



Doosan Infracore
Portable Power



ELECTRONIC SERVICE MANUAL

XP185WIR
P260WIR

7/51
7/71
12/56



This manual contains important safety information.

Do not destroy this manual.

This manual must be available to the personnel who operate and maintain this machine.

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SECTION 1

GENERAL INFORMATION

Operational Theory

The P185/P260WIR machine has an electronic monitor and control system that is used to provide discharge air pressure control and manage monitor functions. The system uses the SECU controller to perform these functions. The electrical system connects all the necessary switches, sensors and transducers to the controller in order for it to perform the monitor and control functions.

SECU Controller

The controller is the heart of the machine monitor and control system. It provides data collection, alarming and control functions for compressor operations. It is a microcontroller based unit with analog and digital inputs and outputs.

The controller has a LED display for diagnostics. A number, 1-9, is shown to indicate a system problem.

The first function of the controller is to scan all analog and digital inputs at a fixed interval. These inputs are scanned every 10 milliseconds. The values are then compared against minimum and maximum values and an ALERT or SHUTDOWN is issued, if a value is out of range. The controller will indicate ALERTS and SHUTDOWNS for compressor system. These are indicated through fault codes that are displayed on the SECU LED display.

The second function of the controller is to communicate with the diesel engine controller via the J1939 CAN network. The CAN communication controls engine speed, start-up functions, and start-up parameters as follows.

Engine Speed Control

The controller monitors the regulation system air pressure and varies the engine throttle to maintain the setpoint discharge air pressure. The setpoint pressure is set using the regulator on the separator tank.

Start Control

- Starter Protection
- Fuel Pump
- Start instructions to engine controller
- Inlet heater (glow plug) control
- Store diagnostic information
- Sets correct operating speeds based on compressor model
- Generator speed control

Start –Up

During SECU/power-up, the 8 digit lights to check the display. Next, the display will step through the 3 digit software revision.

Figure 2-2 shows the connections between the engine controller and the SECU controller.

Sensors and Transducers

The electronics system contains a transducer and switches that are used to monitor the compressor. Various machine temperatures are monitored using temperature switches that open when the switch exceeds its threshold. The open switch disconnects battery voltage input to the SECU controller indicating a problem.

The electronics system uses a pressure switch to monitor engine oil pressure. The pressure switch opens when the oil pressure is below its threshold. The open switch disconnects battery voltage input to the SECU controller indicating a problem.

The electronics system also uses a pressure transducer to measure compressor pressure changes. This device has an output signal of 0.5 VDC to 4.5 VDC, corresponding to 0 psi and the maximum measured psi for that particular device. The transducer is a gauge pressure device. The transducer is powered with a 5 VDC excitation. The transducer is a three wire device: excitation, signal, and ground.

Digital Inputs and Outputs

The controller scans digital inputs such as switch contacts. These are either “ON” (12V DC) or “OFF” (0V DC). These digital inputs are connected to switches within the package such as temperature switches, pressure switches, and ignition switch.

The controller provides 12V DC digital outputs to control relays, fuel pump, and hourmeter. These are 12V DC “ON” and 0V DC “OFF”. They are current limited and short circuit protected.

Engine speed control is performed by a command over the J1939 CAN Network from the SECU to the Engine ECM.

Pressure Control

The discharge pressure is controlled by manipulating the engine speed and compressor inlet valve position. The inlet valve position is controlled pneumatically and the engine speed is determined by the controller based on the position of the inlet valve. The controller measures the pneumatic system regulation pressure and computes an engine throttle setting. This throttle setting is sent to the engine via the J1939 throttle.

J1939 Data Link

The CAN network is twisted pair conductors located with the main chassis harness. Figure 2-3 shows a layout of the CAN harness or "backbone" as it is referred to. The termination resistors (Terminator) are important to prevent reflections on the transmission line and must be in place for the network to function properly.

The engine diagnostics connector is located near the engine ECM. This is used to connect the engine manufacturer's service tools to the CAN network. This connector also provides 12V DC to power these service tools.

The SECU diagnostics connector is located near the SECU controller and is used to connect Doosan/IR diagnostic and reprogramming tools.

Electrical System

The schematic diagrams show the wiring harness connections. Figure 2-1 is a system schematic showing harness connection with devices and controllers.

The electrical circuits are protected using ATC style fuses. A fuse should only be replaced with one of the same rating. Replacing a fuse with one of a large rating could lead to harness damage. If a fault occurs and the circuit does not have the appropriate size fuse, wires could be burned in the harness and damage other circuits.

HARNESS SYSTEM SCHEMATIC

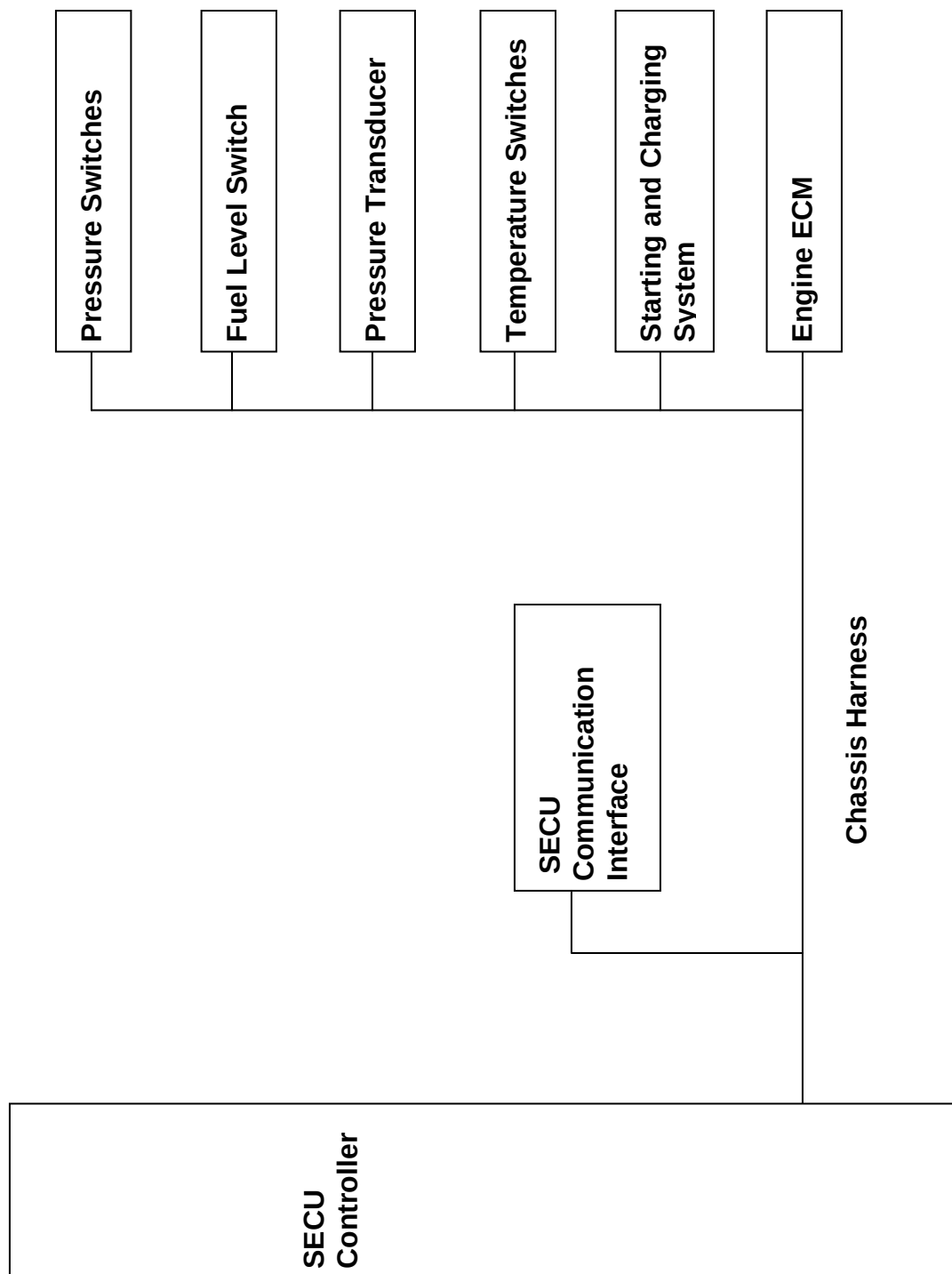


FIGURE 2-1

**SECU TO ENGINE INTERFACE
YANMAR TIER III ENGINE**

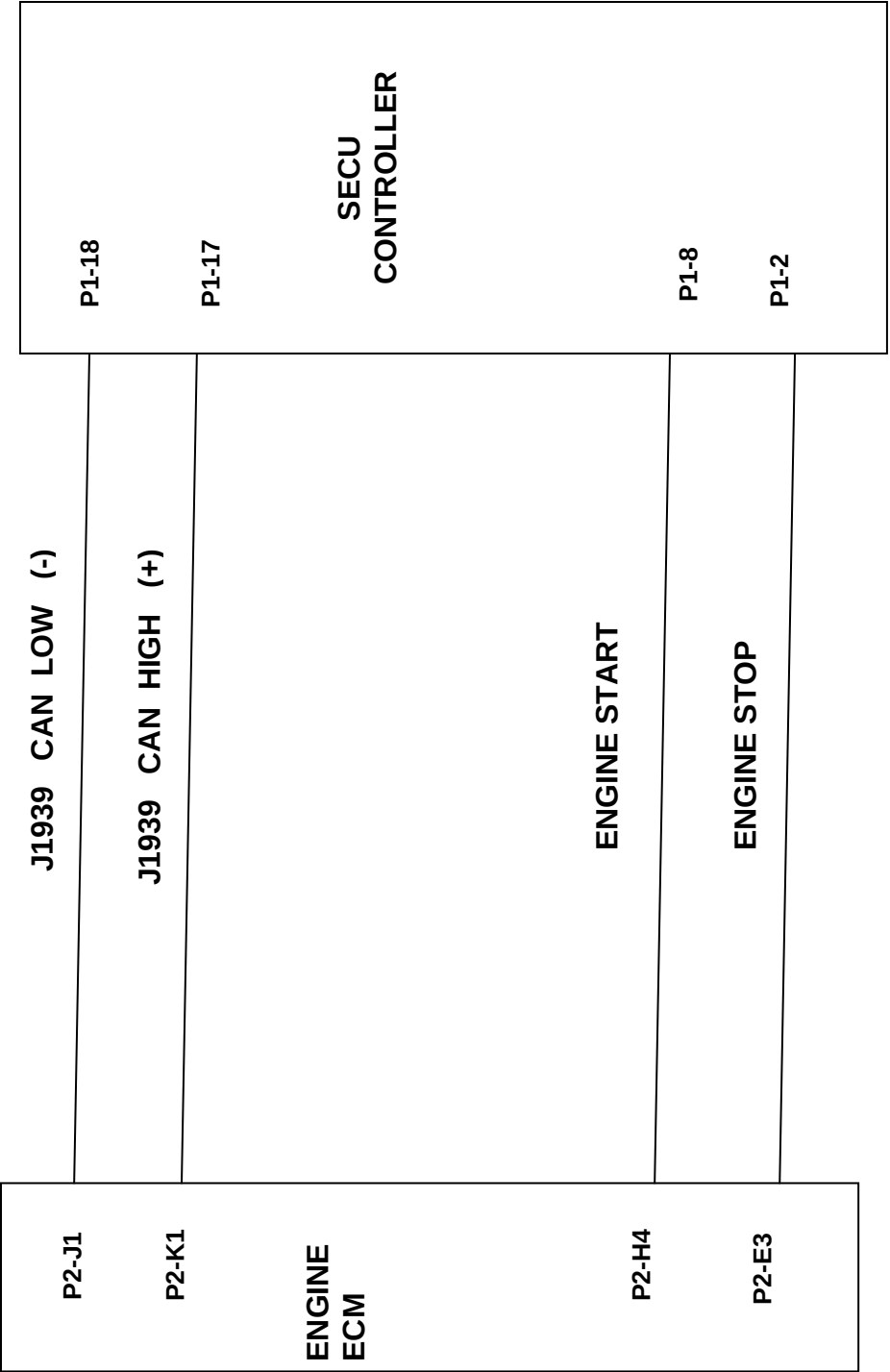


FIGURE 2-2

J1939 CAN COMMUNICATIONS SCHEMATIC

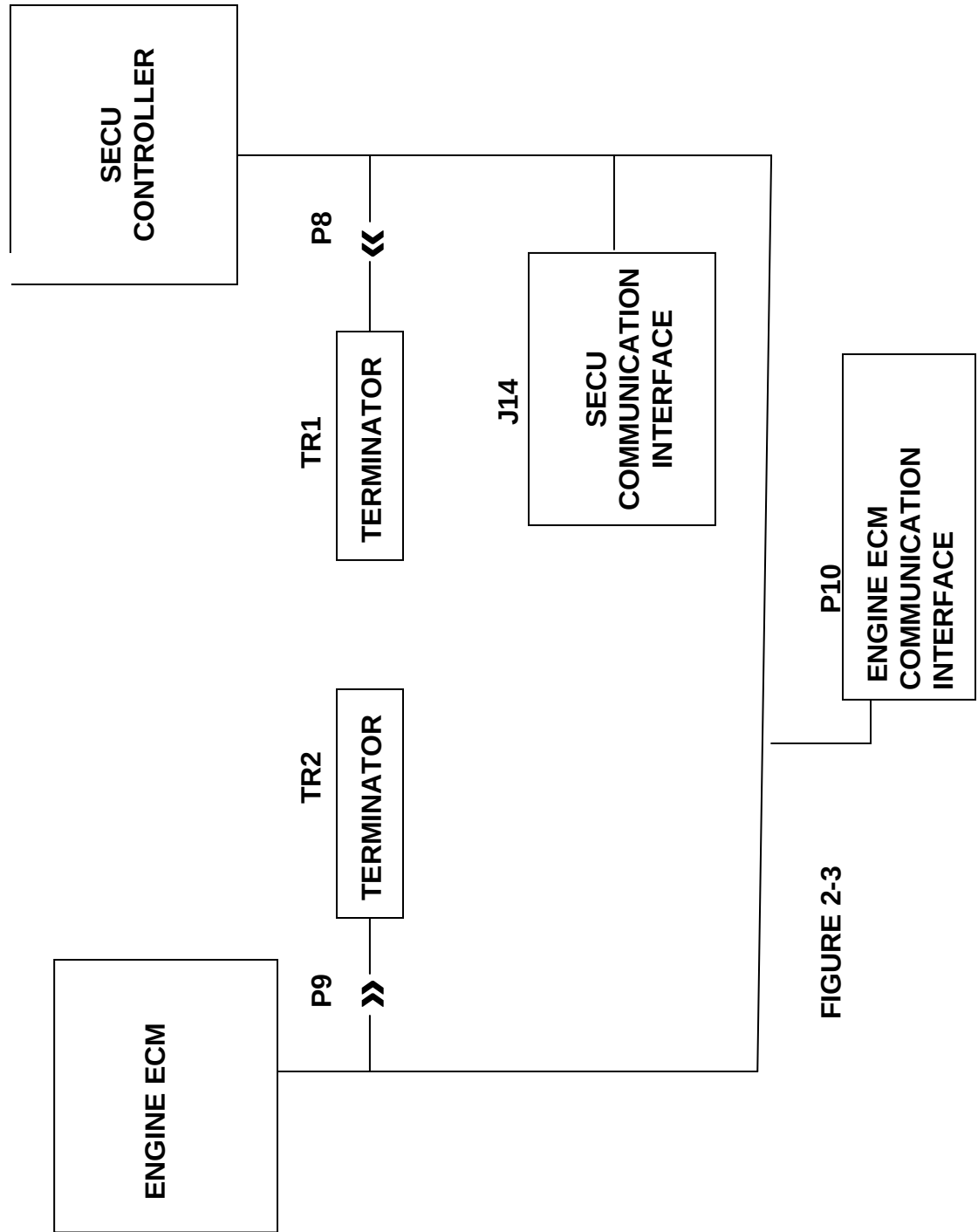


FIGURE 2-3

Key Electrical Component Functions

PS1:	PS1 is a 0-100 psi gauge pressure transducer that measures regulation system pressure.
S2:	S2 is a 248°F/120°C NC temperature switch that monitors separator tank temperature.
S3:	S3 is a 248°F/120°C NC temperature switch that monitors airtend discharge temperature.
S4:	S4 is a 230°F/110°C NC temperature switch that monitors engine coolant temperature.
S5:	S5 is a 12 psi NO pressure switch that monitors engine oil pressure.
K1:	K1 is a SPDT, 12 VDC relay used to engage the starter solenoid.
K2:	K2 is a SPDT, 12 VDC relay used to energize the inlet heater.
K3:	K3 is a SPDT, 12 VDC relay used to energize the engine ECM.
K4:	K4 is a SPDT, 12 VDC relay used to energize the fuel rack actuator.

OPERATIONAL INFORMATION

Power On

When the Ignition switch is turned to the "ON" position:

1. Engine ECM energizes the Engine ECM power relay (K3).
2. Engine ECM energizes the Fuel Rack Actuator relay (K4).

Pre-Heat

When the Ignition switch is turned to the "PRE-HEAT" position:

1. The SECU controller energizes the engine inlet heater.

The engine inlet heater will be de-energized when operator releases switch or after 30 seconds whichever occurs first.

Startup

When the Ignition switch is turned to the "START" position:

1. Engine Start signal (12 VDC) supplied to engine ECM from SECU.
2. Engine ECM energizes the engine starter.

When the engine speed reaches 600 RPM (engine start declared):

1. Engine Start signal (12 VDC) to engine ECM is turned off.

Load

When the Service Air button is pressed (if equipped):

1. SECU varies engine speed based on regulation pressure.

Shut Down

If a machine fault occurs:

1. The SECU controller turns the Engine Stop signal (12 VDC) "ON".
2. Engine ECM de-energizes the Fuel Rack Actuator relay (K4).
3. The SECU displays SHUTDOWN code.

When the ignition switch is turned to the "OFF" position.

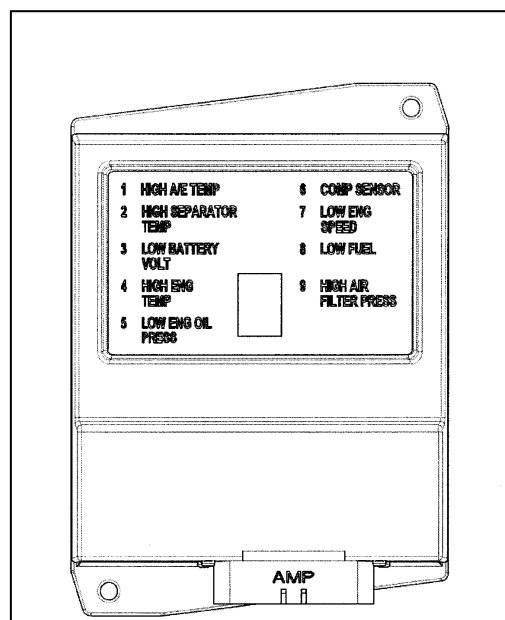
1. The switched battery power is turned off to the machine system.

SECTION 2

COMPRESSOR and ENGINE DIAGNOSTIC CODES

COMPRESSOR DIAGNOSTIC DISPLAY CODES

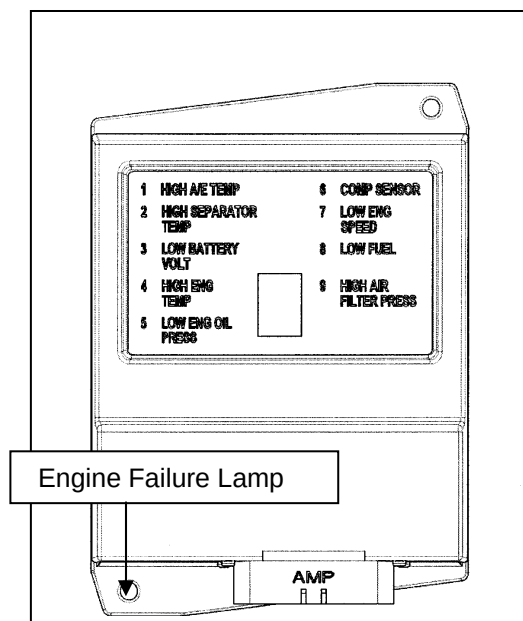
Small Electronic Control Unit (SECU)



-	Center Bar Blinking	Compressor is ready to start (no faults)
A	Engine Model Not Recognized	Compressor will start and operate with a 1700-2300 rpm range.
C	Engine ECM Communication Failure	SECU cannot communicate with engine ECM over J1939 CAN BUSS.
H	Pre-Heat Signal or Start Signal Detected	Displayed while ignition switch is in the pre-heat or start position.
E	Generator Switch "ON"	Switch must be turned off to start the machine.
1	High A/E Temp	SHUTDOWN condition due to high airend discharge temperature. (248°F/120°C)
2	High Separator Temp	SHUTDOWN condition due to high separator tank temperature. (248°F/120°C)
3	Low Battery Voltage	ALERT condition indicating battery or charging system needs service. (<11.6 VDC)
4	High Eng Temp	SHUTDOWN condition due to high engine coolant temperature. (230°F/110°C)
5	Low Eng Oil Press	SHUTDOWN condition due to low engine oil pressure. (12 psi/0.83 bar)
6	Comp Sensor	SHUTDOWN condition due to PS1 pressure sensor failure. Machine will not start.
7	Low Eng Speed	SHUTDOWN condition due to low engine speed. (Idle speed < 200 rpm)
8	Low Fuel	SHUTDOWN condition due to low fuel level. (Optional)
9	High Air Filter Press	ALERT condition indicating engine/compressor air inlet filters need service (20 in. of H ₂ O/508 mm of H ₂ O). (Optional)

Engine Diagnostic Codes

- Failure flashes can be read on the Engine Failure Lamp when the on/off ignition switch is "ON" or when the unit is running.
- The Engine Failure Lamp is located behind the front end panel.
- The Failure Lamp is luminated for 2 seconds when the ECU is powered on.
- A lamp flash duration of 0.5 seconds is a "Short" Flash.
- A failure flash sequence of "1 long and 3 Short" would be displayed by flashing the lamp one time with a duration of 1.5 seconds and three times with a duration of .5 seconds.
- When two or more failures have occurred simultaneously, the failure lamp will pause for 3 seconds between flash sequences.
- Failure flash sequences continuously repeat with 3 second pauses between flash sequences until the failure is corrected.



Failure	Failure Flashes	Remark
Coolant temperature sensor failure	4 Short	
Speed sensor failure	6 Short	
Rack position sensor failure	7 Short	
Rack actuator failure	8 Short	
EGR valve failure	1 Long and 3 Short	
CSD solenoid valve failure	1 Long and 4 Short	
Main relay failure	1 Long and 6 Short	
Rack actuator relay failure	1 Long and 7 Short	
ECU temperature alarm	2 Long and 5 Short	ECU temp > 221°F/105°C
Coolant temperature alarm	3 Long and 6 Short	Coolant temp > 230°F/110°C
ECU failure	4 Long and 1 Short	

SECTION 3

TROUBLESHOOTING COMPRESSOR DIAGNOSTIC CODES

General

A thorough analysis of the problem is the key to successful troubleshooting. The more information known about a problem, the faster and easier the problem can be solved.

Troubleshooting charts are included to act as a guide to the troubleshooting process. They are organized so the easiest and most logical things are performed first. It is not possible to include all the solutions to problems that can occur or list all possible problems. The charts are designed to stimulate a thinking process that will lead to solution of the problem.

Basic Troubleshooting Steps

- Collect all facts concerning the problem
- Analyze the problem thoroughly
- Relate the symptoms to the basic electrical / electronic systems and components
- Consider any recent repairs that could relate to the problem
- Double check before replacing components
- Review the controller fault log for clues as to the problem
- Determine the cause of the problem and make a thorough repair

MEASURING VOLTAGE, RESISTANCE, FREQUENCY AND DUTY CYCLE

General Measuring Guidelines

Since the electrical system uses sealed connectors and splices, access of test points can be difficult. It is recommended that a test probe kit be used to access the signals to prevent damage to wires and connectors. Back probing connectors and insulation piercing test probes can cause damage that can cause future failures.

Measuring Voltage

A digital voltmeter is recommended to make measurements. Voltage measurements are made by connecting the RED + lead to the desired signal and the BLACK lead to the common. The test lead connections must be secure or incorrect readings will result. Use circuit common for the Black lead, not chassis ground or other metal connection. Circuit common will be any of the BROWN wires or battery negative can be used.

IMPORTANT INFORMATION

DO NOT USE MACHINE FRAME, SHEET METAL, PIPING OR OTHER METAL COMPONENTS AS COMMON OR GROUND WHEN MAKING VOLTAGE OR FREQUENCY MEASUREMENTS.

Measuring Resistance

Extra care must be taken when making resistance measurements. Test probe connections are crucial to correct readings. Ensure the test probe makes a solid connection with the wire(s) or connector pin(s) under test. the test probe kit may help with these types of measurements. Make sure system power is turned OFF while making resistance measurements.

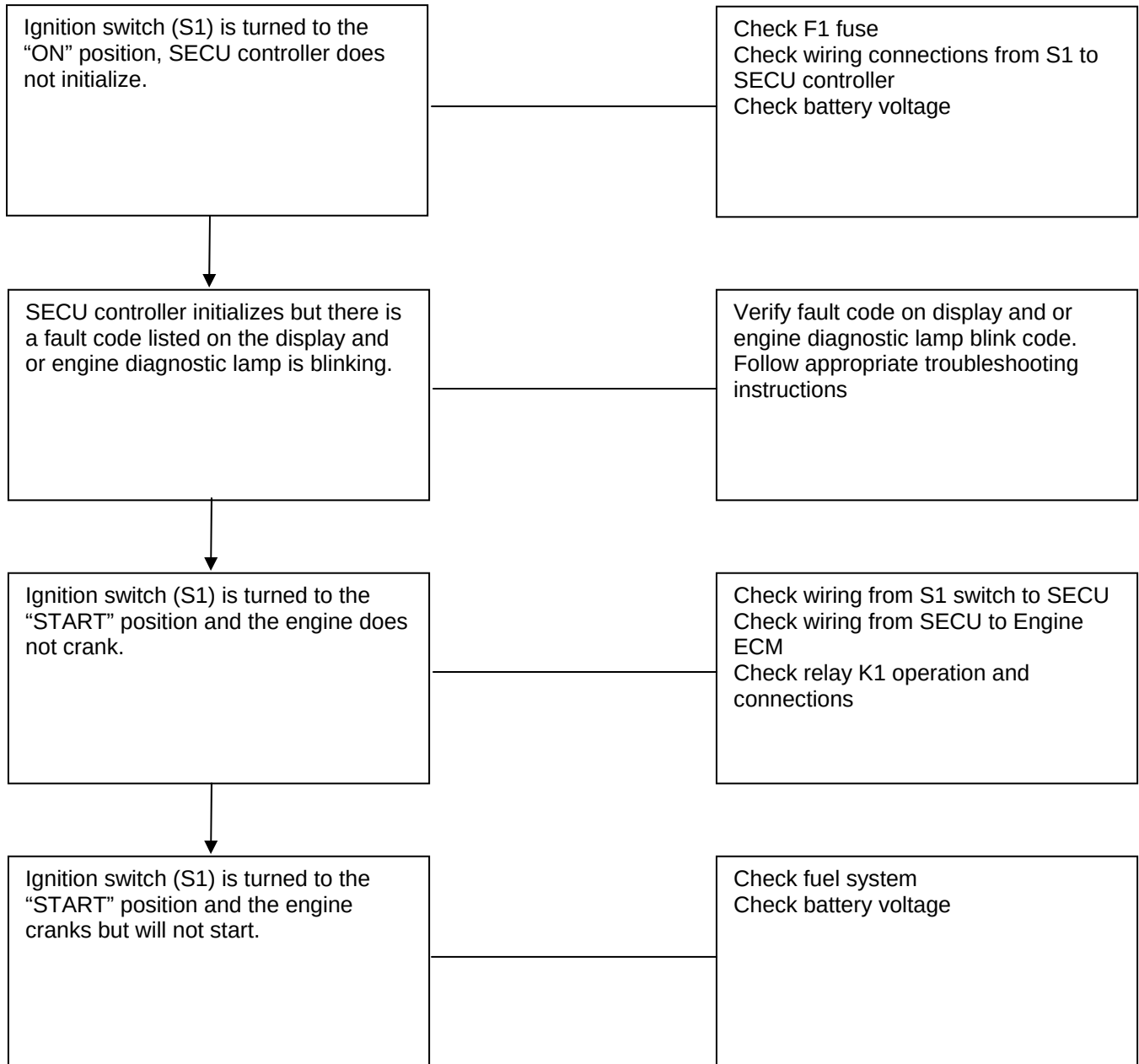
Measuring Frequency:

Frequency is measured in the same manner as voltage, but the meter is set for "HZ" or frequency. Good connections are important or false readings will occur.

Measuring Duty Cycle:

To measure duty cycle, setup the meter as if measuring frequency or voltage. Select the "%" or duty cycle function and take the measurements. As of the date of this writing, Fluke is the only known digital voltmeter that has the duty cycle feature. The Fluke Model 87 Digital Meter has the duty cycle function.

Troubleshooting Flow Chart



COMPRESSOR CODE -

Center Bar on Display Blinking

Explanation:

The SECU has not received any active fault codes and is ready to start.

Effect:

Code - is an INDICATION condition that the machine is ready to start.

COMPRESSOR CODE A

Engine Model Not Recognized

Explanation:

The SECU has not received the engine model number from the engine ECM.

Effect:

Code A is an ALERT condition and will not stop the machine, however the machine will start and operate at a default rpm range of 1700-2300. This rpm may not be correct for certain machine models.

Troubleshooting Steps

Action	Result
Step 1: Replace engine ECM.	

COMPRESSOR CODE C

Engine ECM Communication Failure

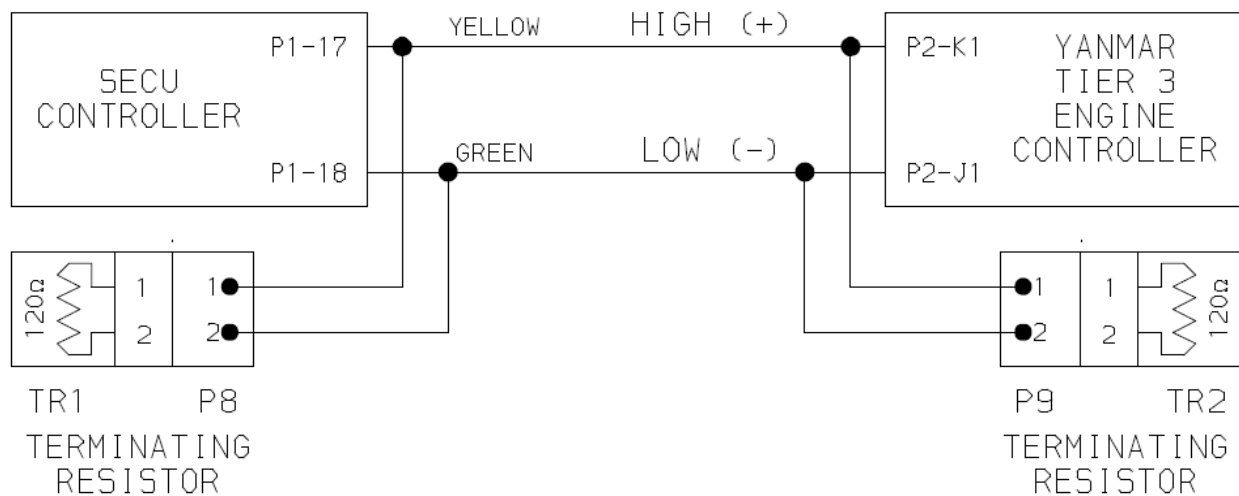
Explanation:

The SECU cannot communicate with the engine ECM via J1939 CAN BUS network.

Effect:

Code C is a SHUTDOWN condition and will stop the machine.

SECU to Engine ECM J1939 CAN BUS circuit:



Circuit Description:

The J1939 CAN BUS twisted pair conductor connects the SECU controller and the engine ECM together as shown in the circuit above. The yellow wire is referred to as J1939 CAN High (+). The green wire is referred to as J1939 CAN Low (-). The twisted pair conductors are the communications link between the SECU and all devices connected to it.

The CAN network has two terminating resistors TR1 and TR2. The resistance value of each terminator is 120 ohms. The terminators are connected together in parallel across the High (+) and Low (-) wires in the cable. When connected the resistance value between the High (+) and Low (-) wires is 60 ohms.

Component Location:

P1 connector is connected to the SECU controller and the P2 connector is connected to the engine ECM. Terminating resistor TR1 is located on the main harness near the SECU controller. Terminating resistor TR2 is located on the main harness near the engine ECM.

Troubleshooting Steps

Action	Result
Step 1: Check fuse F2.	Replace fuse as needed
Step 2: Verify battery + and – connections to the engine ECM.	Repair harness as needed
Step 3: Turn ignition switch S1 to the “ON” position. Using a multimeter, measure the ignition switch signal voltage at P2-G4.	Voltage measure should be 12 VDC at P2-G4. If not, check all harness connections in the ignition switch circuit to the engine ECM.
Step 4: Disconnect P1 connector from the SECU, P2 connector from the engine ECM, and any other devices connected to the J1939 CAN BUSS. Using a multimeter, measure the resistance between P1-17 and P1-18. Using a multimeter, measure the resistance between P2-K1 and P2-J1.	Resistance value measured should be 60 ohms across P1 terminals and P2 terminals If not, measure resistance value of each terminator (120 ohms) and or check for defective splice, broken wire, and loose connection at connector pins
Step 5: Disconnect P1 connector from the SECU and P2 connector from the engine ECM. Disconnect TR1 and TR2 from the harness. Using a multimeter, measure continuity between P1-17 and P2-K1. Using a multimeter, measure continuity between P1-18 and P2-J1. Using a multimeter, measure continuity between P1-17 and P1-18.	Continuity should be shorted between P1-17 and P2-K1 Continuity should be shorted between P1-18 and P2-J1 Continuity should be open between P1-17 and P1-18. If not, check for defective splice and or shorted pins in connectors.
Step 6: Disconnect any devices that are connected to the J1939 CAN BUSS except the SECU controller and engine ECM. Turn ignition switch S1 to the “ON” position. Using a multimeter, measure the voltage at P1-17 to battery -. Using a multimeter, measure the voltage at P1-18 to battery -.	Voltage measured at P1-17 and P1-18 should be 2.5 VDC.
Step 7: If steps 1 through 6 checkout OK, replace SECU.	If not, replace engine ECM.

COMPRESSOR CODE E

Generator Switch “ON” (Optional)

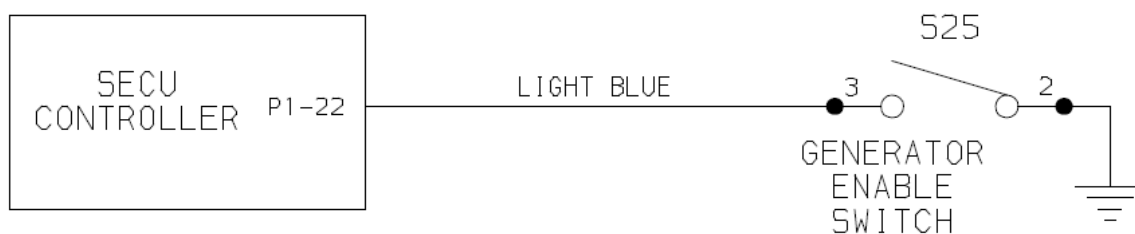
Explanation:

The SECU has received an input indicating the Generator Enable Switch is turned “ON” at startup.

Effect:

Code E is a SHUTDOWN condition and will prevent cranking.

SECU to S25 Generator Enable Switch circuit:



Circuit Description:

The generator enable switch connects to the SECU controller as shown in the circuit above. S25 is a single pole single throw latching switch. When the switch is closed it connects the SECU input to battery-.

Component Location:

S25 toggle switch is located on the control panel.

Troubleshooting Steps

Action	Result
Step 1: Turn Generator Enable switch "OFF" before cranking.	
Step 2: Disconnect S25 switch from the harness and turn ignition switch to the "ON" position.	Code E on display should not appear. If code E does not appear, replace S25 Generator Enable switch
Step 3: Using a multimeter, measure continuity from P1-22 to battery-	Continuity measured should be open. If not, check harness for shorts to battery-.
Step 4: If steps 1 through 3 checkout OK, replace SECU.	

COMPRESSOR CODE H

Pre-Heat Signal or Start Signal Detected

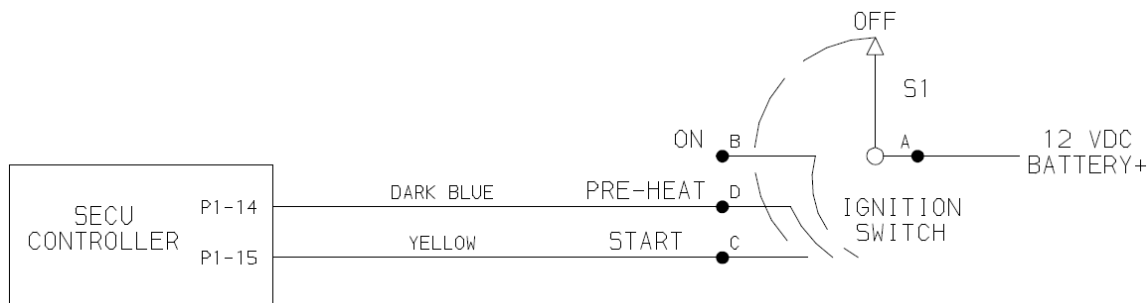
Explanation:

The SECU has received an input indicating the S1 ignition switch has been switched to the Pre-Heat position or Start position.

Effect:

Code H is an INDICATION condition that the machine is in Pre-Heat mode or Start mode.

SECU to S1 Ignition Switch circuit:

**Circuit Description:**

The ignition switch connects to the SECU controller as shown in the circuit above. S1 three position switch. When the switch is turned to the Pre-Heat and Start position it connects the SECU inputs to battery+.

Component Location:

S1 ignition switch is located on the control panel.

COMPRESSOR CODE H

Troubleshooting Steps

Action	Result
Step 1: Disconnect S1 ignition switch from the harness. Using a multimeter, measure the voltage at: 1. SECU connector (P1-14). 2. SECU connector (P1-15).	No voltage should be measured. If voltage is measured, check harness for shorts to battery+
Step 2: Reconnect S1 ignition switch. Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at: 1. Ignition switch (S1-D). 2. Ignition switch (S1-C).	No voltage should be measured with the switch in the "ON" position If voltage is measured, replace S1 ignition switch
Step 3: If steps 1 and 2 checkout OK, replace SECU.	

COMPRESSOR CODE 1

High Airend Discharge Temperature

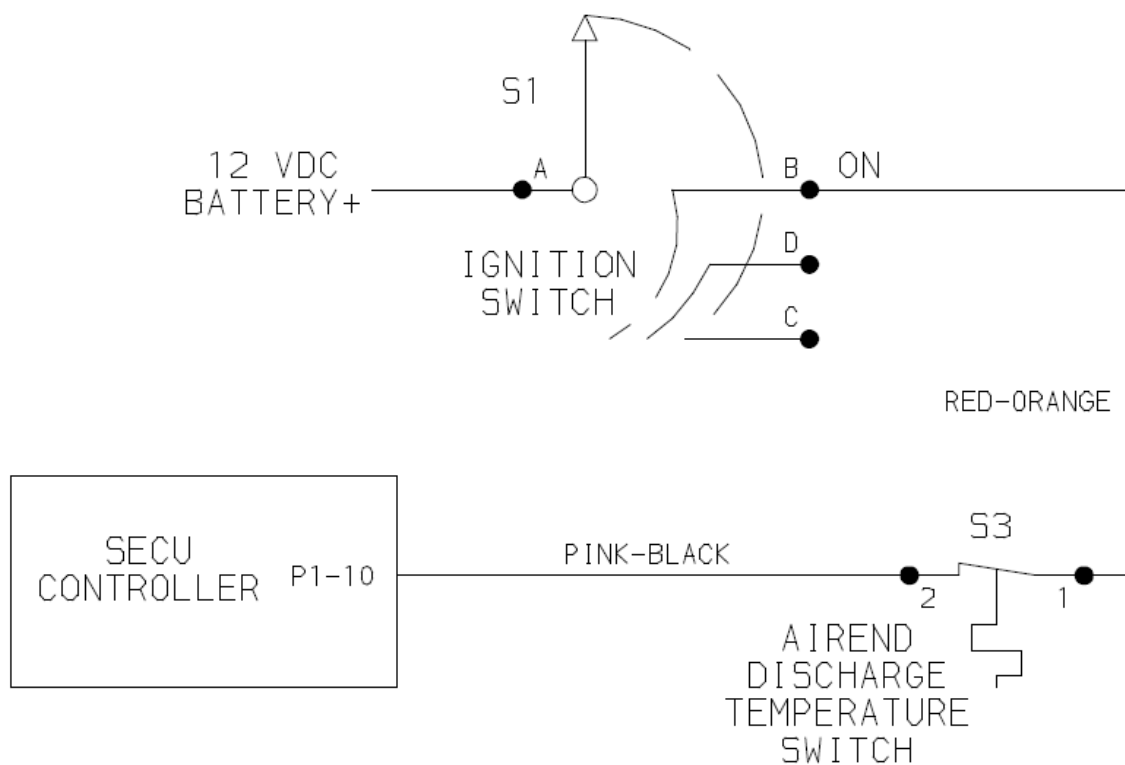
Explanation:

The SECU has detected an open switch contact from S3 temperature switch.

Effect:

Code 1 is a SHUTDOWN condition and will stop the machine.

SECU to S3 Temperature Switch circuit:



Circuit Description:

The temperature switch connects to the SECU controller as shown in the circuit above. S3 is a normally closed temperature switch that opens when the temperature rises above 248°F/120°C. When the switch opens, the input to the SECU is disconnected from switched battery+.

Component Location:

S3 temperature switch is located in the discharge of the airend.

Troubleshooting Steps

Action	Result
Step 1: Check coolers and clean if necessary.	Clogged coolers
Step 2: Check airend oil level.	Low oil level
Step 3: Check all harness connections between SECU and S3 temperature switch.	Repair harness as needed
Step 4: Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at S3-1.	Voltage measure should be 12 VDC at S3-1. If not, check harness connections including internal harness splices
Step 5: Disconnect the harness from S3 temperature switch. Using a multimeter, check ohms across the switch. Switch body must be cool or around ambient temperature.	Continuity should be shorted across the terminals If not, replace S3 temperature switch
Step 6: Reconnect S3 temperature switch. Using a multimeter, measure voltage at P1-10.	Voltage measure should be 12 VDC at P1-10. If not, check harness connections
Step 7: If Steps 1 through 6 checkout OK, replace SECU.	

COMPRESSOR CODE 2

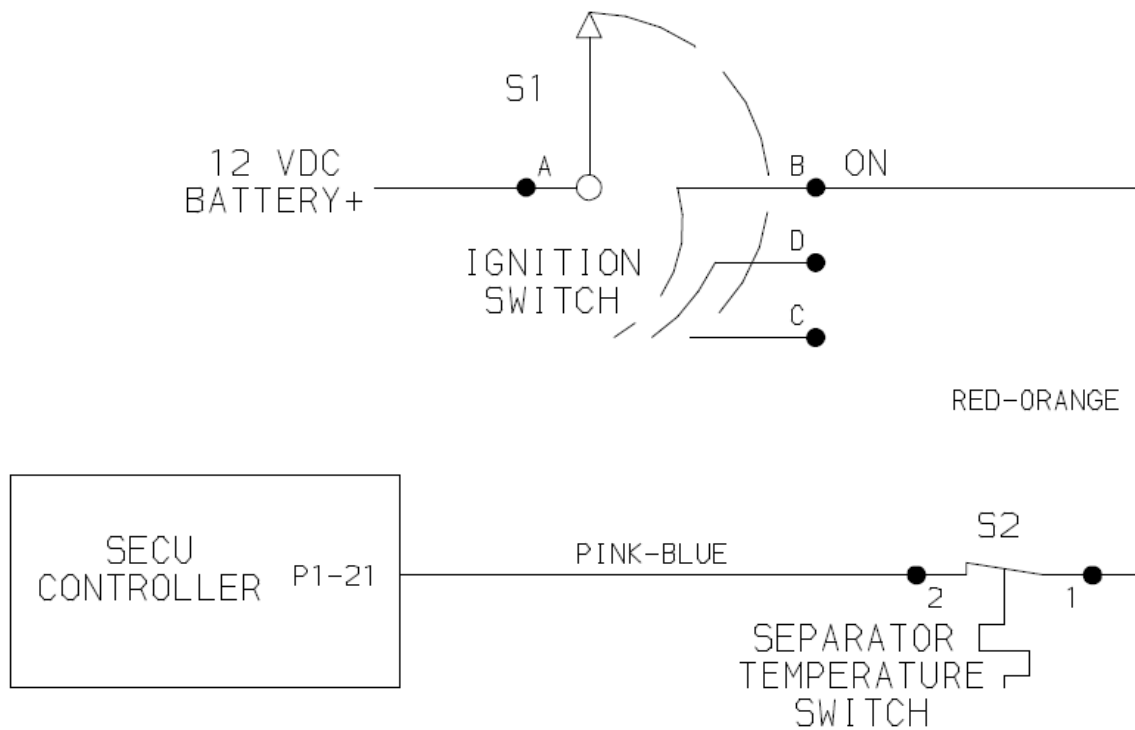
High Separator Temperature

Explanation:

The SECU has detected an open switch contact from S2 temperature switch.

Effect:

Code 2 is a SHUTDOWN condition and will stop the machine.

SECU to S2 Temperature Switch circuit:

Circuit Description:

The temperature switch connects to the SECU controller as shown in the circuit above. S2 is a normally closed temperature switch that opens when the temperature rises above 248°F/120°C. When the switch opens, the input to the SECU is disconnected from switched battery+.

Component Location:

S2 temperature switch is located in the discharge pipe of the separator tank.

Troubleshooting Steps

Action	Result
Step 1: Check coolers and clean if necessary.	Clogged coolers
Step 2: Check airend oil level.	Low oil level
Step 3: Check all harness connections between SECU and S2 temperature switch.	Repair harness as needed
Step 4: Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at S2-1.	Voltage measure should be 12 VDC at S2-1. If not, check harness connections including internal harness splices
Step 5: Disconnect the harness from S2 temperature switch. Using a multimeter, check ohms across the switch. Switch body must be cool or around ambient temperature.	Continuity should be shorted across the terminals If not, replace S2 temperature switch
Step 6: Reconnect S2 temperature switch. Using a multimeter, measure voltage at P1-21.	Voltage measure should be 12 VDC at P1-21. If not, check harness connections
Step 7: If Steps 1 through 6 checkout OK, replace SECU.	

COMPRESSOR CODE 3

Low Battery Voltage

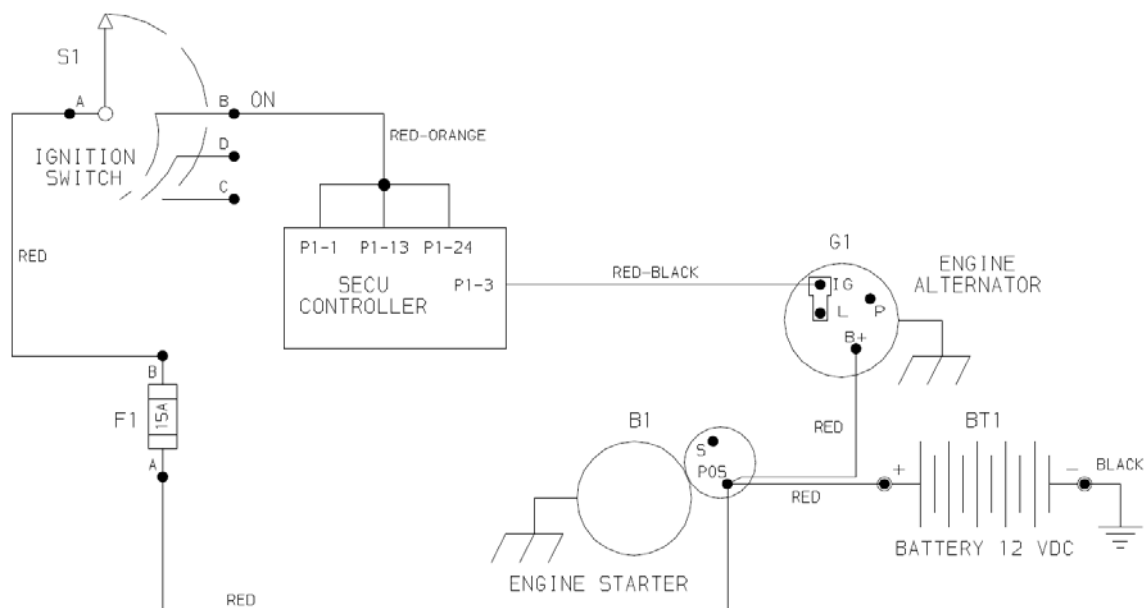
Explanation:

The SECU has detected a battery voltage that is below 11.6 VDC.

Effect:

Code 3 is an ALERT condition and will not stop the machine.

Alternator Circuit:



Circuit Description:

The Alternator charging system connects to the SECU controller as shown in the circuit above. The IG terminal on the alternator is the ignition circuit, driven by the SECU, to start the alternator charging. The switched battery voltage to the SECU from the ignition is used by the SECU to measure system battery voltage.

Component Location:

The alternator is mounted to the engine on the street side of the machine.

Troubleshooting Steps

Action	Result
Step 1: Crank the machine. Using a multimeter, measure the voltage at: 1. Alternator connector (G1-IG). 2. SECU connector (P1-3).	Voltage measure should be 12 VDC at G1-IG If not, check harness connections including internal harness splices Voltage measure should be 12 VDC at P1-3. If not, replace SECU
Step 2: Crank the machine. Using a multimeter, measure the voltage at: 1. S1 ignition switch (S1-A). 2. S1 ignition switch (S1-B). 3. SECU connector (P1-1, P1-13, P1-24).	Voltage measure should be 12 VDC If not, check harness connections If not, replace S1 ignition switch If not, check harness connections including internal splices If 12 VDC is measured, replace SECU
Step 3: Crank the machine. Using a multimeter, measure the voltage across the battery terminals.	Voltage measure should be greater than 13.0 VDC across battery terminals If not, replace alternator
Step 4: If steps 1 and 3 checkout OK, replace battery.	

COMPRESSOR CODE 4

High Engine Coolant Temperature

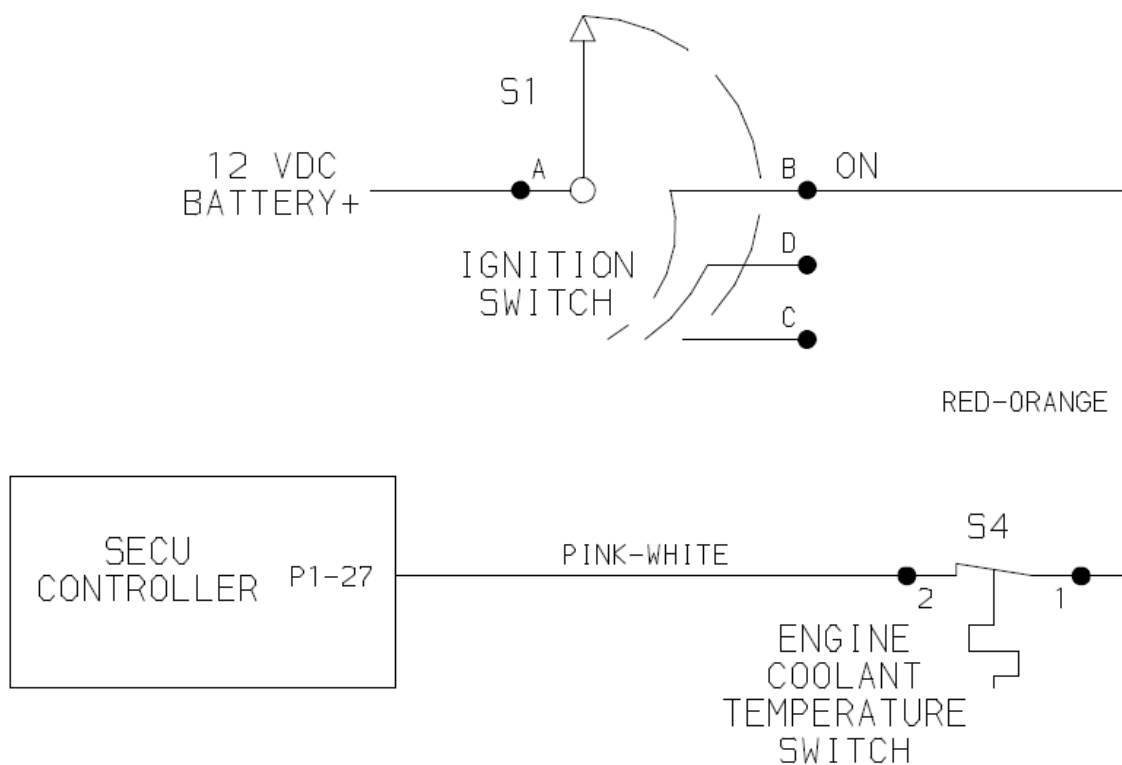
Explanation:

The SECU has detected an open switch contact from S4 temperature switch.

Effect:

Code 4 is a SHUTDOWN condition and will stop the machine.

SECU to S4 Temperature Switch circuit:



Circuit Description:

The temperature switch connects to the SECU controller as shown in the circuit above. S4 is a normally closed temperature switch that opens when the temperature rises above 230°F/110°C. When the switch opens the input to the SECU is disconnected from switched battery+.

Component Location:

S4 temperature switch is located on the engine in the coolant water jacket.

Troubleshooting Steps

Action	Result
Step 1: Check coolers and clean if necessary.	Clogged coolers
Step 2: Check engine coolant level.	Low coolant level
Step 3: Check all harness connections between SECU and S4 temperature switch.	Repair harness as needed
Step 4: Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at S4-1.	Voltage measure should be 12 VDC at S4-1. If not, check harness connections including internal harness splices
Step 5: Disconnect the harness from S4 temperature switch. Using a multimeter, check ohms across the switch. Switch body must be cool or around ambient temperature.	Continuity should be shorted across the terminals If not, replace S4 temperature switch
Step 6: Reconnect S4 temperature switch. Using a multimeter, measure voltage at P1-27.	Voltage measure should be 12 VDC at P1-27. If not, check harness connections
Step 7: If Steps 1 through 6 checkout OK, replace SECU.	

COMPRESSOR CODE 5

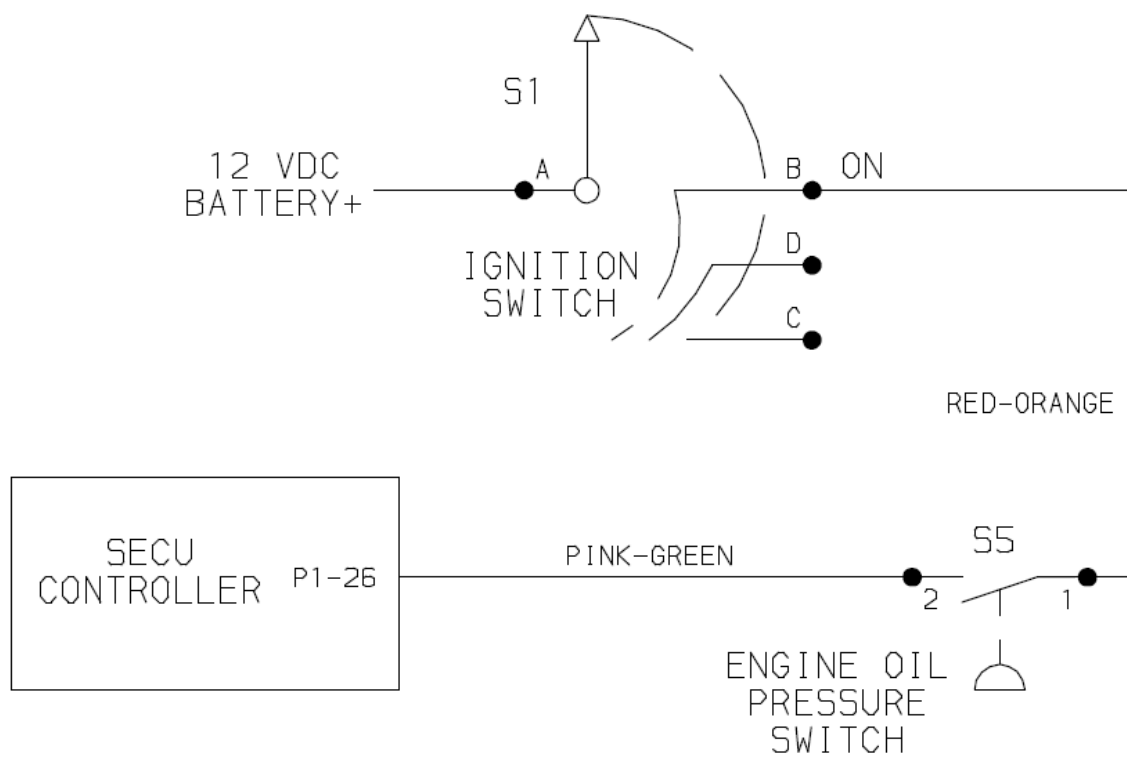
Low Engine Oil Pressure

Explanation:

The SECU has detected an open switch contact from S5 pressure switch.

Effect:

Code 5 is a SHUTDOWN condition and will stop the machine.

SECU to S5 Pressure Switch circuit:

Circuit Description:

The pressure switch connects to the SECU controller as shown in the circuit above. S5 is a normally open pressure switch that closes when the pressure rises above 12 psi/0.83 bar. When the switch opens the input to the SECU is disconnected from switched battery+.

Component Location:

S5 pressure switch is located on the engine in the oil galley.

Troubleshooting Steps

Action	Result
Step 1: Check engine oil level.	Low oil level
Step 2: Check all harness connections between SECU and S5 pressure switch.	Repair harness as needed
Step 3: Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at S5-1.	Voltage measure should be 12 VDC at S5-1. If not, check harness connections including internal harness splices
Step 4: Crank machine. Using a multimeter, measure the voltage at: 1. Oil pressure switch (S5-2). 2. SECU connector (P1-26).	Voltage measure should be 12 VDC If not, replace S5 pressure switch If not, check harness connections
Step 5: If Steps 1 through 4 checkout OK, replace SECU.	

COMPRESSOR CODE 6

PS1, Regulation Pressure Sensor Fault

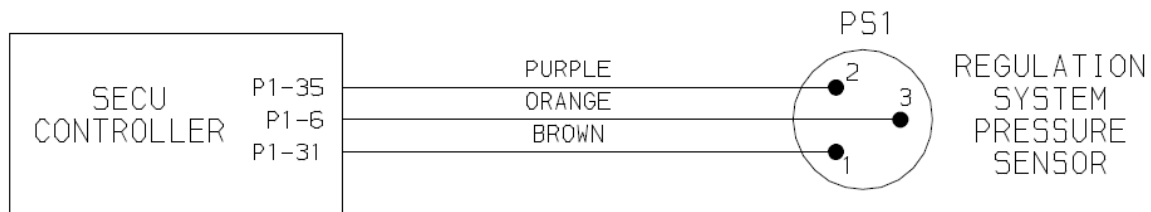
Explanation:

The SECU has detected an out of range reading from the PS1 pressure sensor for 3 seconds while the machine is running.

Effect:

Code 6 is a SHUTDOWN condition and will stop the machine.

PS1 Pressure Sensor Circuit:

**Circuit Description:**

The pressure sensor connects to the SECU controller as shown in the circuit above. The purple wire is the 5 VDC excitation supply from the SECU. The orange wire is the signal output to the SECU with a range of 0.5 to 4.5 VDC. The brown wire is the sensor ground. The pressure range of PT1 is 0 psig (0.5 VDC) to 100 psig (4.5 VDC).

Component Location:

PS1 pressure sensor is located on top of the separator tank in the regulation system piping.

Troubleshooting Steps

Action	Result
Step 1: Check all harness connections between SECU and PS1 pressure sensor.	Repair harness as needed
Step 2: Turn the S1 ignition switch to the "ON" position. Using a multimeter, measure the voltage at PS1-2. Using a multimeter, measure continuity from PS1-1 to battery-.	Voltage measured should be 5 VDC If not, check harness connections Continuity should be shorted between PS1-1 to battery- If not, check harness connections
Step 3: Crank machine. Using a multimeter measure the voltage at: 1. Regulation pressure sensor (PS1-3). 2. SECU connector (P1-6)	Voltage measured should be between 0.5 to 4.5 VDC If not, replace PS1 pressure sensor
Step 4: If Steps 1 through 3 checkout OK, replace SECU.	

COMPRESSOR CODE 7

Low Engine Speed

Explanation:

The SECU has received an engine speed value less than 1500 RPM for 10 seconds from the engine ECM.

Effect:

Code 7 is a SHUTDOWN condition and will stop the machine.

Troubleshooting Steps

Action	Result
Step 1: Check engine fuel system for restrictions.	Dirty fuel filters Clogged fuel hoses Air in fuel system
Step 2: Retrieve active and inactive engine ECM fault codes via engine manufacturer's service tool.	

COMPRESSOR CODE 8

Low Fuel Level (optional)

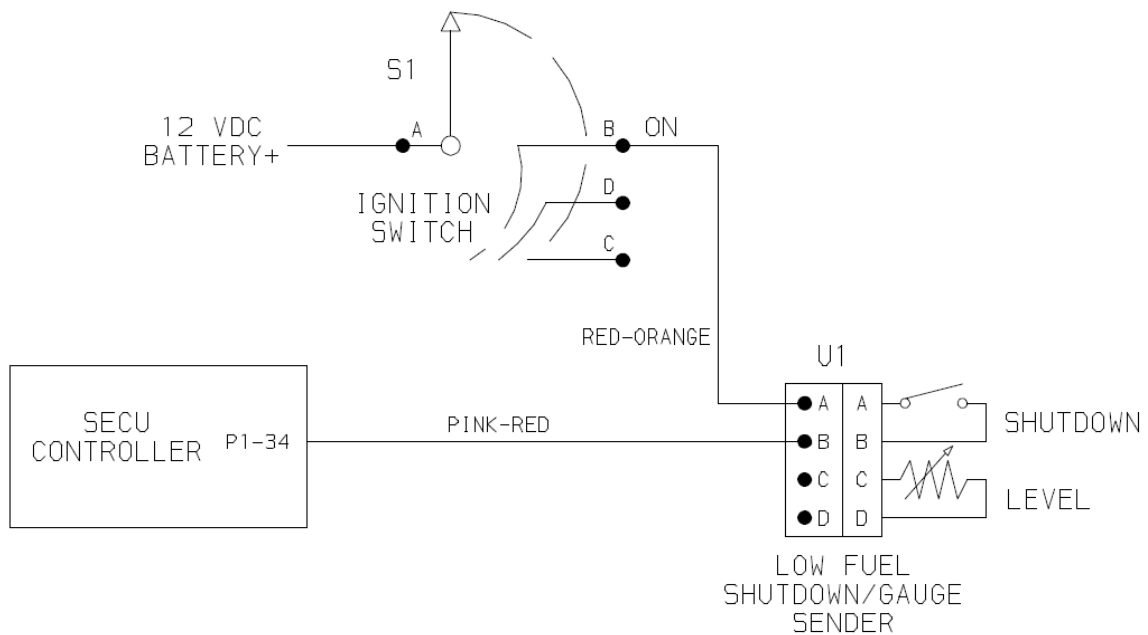
Explanation:

The SECU has detected an open switch contact from U1 fuel level shutdown/gauge sender.

Effect:

Code 8 is a SHUTDOWN condition and will stop the machine.

SECU to U1 Fuel Level Shutdown/Gauge Sender:



Circuit Description:

The low fuel level shutdown/gauge sender connects to the SECU controller as shown in the circuit above. U1 shutdown switch contacts are normally closed and when the fuel level falls below the lower limit the contacts open. When the switch opens the input to the SECU is disconnected from switched battery+.

Component Location:

U1 low fuel level shutdown/gauge sender is located in the fuel tank.

Troubleshooting Steps

Action	Result
Step 1: Check fuel level	Low fuel level
Step 2: Check all harness connections between SECU and U1 low fuel level shutdown/gauge sender.	Repair harness as needed
Step 3: Turn ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at: 1. Low fuel level shutdown/gauge sender (U1-A). 2. Low fuel level shutdown/gauge sender (U1-B). 3. SECU connector (P1-34)	Voltage measure should be 12 VDC If not, check harness connections including internal harness splices If not, replace U1 low fuel level shutdown/gauge sender If not, check harness connections
Step 4: If Steps 1 through 3 checkout OK, replace SECU.	

COMPRESSOR CODE 9

High Air Filter Pressure (optional)

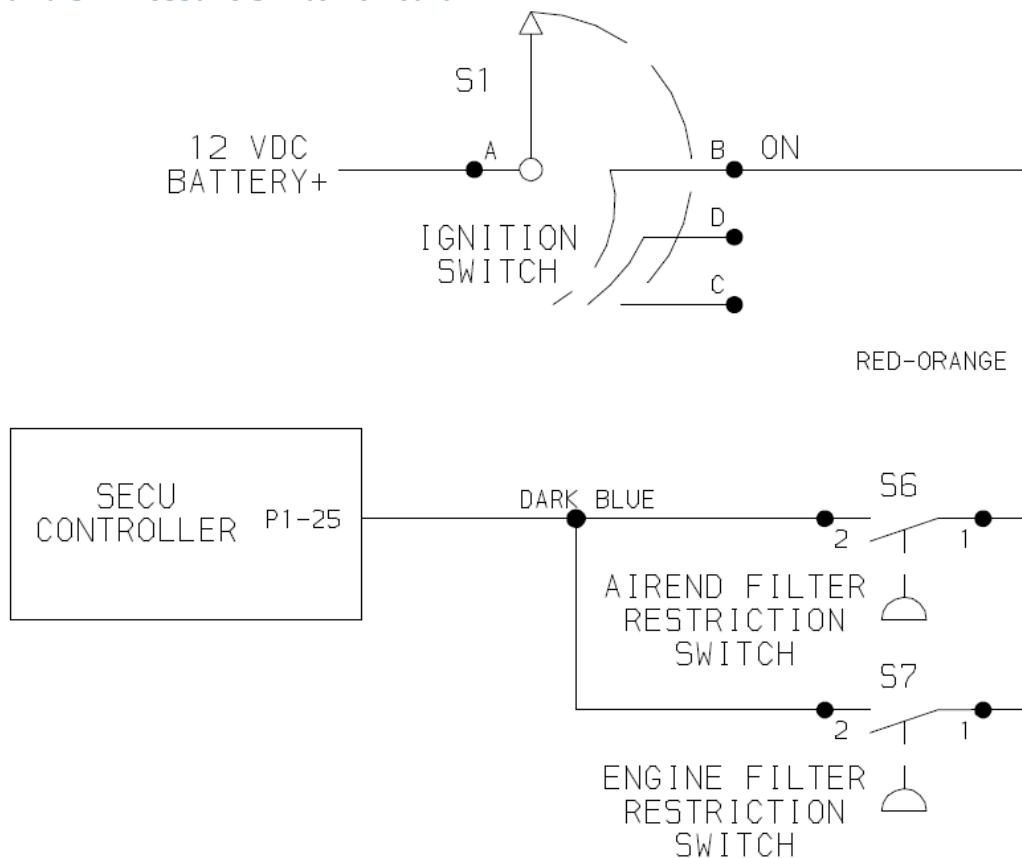
Explanation:

The SECU has detected a closed switch contact from S6 and or S7 pressure switch.

Effect:

Code 9 is an ALERT condition and will not stop the machine.

SECU to S6 and S7 Pressure Switch circuit:



Circuit Description:

The SECU receives a battery+ input from the air filter restriction switch (S6 and or S7) when the switch closes signaling that the filters are clogged. The air filter restriction switch contacts are normally open. The contacts close when the air filter restriction reaches 20 inches of water.

Component Location:

S7 air filter restriction switch is located behind the engine air filter housing. S6 air filter restriction switch is located behind the airend air filter housing.

Troubleshooting Steps

Action	Result
Step 1: Check all harness connections throughout air filter restriction switch circuit.	Repair harness as needed
Step 2: Turn the ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at S6-1 and S7-1.	Voltage measured should be 12 VDC. If not, check harness connections including internal harness splices
Step 3: Turn the ignition switch S1 to the "ON" position. Using a multimeter, measure the voltage at P1-25.	No voltage should be measured If voltage is measured, check harness for short to battery+
Step 4: Disconnect the harness from S6 air filter restriction switch. Using a multimeter, measure ohms across the switch. Repeat the process above for S7.	Continuity should be open across the switch If not, replace filter restriction switch
Step 5: Turn the ignition switch S1 to the "ON" position. Disconnect the harness from S6 air filter restriction switch. Place a jumper across the harness terminals at S6. Remove jumper at S6. Repeat the process above for S7.	Diagnostic code 9 should be showing on the display. Diagnostic code 9 disappear from display
Step 6: If Steps 1 through 5 checkout OK, replace SECU.	

SECTION 4

TROUBLESHOOTING ELECTRICAL CIRCUITS

Troubleshooting Procedures and Techniques

General

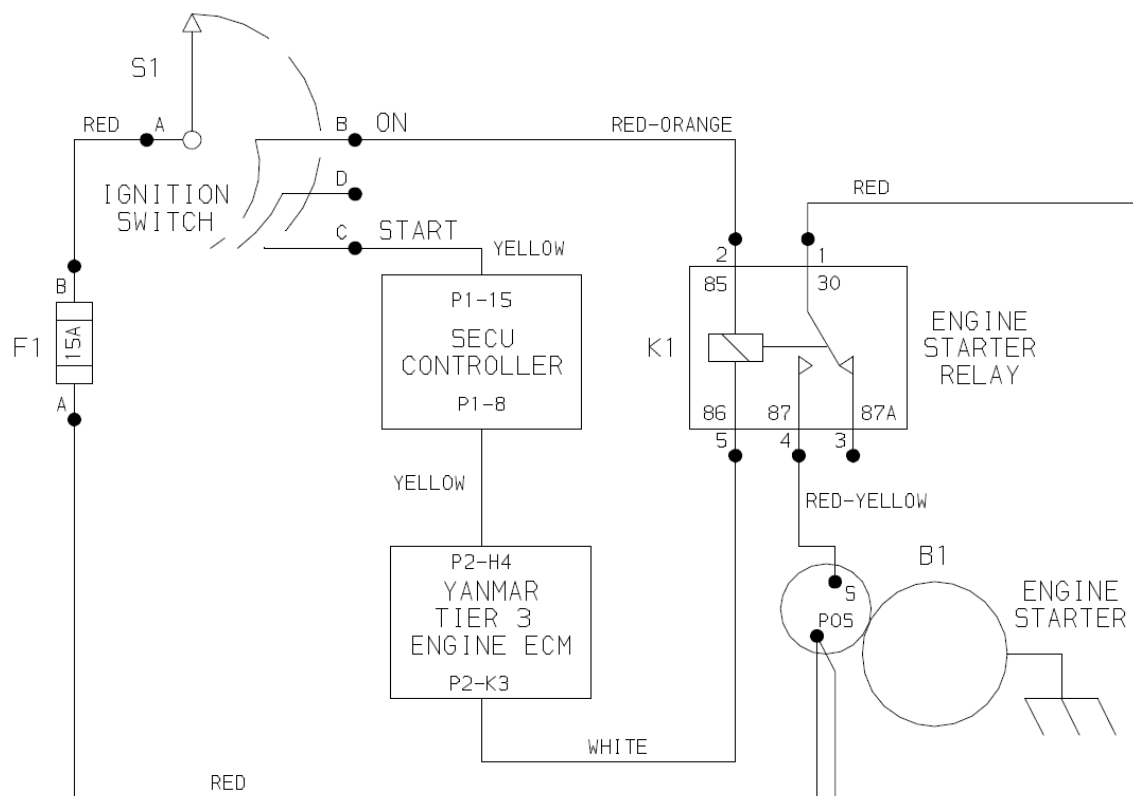
A thorough analysis of the problem is the key to successful troubleshooting. The more information known about a problem, the faster and easier the problem can be solved.

Troubleshooting charts are included to act as a guide to the troubleshooting process. They are organized so the easiest and most logical things are performed first. It is not possible to include all the solutions to problems that can occur or list all possible problems. The charts are designed to stimulate a thinking process that will lead to solution of the problem.

Basic Troubleshooting Steps

- Collect all facts concerning the problem
- Analyze the problem thoroughly
- Relate the symptoms to the basic electrical / electronic systems and components
- Consider any recent repairs that could relate to the problem
- Double check before replacing components
- Review the controller fault log for clues as to the problem
- Determine the cause of the problem and make a thorough repair

Engine Start Circuit



Circuit Description:

The SECURE CONTROLLER (SECURE CONTROLLER) controls engine starter engagement using a 12 VDC input from the ignition switch (S1) and a 12 VDC output to the engine ECM. The engine ECM provides ground to the K1 relay coil, causing the relay to activate and energizing the starter solenoid. The SECURE CONTROLLER provides starter protection by turning off the output to the engine ECM when engine speed reaches 200 RPM even if the operator is still holding the ignition switch in the start position. The SECURE CONTROLLER prevents cranking if a SHUTDOWN code is active.

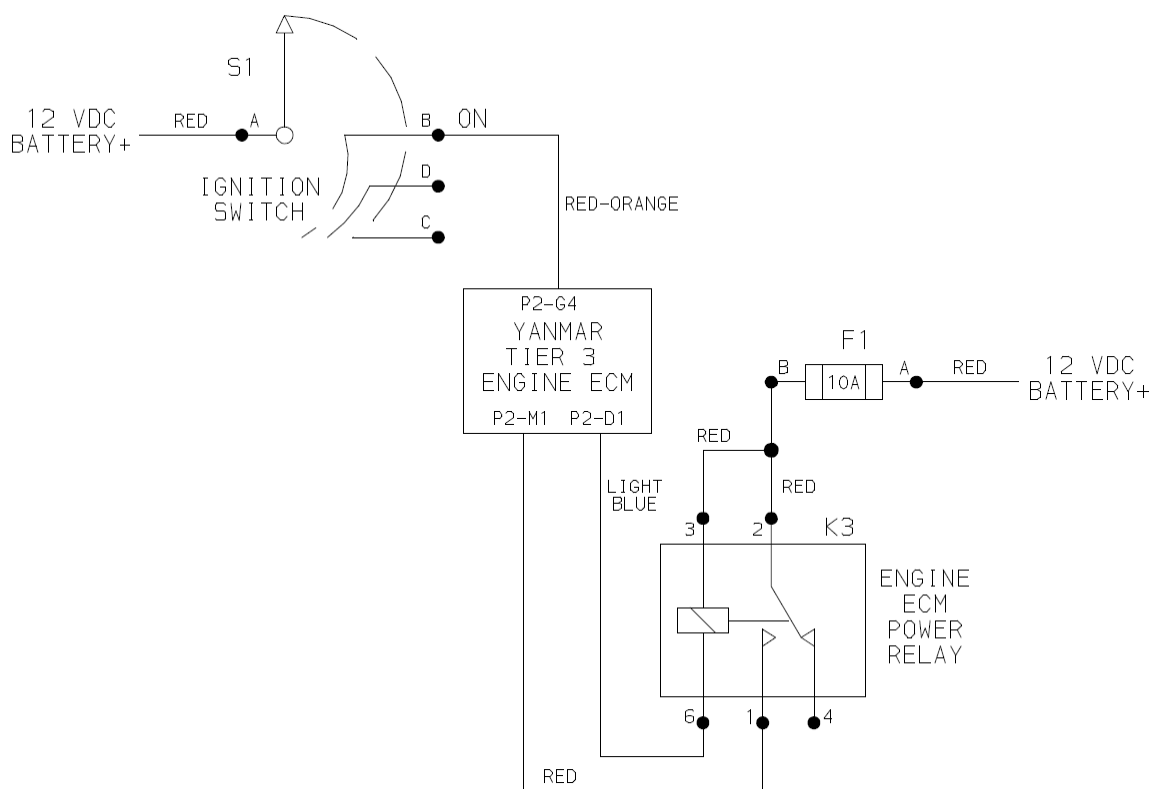
Component Location:

K1 relay is located inside the lift bail. S1 ignition switch is located on the control panel. The engine ECM is located on the lift bail on the starter side of the engine.

Troubleshooting Steps If Starter Does Not Engage During Crank

Action	Result
Step 1: Check display for fault codes.	Clear fault codes by following instructions in this manual
Step 2: Check F1 fuse.	Replace fuse if needed
Step 3: Check all harness connections throughout engine start circuit.	Repair harness as needed
Step 4: Check battery voltage.	Replace batteries if needed
Step 5: Hold the ignition switch (S1) in the "Start" position. Using a multimeter, measure the voltage at: 1. Ignition switch (S1-C). 2. SECU controller connector (P1-15). 3. SECU controller connector (P1-8). 4. Engine ECM connector (P2-H4). Using a multimeter, measure continuity to battery- from : 5. Engine ECM connector (P2-K3). 6. Starter relay (K1-5). Using a multimeter, measure the voltage at: 7. Starter relay (K1-2). 8. Starter relay (K1-1). 9. Starter relay (K1-4). 10. Engine starter (B1-S).	Voltage measured should be 12 VDC If not, replace S1 ignition switch If not, replace SECU Continuity measured should be shorted If not, replace engine ECM Voltage measured should be 12 VDC If 12 VDC is measured, replace K1 relay If not, check wiring If not, replace K1 relay If 12 VDC is measured at B1-S, replace starter

Engine ECM Power Relay Circuit



Circuit Description:

When the ignition switch S1 is turned to the “ON” position, the engine ECM provides ground to the K3 relay coil causing the relay to energize. K3 relay provides the battery+ power to the engine ECM.

Component Location:

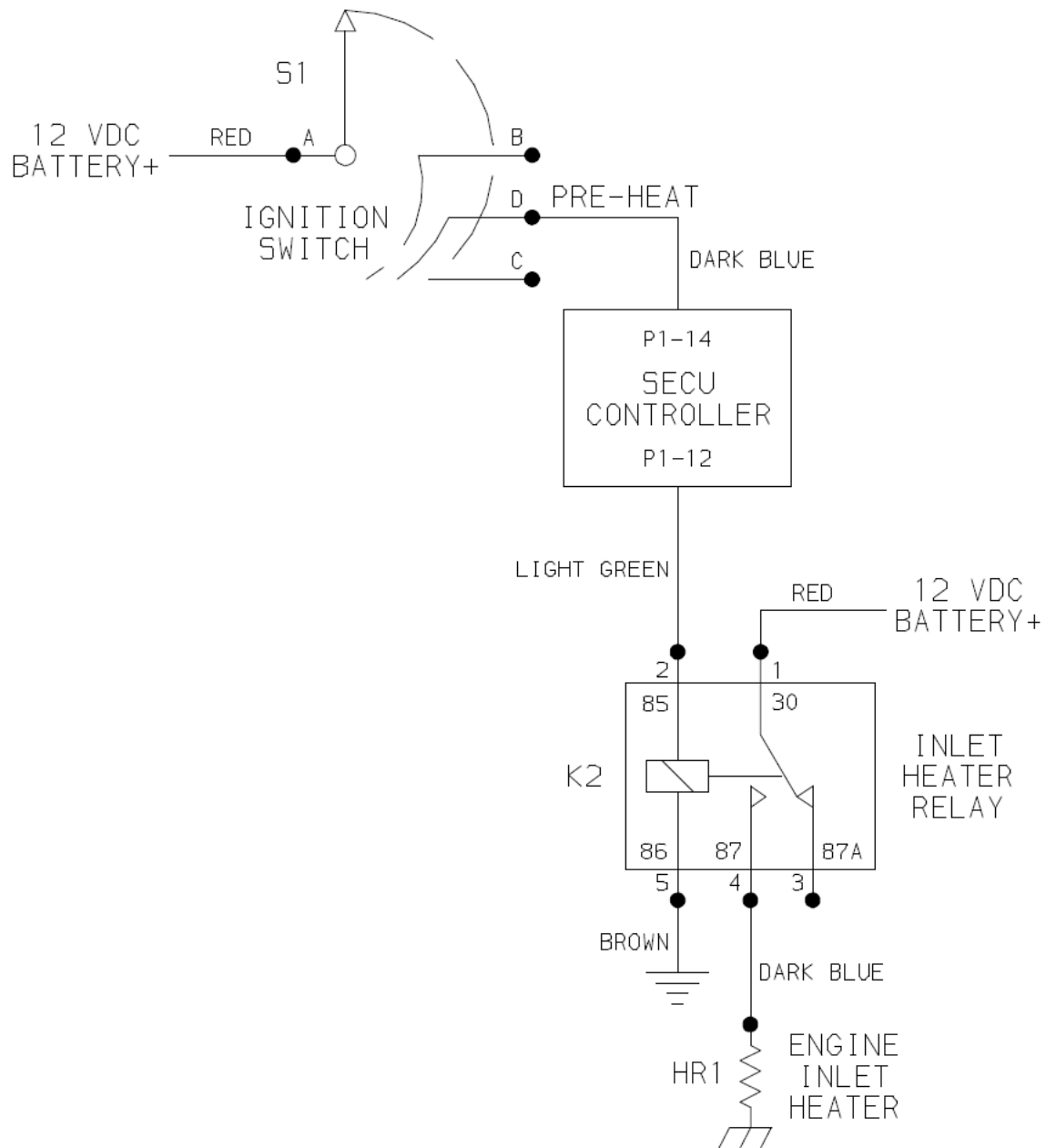
K3 relay is located inside the lift bail. S1 ignition switch is located on the control panel. The engine ECM is located on the lift bail on the starter side of the engine.

Engine ECM Power Relay Circuit

Troubleshooting Steps

Action	Result
Step 1: Check F2 fuse.	Replace fuse if needed
Step 2: Check all harness connections throughout engine ECM power relay circuit.	Repair harness as needed
Step 3: Using a multimeter, measure the voltage at: 1. K3 relay connector (K3-2). 2. K3 relay connector (K3-3).	Voltage measured should be 12 VDC If not, repair harness
Step 4: Turn the ignition switch (S1) to the "ON" position. Using a multimeter, measure continuity from battery- to: 1. Engine ECM connector (P2-D1). 2. K3 relay connector (K3-6).	Continuity should be shorted to battery-. If not, replace Engine ECM If not, repair harness
Step 5: Turn the ignition switch (S1) to the "ON" position. Using a multimeter, measure the voltage at: 11. K3 relay connector (K3-1). 12. Engine ECM connector (P2-G4).	Voltage measured should be 12 VDC If not, replace K3 relay If not, repair harness

Engine Inlet Heater Circuit



Engine Inlet Heater Circuit

Circuit Description:

The SECU controls the engine inlet heater using a 12 VDC output to energize heater relay coil (K2). When the ignition switch is turned to the "Pre-Heat" position, the SECU energizes the inlet heater relay, which turns on the inlet heaters. The inlet heater is disabled after 30 seconds even if the operator is still holding the ignition switch in the "Pre-Heat" position. The inlet heater heats the engine intake air. An "H" will be showing on the SECU display when the ignition switch is in the "Pre-Heat" position.

Component Location:

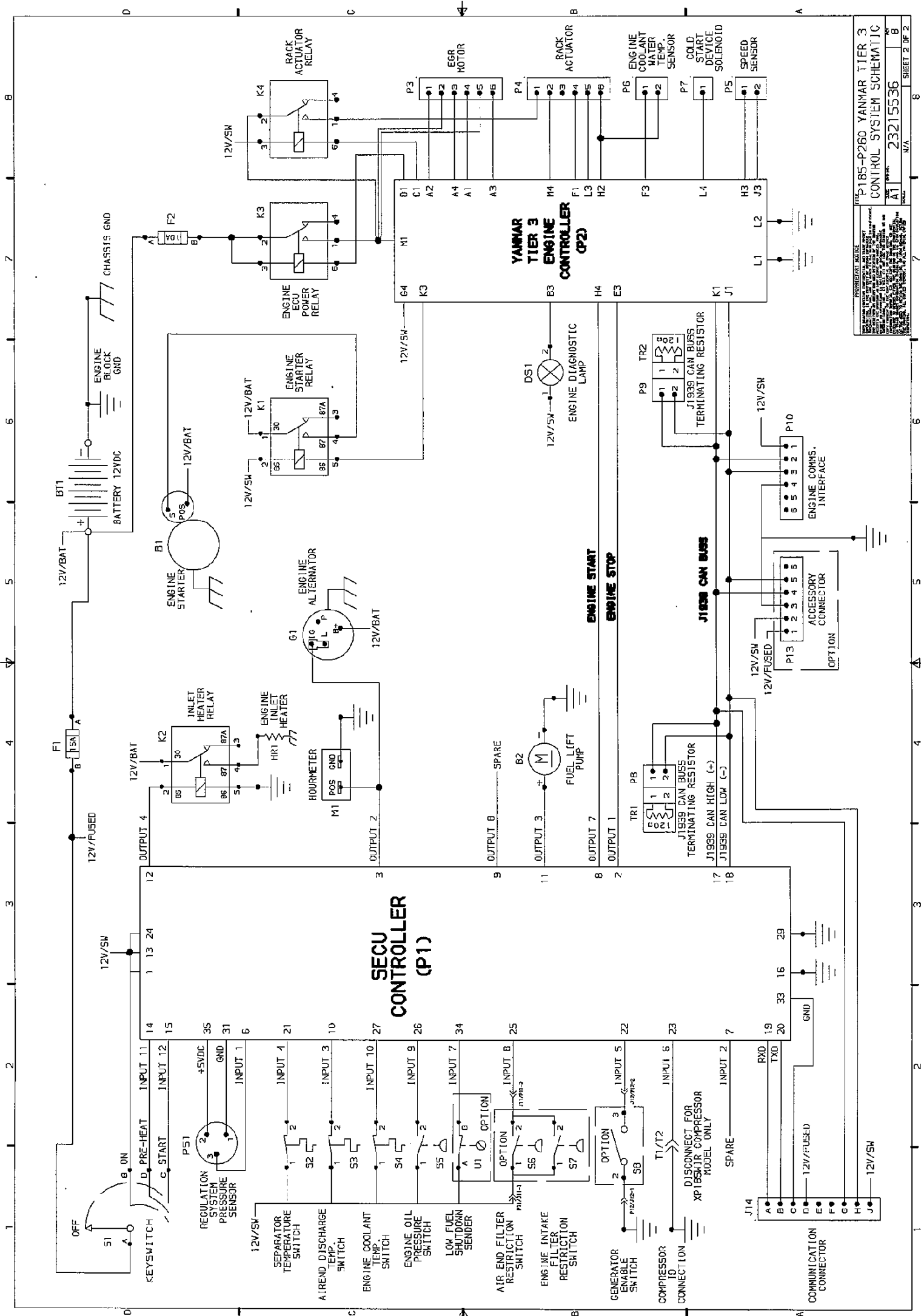
K2 relay is located inside the lift bail. S1 ignition switch is located on the control panel. HR1 engine inlet heater is located on the engine intake.

Troubleshooting Steps

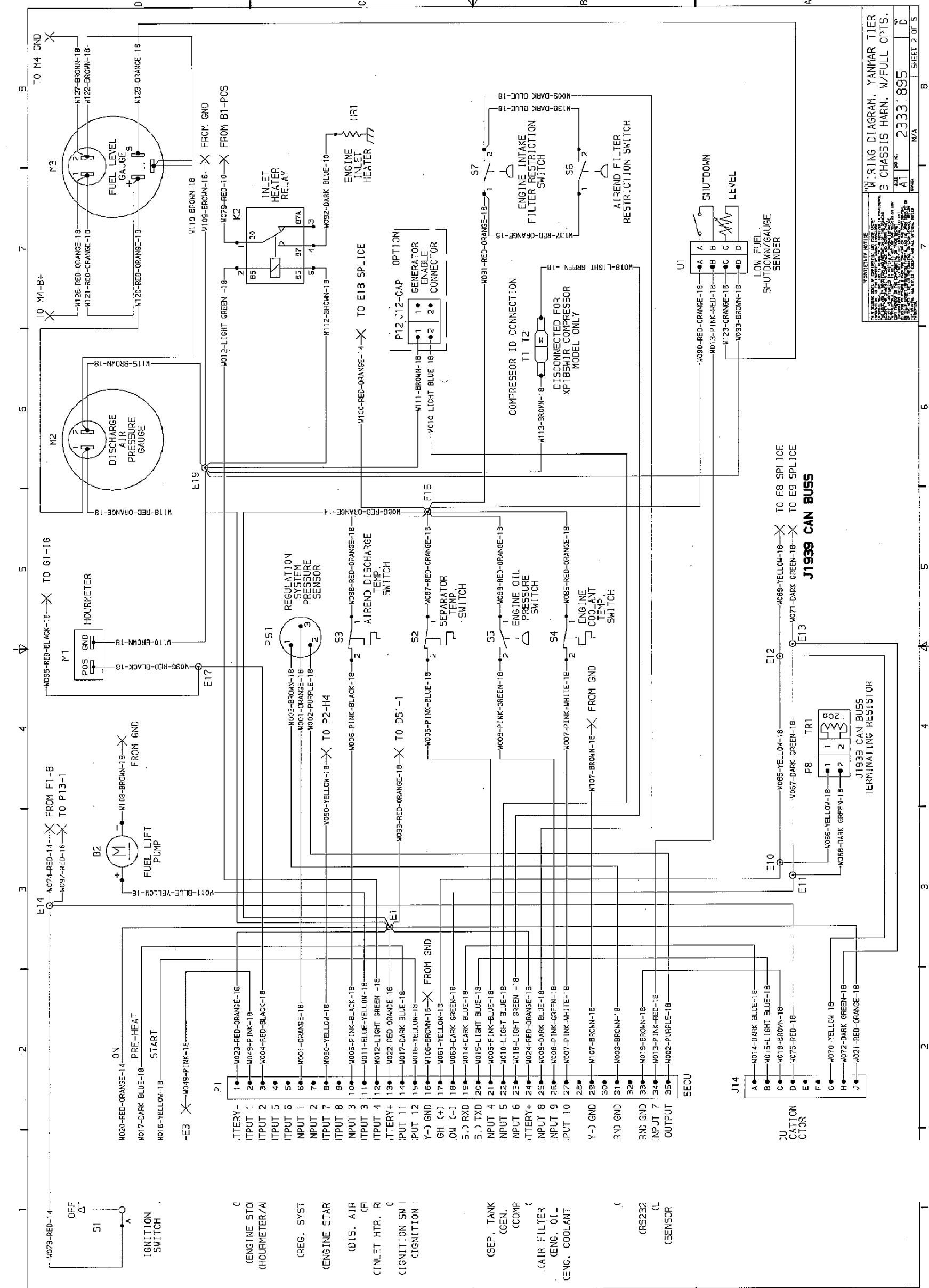
Action	Result
Step 1: Check all harness connections throughout inlet heater circuit.	Repair harness as needed
Step 2: Using a multimeter, measure continuity from K2-5 to battery-.	Continuity should be shorted from K2-5 to battery-.
Step 3: Turn the ignition switch (S1) to the "Pre-Heat" position. Using a multimeter, measure the voltage at: 1. S1 ignition switch (S1-D). 2. SECU controller connector (P1-14). 3. SECU controller connector (P1-12). 4. Inlet heater relay (K2-2). 5. Inlet heater relay (K2-1). 6. Inlet heater relay (K2-4). 7. HR1 inlet heater.	Voltage measured should be 12 VDC If not, replace S1 ignition switch If not, repair harness If not, replace SECU If not, repair harness If not, repair harness If not, replace K2 heater relay If 12 VDC is measured, replace HR1 heater

SECTION 5

SYSTEM SCHEMATICS & WIRING DIAGRAMS

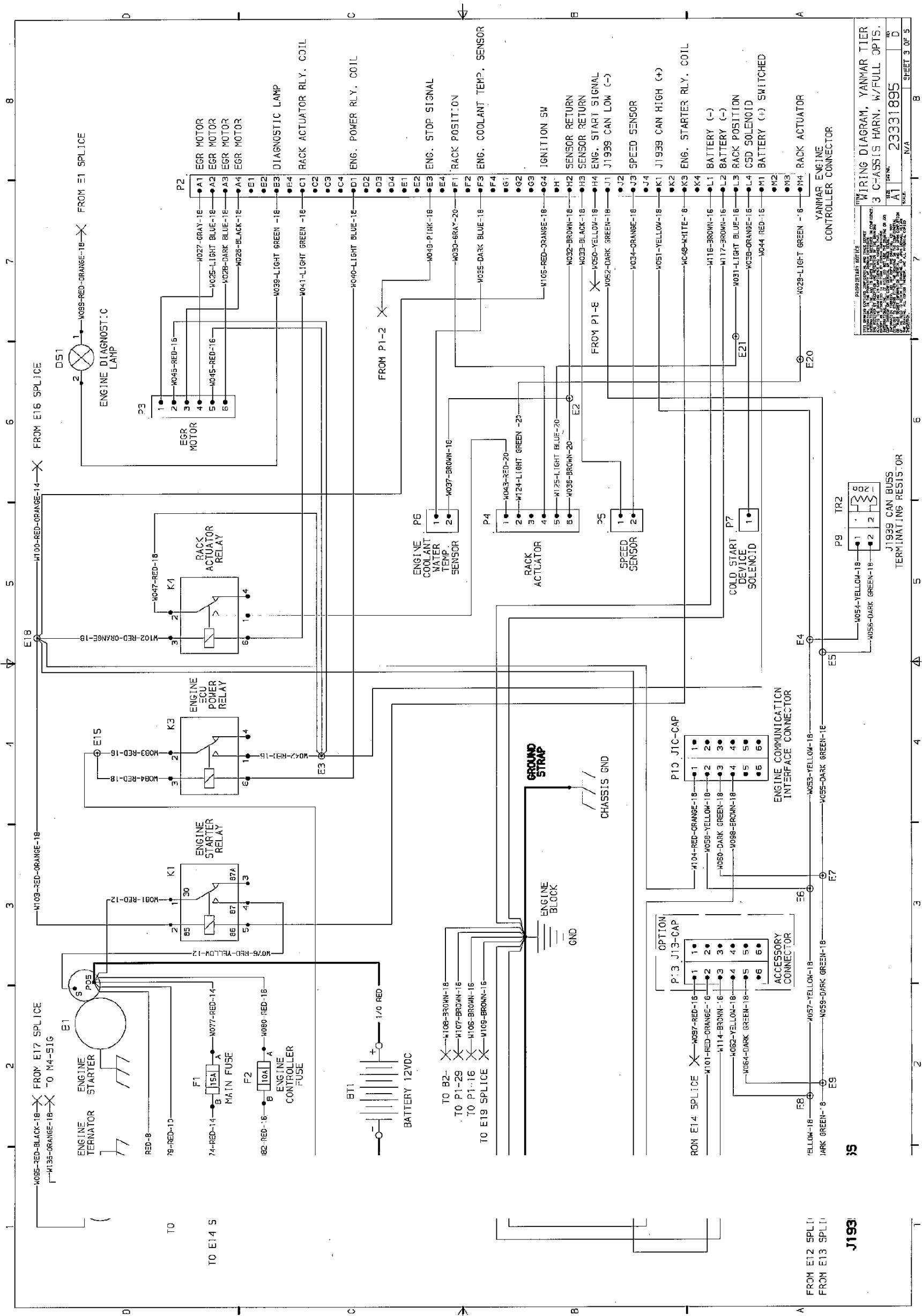


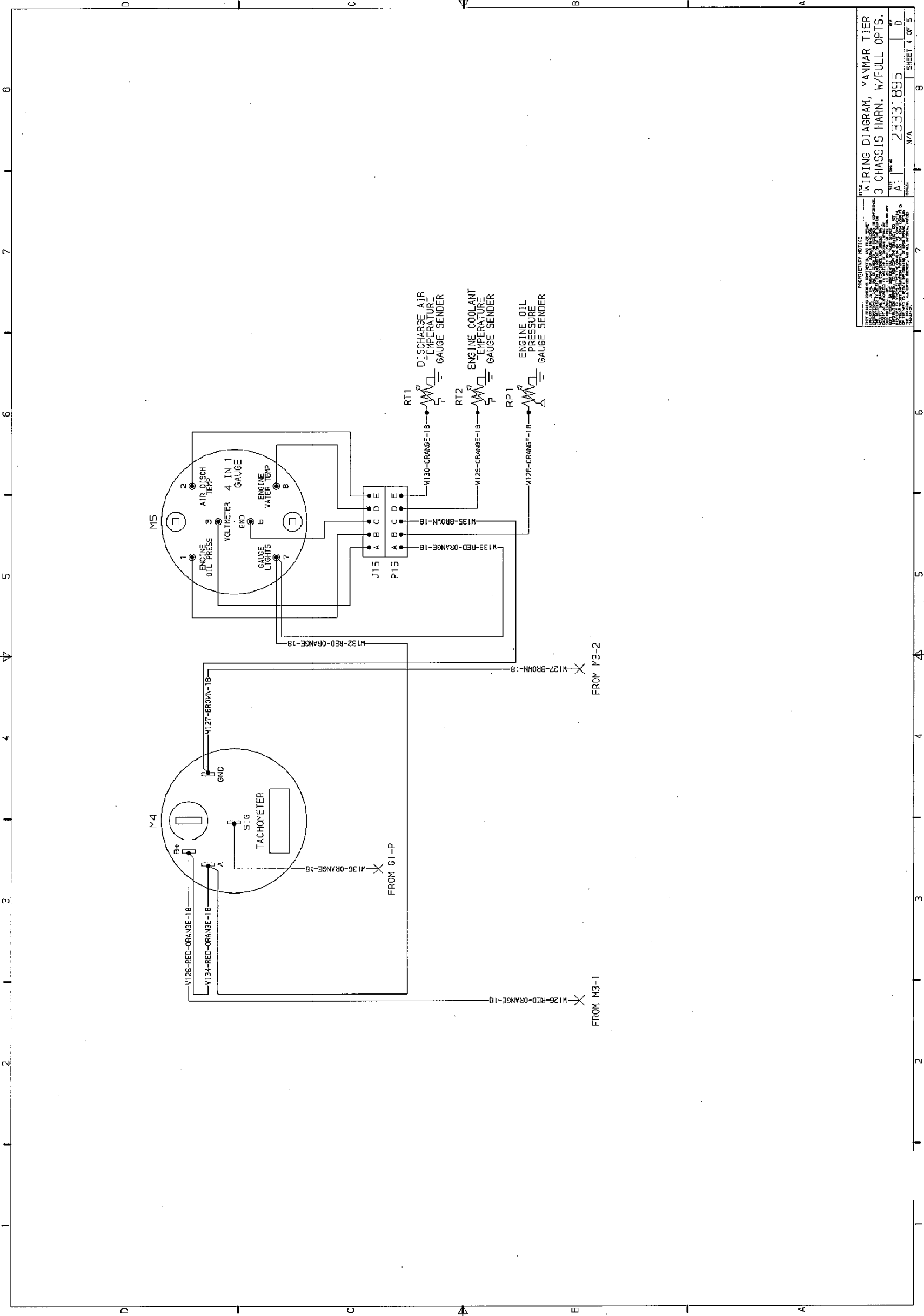
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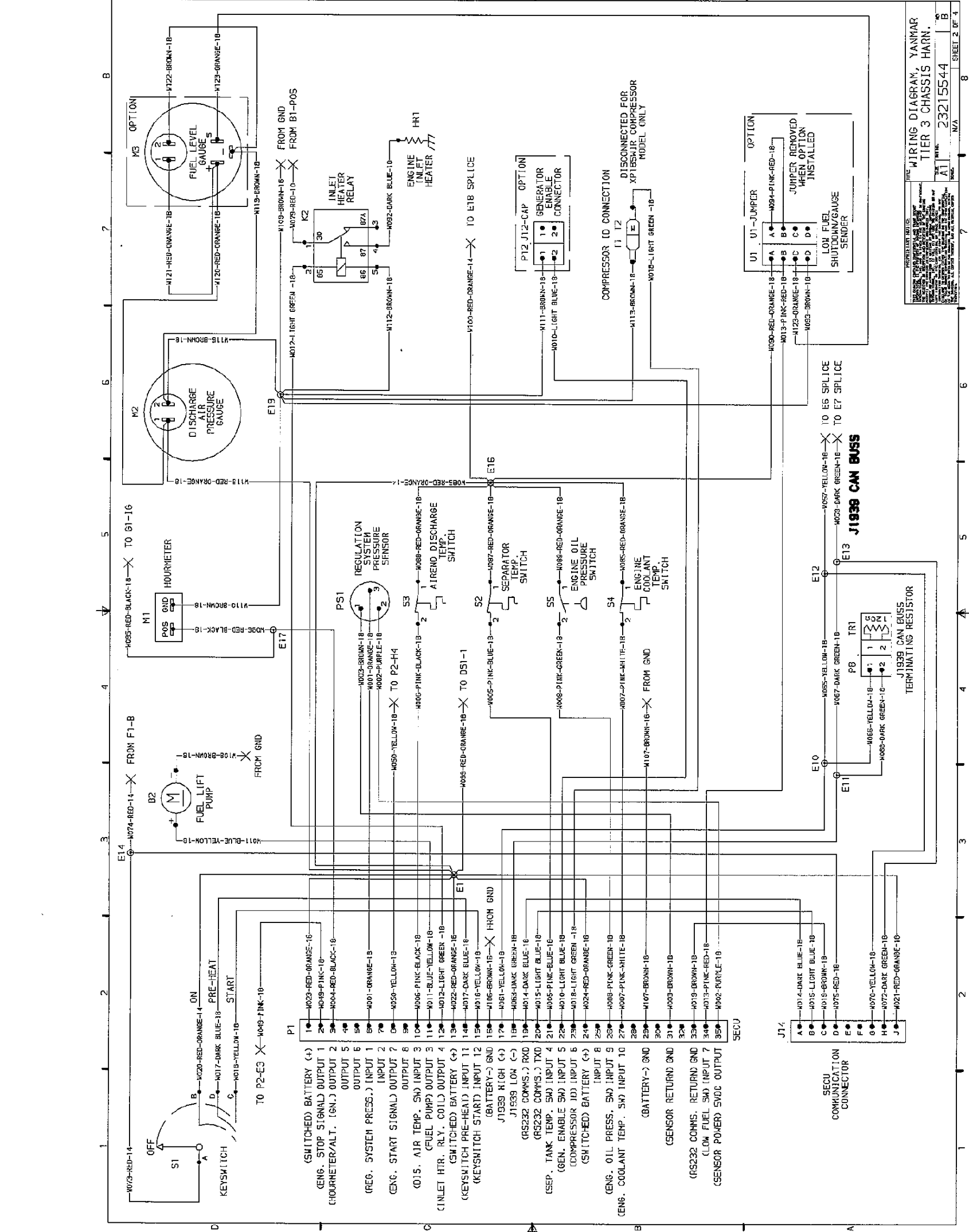


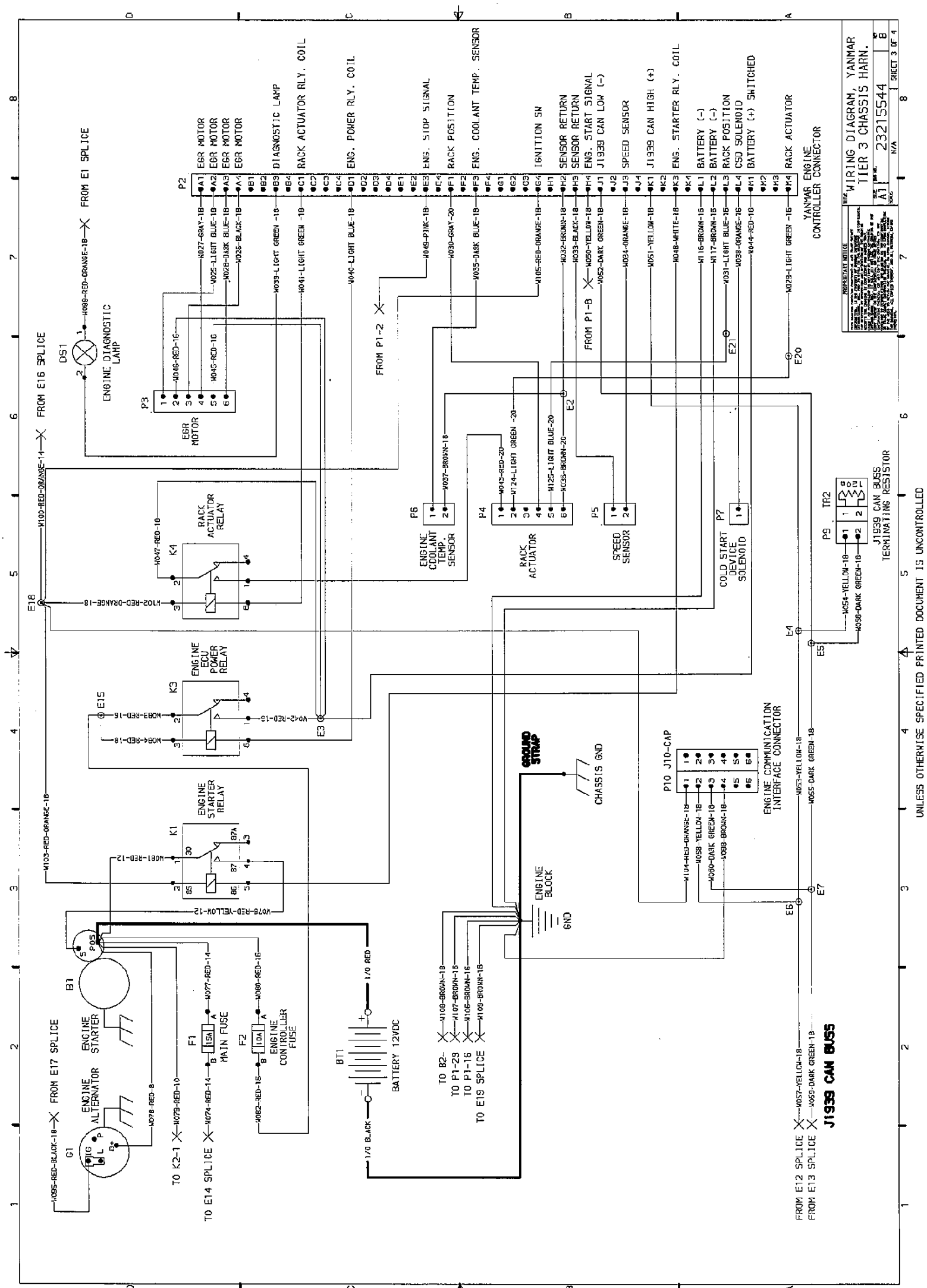
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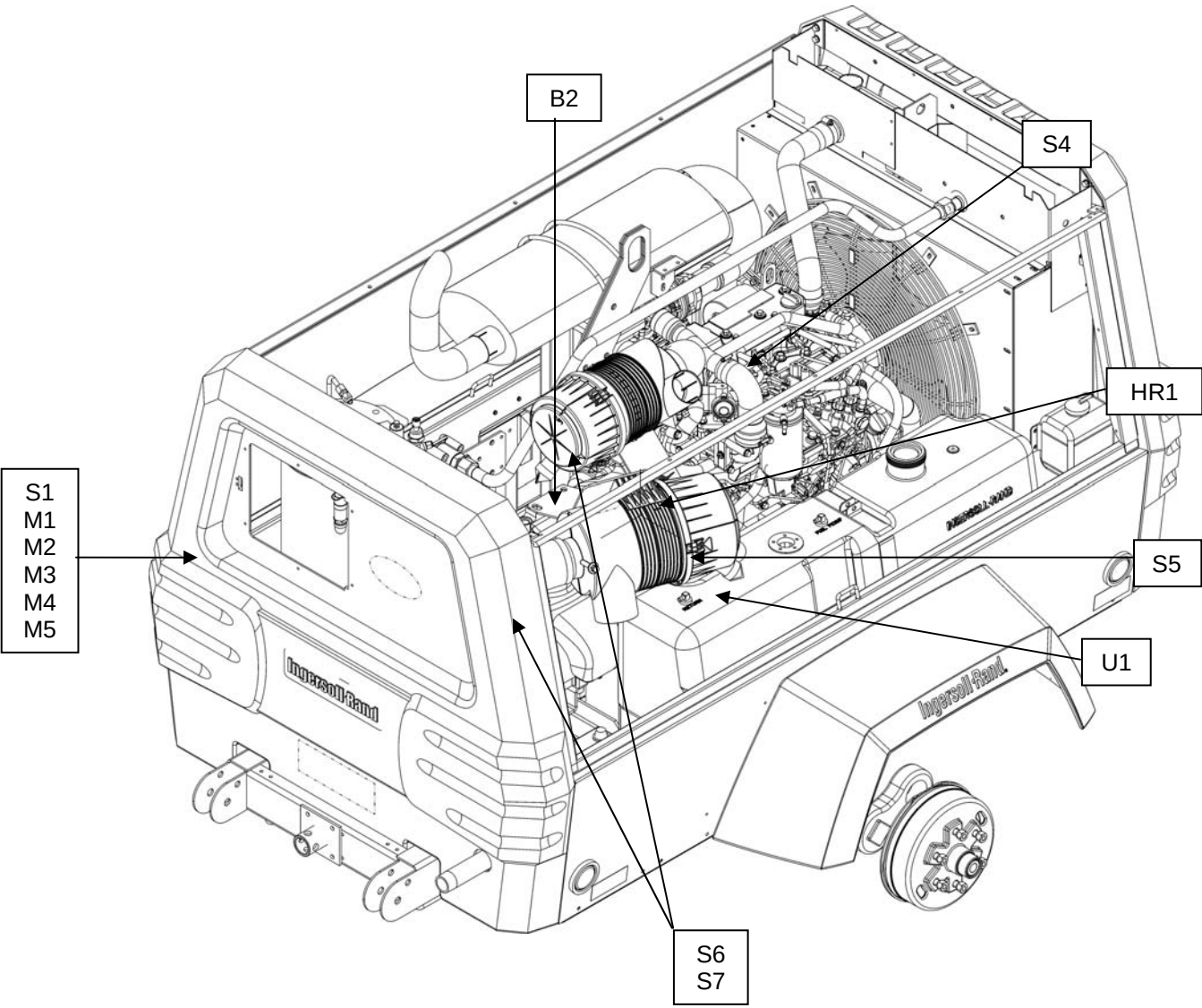




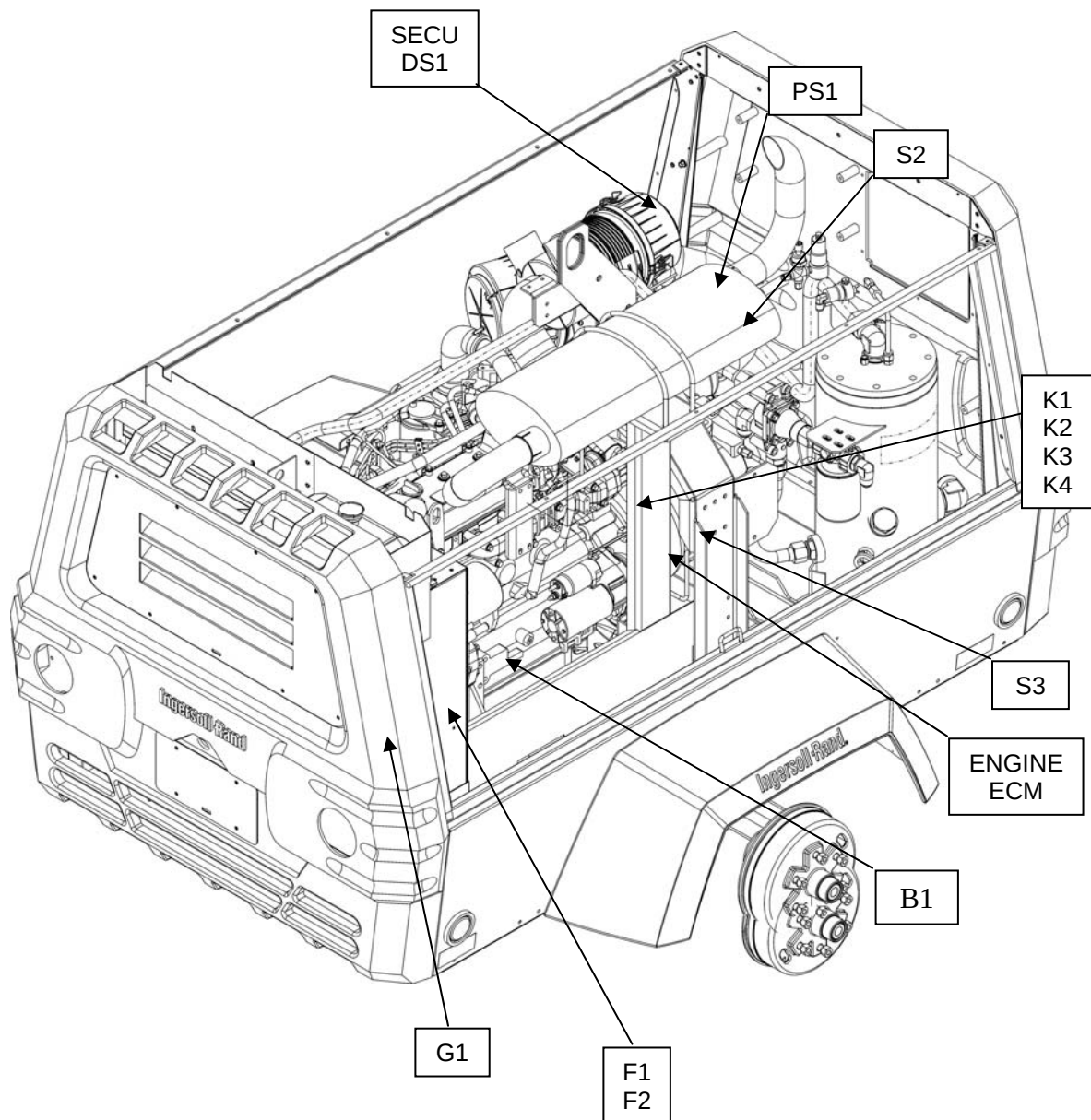
SECTION 6

ELECTRICAL COMPONENT LOCATIONS

ELECTRICAL COMPONENT LOCATION



ELECTRICAL COMPONENT LOCATION



Harness Connector Locations

- P1:** 35 pin connector located on SECU controller
- P2:** 48 pin connector located on engine ECM
- P3:** 6 pin connector located on EGR motor
- P4:** 6 pin connector located on Fuel Rack Actuator
- P5:** 2 pin connector located on Speed Sensor
- P6:** 2 pin connector located on Engine Coolant Temperature Sensor
- P7:** 1 pin connector located on Cold Start Device Solenoid
- P8:** 2 pin connector for termination resistor on J1939 CAN BUSS near SECU controller
- P9:** 2 pin connector for termination resistor on J1939 CAN BUSS near engine ECM
- P10:** 6 pin connector for engine ECM service tool, located near engine ECM
- P12:** 2 pin connector for optional Generator Enable Switch, located behind control panel
- P13:** 6 pin connector for various options, located near separator tank (Included in full option harness only)
- P15:** 5 pin connector located on M5 4 in 1 gauge (Included in full option harness only)
- J14:** 9 pin connector for SECU RS232 and J1939 CAN communications, located near SECU controller.

SECTION 7

ELECTRICAL PARTS LIST

Reference Designator	Description	Part Number
PS1	0-100 psig Pressure Transducer	36920825
S1	Ignition Switch	22127385
S1	Replacement Knob Assembly	22134118
S2	Temperature Switch 248°F/120°C	22823181
S3	Temperature Switch 248°F/120°C	22823199
S4	Temperature Switch 230°F/110°C	15898059
S5	Pressure Switch NO 12 psi	54757935
B2	Fuel Lift Pump	22226385
TR1, TR2	J1939 CAN Terminating Resistor	23091804
K1,K2	Relay 12 VDC SPDT	36878361
K3,K4	Relay 12 VDC SPDT	23286610
F1	Blade Fuse 15 Amp	22071575
F2	Blade Fuse 10 Amp	36782456
DS1	Lamp Holder	36883825
DS1	Replacement Bulb 14.4 volt	35333236
M1	Hourmeter	22054175
M2	Discharge Air Pressure Gauge	35604065
M3	Fuel Level Gauge (Optional)	22773337
M4	Tachometer (Optional)	22422539
M5	4-in-1 Gauge (Optional)	22058291
M2, M3, M4, M5	Replacement Bulb 28VDC	22137418
U1	Fuel Level Sensor (Optional)	22058531
S6, S7	Air Filter Vacuum Switch NO (Optional)	36847838
RT1	Temperature Sender 0-300°F (Optional)	22975403
RT2	Temperature Sender 0-300°F (Optional)	35367218
RP1	Pressure Sender 0-150 psi (Optional)	36870608
	Battery Positive Cable	36793743
	Battery Negative Cable	36892685
	Frame Ground Strap	36783488
	Standard Chassis Harness	23215551
	Full Option Chassis Harness (Optional)	23330145
	SECU Controller	23217185
J14	Replacement Cap with Lanyard	23366768

SECTION 8

HARNESS CONNECTOR & CONNECTOR PARTS INFORMATION

Harness Connector Information

The following is a complete list of the connectors and connector parts that are used on the machine harnesses. The most common replacement connectors and connector parts will be found in the Deutsch terminal repair kit, Packard terminal repair kit, and Wire terminal repair kit. A repair kit is available for the SECU connector and Engine ECM connector. Check the Electrical Parts List section for individual replacement harness parts for certain items. If the connectors and connector parts are not in the kits above, the manufacturer part numbers and contact information will be provided.

Connector and Parts	Manufacturer	Manufacturer's Part No.	Included in Doosan Service Kit Part No.
P1 SECU Connector			
Plug, 35 way	AMP	776164-1	46491502
Terminal, 20-16 Awg Gold	AMP	770854-3	46491502
Cavity Plug	AMP	770678-1	46491502
J14 SECU Controller Communication Connector			
Receptacle, 9 way	Deutsch	HD10-9-96P	46490983
Connector Cap	Deutsch	HDC9-JDL082397	46490983
Pin size 16 Gold	Deutsch	0460-202-1631	46490983
Sealing plug size 16-12	Deutsch	114017	46490983
S1 Ignition Switch Connector			
Plug, 4 way	Packard	12052856	46491296
TPA	Packard	15324456	46491296
Terminal, 18-16 Awg	Packard	12034046	46491296
Terminal, 16-14 Awg	Packard	12066214	46491296
PS1 Pressure Sensor Connector			
Plug, 3 way	Packard	13532244	46491296
TPA	Packard	15452678	46491296
Terminal, 18 Awg	Packard	15326267	46491296
Cable Seal	Packard	15305351	46491296
P13 Accessory Connector (Full Option Harness Only)			
Plug, 6 way	Deutsch	DT06-6S-EP06	46490983
Wedgeloock	Deutsch	W6S-P012	46490983
Socket size 16 Gold	Deutsch	0462-201-1631	46490983
J13-Cap Accessory Connector (Full Option Harness Only)			
Receptacle, 6 way	Deutsch	DT04-6P-E005	46490983
Sealing plug size 16-12	Deutsch	114017	46490983

Connector and Parts	Manufacturer	Manufacturer's Part No.	Included in Doosan Service Kit Part No.
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P10 Engine Communication Interface Connector			
Plug, 6 way	Deutsch	DTM06-6S-E005	
Wedglock	Deutsch	WM-6S	
Socket size 20 Gold	Deutsch	0462-201-2031	46490983
Sealing plug size 20	Deutsch	0413-204-2005	46490983
J10-Cap Engine Communication Interface Connector			
Receptacle, 6 way	Deutsch	DTM04-6P-E005	
Sealing plug size 20	Deutsch	0413-204-2005	46490983
P8, P9 J1939 CAN Terminator Connector			
Plug, 2 way	Deutsch	DTM06-2S-E005	46490983
Wedglock	Deutsch	WM-2SB	46490983
Socket size 20 Gold	Deutsch	0462-201-2031	46490983
TR1, TR2 J1939 CAN Terminators			
Receptacle, 2 way terminator	Deutsch	DTM04-2P-EP10	46490983

P12 Generator Enable Connector			
Plug, 2 way	Deutsch	DTM06-2S-E005	46490983
Wedglock	Deutsch	WM-2S	46490983
Socket size 20 Gold	Deutsch	0462-201-2031	46490983
J12-Cap Generator Enable Connector			
Receptacle, 2 way	Deutsch	DTM04-2P-E005	46490983
Sealing plug size 20	Deutsch	0413-204-2005	46490983
B2 Fuel Lift Pump Connector			
Plug, 2 way	AMP	172130-1	
Terminal, 20-14 Awg	AMP	170032-5	
U1 Low Fuel Shutdown/Gauge Sender Connector			
Plug, 4 way	Packard	12015797	46491296
Terminal, 20-18 Awg	Packard	12089188	46491296
Cable Seal	Packard	12089679	46491296
U1-Jumper Low Fuel Shutdown/Gauge Sender Jumper Connector (Standard Harness Only)			
Receptacle, 4 way	Packard	12010974	
Terminal, 20-18 Awg	Packard	12089040	
Cable Seal	Packard	12089679	46491296
Cavity Plug	Packard	12010300	46491296
K1 Engine Starter Relay			
Plug, 4 way Relay	Packard	12065686	46491296
Terminal, 20-18 Awg	Packard	12020156	46491296
Terminal, 12-10 Awg	Packard	12033997	46491296

Connector and Parts	Manufacturer	Manufacturer's Part No.	Included in Doosan Service Kit Part No.
K2 Inlet Heater Relay			
Plug, 4 way Relay	Packard	12065686	46491296
Terminal, 20-18 Awg	Packard	12020156	46491296
Terminal, 12-10 Awg	Packard	12033997	46491296
K3 Engine ECM Power Relay Connector			
Plug, 6 way Relay	Sumitomo	6020-6161	
Terminal, 18-16	Sumitomo	8240-4438	
K4 Rack Actuator Relay Connector			
Plug, 6 way Relay	Sumitomo	6020-6161	
Terminal, 18-16	Sumitomo	8240-4438	
F1 Main Fuse Connector			
Plug, 2 way Fuse	Packard	12033769	46491296
Fuse Connector Cap	Packard	12033731	46491296
Terminal, 16-14 Awg	Packard	12066614	46491296
F2 Engine ECM Fuse Connector			
Plug, 2 way Fuse	Packard	12033769	46491296
Fuse Connector Cap	Packard	12033731	46491296
Terminal, 16-14 Awg	Packard	12066614	46491296
G1-IG Alternator Connector			
Plug, 2 way	AMP	172130-1	
Terminal, 20-14 Awg	AMP	170032-5	

G1-P Alternator Tachometer Output Terminal (Full Option Harness Only)			
Terminal, Bullet .156" Dia	AMP	607662	
P2 Yanmar Engine ECM Connector			
Plug, 48 way	Molex	98993-3319	46491411
Cover, 48 way	Molex	98993-1301	46491411
Terminal, 1.5mm	Molex	98915-1029	46491411
Terminal, 0.6mm	Molex	98913-1029	46491411
Cavity Seal, 1.5mm	Molex	98575-1023	46491411
Cavity Seal, 0.6mm	Molex	98575-1010	46491411
P3 EGR Motor Connector			
Plug, 6 way	Sumitomo	6195-0021	
Terminal, 18-16 Awg	Sumitomo	8100-1429	
Wire Seal, 18 Awg	Sumitomo	7165-0118	
Wire Seal, 16 Awg	Sumitomo	7165-0119	

Connector and Parts	Manufacturer	Manufacturer's Part No.	Included in Doosan Service Kit Part No.
P4 Rack Actuator Connector			
Plug, 6 way	Yazaki	7283-8850-30	
Terminal, 20-18 Awg	Yazaki	7116-4417-02	
Wire Seal, 20-18 Awg	Yazaki	7158-3167-80	
Cavity Seal	Yazaki	7158-3169-40	
P5 Speed Sensor Connector			
Plug, 2 way	Sumitomo	6189-0552	
Terminal, 20-18 Awg	Sumitomo	8240-4992	
Wire Seal	Sumitomo	7165-0194	
Retainer, 2 way	Sumitomo	6918-1260	
P6 Engine Coolant Temperature Sensor Connector			
Plug, 2 way	AMP	178390-2	
Terminal, 20-16 Awg Gold	AMP	171662-5	
Wire Seal	AMP	172888-2	
P7 Cold Start Device Solenoid Connector			
Plug, 1 way	Yazaki	7123-7414-40	
Terminal, 18-14 Awg	Yazaki	7116-1472	
Wire Seal	Yazaki	7157-7899-90	
P15 4-In-1 Gauge Connector (Full Option Harness Only)			
Plug, 5 way	Packard	12084891	
TPA, 5 way	Packard	15300017	
Terminal, 18-16 Awg	Packard	12077411	46491296
Cable Seal	Packard	12089679	46491296
S4 Engine Coolant Temperature Switch Terminals			
Terminal, Bullet .156" Dia	AMP	42142-1	
Quick Disconnects, Ring Terminals, and Butt Splices			
Most Common used Quick Disconnects, Ring Terminals, and Butt Splices can be found in the Doosan Wire Terminal Service Kit.			22252969

Harness Connector Information

Contact For Packard and Molex Connector and Connector Parts:

Power and Signal Group
6675 Parkland Blvd.
Solon, OH 44139
1-800-722-5273

Contact For Deutsch Connector and Connector Parts:

Ladd Industries. Inc.
4849 Hempstead Station Dr.
Kettering, OH 45429
1-800-223-1236

Contact For AMP Connector and Connector Parts:

AMP Incorporated
Harrisburg, PA 17105
1-800-522-6752

Contact For Sumitomo Connector and Connector Parts:

Sumitomo Wiring Systems
39555 Orchard Hill Place, Suite L60
Novi, MI 48375
248-347-9450

Contact For Yazaki Connector and Connector Parts:

Yazaki North America
6801 Haggerty Road
Canton, MI 48187
1-888-942-9152

SECTION 9

SERVICE TOOLS and REPAIR KITS

Service Tools

The following list of special service tools are recommended to perform service and troubleshooting procedures in this manual. These tools can be purchased through Doosan Infracore Portable Power.

Part Number	Description
22216691	Digital Multimeter (Fluke 87) Used to measure electrical circuits: Volts, Amps, Ohms
22216733	Fluke Meter Case Storage Case for Fluke meter and test leads
22216709	Fluke Test Lead Set Contains needle probes, alligator clips, and test leads
22216725	Fluke Wire Insulation Piercing Probe Used to pierce wire insulation when making electrical measurements
22147540	Kit, Test Adapters Used to interconnect between devices and harness for electrical measurements
22281588	T-Handle Hex Wrench 5/32" Used to remove WEDGE, Caterpillar ECM, and Cummins ECM connectors
22282107	Screw Driver Hex 5/32" Used to remove WEDGE, Caterpillar ECM, and Cummins ECM connectors
22282172	Flex Driver 1/4" Used to remove John Deere ECM connector
54740675	RS232 Heavy Duty Serial Cable Used for communication connection to Doosan controllers
54699640	Deutsch Terminal Removal Tool Size 20 Used to remove Deutsch size 20 terminals from connectors
54699632	Deutsch Terminal Removal Tool Size 16 Used to remove Deutsch size 16 terminals from connectors
46490942	Deutsch Terminal Removal Tool Size 14 Used to remove Deutsch size 14 terminals from connectors
54699624	Deutsch Terminal Removal Tool Size 12 Used to remove Deutsch size 12 terminals from connectors
54699616	Deutsch Terminal Removal Tool Size 8 Used to remove Deutsch size 8 terminals from connectors
54699657	Deutsch Wedgelock and Terminal Removal Tool Used to remove Deutsch DT style connector wedgelocks and terminals
22146393	Kit, Deutsch Terminal Removal Tool Size 20 Through 8 Used to remove Deutsch size 20 through 8 terminals from connectors
22216667	Deutsch Terminal Crimp Tool Used to crimp Deutsch connector terminals
54729660	Packard Weather-Pack Terminal Removal Tool Used to remove Packard Weather-Pack connector terminals
54749643	Packard Metri-Pack Terminal Removal Tool Used to remove Packard Metri-Pack connector terminals
46490959	Packard Metri-Pack Terminal Removal Tool Used to remove Packard Metri-Pack connector terminals
22254734	Packard Weather-Pack Terminal Crimp Tool Used to crimp Packard Weather-Pack connector terminals

22216683	Packard Metri-Pack Terminal Crimp Tool Used to crimp Packard 150 and 280 series connector terminals
22255947	Packard Metri-Pack Terminal Crimp Tool Used to crimp Packard 150 series pull-to-seat connector terminals
46490967	Packard Metri-Pack Terminal Crimp Tool Used to crimp Packard 150-GT series connector terminals
46490975	Packard Metri-Pack Terminal Crimp Tool Used to crimp Packard 630 series connector terminals
54749544	RTD Simulator Used to troubleshoot RTD type temperature sensor problems
54749551	Thermistor Simulator Used to troubleshoot Thermistor type temperature sensor problems
22073878	Thermistor Simulator Used to troubleshoot Thermistor type temperature sensor problems
22168868	Pressure Transducer Simulator Used to troubleshoot pressure sensor problems
54729710	Electrical Contact Cleaner Used to clean electrical terminals and connectors
22409114	Electrical Grease Used to prevent corrosion in connector terminals
46491338	Molex 1.5 Terminal Crimp Tool Used to crimp Molex CMC 1.5 series connector terminals
46491346	Molex 0.6 Terminal Crimp Tool Used to crimp Molex CMC 0.6 series connector terminals
46491653	Molex 1.5 Terminal Removal Tool Used to remove Molex CMC connector terminals
46491361	Molex 0.6 Terminal Removal Tool Used to remove Molex CMC connector terminals
46491320	AMP Ampseal Terminal Crimp Tool Used to crimp Ampseal series connector terminals

Connector Repair Kits

The following is a list of harness connector repair kits that can be purchased through Doosan Portable Power to service or repair the most common used connectors.

Part Number	Description
46490983	Kit, Deutsch Connector Repair Assortment of Deutsch connectors and terminals
22252969	Kit, Wire Terminal Repair Assortment of ring and quick disconnect terminals
22254775	Kit, Fuses Assortment of ATC and ATM style fuses
22253017	Kit, Adhesive Lined Heat Shrink Assortment of adhesive lined heat shrink sizes
22252993	Kit, WEDGE Connector Repair Used to repair WEDGE connector and terminals
46491296	Kit, Packard Connector Repair Assortment of Packard connectors and terminals
46491304	Kit, Caterpillar C9, C15, and C18 Engine ECM Connector Repair Used to repair engine ECM connector and terminals
46491312	Kit, OTC and AutoStart Controller Connector Repair Used to repair 23 way controller connector and terminals
46491411	Kit, John Deere and Yanmar Tier 3 Engine ECM Connector Repair Used to repair engine ECM connector and terminals
46491429	Kit, Cummins QSX15 Engine ECM Connector Repair Used to repair engine ECM connector and terminals
46491502	Kit, SECU and Mote Controller Connector Repair Used to repair 35 way controller connector and terminals
46491569	Kit, Cummins OSL9 and QSC 8.3 Engine ECM Connector Repair used to repair engine ECM connector and terminals.

Terminal Crimp Tool Usage

The following chart shows which manufacturer's crimp tool to use with each terminal when making repairs. Most of the common crimp tools are available through Doosan Portable Power. If the tools needed are not available through Doosan Portable Power, the manufacturer part numbers and contact information will be provided.

Terminal	Manufacturer	Manufacturer's Part No.	Manufacturer's Crimp Tool Part No.	Doosan Crimp Tool Part No.
Socket size 20 Tin	Deutsch	0462-201-20141	HDT-48-00	2221667
Socket size 20 Gold	Deutsch	0462-201-2031	HDT-48-00	2221667
Pin size 20 Tin	Deutsch	0460-202-20141	HDT-48-00	2221667
Pin size 20 Gold	Deutsch	0460-202-2031	HDT-48-00	2221667
Socket size 16 Tin	Deutsch	0462-201-16141	HDT-48-00	2221667
Socket size 16 Gold	Deutsch	0462-201-1631	HDT-48-00	2221667
Pin size 16 Tin	Deutsch	0460-202-16141	HDT-48-00	2221667
Pin size 16 Gold	Deutsch	0460-202-1631	HDT-48-00	2221667
Socket size 14 Tin	Deutsch	0462-209-16141	HDT-48-00	2221667
Socket size 14 Gold	Deutsch	0462-209-1631	HDT-48-00	2221667
Pin size 14 Tin	Deutsch	0460-215-16141	HDT-48-00	2221667
Pin size 14 Gold	Deutsch	0460-215-1631	HDT-48-00	2221667
Socket size 12 Tin	Deutsch	0462-203-12141	HDT-48-00	2221667
Socket size 12 Gold	Deutsch	0462-210-1231	HDT-48-00	2221667
Pin size 12 Tin	Deutsch	0460-204-12141	HDT-48-00	2221667
Pin size 12 Gold	Deutsch	0460-220-1231	HDT-48-00	2221667
Terminal	Packard	15326267	15359996	46490967
Terminal	Packard	12077411	12155975	22216683
Terminal	Packard	12048074	12155975	22216683
Terminal 16-18 Awg	Packard	12110847	12155975	22216683
Terminal 16-14 Awg	Packard	12129409	12155975	22216683
Pin Grip Terminal	Packard	08911072	12155975	22216683
Terminal 18-16 Awg	Packard	12034046	12155975	22216683
Terminal 20-16 Awg Gold	AMP	770854-3	58440-1	46491320

Contact for Packard & Molex Tools:

Power and Signal Group
6675 Parkland Blvd.
Solon, OH 44139
1-800-722-5273

Contact for Deutsch Tools:

Ladd Industries. Inc.
4849 Hempstead Station Dr.
Kettering, OH 45429
1-800-223-1236

Contact For AMP Tools:

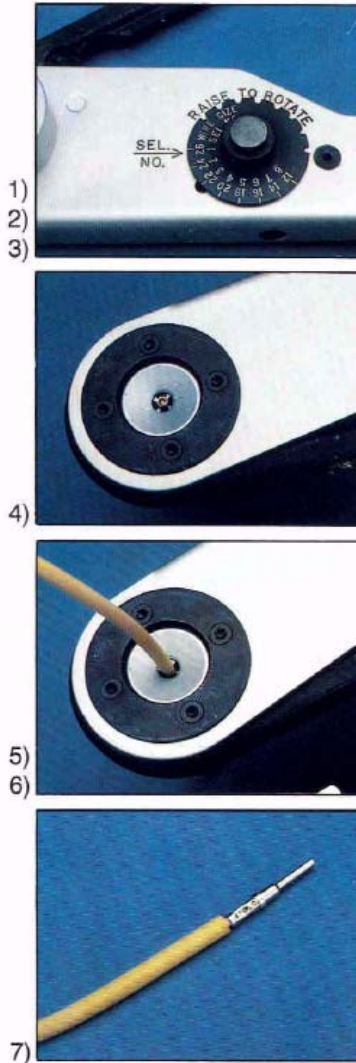
AMP Incorporated
Harrisburg, PA 17105
1-800-522-6752

Deutsch Crimp Tool HDT-48-00 Instructions

Crimping Procedure (HDT-48-00)

- 1) Strip (see recommended strip lengths) insulation from wire.
- 2) Raise selector knob and rotate until arrow is aligned with wire size to be crimped.
- 3) Loosen lock nut, turn adjusting screw in until it stops.
- 4) Insert contact, turn adjusting screw counter clockwise out until contact is flush with indenter cover. Tighten lock nut.
- 5) Insert wire in contact, contact must be centered between indicators, close handles until handle contacts the stop.
- 6) Release handles and remove crimped contact.
- 7) Inspect terminal to insure that all strands are in crimp barrel.

NOTE: Tool must be readjusted for each type/size of contact.



Wire Termination

Do's and Don'ts

Do's

- ✓ Check strip lengths.
- ✓ Protect wire strands.
- ✓ Gauge the crimp indenters.
- ✓ Check crimp selector for correct wire size settings.
- ✓ Check air pressure on semi- and automatic crimp equipment.
- ✓ Tensile pull test.
- ✓ Specify Deutsch manufactured terminals.
- ✓ Check crimp locations.

Don'ts

- ✓ Add solder.
- ✓ Apply heat.
- ✓ Leave exposed conductor wire strands.
- ✓ Overcrimp.
- ✓ Rely on T-Dim measurements only.
- ✓ Use "Field-Maintenance" crimp tools for volume production.
- ✓ Buy bogus terminals.

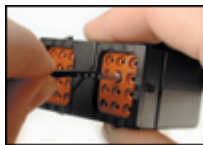


Deutsch DRC Series Connector Service Procedures

Contact Insertion



1. Grasp contact approximately 1.00" (25.4 mm) behind the contact crimp barrel.



2. Hold connector with rear grommet facing you.



3. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

Contact Removal



1. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.



2. Slide tool along wire into the insert cavity until it engages contact and resistance is felt.
NOTE: Do not twist or insert tool at an angle.



3. Pull contact-wire assembly out of connector.

Deutsch DT Series Connector Service Procedures

Contact Insertion



1. Grasp crimped contact approximately (25.2 mm) one inch behind the contact barrel.



2. Hold connector with rear grommet facing you.



3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.



Once all contacts are in place, insert orange wedge with arrow pointing toward exterior locking mechanism. The orange wedge will snap into place. Rectangular wedges are not oriented. They may go in either way.

NOTE: The receptacle is shown - use the same procedure for plug.

Contact Removal



1. Remove orange wedge using needle nose pliers or a hook shaped wire to pull wedge straight out.



2. To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.



3. Hold the rear seal in place, as removing the contact will displace the seal.

Deutsch DTM Series Connector Service Procedures

Contact Insertion



1. Grasp crimped contact approximately 1.0" (25.4 mm) behind the contact barrel.



2. Hold connector with rear grommet facing you.



3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.



Once all contacts are in place, insert orange wedge: receptacles - with half holes aligning with contacts. Plugs - with contacts aligning behind full holes. The orange wedge will snap into place.

NOTE: The receptacle is shown - use the same procedure for plug.

Contact Removal



1. Remove orange wedge using needle nose pliers to pull wedge straight out.



2. To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.



3. Hold the rear seal in place, as removing the contact will displace the seal.

Deutsch HD10 Series Connector Service Procedures

Contact Insertion



1. Grasp the contact-wire assembly between the thumb and forefinger on the wire approximately one inch behind the contact crimp barrel.



2. Hold the connector with the rear grommet facing you.



3. Push the contact straight into the connector grommet until a positive stop is felt. The retaining fingers in the connector will snap behind the shoulder of the contact and lock it in place. A slight tug will confirm that it is properly sealed.

Contact Removal



1. With rear insert toward you, snap the appropriate size plastic tool over the wire of the contact to be removed.



2. Slide the tool along the wire into the insert cavity until it engages the contact and resistance is felt. The contact retaining clip will be in the unlocked position.



3. Pull the contact-wire assembly out of the connector.

Deutsch HD30 and HDP20 Series Connector Service Procedures

Contact Insertion



1. Grasp contact approximately (25.4 mm) one inch behind the contact crimp barrel.



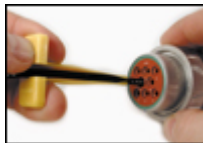
2. Hold connector with rear grommet facing you.



3. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

NOTE: For unused wire cavities, insert sealing plugs for full environmental sealing

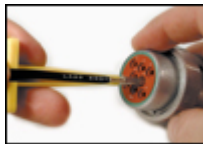
Contact Removal



1. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.



2. Slide tool along into the insert cavity until it engages contact and resistance is felt.



3. Pull contact-wire assembly out of connector.

NOTE: Do not twist or insert tool at an angle

AMP Crimp Tool 58440-1 Instructions

PROPER USE GUIDELINES

Cumulative Trauma Disorders can result from the prolonged use of manually powered hand tools. AMP hand tools are intended for occasional use and low volume applications. AMP offers a wide selection of powered application equipment for extended-use, production operations.

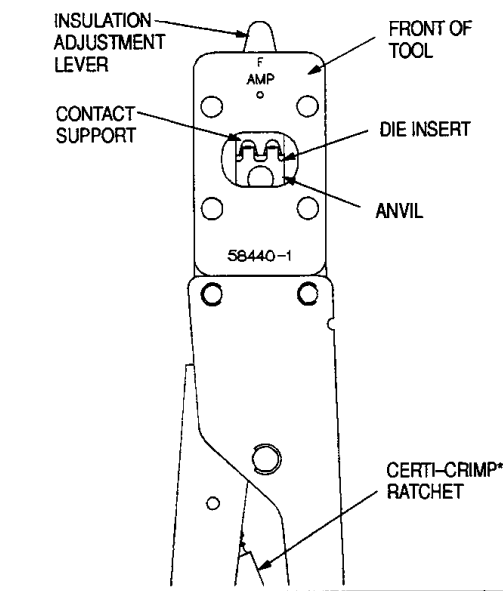


Figure 1

cad

1. INTRODUCTION

AMP Hand Crimping Tool 58440-1, shown in Figure 1, is designed for crimping AMPSEAL® Loose Piece contacts listed in Figure 2. Read these instructions thoroughly before crimping any contact.

NOTE All dimensions on this document are in metric units [with U.S. customary units in brackets].

2. DESCRIPTION

The FRONT of the tool, into which the contact is inserted, has the tool number marked on it. The BACK of the tool (wire side), into which the wire is inserted, has the wire size marked above the crimp section.

The tool features two fixed upper die inserts, two bottom movable dies (anvils), an insulation crimp adjustment lever, a contact support, a locator, an ejector, and a CERTI-CRIMP ratchet. The insulation adjustment lever is used to regulate the crimp height of the contact insulation barrel. Refer to Paragraph 4, INSULATION CRIMP ADJUSTMENT. The contact

support prevents the contact from bending during the crimping operation.

The locator has two functions: first, it positions the contact between the upper insert and the anvil before crimping; and, second, it limits the insertion distance of the stripped wire into the contact. In use, it rests in the locator slot of the contact (see Figures 2 and 3).

The ejector pulls the locator down, and ejects the crimped contact when the tool handles are fully opened.

The CERTI-CRIMP ratchet assures full crimping of the contact. Once engaged, the ratchet will not release until the handles have been fully closed.

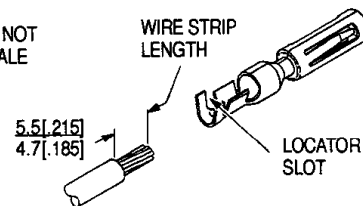
CAUTION The crimping jaws bottom before the CERTI-CRIMP ratchet releases. This is a design feature that ensures maximum electrical and tensile performance of the crimp. Do NOT re-adjust the ratchet.

3. CRIMPING PROCEDURE

Refer to the chart in Figure 2 and ensure that the wire is of the specified size and insulation diameter, and is compatible with the contact and the wire size marking on the BACK of the tool. Strip the wire to the length indicated — do NOT cut or nick the wire strands.

WIRE SIZE (AWG)	INSULATION DIAMETER RANGE	TOOL CRIMP SECTION (Wire Size Marking)	CONTACT PART NUMBER	
			LOOSE PIECE	STRIP FORM*
16	1.7 – 2.7	16	770854-1	770520-1
20 – 18	[.067 – .106]	20 – 18		

NOTE: NOT TO SCALE



• SEE CAUTION BELOW

Figure 2

cad

CAUTION Do NOT cut strip form* (reeled) contacts into loose piece form. This will produce burrs on the cut-off tab which will damage the wire seal in the plug assembly.

AMP Crimp Tool 58440-1 Instructions

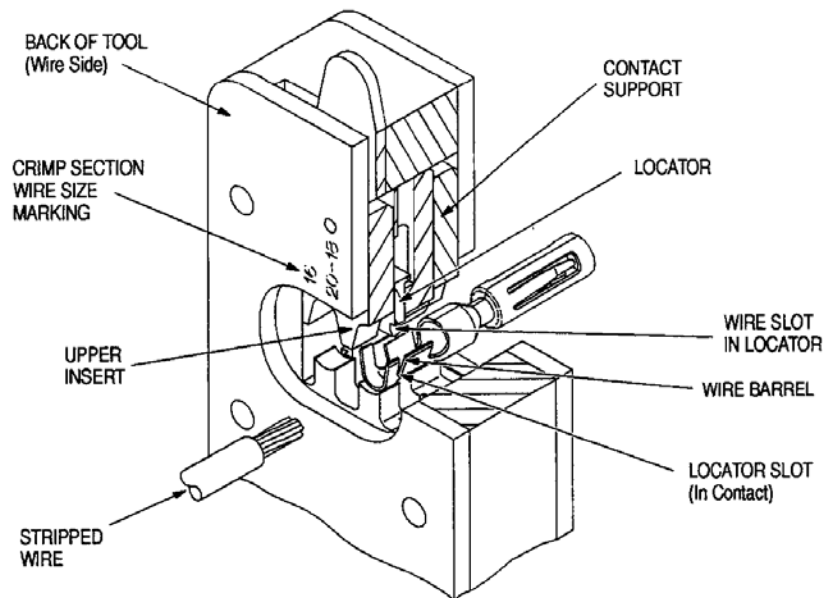


Figure 3

cad

For dimensional information on the product, refer to AMP Application Specification 114-16016. Then proceed as follows:

1. Hold tool so BACK side (wire side) faces you. See Figure 3.
2. Ensure that tool ratchet is released by squeezing tool handles and allowing them to open.
3. Holding contact by its mating portion and looking straight into crimp section, insert contact from the FRONT of tool into BACK of crimp section. Position contact between the crimping dies so the locator-insulation stop enters the locator slot in contact. The wire barrel should butt against the locator/insulation stop.
4. Holding contact in this position, squeeze tool handles together until insulation barrel anvil starts entry into the upper insert (insulation). Do NOT deform insulation barrel or wire barrel.
5. Insert properly stripped wire through the wire slot in locator and into wire barrel of contact until insulation butts against the locator/insulation stop.
6. Holding wire in place, crimp contact to wire by squeezing tool handles together until ratchet releases.
7. Allow tool handles to open FULLY and remove crimped contact from tool.

4. INSULATION CRIMP ADJUSTMENT

The insulation barrel crimp height is regulated by the insulation adjustment lever. To determine the proper setting, test crimp a contact using the setting which approximates the insulation size: (1) small, (2) medium, or (3) large. If the crimped insulation barrel is too tight or too loose, change the setting accordingly. The crimp should hold the insulation firmly without cutting into it.

5. MAINTENANCE/INSPECTION

These instructions have been approved by AMP Design, Production, and Quality Control Engineers to provide documented maintenance and inspection procedures. Through AMP test laboratories and the inspection of production assembly, the procedures described herein have been established to ensure quality and reliability of AMP hand crimping tools.

Customer-replaceable parts are listed in Figure 4. A complete inventory should be stocked and controlled to prevent lost time when replacement of parts is necessary. When parts are needed, order by part number and description.

5.1. Daily Maintenance

Remove all foreign particles with a clean, soft brush, or a clean, soft lint-free cloth. Make sure the proper retaining pins are in place, and secured with the proper retaining rings. If foreign matter/substances

AMP Crimp Tool 58440-1 Instructions

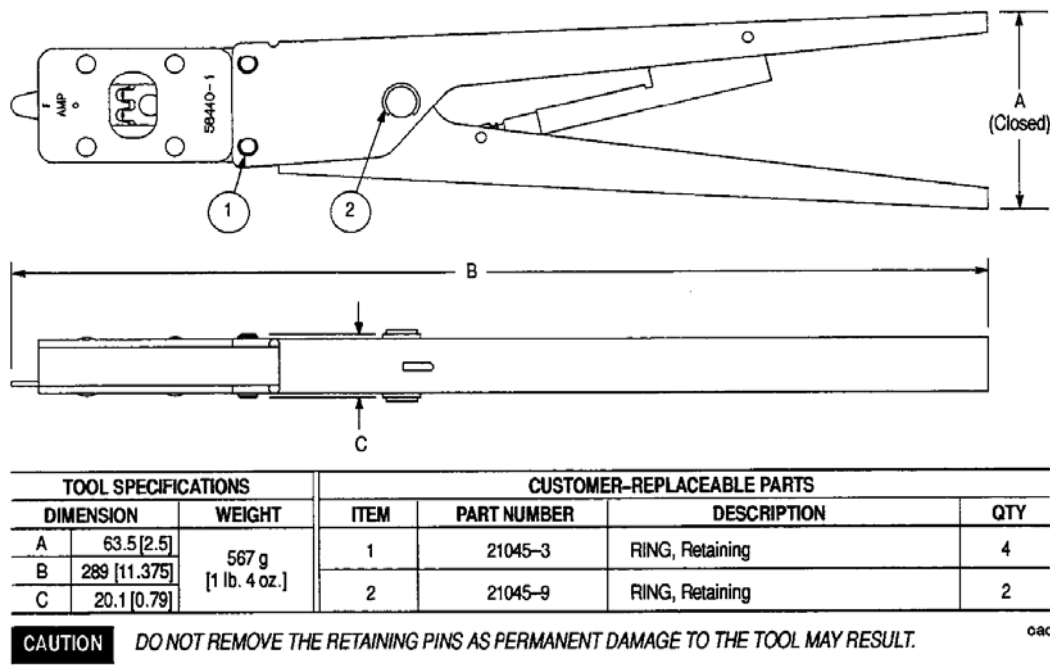


Figure 4

cannot be removed easily, or if the proper replacement parts are not available, return the tool to your supervisor.

Make certain all pivot points and bearing surfaces are protected with a THIN coat of any good SAE No. 20 motor oil. Do NOT oil excessively. When tool is not on use, keep the handles closed to prevent objects from becoming lodged between the crimping dies, and store the tool in a clean, dry area.

5.2. Periodic Inspection

Regular inspections should be performed by quality control personnel. A record of scheduled inspection should remain with the tool and/or be supplied to supervisory personnel responsible for the tool. Though recommendations call for at least one inspection a month, the inspection frequency should be based on the amount of use, ambient working conditions, operator training and skill, and established company standards. These inspections should be performed in the following sequence:

A. Visual Inspection

1. Remove all lubrication and accumulated film by immersing the tool (handles partially closed) in a suitable commercial degreaser that will not affect paint or plastic material.

2. Make certain all retaining pins are in place and secured with retaining rings. If replacements are necessary, refer to parts listed in Figure 4.

3. Close the tool handles until the ratchet releases, then allow the tool handles to open freely. If they do not open quickly and fully, the spring is defective and must be replaced (see Paragraph 6, REPAIR).

4. Inspect the head assembly, with special emphasis on checking for worn, cracked, or broken dies. If damage to any part of the head assembly is evident, return the tool to AMP for evaluation and repair (see Paragraph 6, REPLACEMENT AND REPAIR).

B. Crimp Height Inspection

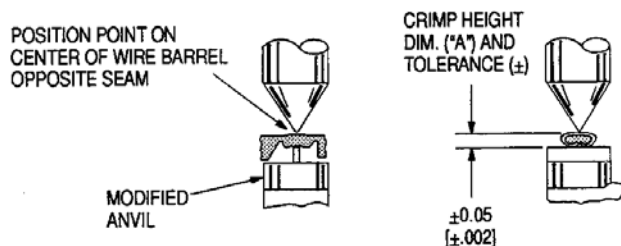
This inspection requires the use of a micrometer with a modified anvil as shown in Figure 5. AMP recommends the modified micrometer (Crimp Height Comparator RS-1019-5LP) which can be purchased from:

York Machinery & Supply Co.
20 North Penn Street
York, PA 17401-1014

or

VALCO
1410 Stonewood Drive
Bethlehem, PA 18017-3527

AMP Crimp Tool 58440-1 Instructions



CONTACT NUMBER STRIP FORM	CONTACT NUMBER LOOSE PIECE	WIRE SIZE AWG (Max)	CRIMP SECTION (Wire Size Marking)	CRIMP HEIGHT DIMENSION "A"	HAND TOOL NUMBER
770520-1	770854-1	20	20 - 18	1.22 [.048]	58440-1
		18	20 - 18	1.22 [.048]	
		16	16	1.40 [.055]	

Figure 5

200-002E

Proceed as follows:

1. Refer to chart in Figure 5 and select a contact and a wire (maximum size) for each crimp section listed in the chart.
2. Refer to Paragraph 3, CRIMPING PROCEDURE, and crimp the contact(s) accordingly.
3. Using a crimp height comparator, measure wire barrel crimp height as shown in Figure 5. If the crimp height conforms to that shown in the chart, the tool is considered dimensionally correct. If not, return the tool to AMP for evaluation and repair (see Paragraph 6, REPLACEMENT AND REPAIR).

For additional information concerning the use of the crimp height comparator, refer to AMP instruction sheet 408-7424.

C. CERTI-CRIMP Ratchet Inspection

Obtain a .025mm [.001-in] shim that is suitable for checking the clearance between the bottoming surfaces of the crimping dies.

Proceed as follows:

1. Select a contact, wire (maximum size) and the designated crimp section for the wire you are using (see Figure 5).
2. Position the contact and wire between the crimping dies, according to Paragraph 3, CRIMPING PROCEDURE (STEPS 1 THROUGH 5). Holding the wire in place, squeeze the handles together until the CERTI-CRIMP ratchet releases.

Hold the tool handles in this position, maintaining just enough pressure to keep the dies closed.

3. Check the clearance between the bottoming surfaces of the crimping dies. If the clearance is .025mm [.001 in], or less, the ratchet is satisfactory. If clearance is greater, the ratchet is out of adjustment and must be repaired (see Paragraph 6, REPLACEMENT AND REPAIR).

If the tool conforms to these inspection procedures, lubricate it with a THIN coat of any good SAE No. 20 motor oil and return it to service.

6. REPLACEMENT AND REPAIR

The parts listed in Figure 4 are customer-replaceable. A complete inventory can be stocked and controlled to prevent lost time when replacement of parts is necessary. Order replacement parts through your AMP representative, or call 1-800-526-5142, or send a facsimile of your purchase order to 1-717-986-7605, or write to:

CUSTOMER SERVICE (38-35)
AMP INCORPORATED
P.O. BOX 3608
HARRISBURG PA 17105-3608

Tools may also be returned to AMP for evaluation and repair. For repairs, send tool, with a written description of the problem, to:

CUSTOMER REPAIR (01-12)
AMP INCORPORATED
1523 NORTH 4TH STREET
HARRISBURG, PA 17102-1604

AMP Ampseal Series Connector Service Procedures

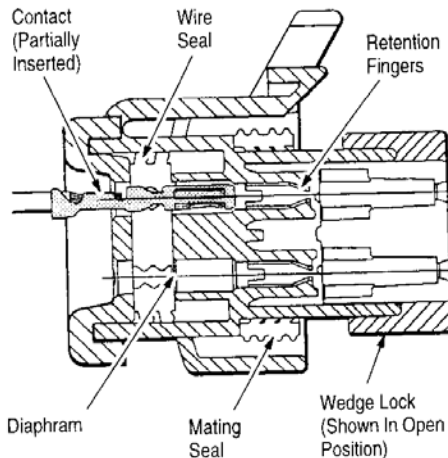
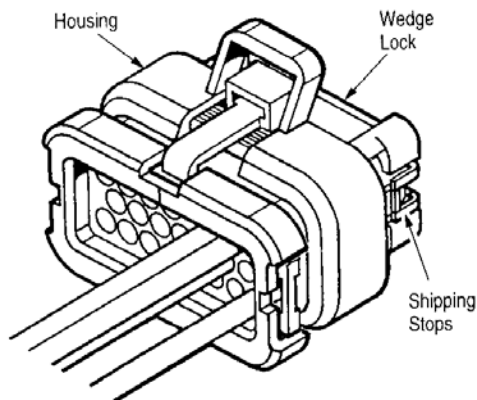


Figure 1

92-146

1. INTRODUCTION

This instruction sheet provides assembly and disassembly procedures for the AMP® AMPSEAL Automotive Plug Connector Assembly shown in Figure 1.

NOTE

All dimensions are in millimeters.

Reasons for reissue of this sheet are provided in Section 9, REVISION SUMMARY.

2. DESCRIPTION

The plug assembly is shipped in one piece, with the wedge lock in the open position. The assembly consists of a housing, a cover, a wedge lock, a wire seal, and a mating seal.

Contacts are available in strip-form or in loose piece. Strip-form contacts are designed to be crimped with AMP Mini-Applicator 567333-2. Loose piece contacts are designed to be crimped with AMP Hand Tool 58440 or AMP PRO-CRIMPER® Tool 58529-1.

3. ASSEMBLY PROCEDURES

Check to be sure the wedge lock is in the **open**, or as-shipped, position (see Figure 1). If the wedge lock is closed, see Section 7. Then, proceed as follows:

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (see Figure 2).

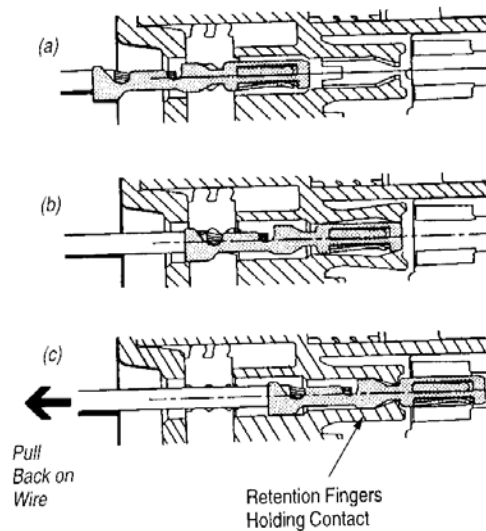


Figure 2

91-591A

2. Pull back on the contact wire with a force of about 4 to 9 Newtons [1 or 2 pounds] to be sure the retention fingers are holding the contact (see Figure 2).

AMP Ampseal Series Connector Service Procedures

3. After all required contacts have been inserted, the wedge lock must be closed to its **locked** position. Release the locking latches by squeezing them inward (see Figure 3).

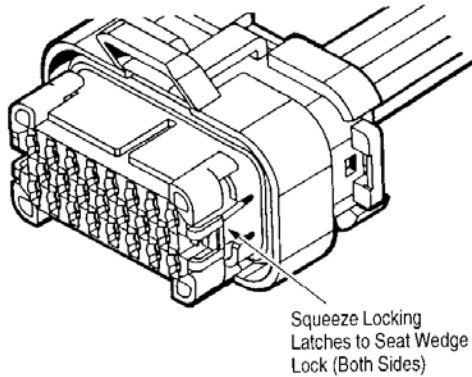


Figure 3

91-591b

4. Slide the wedge lock into the housing until it is flush with the housing (see Figure 4).

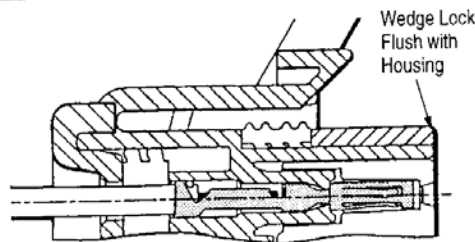


Figure 4

92-147

4. SEAL PLUG (Figure 5)

All circuits are sealed by a diaphragm in the rubber wire seal. When assembling the connector, the diaphragm is pierced as the contact passes through it. Unused circuit cavities will remain sealed, unless perforated by accidentally inserting and removing a contact in the wrong cavity. AMP Seal Plug 770678-1 is designed to keep out contaminants if the diaphragm is pierced. Insert seal plug, **large end first**, into the circuit cavity as far as it will go. An insertion tool is generally **not** required for this procedure.

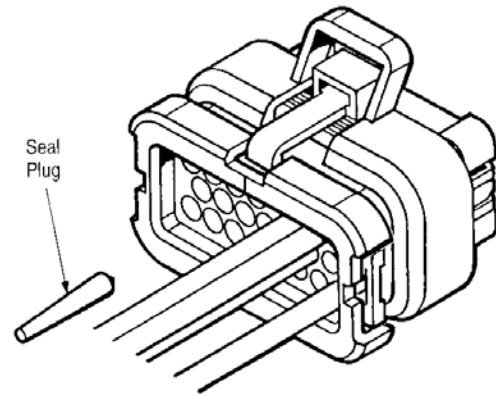


Figure 5

92-148

5. DISASSEMBLY PROCEDURES (Contact Removal)

Refer to Figure 6 and proceed as follows:

1. Insert a screwdriver blade between the mating seal and one of the red wedge lock tabs.
2. Pry open the wedge lock to the open (as shipped) position.
3. While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.

NOTE

The wedge lock should never be removed from the housing for insertion or removal of the contacts.

6. ADDITIONAL INFORMATION

For information on contact crimping, refer to the instructions packaged with the tooling. For inspection information on crimped contacts, refer to instruction sheet 408-3284. For panel cutout dimensions, printed circuit board layout, etc. for the header assembly, refer to 408-3285. For application information on the AMPSEAL product line, refer to Application Specification 114-16016.

7. OPENING WEDGE LOCK

It is possible during adverse shipping conditions that some wedge locks may get bumped into the closed position (see Figure 4). If so, refer to Section 5, DISASSEMBLY PROCEDURES, Steps 1 and 2.

AMP Ampseal Series Connector Service Procedures

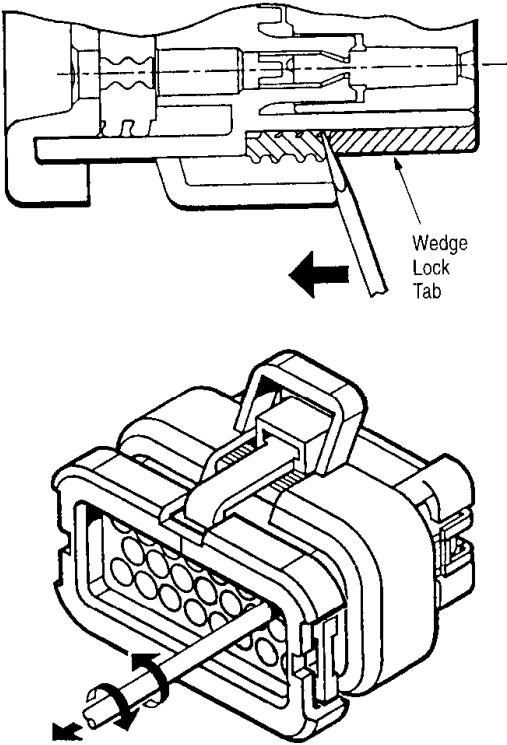


Figure 6

92-149

8. CURRENT RATING

Refer to Figure 7 for current ratings of special-use connectors, AMPSEAL Series 770669 (headers) and 770680 (plugs).

SINGLE-CIRCUIT PLATING	WIRE SIZE (AWG)	CURRENT RATING (MAX.)
Tin	16, 18, and 20	8A
	16	14.5A
Gold	18	13A
	20	11.5A

Figure 7

9. REVISION SUMMARY

Revisions to this document include:

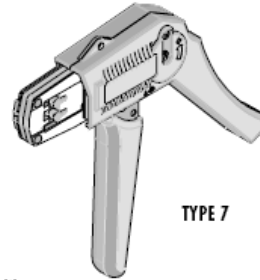
Per EC 0740-0073-95:

- Added PRO-CRIMPER Tool and part number to Section 2
- Deleted two NOTES from Section 2

Molex Crimp Tool 0638118900 Instructions



HAND CRIMP TOOL SPECIFICATION SHEET Order No. 63811-8900



TYPE 7

FEATURES

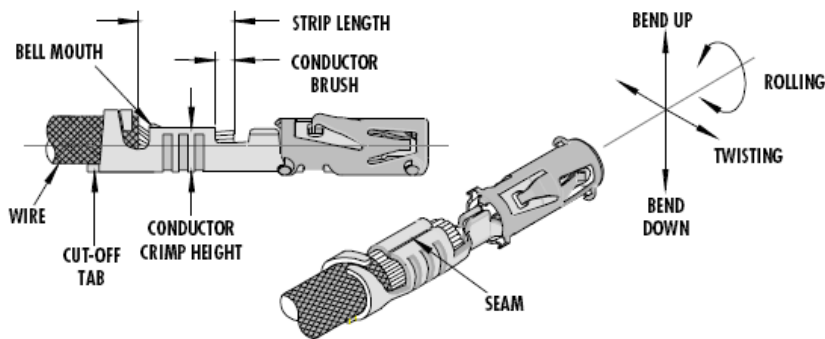
- A full cycle ratcheting hand tool ensures complete crimps
- A precision user-friendly terminal locator wire stop holds terminals in the proper crimping position
- This tool is WHMA-IPCA620 Class 3 only with specified wire types and RoHS compliant

SCOPE

Products: 1.50mm (.059") CP 1.5 Female Crimp Terminals for CMC connector, 18-20 AWG and 1.00-0.50mm².

Terminal Series No.	Terminal Order No.	Wire Size		Insulation Diameter		Strip Length	
	Available in Reel form only	AWG	mm ²	mm	In.	mm	In.
98915	98915-1029 98915-1319		1.00	1.75-1.90	.069-.075	4.50	.177
		18		1.91-2.06	.075-.081	4.50	.177
			0.75	1.60-1.80	.063-.071	4.50	.177
			0.60	1.75-1.90	.069-.075	4.50	.177
		20		1.70-1.85	.067-.073	4.50	.177
			0.50	1.40-1.50	.055-.059	4.50	.177
Follow the Cut-Off Tab specifications on the Applicator specification sheets. Note: Terminal will accommodate the thin wall small insulation with the TXL type American wires and the 1R or ID type Metric wires.							

DEFINITION OF TERMS



Molex Crimp Tool 0638118900 Instructions

CRIMP SPECIFICATION

After crimping, the conductor profiles should measure the following (see notes on page 5).

Terminal Series No.	Wire Size		Conductor Crimp Height (Ref.)		Insulation Crimp Height (Ref.)		Pull Force Minimum		Profile	
	AWG	mm ²	mm	In.	mm	In.	N	Lb.	20 AWG 0.5-0.6	18 AWG 0.75-1.00
98915		1.00	1.25-1.35	.049-.053	2.45-2.65	.096-.104	115.0	25.90		X
	18		1.25-1.35	.049-.053	2.45-2.65	.096-.104	90.0	20.25		X
		0.75	1.25-1.35	.049-.053	2.25-2.45	.089-.096	90.0	20.25		X
		0.60	1.20-1.30	.047-.051	2.15-2.35	.085-.093	80.0	18.00	X	
	20		1.20-1.30	.047-.051	2.15-2.35	.085-.093	75.0	16.90	X	
		0.50	1.20-1.30	.047-.051	2.15-2.35	.085-.093	70.0	15.75	X	

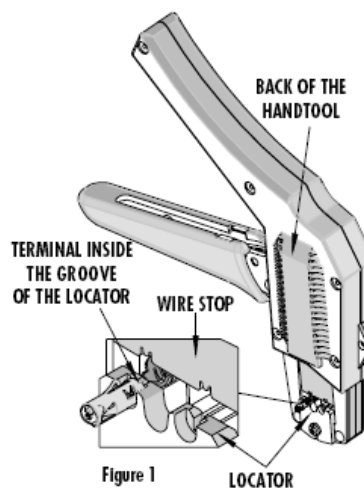
OPERATION

CAUTION: Install only Molex terminals listed above with this tool. Do not crimp hardened objects as damage can occur to the tool or die.

Open the tool by squeezing the handles together, at the end of the closing stroke, the ratchet mechanism will release the handles, and the hand tool will spring open.

Crimping Terminals

1. Select the desired terminal listed in the preceding charts.
2. Position the terminal from the back of the hand tool up and into the proper locator opening with the crimp barrels centered over the anvils. See Figure 1. Make sure when choosing the correct nest and locator opening, it will correspond with the pocket marked with the wire size profile on the hand tool.
3. Partially close the jaws of the hand tool by squeezing the handles until you hear the first click of the ratchet. This will move the wire stop into position.
4. From the front of the hand tool insert the pre-stripped wire over the terminal and against the wire stop. See Figure 2.
5. Compress the terminal by squeezing the tool handles until the ratchet mechanism cycle has been completed. Release handles to open the jaws.



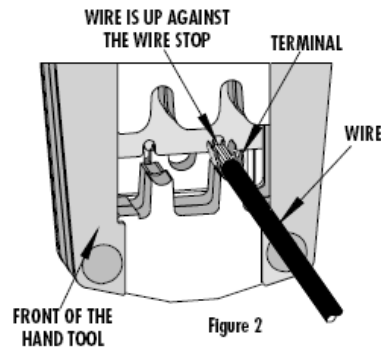
Note: The tamper proof ratchet action will not release the tool until it has been fully closed.

Molex Crimp Tool 0638118900 Instructions

6. Remove the crimped terminal from the terminal locator.
7. Visually inspect the crimped terminal for proper crimp location.

Note:

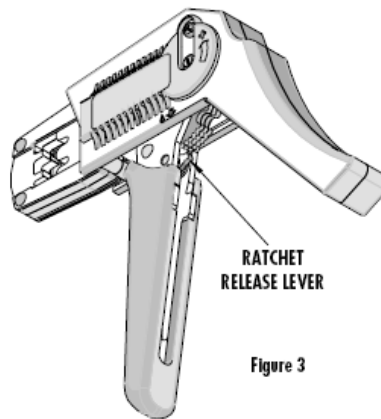
A crimp height chart is provided with this manual as Reference Only. Due to the wide range of wires, strands, insulation diameters, and durometers, actual crimp height measurements may vary slightly. An occasional, destructive, pull force test should be performed to check hand tool crimp. Pull Force value Must exceed the Minimum pull force specifications listed.



Maintenance

It is recommended that each operator of the tool be made aware of, and responsible for, the following maintenance steps:

1. Remove the plastic handles from the metal tool frame by removing the screws and remove dust, moisture, and other contaminants with a clean brush, or soft, lint free cloth.
2. Do not use any abrasive materials that could damage the tool.
3. Make certain all pins; pivot points and bearing surfaces are protected with a thin coat of high quality machine oil. Do not oil excessively. The tool was engineered for durability but like any fine piece of equipment it needs cleaning and lubrication for a maximum service life of trouble free crimping. Light oil used at the pivot points every 5,000 crimps or 3 months, will significantly enhance the tool life.
4. Wipe excess oil from hand tool, particularly from crimping area.
5. When tool is not in use, keep the handles closed to prevent objects from becoming lodged in the crimping dies, and store the tool in a clean, dry area.



Miscrimps or Jams

Should this tool ever become stuck or jammed in a partially closed position, **Do Not force the handles open or closed**. The tool will open easily by pressing the ratchet release lever up. See Figure 3.

Molex Crimp Tool 0638118900 Instructions

How to Adjust Tool Preload

It may be necessary over the life of the tool to adjust tool handle preload force. Listed below are the steps required to adjust the crimping force of the hand tool to obtain proper crimp conditions:

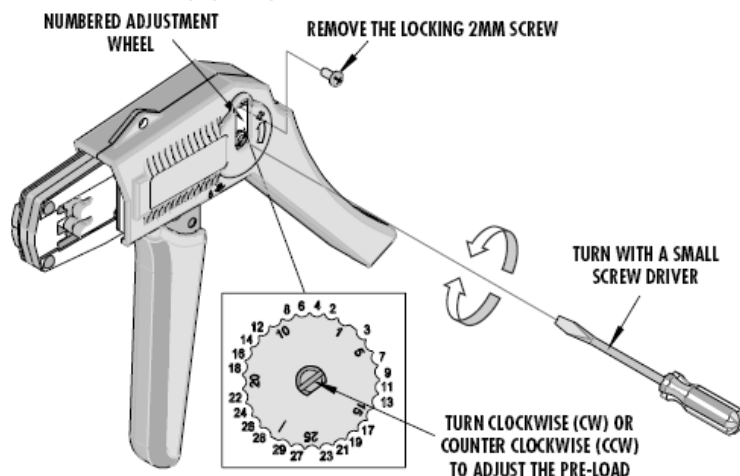


Figure 4

1. Remove the 2mm locking screw from the numbered adjusting wheel using a screw driver. See Figure 4.
2. Using the same screw driver turn the adjustment wheel to the next highest number.
Note: The uneven numbers are in clockwise (CW) direction and the even numbers are counter clockwise (CCW).
3. Example: If the preload is set at number 5, then to increase the preload, turn the adjustment wheel until the 6th position is located over the 2mm locking screw tapped hole. If it is necessary to move to the 7th position, then the adjustment wheel should be turned counter clockwise (CCW) until the 7th position is over the 2mm locking screw tapped hole.
4. Replace the 2mm locking screw, aligning the nearest notch in the setting wheel to locking screw.
5. Check the crimp specifications and conduct a pull test after tool handle preload force is adjusted. Repeat these steps until the desired result is obtained.

Warranty

This tool is for electrical terminal crimping purposes only. This tool is made of the best quality materials. All vital components are long life tested. All tools are warranted to be free of manufacturing defects for a period of 30 days. Should such a defect occur, we will repair or exchange the tool free of charge. This repair or exchange will not be applicable to altered, misused, or damaged tools. This tool is designed for hand use only. Any clamping, fixturing, or use of handle extensions voids this warranty.

CAUTION: Molex crimp specifications are valid only when used with Molex terminals and tooling.

Molex Crimp Tool 0638118900 Instructions

CAUTIONS:

1. Manually powered hand tools are intended for low volume, prototyping, or field repair. This tool is **NOT** intended for production use. Repetitive use of this tool should be avoided.
2. Insulated rubber handles are not protection against electrical shock.
3. Wear eye protection at all times.
4. Use only the Molex terminals specified for crimping with this tool.

Certification

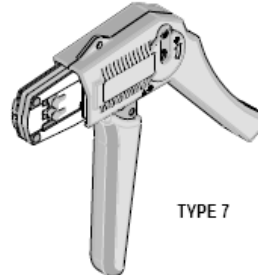
Molex does not certify or re-certify hand tools but rather supplies the following guidelines for customers to re-certify hand tools.

- This tool is qualified to pull force only. To re-certify, crimp a terminal to a wire, which has been stripped 12.7mm (1/2") long, so there is no crimping of the insulation. Pull the terminal and wire at a rate no faster than 25mm (1.00") per minute. See the Molex web site for the Quality Crimp Handbook for more information on pull testing.
- If the tool does not meet minimum pull force values, handle preload should be increased and the pull test rerun, (See How To Adjust Preload).
- When the hand tool is no longer capable of achieving minimum pull force, it should be taken out of service and replaced.

Molex Crimp Tool 0638119200 Instructions



HAND CRIMP TOOL SPECIFICATION SHEET Order No. 63811-9200



TYPE 7

FEATURES

- A full cycle ratcheting hand tool ensures complete crimps
- A precision user-friendly terminal locator wire stop holds terminals in the proper crimping position
- This tool is WHMA-IPCA620 Class 3 only with specified wire types and RoHS compliant

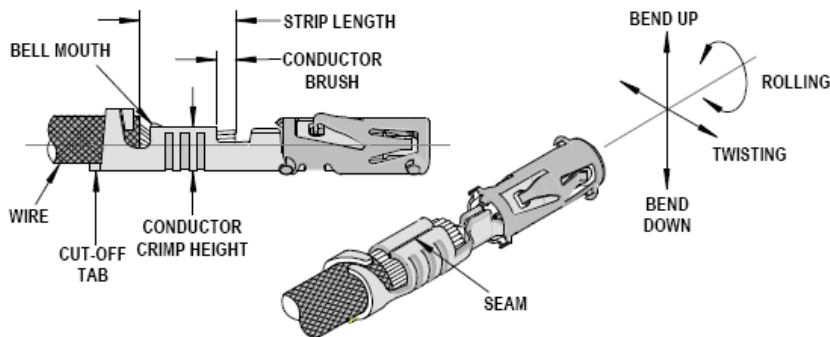
SCOPE

Products: 0.60mm (.027") CP0.6 Female Crimp Terminals for CMC connector 18-20 AWG and 0.50-0.75mm².

Terminal Series No.	Terminal Order No.		Wire Size		Insulation Diameter		Strip Length	
	*Available in Reel form only		AWG	mm ²	mm	In.	mm	In.
98913	*98913-1029 *98913-1219 *98913-1319 *98913-1359	*98913-1339	18		1.91-2.06	.075-.081	3.50	.138
		*98913-1039		0.75	1.60-1.80	.063-.071	3.50	.138
		*98913-1239		0.60	1.75-1.90	.069-.075	3.50	.138
		*98913-1339	20		1.70-1.85	.067-.073	3.50	.138
		*98913-1359		0.50	1.40-1.50	.055-.059	3.50	.138

* Follow the Cut-Off Tab specifications on the Applicator specification sheets.
 Note: Terminal will accommodate the thin wall small insulation with the TXL type American wires and the IR or ID type Metric wires.

DEFINITION OF TERMS



Molex Crimp Tool 0638119200 Instructions

CRIMP SPECIFICATION

After crimping, the conductor profiles should measure the following (see notes on page 5).

Terminal Series No.	Wire Size		Conductor Crimp Height (Ref.)		Insulation Crimp Height (Ref.)		Pull Force Minimum		Profile	
	AWG	mm ²	mm	In.	mm	In.	N	Lb.	18-20 AWG 0.6-0.75	0.50
98913	18		1.02-1.08	.040-.043	1.80-1.95	.071-.077	90.0	20.25	X	
		0.75	1.02-1.08	.040-.043	1.80-1.95	.071-.077	90.0	20.25	X	
		0.60	1.00-1.06	.039-.042	1.80-1.95	.071-.077	80.0	18.00	X	
	20		1.00-1.06	.039-.042	1.80-1.95	.071-.077	75.0	16.90	X	
		0.50	0.97-1.03	.038-.040	1.70-1.85	.067-.073	70.0	15.75		X

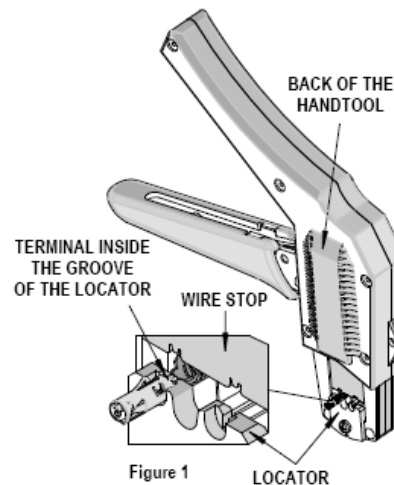
OPERATION

CAUTION: Install only Molex terminals listed above with this tool. Do not crimp hardened objects as damage can occur to the tool or die.

Open the tool by squeezing the handles together, at the end of the closing stroke, the ratchet mechanism will release the handles, and the hand tool will spring open.

Crimping Terminals

1. Select the desired terminal listed in the preceding charts.
2. Position the terminal from the back of the hand tool up and into the proper locator opening with the crimp barrels centered over the anvils. See Figure 1. Make sure when choosing the correct nest and locator opening, it will correspond with the pocket marked with the wire size profile on the hand tool.
3. Partially close the jaws of the hand tool by squeezing the handles until you hear the first click of the ratchet. This will move the wire stop into position.
4. From the front of the hand tool insert the pre-stripped wire over the terminal and against the wire stop. See Figure 2.
5. Compress the terminal by squeezing the tool handles until the ratchet mechanism cycle has been completed. Release handles to open the jaws.



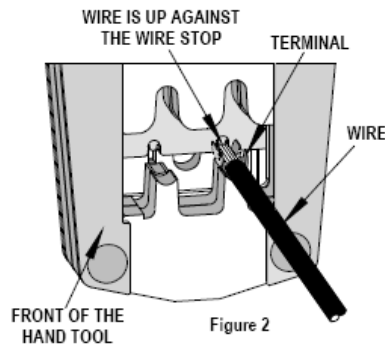
Note: The tamper proof ratchet action will not release the tool until it has been fully closed.

Molex Crimp Tool 0638119200 Instructions

6. Remove the crimped terminal from the terminal locator.
7. Visually inspect the crimped terminal for proper crimp location.

Note:

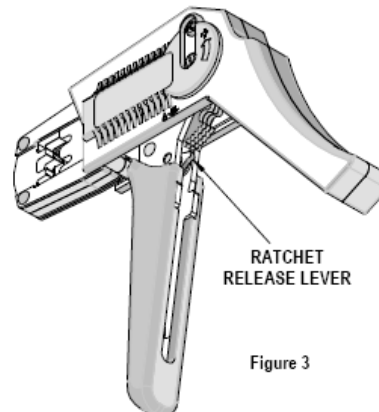
A crimp height chart is provided with this manual as Reference Only. Due to the wide range of wires, strands, insulation diameters, and durometers, actual crimp height measurements may vary slightly. An occasional, destructive, pull force test should be performed to check hand tool crimp. Pull Force value Must exceed the Minimum pull force specifications listed.



Maintenance

It is recommended that each operator of the tool be made aware of, and responsible for, the following maintenance steps:

1. Remove the plastic handles from the metal tool frame by removing the screws and remove dust, moisture, and other contaminants with a clean brush, or soft, lint free cloth.
2. Do not use any abrasive materials that could damage the tool.
3. Make certain all pins, pivot points and bearing surfaces are protected with a thin coat of high quality machine oil. Do not oil excessively. The tool was engineered for durability but like any fine piece of equipment it needs cleaning and lubrication for a maximum service life of trouble free crimping. Light oil used at the pivot points every 5,000 crimps or 3 months, will significantly enhance the tool life.
4. Wipe excess oil from hand tool, particularly from crimping area.
5. When tool is not in use, keep the handles closed to prevent objects from becoming lodged in the crimping dies, and store the tool in a clean, dry area.



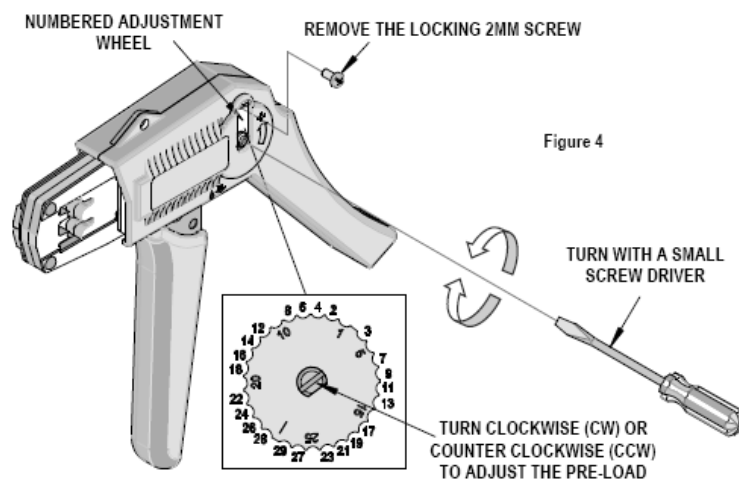
Miscrimps or Jams

Should this tool ever become stuck or jammed in a partially closed position, **Do Not** force the handles open or closed. The tool will open easily by pressing the ratchet release lever up. See Figure 3.

Molex Crimp Tool 0638119200 Instructions

How to Adjust Tool Preload

It may be necessary over the life of the tool to adjust tool handle preload force. Listed below are the steps required to adjust the crimping force of the hand tool to obtain proper crimp conditions:



1. Remove the 2mm locking screw from the numbered adjusting wheel using a screw driver. See Figure 4.
2. Using the same screw driver turn the adjustment wheel to the next highest number.
Note: The uneven numbers are in clockwise (CW) direction and the even numbers are counter clockwise (CCW).
3. Example: If the preload is set at number 5, then to increase the preload, turn the adjustment wheel until the 6th position is located over the 2mm locking screw tapped hole. If it is necessary to move to the 7th position, then the adjustment wheel should be turned counter clockwise (CCW) until the 7th position is over the 2mm locking screw tapped hole.
4. Replace the 2mm locking screw, aligning the nearest notch in the setting wheel to locking screw.
5. Check the crimp specifications and conduct a pull test after tool handle preload force is adjusted. Repeat these steps until the desired result is obtained.

Warranty

This tool is for electrical terminal crimping purposes only. This tool is made of the best quality materials. All vital components are long life tested. All tools are warranted to be free of manufacturing defects for a period of 30 days. Should such a defect occur, we will repair or exchange the tool free of charge. This repair or exchange will not be applicable to altered, misused, or damaged tools. This tool is designed for hand use only. Any clamping, fixturing, or use of handle extensions voids this warranty.

CAUTION: Molex crimp specifications are valid only when used with Molex terminals and tooling.

Molex Crimp Tool 0638119200 Instructions

CAUTIONS:

1. Manually powered hand tools are intended for low volume, prototyping, or field repair. This tool is **NOT** intended for production use. Repetitive use of this tool should be avoided.
2. Insulated rubber handles are not protection against electrical shock.
3. Wear eye protection at all times.
4. Use only the Molex terminals specified for crimping with this tool.

Certification

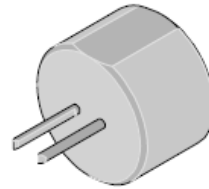
Molex does not certify or re-certify hand tools but rather supplies the following guidelines for customers to re-certify hand tools.

- % This tool is qualified to pull force only. To re-certify, crimp a terminal to a wire, which has been stripped 12.7mm (1/2") long, so there is no crimping of the insulation. Pull the terminal and wire at a rate no faster than 25mm (1.00") per minute. See the Molex web site for the Quality Crimp Handbook for more information on pull testing.
- % If the tool does not meet minimum pull force values, handle preload should be increased and the pull test rerun, (See How to Adjust Preload).
- % When the hand tool is no longer capable of achieving minimum pull force, it should be taken out of service and replaced.

Molex Removal Tool 0638132400 Instructions



Extractor Tool Instruction Sheet Order No. 63813-2400



FEATURES

- This Extractor Tool is for the removal of 98913 Series female terminals from CMC connector.

SCOPE

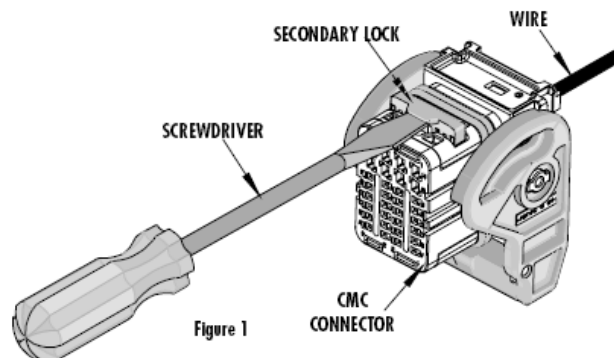
Products: 0.6mm (.02") CP Crimp Terminal for CMC connector.

Terminal Series No.	Terminal Order No.	
98913	98913-1019	98913-1229
	98913-1029	98913-1319
	98913-1219	98913-1329

OPERATION:

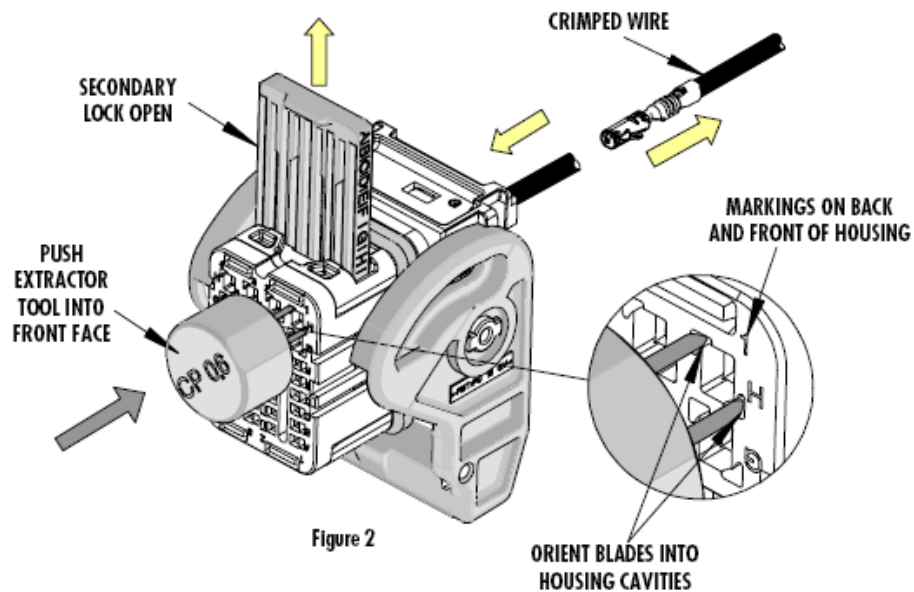
When removing a damaged crimped wire from the CMC connector follow the steps below:

1. The secondary lock on the CMC connector will need to be opened first. See Figure 1.
2. Using a screwdriver insert the flat edge under the tab of the secondary lock and pull up. Use your fingers to open the lock completely.



Molex Removal Tool 0638132400 Instructions

3. Position the blades of the extraction tool into the two small cavities of the slot in the front face of the housing as shown in Figure 2. Use the identifying markings on both the front and back of the connector to locate the opening used to extract the crimped wire.

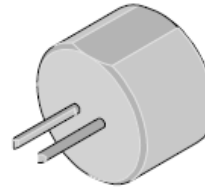


4. Push extractor tool into the desired slot until it clicks or comes to a stop. Do not force the extractor tool any further or there can be damage to the housing.
5. Gently push the wire forward towards the housing and then pull out of the CMC housing.
6. Molex does not offer repair parts for Extractor Tools due to the inexpensive nature of these tools.

Molex Removal Tool 0638132300 Instruction



Extractor Tool Instruction Sheet Order No. 63813-2300



FEATURES

- This Extractor Tool is for the removal of 98915 Series female terminals from CMC connector.

SCOPE

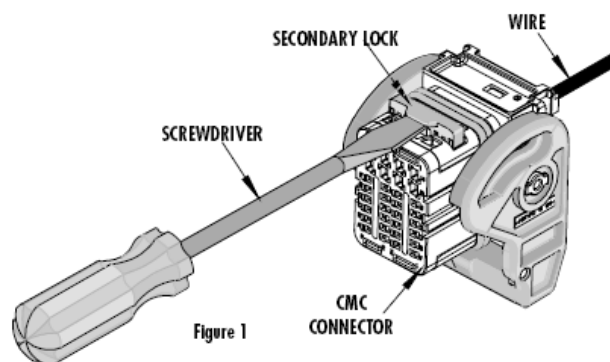
Products: 1.50mm (.059") CP Crimp Terminal for CMC connector.

Terminal Series No.	Terminal Order No.
98915	98915-1029
	98915-1039
	98915-1219
	98915-1319

OPERATION:

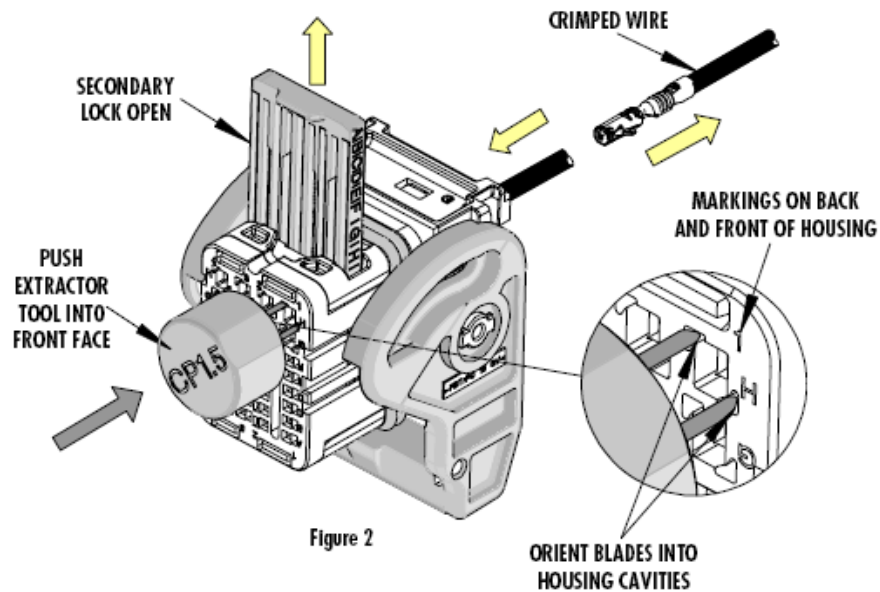
When removing a damaged crimped wire from the CMC connector follow the steps below:

1. The secondary lock on the CMC connector will need to be opened first. See Figure 1.
2. Using a screwdriver insert the flat edge under the tab of the secondary lock and pull up. Use your fingers to open the lock completely.



Molex Removal Tool 0638132300 Instruction

3. Position the blades of the extraction tool into the two small cavities of the slot in the front face of the housing as shown in Figure 2. Use the identifying markings on both the front and back of the connector to locate the opening used to extract the crimped wire.



4. Push extractor tool into the desired slot until it clicks or comes to a stop. Do not force the extractor tool any further or there can be damage to the housing.
5. Gently push the wire forward towards the housing and then pull out of the CMC housing.
6. Molex does not offer repair parts for Extractor Tools due to the inexpensive nature of these tools.

SECTION 11

RECOMMENDED SPARES

Recommended Spare Parts

Quantity	Description	Part Number
1	SECU Controller	23217185
1	0-100 psig Pressure Transducer	36920825
1	Temperature Switch 248°F/120°C	22823181
1	Temperature Switch 248°F/120°C	22823199
1	Temperature Switch 230°F/110°C	15898059
1	Pressure Switch NO 12 psi	54757935
1	Relay 12V DC SPDT	36878361
1	Relay 12V DC SPDT	23286610

SECTION 12

SOFTWARE INFORMATION

Software Updates

Software updates are available on a website for downloading. The website will always contain the latest software revisions for all applications of Doosan Portable Power products.

The website address is: WWW.iembedded.com



Doosan Infracore
Portable Power



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