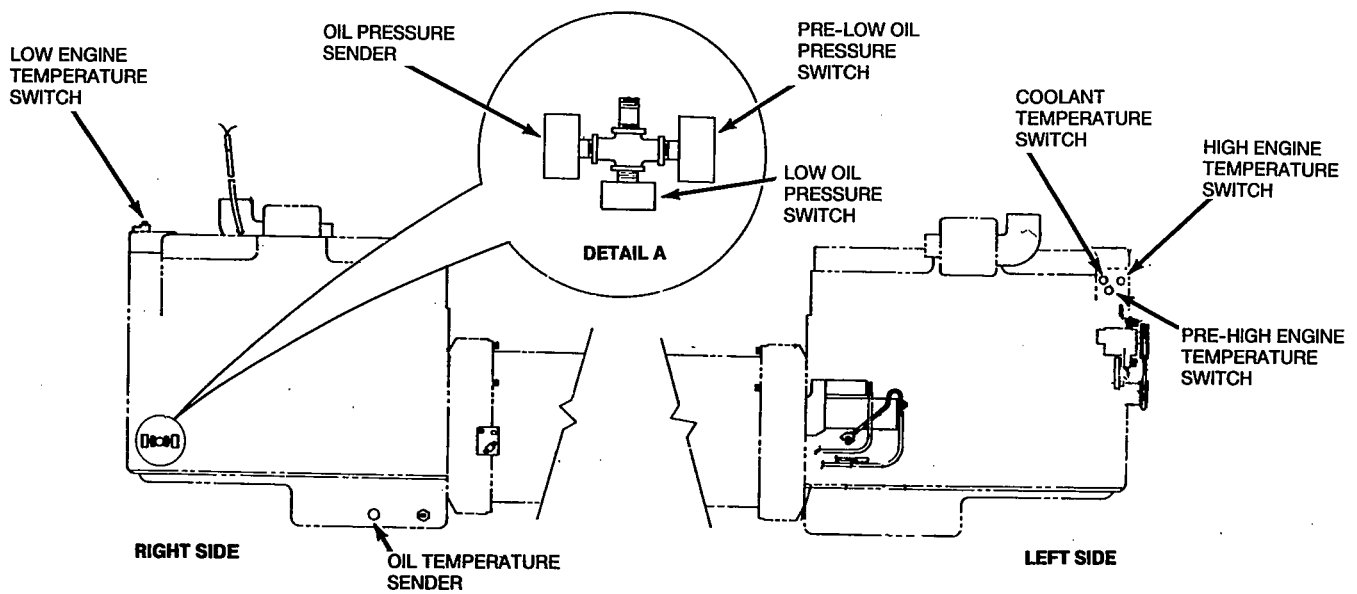
Section 6. Engine Sensor Location



MODELS DFE, DFM, DFP



MODEL DFN

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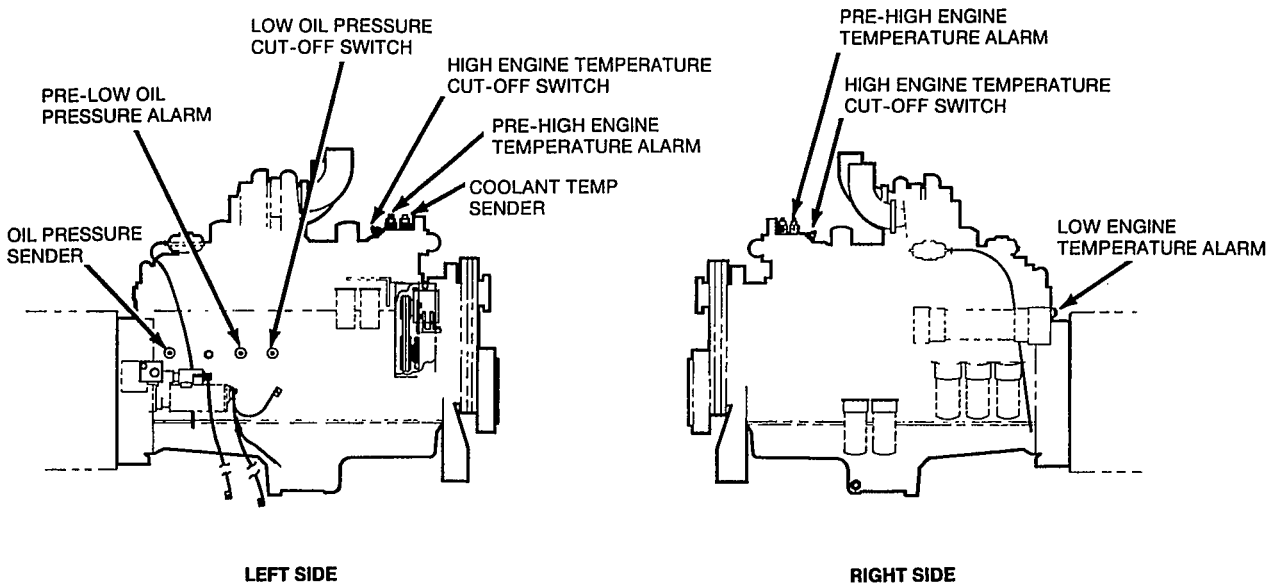
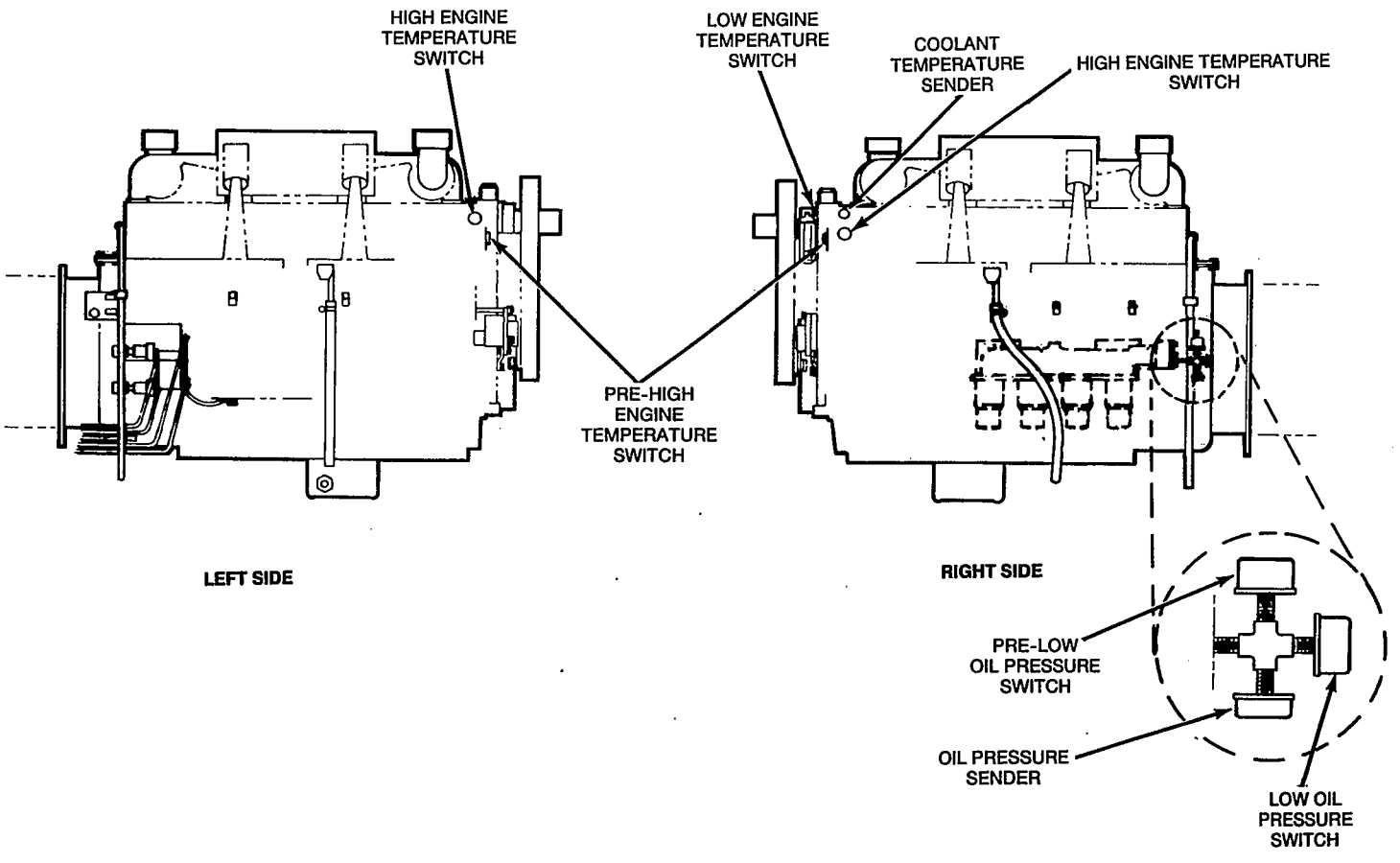


MODEL DFW,DFY



MODEL DFZ

M-1684

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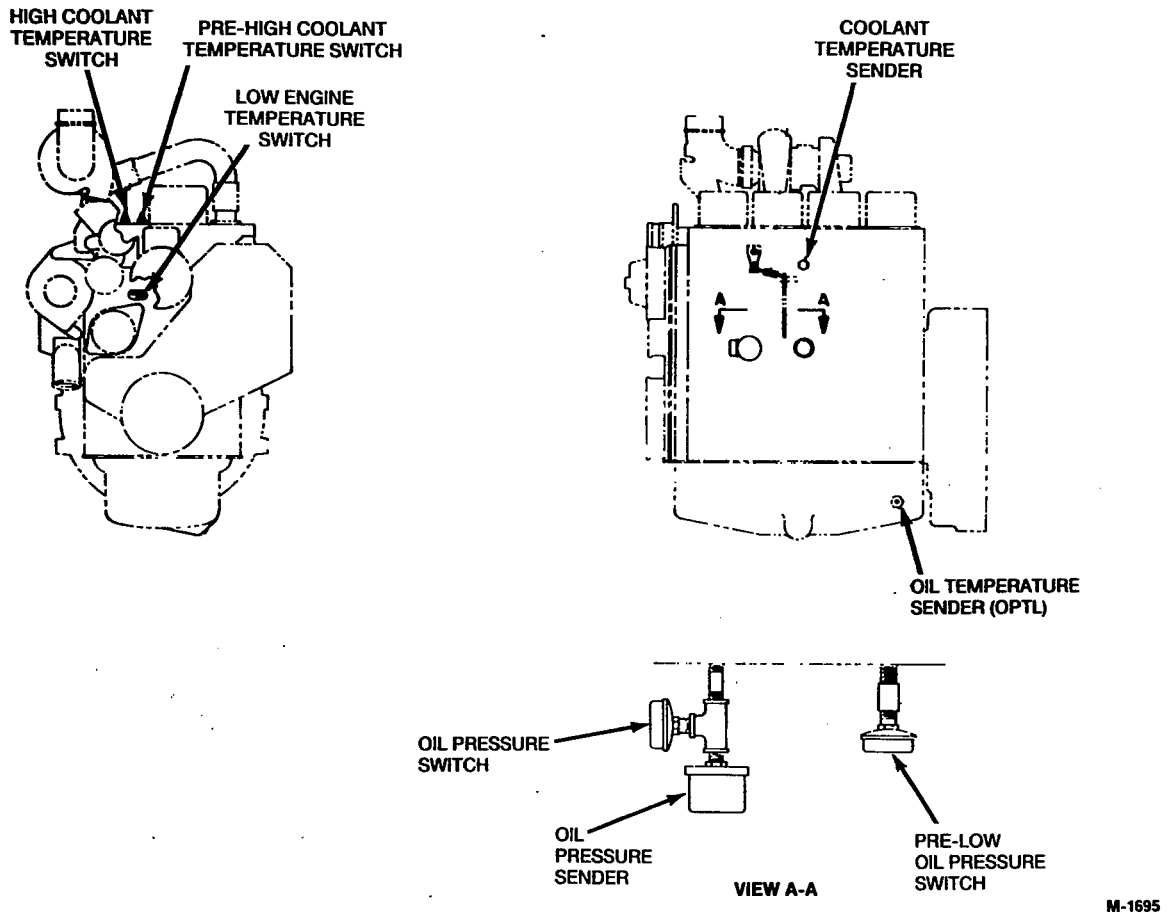
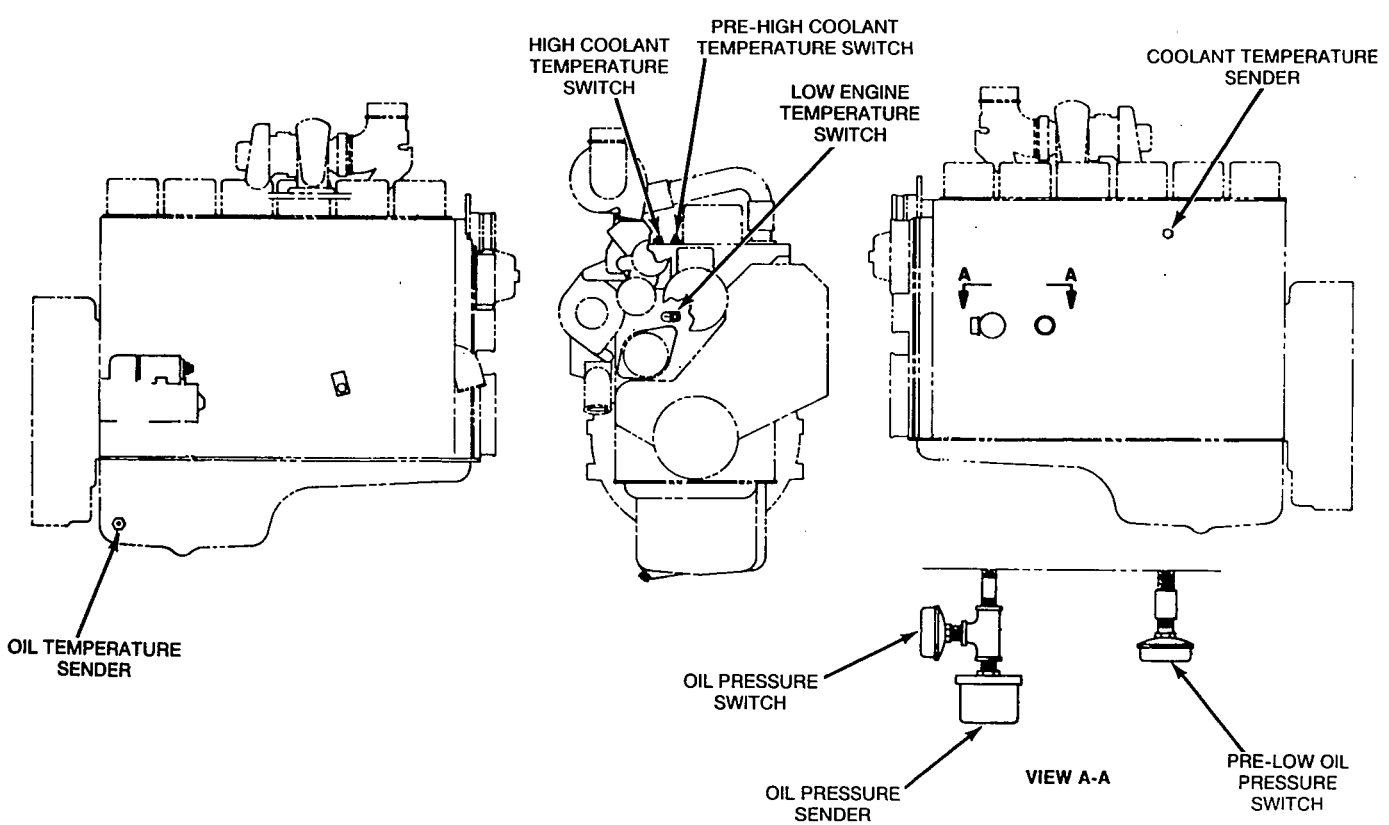


MODEL DGCA, DGCB



MODEL DGDA, DGDB

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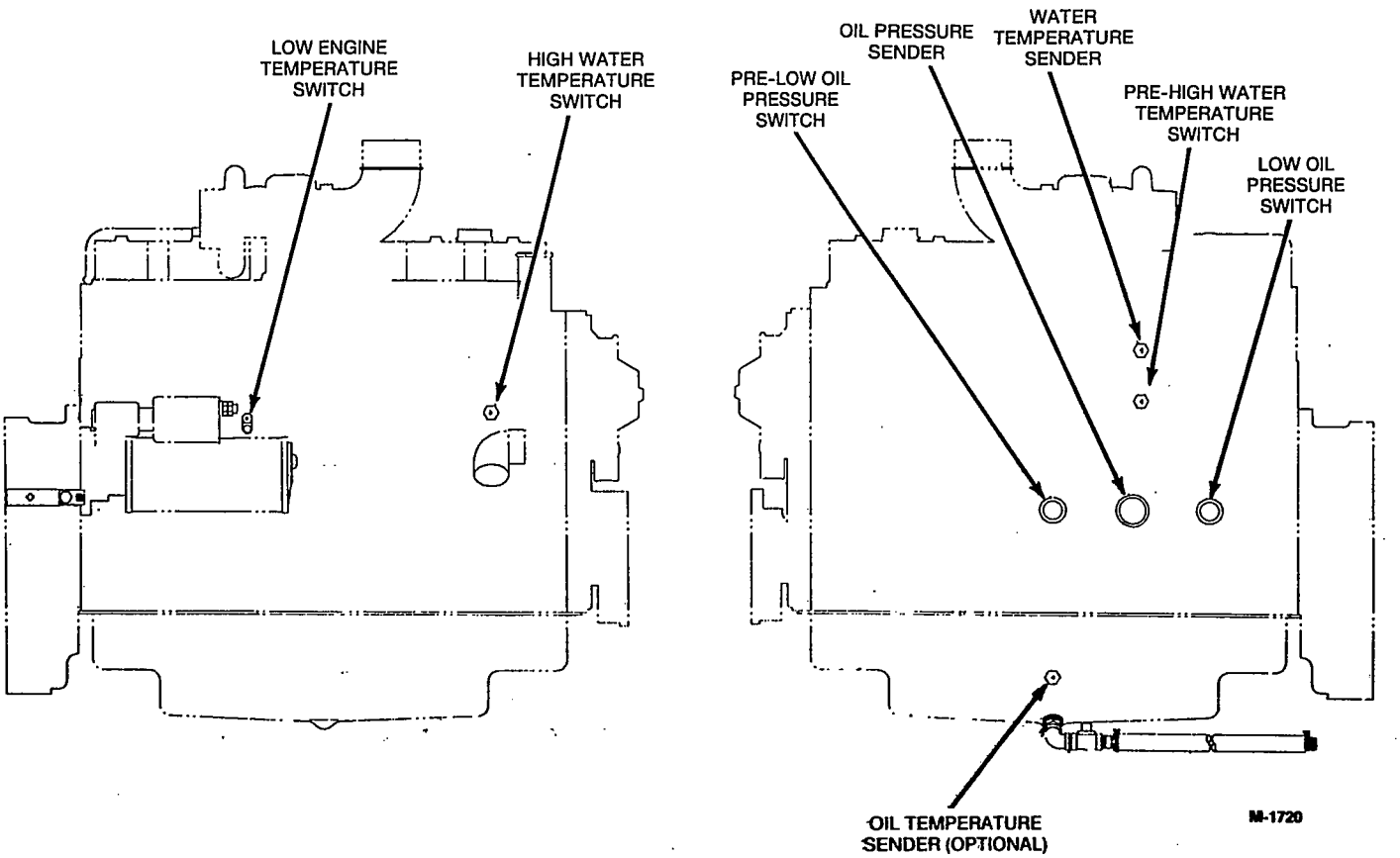

MODELS DGEA, DGFA

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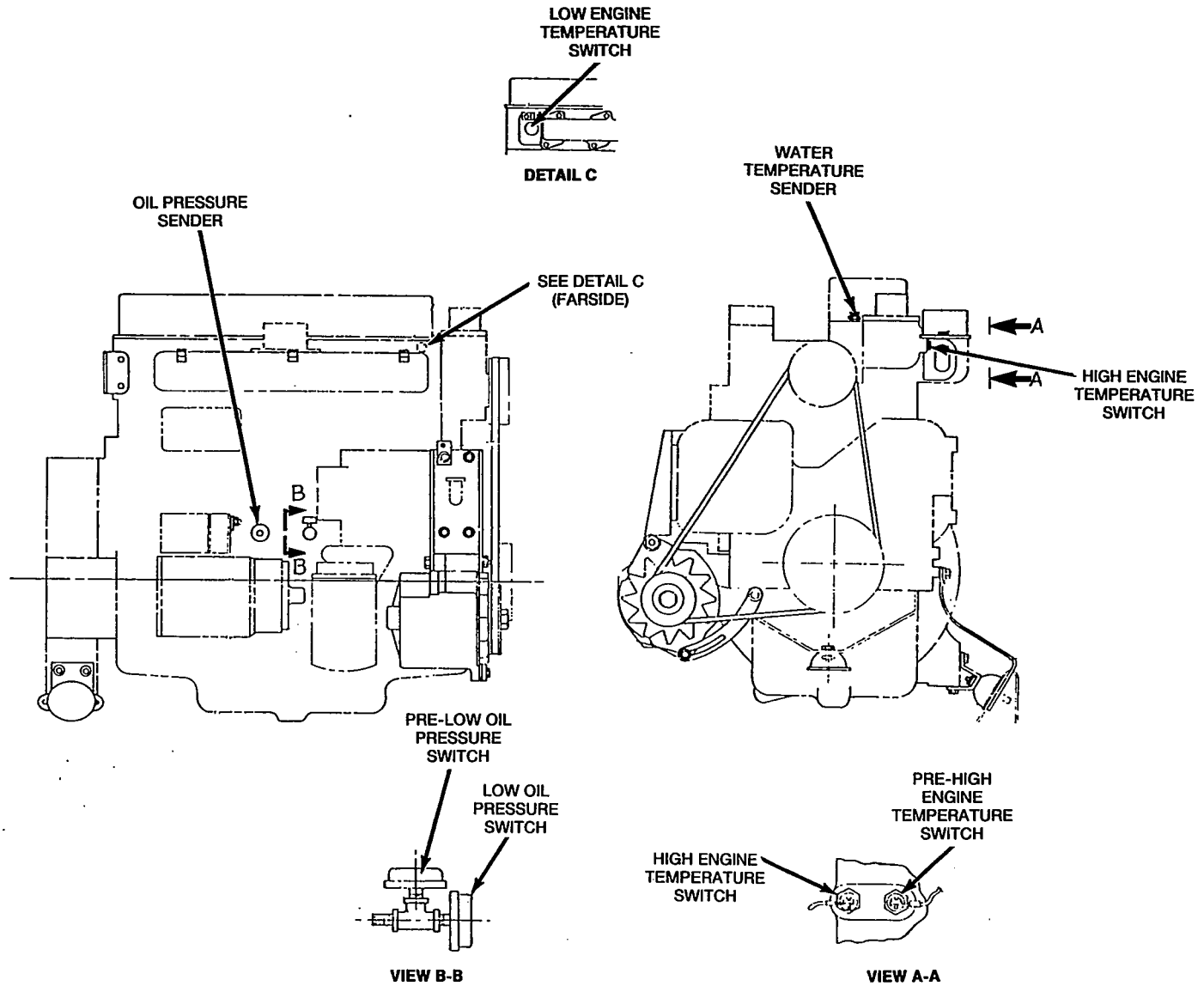

DL SERIES

M-1745

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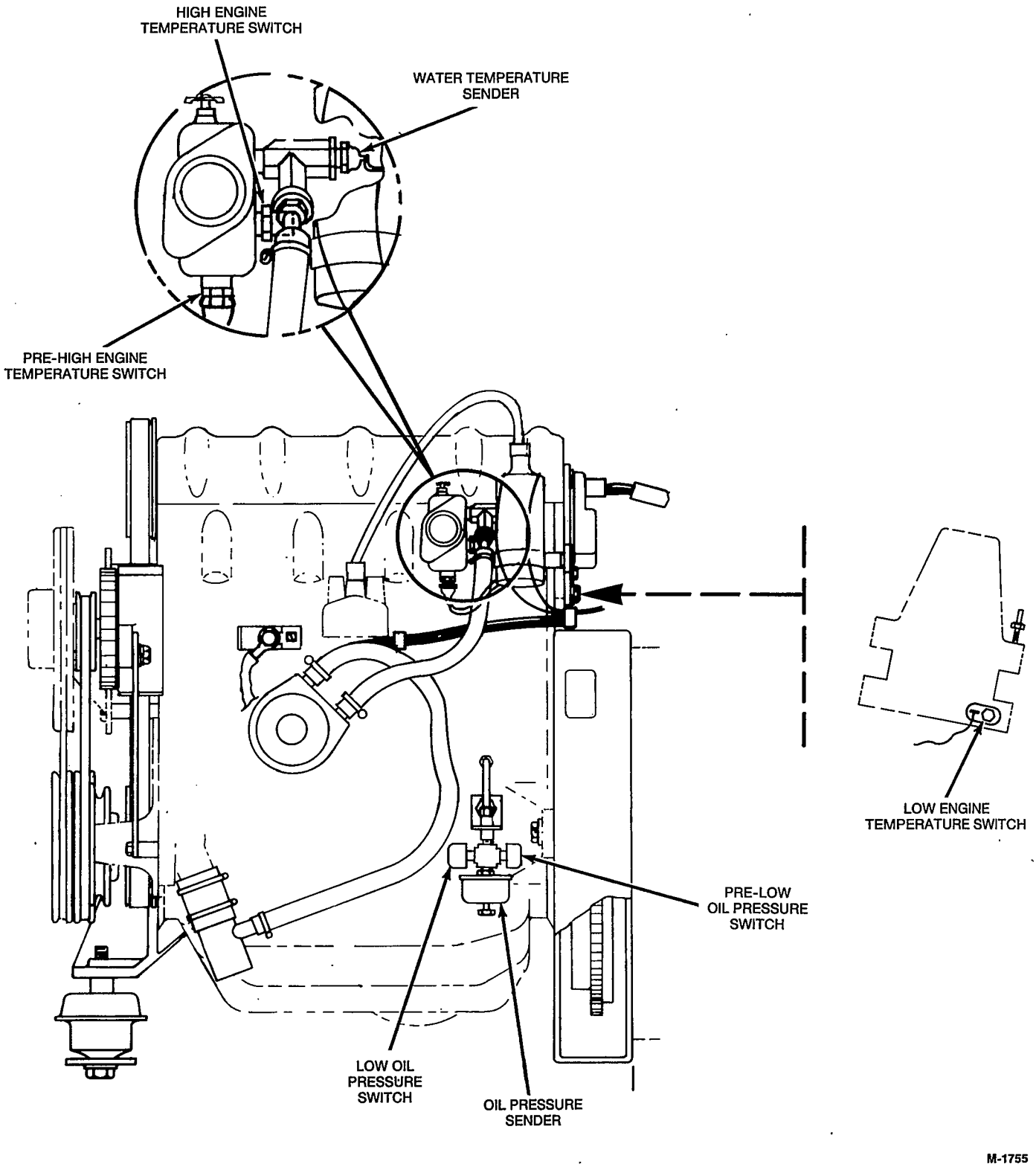

CURRENT MODEL SJB

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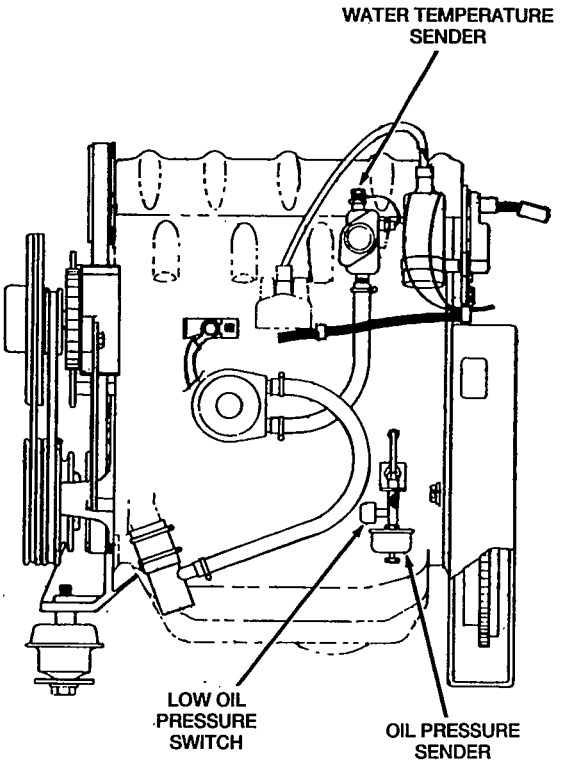
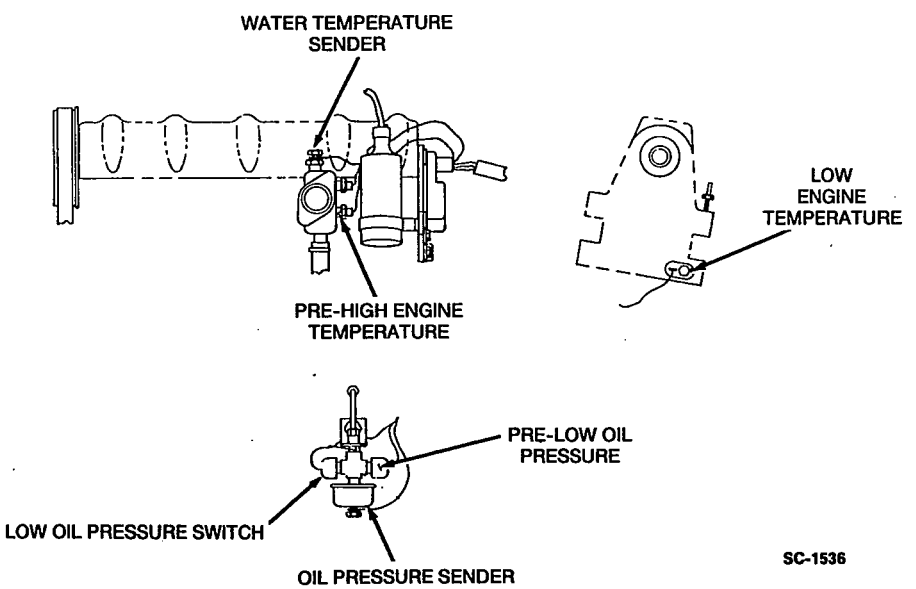


OLDER MODEL SJB WITH 2-LIGHT CONTROL



OLDER MODEL SJB WITH 12-LIGHT CONTROL

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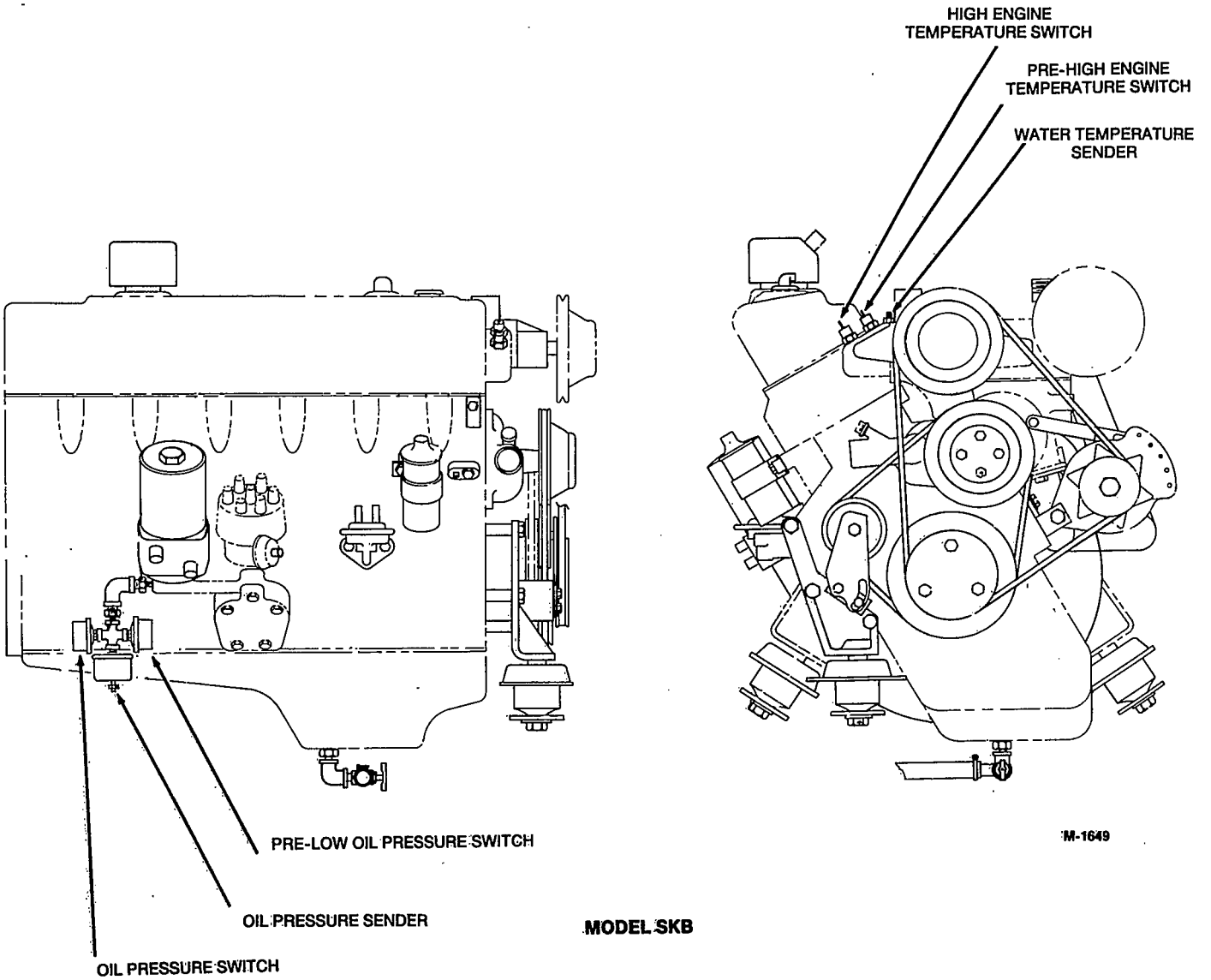

MODEL SKB

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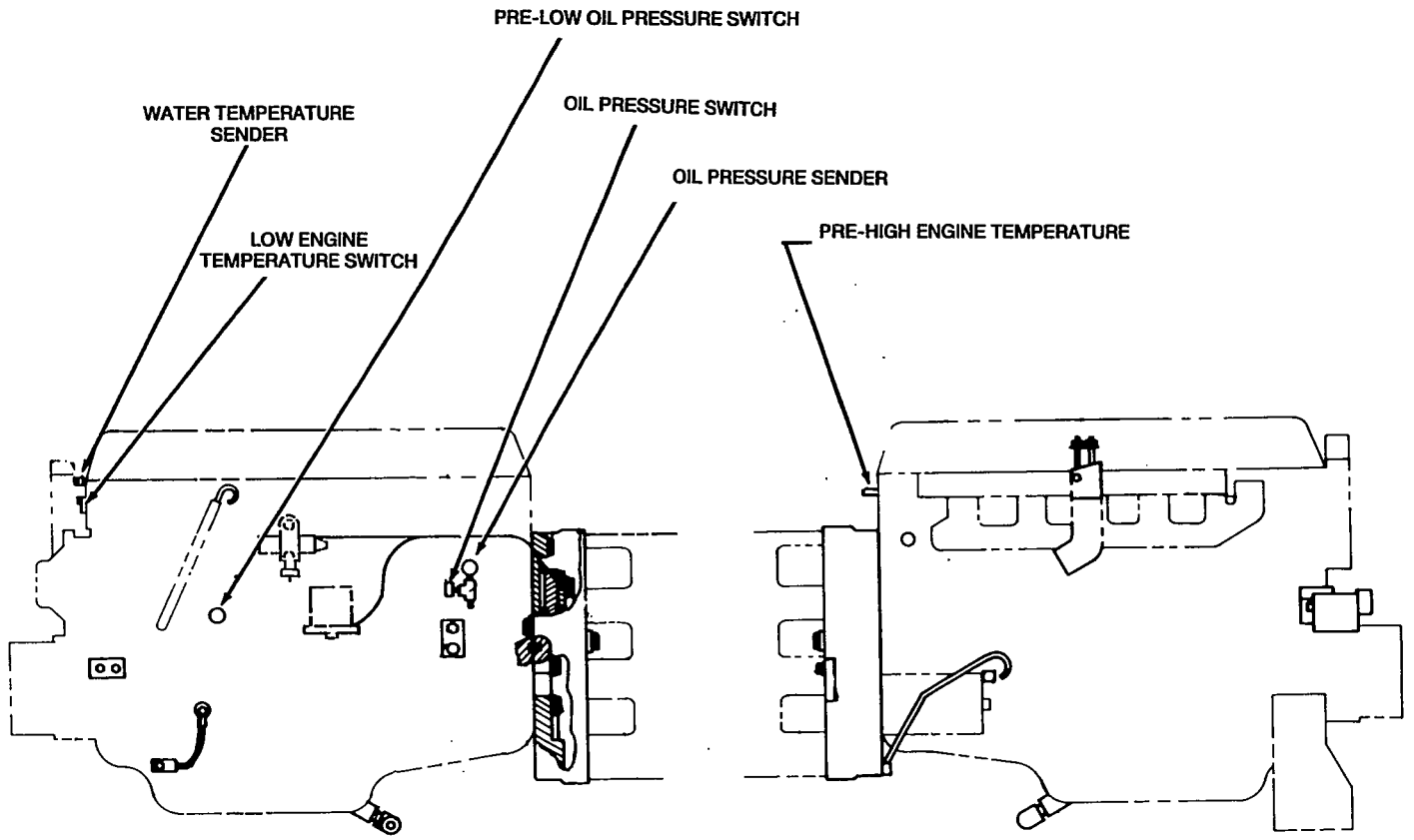

MODELS EK, EM (BEGIN SPEC P)

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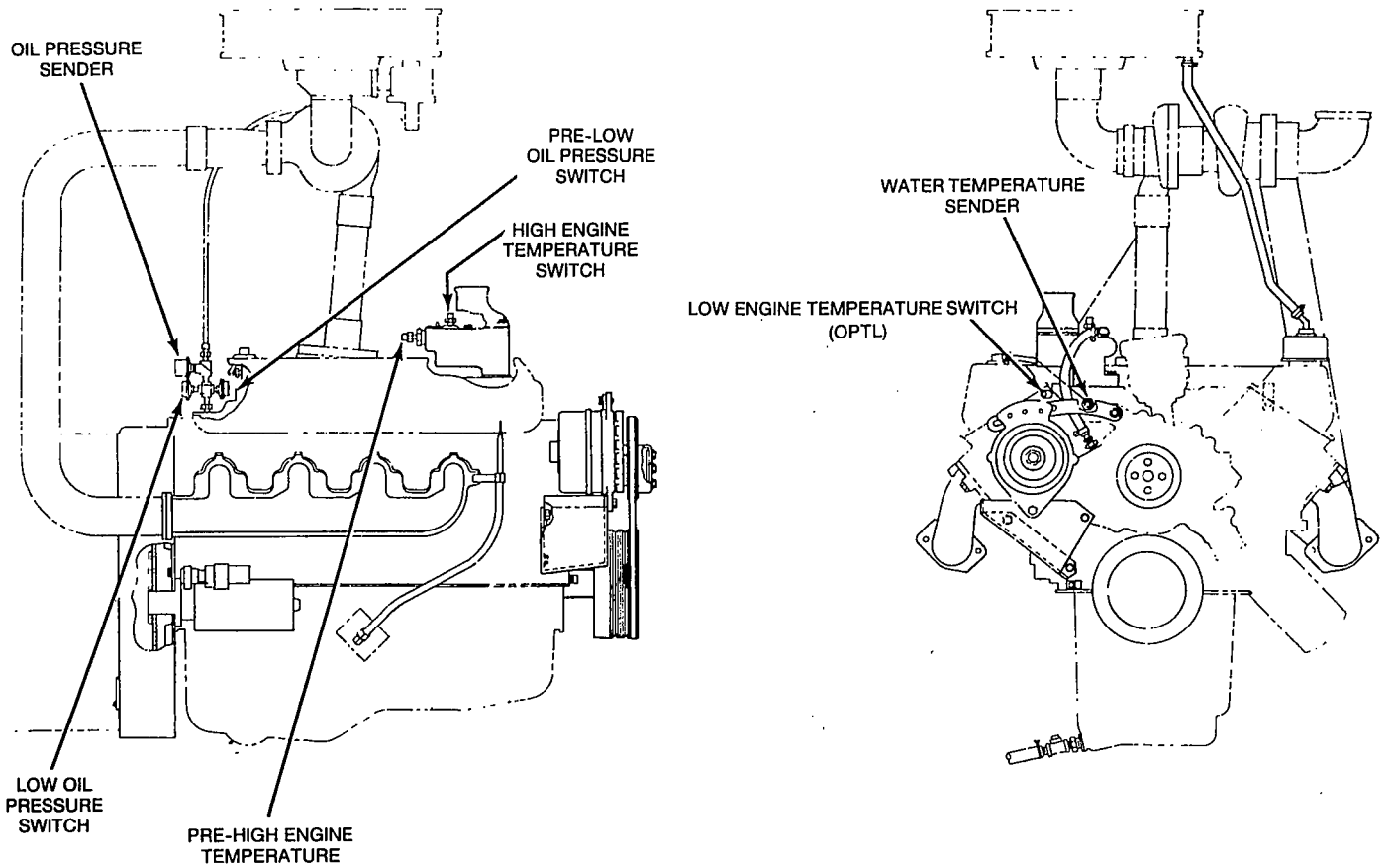
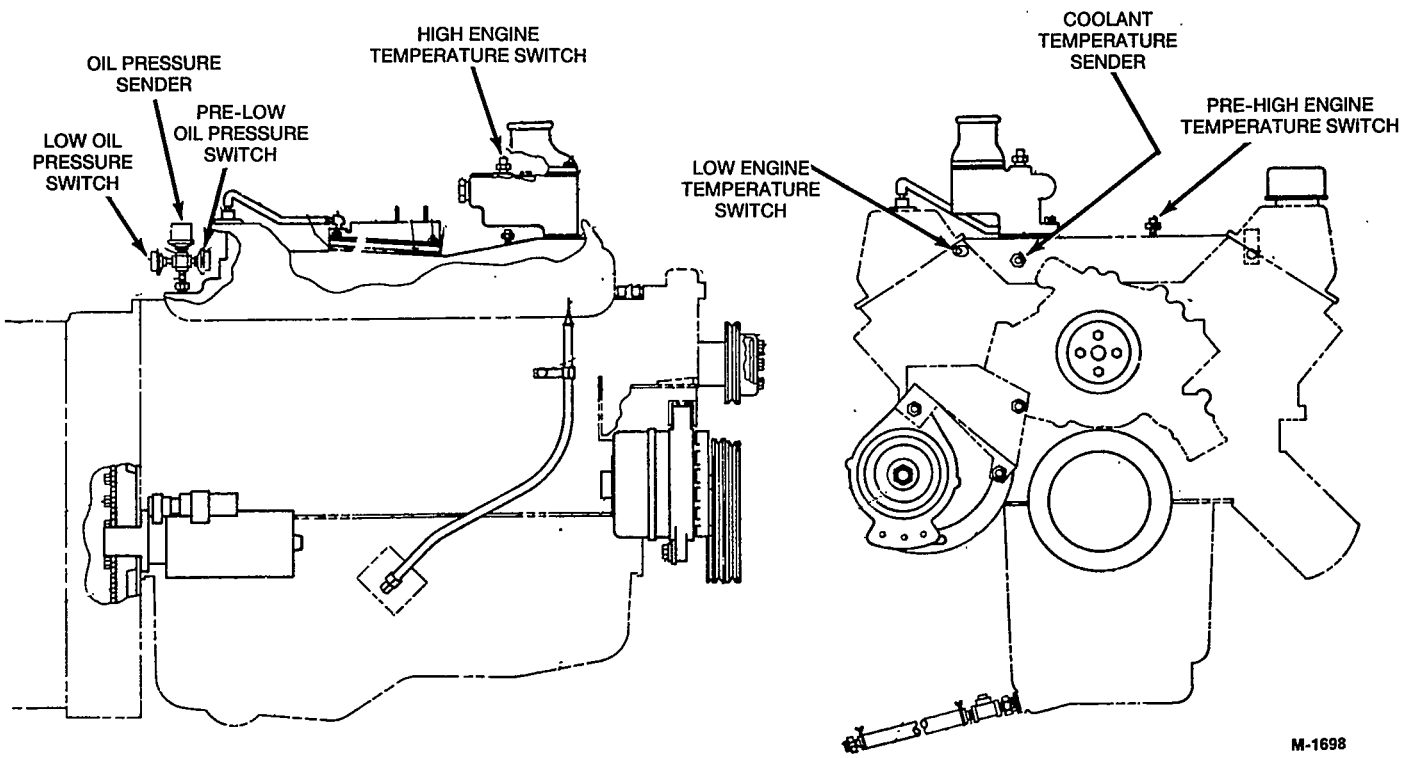


MODEL ENTX



MODEL EN

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ENGINE SENSOR SETTINGS

SERIES	PRE-LOW OIL PRESSURE	LOW OIL PRESSURE	PRE-HIGH ENG. TEMP.	HIGH ENG. TEMP.
DFE DFM DFP	20 psi (138 kPa)	14 psi (97 kPa)	215°F (102°C)	222°F (105°F)
DFW DFY DFZ	20 psi (138 kPa)	14 psi (97 kPa)	205°F (96°C)	215°F (102°C)
DGCA DGCB DGDA DGDB DGEA DGFA	20 psi (138 kPa)	14 psi (97 kPa)	220°F (104°C)	230°F (110°C)
DL4 DL6 DL6T	20 psi (138 kPa)	14 psi (97 kPa)	202°F (94°C)	222°F (105°C)
EN ENTX	30 psi (207 kPa)	25 psi (172 kPa)	205°F (96°C)	215°F (102°C)
SJB SKB	20 psi (138 kPa)	14 psi (97 kPa)	216°F (102°C)	227°F (108°C)

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