*ARMY	TM 9-6115-729-24
AIR FORCE	TO 35C2-3-519-2
MARINE CORPS	TM 07464C-24/2A
NAVY	NAVAIR 19-50-27

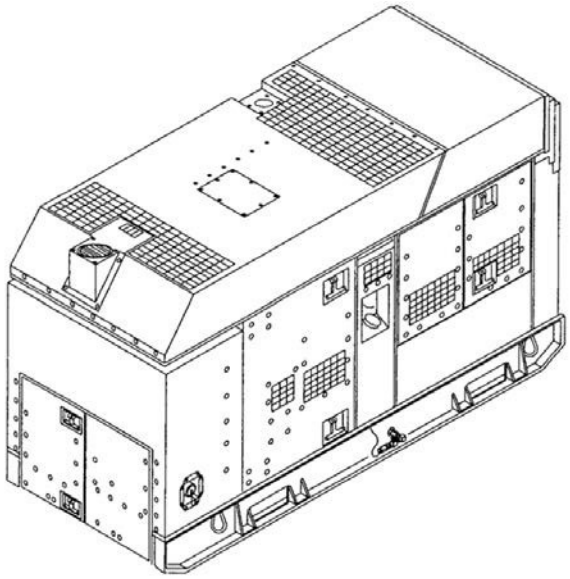
TECHNICAL MANUAL

FIELD AND SUSTAINMENT MAINTENANCE MANUAL

FOR

GENERATOR SET, SKID MOUNTED, TACTICAL QUIET 100 kW, 50/60 Hz, MEP-807A (NSN: 6115-01-296-1463) (EIC: KP1)

GENERATOR SET, SKID MOUNTED, TACTICAL QUIET 100 kW, 50/60 Hz, PU-807A (NSN: 6115-01-471-7088) (EIC: KPB)



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HEADQUARTERS, DEPARTMENTS OF THE ARMY, AIR FORCE, NAVY, AND HEADQUARTERS, U.S. MARINE CORPS

1 FEBRUARY 2012

PCN: 182 074643 00

WARNING SUMMARY

FIRST AID

For First Aid information, refer to FM 4-25.11.

5 5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING SUMMARY - Continued

WARNING AND CAUTION STATEMENTS

Warning and Caution statements have been strategically placed throughout this text prior to operating procedures, practices, or conditions considered essential to the protection of personnel (WARNING) or equipment and property (CAUTION).

A WARNING or CAUTION will apply each time the related step is repeated. Prior to starting any task the WARNINGs or CAUTIONs included in the text for that task must be reviewed and understood. Refer to the materials list at the beginning of the appropriate work package for materials used during maintenance of this equipment. This warning summary contains the WARNINGs.

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

DO NOT wear loose clothing when performing checks, services and maintenance. Failure to comply can cause injury or death to personnel.

WARNING

High voltage is produced when this generator set is in operation. Make sure unit is completely shut down and free of any power source before attempting any repair or maintenance on the unit. Failure to comply can cause injury or death to personnel.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to connect or disconnect load cables while the generator set is running. Failure to comply can cause injury or death to personnel.

WARNING

If necessary to move a generator set which has been operating in parallel with another generator set, shut down both generator sets prior to removing load cables or ground. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

Before making any connections for parallel operation or moving generator set which has been operating in parallel, ensure there is no input to the load output terminal board and the generator sets are shut down. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage power is available when the main contactor is closed. Avoid accidental contact with live components. Ensure load cables are properly connected and the load cable door is shut before closing main contactor. Ensure load is turned off before closing main contactor. Ensure that soldiers working with/on loads connected to the generator set are aware that main contactor is about to be closed before closing main contactor. Failure to observe this warning can result in severe personal injury or death by electrocution.

WARNING SUMMARY - Continued

WARNING

A qualified technician must make the power connections and perform all continuity checks. The power source may be a generator or commercial power. Failure to comply with this warning can result in injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

WARNING

Slave receptacle (NATO connector) is electrically live at all times and is unfused. The Battery Disconnect Switch does not remove power from the slave receptacle. NATO slave receptacle has 24 VDC even when Battery Disconnect Switch is set to OFF. This circuit is only dead when the batteries are fully disconnected. Disconnect the batteries before performing maintenance on the slave receptacle. Failure to comply can cause injury or death to personnel.

WARNING

Ensure power is off before performing troubleshooting procedures. Failure to comply can cause injury to personnel.

WARNING

A strong electrical shock hazard is present if the electrical power is not removed from the ECM. The electronic unit injector system uses 90 to 120 volts. Failure to comply can cause injury or death to personnel.

WARNING

Ensure that the engine cannot be started while maintenance is being performed. (ENGINE CONTROL switch set to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.) Failure to comply can cause injury or death to personnel.

WARNING

Lethal voltages up to 440 VAC are present on wiring any time the generator set is operating or paralleled with other generator sets that are operating. Be very careful when working around these wires and making measurements during troubleshooting. Failure to comply can cause serious injury or death to personnel.

WARNING

High voltages may be present at the generator terminals when the unit is rotating. Tools, equipment, clothing, and your body must be kept clear of rotating parts and electrical connections. Special precautions must be taken during troubleshooting since protective covers and safety devices may be removed or disabled to gain access and perform tests. Be extremely careful. Failure to comply can cause serious injury or death to personnel.

WARNING

Dangerously high voltage can exist across current transformer (CT) output with engine running. CT could explode if disconnected from load with engine running. Do not disconnect CT with generator rotating. Failure to comply can cause serious injury or death to personnel.

WARNING SUMMARY - Continued

WARNING

When disconnecting or removing batteries, disconnect the negative lead that connects directly to the grounding stud first: Disconnect the negative end of the interconnection cable next. When installing batteries, reverse the connection sequence. Failure to comply can cause serious injury to personnel.

WARNING

When running, generator set engine has hot metal surfaces that will burn flesh on contact. Shut down generator set, and allow engine to cool before performing checks, services, and maintenance. Wear gloves and additional protective clothing as required. Failure to comply can cause injury or death to personnel.

WARNING

The muffler blanket heat insulation material can cause skin and eye irritation and deteriorate after continued use. Avoid breathing and eye and skin contact with the insulation particles. Wear dust mask, safety goggles, gloves and long sleeve clothes when working on muffler blanket. Failure to comply can cause injury to personnel.

WARNING

Top housing panels can get very hot. Allow panels to cool down before performing maintenance. Failure to comply can cause injury or death to personnel.

WARNING

Exhaust system can get very hot. Shut down generator set, and allow system to cool before performing checks, services and maintenance. Failure to comply can cause severe burns and injury or death to personnel.

WARNING

When running, winterization heater has hot metal surfaces that will burn flesh on contact. Shut down generator set and allow heater to cool before performing maintenance. Wear gloves and additional protective clothing as required. Failure to comply can cause injury or death to personnel.

WARNING

The high pressure oil system operates at high temperature and pressure. Contact with hot oil can result in burns and scalding. Shut down generator set, and allow system to cool before performing checks, services, and maintenance. Wear heat resistant gloves and avoid contacting hot surfaces. Do not allow hot oil or components to contact skin or hands. Failure to comply can cause injury or death to personnel.

WARNING

Wear heat resistant gloves and avoid contacting hot metal surfaces with your hands after components have been heated. Wear additional protective clothing as required. Failure to comply can cause injury to personnel.

WARNING

Cooling system operates at high temperature and pressure. Contact with high pressure steam and/or liquids can result in burns and scalding. Shut down generator set, and allow system to cool before performing checks, services, and maintenance. Failure to comply can cause injury or death to personnel.

WARNING SUMMARY - Continued

WARNING

In extreme cold weather, skin can stick to metal. Avoid contacting metal items with bare skin in extreme cold weather. Failure to comply can cause injury or death to personnel.

WARNING

Operating the generator set exposes personnel to a high noise level. Hearing protection must be worn when operating or working near the generator set when the generator set is running. Failure to comply can cause hearing damage to personnel.

WARNING

Many components require a two-person lift. Lifting heavy components can cause back strain. Ensure proper lifting techniques are used when lifting heavy components. Failure to comply can cause injury to personnel.

WARNING

Each battery weighs more than 70 pounds (32 kg) and requires a two-person lift. Lifting batteries can cause back strain. Ensure proper lifting techniques are used when lifting batteries. Failure to comply can cause injury to personnel.

WARNING

Flywheel weighs more than 50 pounds (23 kg) and requires a two-person lift. Lifting flywheel can cause back strain. Ensure proper lifting techniques are used when lifting flywheel. Failure to comply can cause injury to personnel.

WARNING

The generator set, engine, and generator are extremely heavy and require an assistant and a lifting device (forklift, overhead lifting device) with sufficient capacity. Failure to comply can cause serious injury or death to personnel.

WARNING

Be extremely careful when working near the generator set as it is being positioned on the trailer. Failure to comply can cause injury to personnel.

WARNING

Support components when removing attaching hardware or component may fall. Failure to comply can cause injury to personnel and equipment damage.

WARNING

Retaining rings and springs are under tension and can act as projectiles when being removed. Use eye protection when removing retaining rings or springs. Failure to comply can cause injury to personnel.

WARNING

Oil filter base and housing springs are under tension and can act as projectiles when being removed. Use eye protection when removing springs. Failure to comply can cause injury to personnel.

WARNING

Do not use the engine starter to turn the flywheel. Failure to comply can cause injury to personnel.

WARNING SUMMARY - Continued

WARNING

Fan has sharp blades. Use caution and wear gloves when removing or installing belts. Failure to comply can cause injury to personnel.

WARNING

Batteries give off a flammable gas. Do not smoke or use open flame when performing maintenance. Failure to comply can cause injury or death to personnel and equipment damage due to flames and explosion.

WARNING

The connection of any electrical equipment and the disconnection of any electrical equipment may cause an explosion hazard which may result in injury or death. Do not connect any electrical equipment or disconnect any electrical equipment in an explosive atmosphere.

WARNING

Diesel fuel is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection are required when working in contact with diesel fuel. Avoid repeated or prolonged contact. Provide adequate ventilation. Personnel are to wash exposed skin and change chemical soaked clothing promptly if exposed to fuel. Failure to comply can cause injury or death to personnel.

WARNING

Cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection are required when working in contact with cleaning solvent. Avoid repeated or prolonged contact. Work in ventilated area only. Failure to comply can cause injury or death to personnel.

WARNING

Carbon removing compound is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection are required when working in contact with carbon removing compound. Avoid repeated or prolonged contact. Work in ventilated area only. Failure to comply can cause injury or death to personnel.

WARNING

Fuels used in the generator set are flammable. Do not smoke or use open flames when performing maintenance. Failure to comply can result in flames and possible explosion and can cause injury or death to personnel and damage to the generator set.

WARNING

Fuels used in the generator set are flammable. When filling the fuel tank, maintain metal-to-metal contact between filler nozzle and fuel tank opening to eliminate static electrical discharge. Failure to comply can result in flames and possible explosion and cause injury or death to personnel and damage to the generator set.

WARNING

Hot exhaust gases can ignite flammable materials. Allow room for safe discharge of hot gases and sparks. Failure to comply can cause injury or death to personnel.

WARNING

High pressure steam can blow particles or chemicals into eyes, can cause severe burns, and creates hazardous noise levels. Wear protective eye, skin, and hearing protection when using high pressure steam. Failure to comply can cause serious injury to personnel.

WARNING SUMMARY - Continued

WARNING

Eye protection is required when working with compressed air. Compressed air can propel particles at high velocity and injure eyes. Do not exceed 15 PSI pressure when using compressed air. Failure to comply could cause serious injury to personnel.

WARNING

Cleaning compound is toxic. Avoid prolonged breathing of vapors. Use only in a well-ventilated area. Failure to comply can cause serious injury to personnel.

WARNING

Avoid breathing fumes generated by soldering. Eye protection is required. Good general ventilation is normally adequate. Failure to comply can cause injury to personnel.

WARNING

Chemical Agent Resistant Coating (CARC) paint is a health hazard, and is irritating to eyes, skin, and respiratory system. Wear protective eyewear, mask, and gloves when applying or removing CARC paint. Failure to comply can cause injury to personnel.

WARNING

Steel strapping used in packaging of the power plant/power unit has sharp edges. Wear gloves and use care when cutting and handling steel strapping. Failure to comply with this warning can cause injury to personnel.

WARNING

Exhaust discharge contains deadly gases including carbon monoxide. DO NOT operate generator set in enclosed areas unless exhaust discharge is properly vented outside. Failure to comply with this warning can cause injury or death to personnel.

WARNING

If not shielded, hot exhaust pipe can ignite flammable wall materials. Failure to comply with this warning can cause injury or death to personnel.

WARNING

An unwrapped exhaust pipe can cause injury if touched. Failure to comply with this warning can cause injury to personnel.

LIST OF EFFECTIVE PAGES / WORK PACKAGES

NOTE: TM 9-6115-729-24 dated 1 February 2012 supersedes TM 9-6115-729-24 dated 1 October 2006, , , including all changes. Zero in the "Change No." column indicates an original page or work package.

Date of issue for the original manual is:

Original: 1 FEBRUARY 2012

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 77 AND TOTAL NUMBER OF WORK PACKAGES IS 124, CONSISTING OF THE FOLLOWING:

Page / WP No.	Change No.	Page / WP No.	Change No.
Front Cover	0	WP 0031 (2 pgs)	0
Blank	0	WP 0032 (6 pgs)	0
Warning summary (8 pgs)	0	WP 0033 (4 pgs)	0
i - xxvi	0	WP 0034 (4 pgs)	0
Chp 1 title page	0	WP 0035 (4 pgs)	0
Chp 1 Index	0	WP 0036 (2 pgs)	0
WP 0001 (10 pgs)	0	WP 0037 (4 pgs)	0
WP 0002 (12 pgs)	0	WP 0038 (4 pgs)	0
WP 0003 (32 pgs)	0	WP 0039 (10 pgs)	0
Chp 2 title page	0	WP 0040 (12 pgs)	0
Chp 2 Index	0	WP 0041 (4 pgs)	0
WP 0004 (14 pgs)	0	WP 0042 (2 pgs)	0
WP 0005 (4 pgs)	0	WP 0043 (4 pgs)	0
WP 0006 (4 pgs)	0	WP 0044 (4 pgs)	0
WP 0007 (10 pgs)	0	WP 0045 (6 pgs)	0
WP 0008 (40 pgs)	0	WP 0046 (4 pgs)	0
WP 0009 (8 pgs)	0	WP 0047 (4 pgs)	0
WP 0010 (46 pgs)	0	WP 0048 (4 pgs)	0
WP 0011 (8 pgs)	0	WP 0049 (4 pgs)	0
WP 0012 (40 pgs)	0	WP 0050 (6 pgs)	0
Chp 3 title page	0	WP 0051 (4 pgs)	0
Chp 3 Index	0	WP 0052 (4 pgs)	0
WP 0013 (6 pgs)	0	WP 0053 (8 pgs)	0
WP 0014 (4 pgs)	0	WP 0054 (4 pgs)	0
WP 0015 (10 pgs)	0	WP 0055 (8 pgs)	0
WP 0016 (4 pgs)	0	WP 0056 (4 pgs)	0
WP 0017 (4 pgs)	0	WP 0057 (4 pgs)	0
WP 0018 (4 pgs)	0	WP 0058 (6 pgs)	0
WP 0019 (4 pgs)	0	WP 0059 (4 pgs)	0
WP 0020 (4 pgs)	0	WP 0060 (6 pgs)	0
WP 0021 (4 pgs)	0	WP 0061 (4 pgs)	0
WP 0022 (4 pgs)	0	WP 0062 (4 pgs)	0
WP 0023 (4 pgs)	0	WP 0063 (4 pgs)	0
WP 0024 (4 pgs)	0	WP 0064 (8 pgs)	0
WP 0025 (4 pgs)	0	WP 0065 (6 pgs)	0
WP 0026 (4 pgs)	0	WP 0066 (6 pgs)	0
WP 0027 (2 pgs)	0	WP 0067 (4 pgs)	0
WP 0028 (6 pgs)	0	WP 0068 (2 pgs)	0
WP 0029 (4 pgs)	0	WP 0069 (4 pgs)	0
WP 0030 (4 pgs)	0	WP 0070 (6 pgs)	0

LIST OF EFFECTIVE PAGES / WORK PACKAGES - CONTINUED

Page / WP No.	Change No.
WP 0071 (4 pgs)	0
WP 0072 (4 pgs)	0
WP 0073 (2 pgs)	0
WP 0074 (4 pgs)	0
WP 0075 (4 pgs)	0
WP 0076 (4 pgs)	0
WP 0077 (4 pgs)	0
WP 0078 (4 pgs)	0
WP 0079 (4 pgs)	0
WP 0080 (4 pgs)	0
WP 0081 (4 pgs)	0
WP 0082 (4 pgs)	0
WP 0083 (4 pgs)	0
WP 0084 (2 pgs)	0
WP 0085 (4 pgs)	0
WP 0086 (4 pgs)	0
WP 0087 (4 pgs)	0
WP 0088 (2 pgs)	0
WP 0089 (4 pgs)	0
WP 0090 (8 pgs)	0
WP 0091 (4 pgs)	0
WP 0092 (24 pgs)	0
WP 0093 (2 pgs)	0
WP 0094 (4 pgs)	0
WP 0095 (2 pgs)	0
WP 0096 (48 pgs)	0
Chp 4 title page	0
Chp 4 Index	0
WP 0097 (2 pgs)	0
WP 0098 (2 pgs)	0
Chp 5 title page	0
Chp 5 Index	0
WP 0099 (2 pgs)	0
WP 0100 (4 pgs)	0
WP 0101 (2 pgs)	0
WP 0102 (6 pgs)	0
WP 0103 (6 pgs)	0
WP 0104 (6 pgs)	0
WP 0105 (2 pgs)	0
WP 0106 (6 pgs)	0
WP 0107 (4 pgs)	0
WP 0108 (6 pgs)	0
WP 0109 (4 pgs)	0
WP 0110 (4 pgs)	0
WP 0111 (4 pgs)	0
WP 0112 (4 pgs)	0
WP 0113 (4 pgs)	0
WP 0114 (2 pgs)	0
WP 0115 (4 pgs)	0
WP 0116 (4 pgs)	0
WP 0117 (6 pgs)	0
WP 0118 (4 pgs)	0
WP 0119 (4 pgs)	0
Chp 6 title page	0
Chp 6 Index	0
WP 0120 (4 pgs)	0
WP 0121 (4 pgs)	0
WP 0122 (6 pgs)	0
WP 0123 (6 pgs)	0
WP 0124 (30 pgs)	0
Glossary (2 pgs)	0
INDEX-1 - INDEX-8	0
FP-1	0
FP-2 Blank	0
FP-3	0
FP-4 Blank	0
FP-5	0
FP-6 Blank	0
FP-7	0
FP-8 Blank	0
FP-9	0
FP-10 Blank	0
FP-11	0
FP-12 Blank	0
FP-13	0
FP-14 Blank	0
FP-15	0
FP-16 Blank	0
FP-17	0
FP-18 Blank	0
FP-19	0
FP-20 Blank	0
FP-21	0
FP-22 Blank	0
FP-23	0
FP-24 Blank	0
FP-25	0
FP-26 Blank	0
FP-27	0
FP-28 Blank	0
FP-29	0
FP-30 Blank	0
Inside back cover	0
Back cover	0

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WASHINGTON, D.C., 1 FEBRUARY 2012

TECHNICAL MANUAL

FIELD AND SUSTAINMENT MAINTENANCE MANUAL

FOR

GENERATOR SET, SKID MOUNTED, TACTICAL QUIET
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GENERATOR SET, SKID MOUNTED, TACTICAL QUIET
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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(a) (A) Army - Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Communications-Electronics Command, 6001 Combat Drive, ATTN: AMSEL-LCL-ECM, Aberdeen Proving Ground, MD 21005-1846. You may also send in your recommended changes via electronic mail or by fax. Our fax number is 443-861-5521, DSN 848-5521. Our e-mail address is MONM-AMSELLEOPUBSCHG@conus.army.mil. Our online web address for entering and submitting DA Form 2028s is http://edm.apg.army.mil/pubs/2028.html.

(b) (MC) Marine Corps - Submit notice of discrepancies or suggest changes on a NAVMC 10772. The NAVMC may be submitted using either of the following:

a. The first method of submittal does not require a Common Access Card (CAC) to access the form. Click on URL http://192.156.19.109/ar/mcefs.nsf, select the 'By Form Type' button, choose 'NAVMC' then advance several pages to 'NAVMC 10772 R 10-09'. Once the form is completed, click on the mail envelope in the PDF toolbar above the .pdf form, in the pop-up screen select " Send copy" and this will open up an email message and attach the NAVMC as a PDF file, including your information. On the "To" line add: SMB.LOG.Tech.Pubs.fct@usmc.mil and any add any additional information / instructions in the body of the email.

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(c) (N) Navy - By letter directly to Commander, Space and Naval Warfare Systems Command, ATTN: SPAWAR 8122, Washington, DC 20363-5100.

(d) (F) Air Force - By Air Force AFTO Form 22 (Technical Manual (TM) Change Recommendation and Reply) in accordance with TO 00-5-1.

A reply will be furnished to you.

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TABLE OF CONTENTS

Page No.
WP Sequence No.

How to Use This Manual
Chapter 1 - Field General Information, Equipment Description and Theory of Operation

General Information ..... WP 0001
Scope 0001-1
Maintenance Forms, Records, and Reports 0001-1
Reporting Equipment Improvement Recommendation (EIR) 0001-2
Corrosion Prevention and Control (CPC) 0001-2
Table 1. Manufacturer's Warranties for 100 kW Generator Set 0001-4
List of Abbreviations/Acronyms 0001-5
Supporting Information for Repair Parts, Special Tools, TMDE and Support Equipment 0001-9
Special Tools, TMDE, and Support Equipment 0001-9
Common Tools and Test Equipment 0001-9

Equipment Description and Data ..... WP 0002
Location and Description of Major Components 0002-1
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 1 of 6). 0002-2
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 2 of 6). 0002-3
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 3 of 6). 0002-4
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 4 of 6). 0002-5
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 5 of 6). 0002-6
Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 6 of 6). 0002-7
Equipment Data 0002-9
Table 1. 100 kW TQG Equipment Data. 0002-9

Theory of Operation ..... WP 0003
Engine Overview 0003-1
Engine Control Module 0003-1
Electronic Components 0003-1
Engine Sensors 0003-1
Boost Pressure 0003-1
Oil Pressure 0003-1
Coolant Level Sensor 0003-2
Primary and Backup Engine Speed/timing Sensors 0003-2
Fuel Pressure Sensor 0003-2
Inlet Air Manifold Temperature Sensor 0003-2
Coolant Temperature Sensor 0003-2
Speed Input 0003-2
Engine Starting System 0003-3
Figure 1. Engine Starting System 0003-3
Fuel System 0003-4
Figure 2. Fuel System 0003-4
Auxiliary Fuel System 0003-5
Hydraulic Electronic Unit Injector (HEUI) Fuel System 0003-5
Figure 3. Hydraulic Electronic Unit Injector System 0003-6
Electronic Control Module (ECM) 0003-6

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Hydraulic Pump 0003-6
Injection Actuation Pressure (IAP) Control Valve 0003-7
Fuel Transfer Pump 0003-7
Injection Actuation Pressure (IAP) Sensor 0003-7
HEUI Fuel System Operation 0003-7
Low Pressure Fuel System 0003-7
Injection Actuation System 0003-7
Lubrication System 0003-8
Oil Distribution 0003-8
Injection Pump 0003-9
Figure 4. Lubrication System 0003-9
High and Low Pressure Systems 0003-10
Engine Cooling System 0003-10
Figure 5. Engine Cooling System 0003-11
Air Inlet and Exhaust System 0003-12
Figure 6. Air Inlet and Exhaust System 0003-12
Turbocharger 0003-13
Inlet Air Preheater 0003-13
AC Power Output 0003-14
Figure 7. AC Power Output 0003-15
DC Power Distribution (Figure FO-1, Sheets 2 and 3) 0003-15
Figure 8. DC Power Distribution 0003-16
Batteries 0003-16
Emergency Stop Push Button 0003-17
Field Flash Relay 0003-17
Electronic Governor Relay (EGR) Communications Data Links, MPU, CTR, and GFR 0003-17
Engine Control Switch (ECS) 0003-17
Power to ECM, DVR, OL/SC, Fuel Gauge, Panel Lights, Winterization Kit 0003-17
Coolant Low Sensor Interface 0003-18
Load Sharing Module (LSM) A4 0003-18
Alarm Module A2 0003-18
Dead Bus Hi/lo Inputs 0003-18
BATTLE SHORT Switch (BSS) Input to ECM 0003-18
Auxiliary Fuel Pump Circuit 0003-19
SYNC MODE Switch (SMS) 0003-19
Load Contactor K1, K1 Relay (KR), and Contactor Control Switch (CCS), Also Known As AC CIRCUIT INTERRUPTER 0003-19
AC Power Distribution (Figure FO-1, Sheets 4 And 5) 0003-20
Generator G1 0003-20
Digital Voltage Regulator (DVR) A3 0003-20
Load Sharing Module (LSM) A4 0003-21
Ground Fault Circuit Interrupter (GFCI) 0003-21
GSC Voltage and Current Monitoring 0003-21
Dead Bus Low (DBLO) and Dead Bus High (DBHI) Monitoring 0003-21

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Overload and Short Circuit (OL/SC) Module 0003-21
Electronic Modular Control Panel (EMCP) 0003-21
Generator Set Control (GSC) 0003-22
GSC Inputs 0003-22
Figure 9. Generator Set Control. 0003-23
GSC Outputs 0003-23
GSC Displays 0003-24
Table 1. GSC Display Relay Identification 0003-24
Digital Voltage Regulator (DVR A3) Module Operation 0003-25
Figure 10. Digital Voltage Regulator 0003-25
Touch Pad and Digital Display 0003-25
Central Processing Unit (CPU) 0003-25
Voltage and Current Monitoring Circuits and Field Drive Circuits 0003-26
Startup Profile 0003-26
Figure 11. DVR Startup Profile 0003-26
Loading and Stopping Profile 0003-26
Figure 12. DVR Loading and Stopping Profile 0003-27
Voltage Droop When Connected In Parallel 0003-27
Load Sharing Module (LSM A4) Internal Operation 0003-27
Load Power Monitoring 0003-28
Load Comparator Circuit 0003-28
Sync Dynamics Summer 0003-28
Speed Trim Summer 0003-28
Pulse Width Modulation (PWM) Output 0003-28
Relay A4K1 0003-29
Generator 0003-29
Figure 13. Generator 0003-30
Winterization Kit (Figure FO-1, Sheet 6) 0003-30
Figure 14. Winterization Kit 0003-31

Chapter 2 - Field Troubleshooting Procedures

Troubleshooting Index ..... WP 0004
Malfunction/symptom Index 0004-1
Figure 1. Generator Set Control (GSC) Displays and Dedicated Alarm Indicators 0004-3

Troubleshooting Procedures for GSC Alarm Indicators and Fault Code ..... WP 0005
Troubleshooting Using Dedicated Shutdown Indicators 0005-1

Troubleshooting Procedures for SP Fault Code ..... WP 0006

Troubleshooting Procedures for AL Fault Code ..... WP 0007

Troubleshooting Procedures for GSC Fault Code ..... WP 0008

Troubleshooting Procedures for DVR Fault Code ..... WP 0009

Troubleshooting Procedures for Failures Without a Fault Code ..... WP 0010
Figure 1. IAP Control Valve Location 0010-2
Figure 2. SMMS Relay Location 0010-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Electronic Technician (ET) Troubleshooting Software Installation ..... WP 0011
Troubleshooting Using Maintenance Support Device (MSD) and Electronic Technician (ET) Tool 0011-2
Figure 1. Connecting Caterpillar Communication Adapter 0011-2
Loading Electronic Technician (ET) Software 0011-3
Using Electronic Technician (ET) Software 0011-3
Figure 2. Caterpillar ET Opening Screen 0011-4
Table 1. Caterpillar ET Tool Navigation Icons. 0011-4
Figure 3. Caterpillar Electronic Technician (Cat ET) Diagnostic Tests. (Sheet 1 of 2). 0011-6
Figure 3. Caterpillar Electronic Technician (Cat ET) Diagnostic Tests. (Sheet 2 of 2). 0011-7

Troubleshooting Procedures Using Electronic Technician (ET) ..... WP 0012
Electronic Technician (ET) Troubleshooting. 0012-2
Figure 1. Air Inlet Heater Relay Circuit 0012-2
Figure 2. Air Inlet Heater Relay 0012-3
Figure 3. 24 VDC Electrical Circuits 0012-10
Table 1. ECM Supply Voltage Test Points. 0012-12
Table 2. Battery Voltage Input to ECM Test Points. 0012-12
Figure 4. Engine Timing Circuit 0012-13
Figure 5. Timing Sensor Troubleshooting 0012-14
Figure 6. Location of Components for Injection Actuation Pressure Tests 0012-16
Table 3. Injection Actuation Pressure Test Results. 0012-17
Table 4. Injection Actuation Pressure Output Results. 0012-18
Table 5. Injection Actuation Pressure Test at Low Idle and Operating RPM. 0012-19
Figure 7. Injection Actuation Pressure Control Valve Circuit 0012-22
Figure 8. Injection Actuation Pressure Sensor Circuit 0012-24
Table 6. Caterpillar Electronic Technician (Cat ET) Injection Actuation Pressure vs. Pressure Gauge Readings 0012-25
Table 7. Injector Harness Injector Solenoid Terminals. 0012-29
Figure 9. Speed Control Circuits 0012-32
Table 8. Speed Control Test Voltage Measurement Points. 0012-33
Table 9. Tools Required. 0012-36
Figure 10. Timing Calibration Plugs 0012-37

Chapter 3 - Field Maintenance Instructions

Service Upon Receipt ..... WP 0013
Unpacking 0013-1
Checking Unpacked Equipment 0013-2
Figure 1. Reconnection Terminal Board Voltage Setting 0013-5

PMCS Introduction ..... WP 0014
General 0014-1
Fluid Leakage 0014-1
Leakage Definitions 0014-1
Inspection 0014-1
PMCS Column Descriptions 0014-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

PMCS, Including Lubrication Instructions ..... WP 0015
Table 1. Field Preventive Maintenance Checks and Services. 0015-1
Table 2. PMCS Mandatory Replacement Parts List. 0015-7
Lubrication Instructions 0015-7
Table 3. Engine Oil. 0015-8
Table 4. Engine Coolant. 0015-8
Table 5. Fuel. 0015-9
Table 6. Lubrication Requirements. 0015-9

General Maintenance Instructions: Work Safety, Cleaning, Inspection, Tagging Instructions, Repair ..... WP 0016
Scope 0016-1
Work Safety 0016-1
Cleaning 0016-1
Inspection 0016-2
Tagging Instructions 0016-3
Repair 0016-3

Right Battery Access Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0017
Removal 0017-1
Disassembly 0017-1
Figure 1. Right Battery Access Door Assembly 0017-2
Assembly 0017-3
Installation 0017-3

Left Battery Access Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0018
Removal 0018-1
Disassembly 0018-1
Figure 1. Left Battery Access Door Assembly 0018-2
Assembly 0018-2
Installation 0018-3

Control Box Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0019
Removal 0019-1
Disassembly 0019-1
Assembly 0019-1
Figure 1. Control Box Door Assembly 0019-2
Installation 0019-3

Left Front Door Assembly (Latch): Removal, Disassembly, Assembly, Installation ..... WP 0020
Removal 0020-1
Disassembly 0020-1
Figure 1. Left Front Door Assembly (Latch) 0020-2
Assembly 0020-3
Installation 0020-3

Left Rear Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0021
Removal 0021-1

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Disassembly 0021-1
Figure 1. Left Rear Door Assembly 0021-2
Assembly 0021-2
Installation 0021-3

Left Rear Door Assembly (Latch): Removal, Disassembly, Assembly, Installation ..... WP 0022
Removal 0022-1
Disassembly 0022-1
Figure 1. Left Rear Door Assembly (Latch) 0022-2
Assembly 0022-2
Installation 0022-3

Load Board Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0023
Removal 0023-1
Disassembly 0023-1
Figure 1. Load Board Door Assembly 0023-2
Assembly 0023-3
Installation 0023-3

Right Front Door Assembly (Latch): Removal, Disassembly, Assembly, Installation ..... WP 0024
Removal 0024-1
Disassembly 0024-1
Figure 1. Right Front Door Assembly (Latch) 0024-2
Assembly 0024-3
Installation 0024-3

Right Rear Door Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0025
Removal 0025-1
Disassembly 0025-1
Figure 1. Right Rear Door Assembly 0025-2
Assembly 0025-2
Installation 0025-3

Right Rear Door Assembly (Latch): Removal, Disassembly, Assembly, Installation ..... WP 0026
Removal 0026-1
Disassembly 0026-1
Figure 1. Right Rear Door Assembly (Latch) 0026-2
Assembly 0026-3
Installation 0026-3

Access Covers: Removal, Disassembly, Assembly, Installation ..... WP 0027
Removal 0027-1
Disassembly 0027-1
Assembly 0027-2
Installation 0027-2
Figure 1. Access Covers 0027-2

Front Roof Section Housing Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0028
Removal 0028-1

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Disassembly 0028-2
Figure 1. Front Roof Section Housing Assembly (Sheet 1 of 2). 0028-3
Figure 1. Front Roof Section Housing Assembly (Sheet 2 of 2). 0028-4
Assembly 0028-4
Installation 0028-5

Rear Roof Section Housing Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0029
Removal 0029-1
Figure 1. Rear Roof Section Housing Assembly (Sheet 1 of 2). 0029-2
Figure 1. Rear Roof Section Housing Assembly (Sheet 2 of 2). 0029-3
Disassembly 0029-4
Assembly 0029-4
Installation 0029-4

Engine Generator Compartment Ceiling Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0030
Removal 0030-2
Disassembly 0030-2
Assembly 0030-2
Figure 1. Engine Generator Compartment Ceiling Assembly 0030-3
Installation 0030-4

Generator Access Cover Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0031
Removal 0031-1
Disassembly 0031-1
Assembly 0031-1
Installation 0031-2
Figure 1. Generator Access Cover Assembly 0031-2

Front Section Housing Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0032
Removal 0032-2
Figure 1. Front Section Housing Assembly (Sheet 1 of 2). 0032-2
Figure 1. Front Section Housing Assembly (Sheet 2 of 2). 0032-3
Disassembly 0032-4
Assembly 0032-4
Installation 0032-4

Rear Section Housing Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0033
Removal 0033-1
Figure 1. Rear Section Housing Assembly 0033-2
Disassembly 0033-3
Assembly 0033-3
Installation 0033-3

Left Center Panel Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0034
Removal 0034-1
Removal 0034-2
Installation 0034-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 1. Left Center Panel Assembly 0034-3
Disassembly 0034-4
Assembly 0034-4
Installation 0034-4

Right Center Panel Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0035
Removal 0035-1
Disassembly 0035-1
Figure 1. Right Center Panel Assembly 0035-2
Assembly 0035-2
Installation 0035-3

Right Rear Panel Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0036
Removal 0036-1
Disassembly 0036-1
Assembly 0036-1
Installation 0036-2
Figure 1. Right Rear Panel Assembly 0036-2

Left Rear Panel Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0037
Removal 0037-1
Figure 1. Left Rear Panel Assembly 0037-2
Disassembly 0037-2
Assembly 0037-2
Installation 0037-3

Door Support Assembly: Removal, Installation ..... WP 0038
Removal 0038-1
Figure 1. Door Support Assembly 0038-2
Installation 0038-2

Control Box Panel Assembly: Removal, Disassembly, Testing, Installation ..... WP 0039
Table 1. WP 0039 Guide. 0039-2
Removal 0039-2
Figure 1. Control Box Panel Assembly (Sheet 1 of 4). 0039-3
Figure 1. Control Box Panel Assembly (Sheet 2 of 4). 0039-4
Figure 1. Control Box Panel Assembly (Sheet 3 of 4). 0039-5
Figure 1. Control Box Panel Assembly (Sheet 4 of 4). 0039-6
Disassembly 0039-6
Testing 0039-8
Assembly 0039-8
Installation 0039-9

Control Box Assembly: Removal, Disassembly, Assembly, Installation, Adjustment ..... WP 0040
Table 1. WP 0040 Guide. 0040-2
Removal 0040-2
Figure 1. Control Box 0040-3
Disassembly 0040-4

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 2. Control Box Assembly (Sheet 1 of 5). 0040-5
Figure 2. Control Box Assembly (Sheet 2 of 5). 0040-6
Figure 2. Control Box Assembly (Sheet 3 of 5). 0040-7
Figure 2. Control Box Assembly (Sheet 4 of 5). 0040-8
Figure 2. Control Box Assembly (Sheet 5 of 5). 0040-9
Assembly 0040-10
Installation 0040-12
LSM A4 Load Gain Adjustment 0040-12

Resistor Assembly A7: Disassembly, Testing, Assembly .... WP 0041
Disassembly 0041-1
Figure 1. Resistor Assembly A7 0041-2
Testing 0041-2
Assembly 0041-2

Control Box Harness Assembly: Removal, Repair, Installation .... WP 0042
Removal 0042-1
Repair 0042-2
Installation 0042-2

Reconnection Terminal Board Assembly: Disassembly, Assembly .... WP 0043
Disassembly 0043-1
Figure 1. Reconnection Terminal Board Assembly 0043-2
Assembly 0043-3

Load Terminal Board Assembly: Disassembly, Assembly .... WP 0044
Disassembly 0044-1
Figure 1. Load Terminal Board Assembly 0044-2
Assembly 0044-3

Battery Cable Assemblies: Removal, Installation .... WP 0045
Removal 0045-2
Figure 1. Battery Cable Assemblies (Sheet 1 of 2). 0045-3
Figure 1. Battery Cable Assemblies (Sheet 2 of 2). 0045-4
Installation 0045-4

Power Cable Assemblies: Removal, Installation .... WP 0046
Removal 0046-1
Figure 1. Power Cable Assemblies 0046-2
Installation 0046-3

Main Load Contactor K1: Removal, Installation .... WP 0047
Removal 0047-1
Figure 1. Main Load Contactor K1 0047-2
Installation 0047-2

Batteries: Removal, Testing and Charging, Installation .... WP 0048
Removal 0048-2
Testing and Charging 0048-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 1. Batteries 0048-3
Installation 0048-3

Battery Disconnect Switch: Removal ..... WP 0049
Removal 0049-2
Figure 1. Battery Disconnect Switch 0049-3
Installation 0049-3

Current Transformer: Removal, Testing, Installation ..... WP 0050
Removal 0050-1
Testing 0050-2
Installation 0050-2
Figure 1. Current Transformer (Sheet 1 of 2). 0050-3
Figure 1. Current Transformer (Sheet 2 of 2). 0050-4

Potential Transformer: Removal, Installation ..... WP 0051
Removal 0051-1
Installation 0051-2
Figure 1. Potential Transformer 0051-3

Slave Receptacle: Removal, Installation ..... WP 0052
Removal 0052-2
Installation 0052-2
Figure 1. Slave Receptacle 0052-3

Electrical Installation: Removal, Installation ..... WP 0053
Removal 0053-2
Table 1. WP 0053 Guide. 0053-2
Figure 1. Electrical Installation (Sheet 1 of 3). 0053-3
Figure 1. Electrical Installation (Sheet 2 of 3). 0053-4
Figure 1. Electrical Installation (Sheet 3 of 3). 0053-5
Installation 0053-6

Fuel Level Switch Assembly: Removal, Installation ..... WP 0054
Removal 0054-2
Installation 0054-2
Figure 1. Fuel Level Switch Assembly 0054-3

Fuel Hoses: Removal, Installation ..... WP 0055
Removal 0055-2
Figure 1. Fuel Hoses (Sheet 1 of 3). 0055-3
Figure 1. Fuel Hoses (Sheet 2 of 3). 0055-4
Figure 1. Fuel Hoses (Sheet 3 of 3). 0055-5
Installation 0055-6

Fuel Pickup Tube Assembly: Removal, Installation ..... WP 0056
Removal 0056-2
Installation 0056-2
Figure 1. Fuel Pickup Tube Assembly 0056-3

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Auxiliary Fuel Pump Assembly and Solenoid Valve: Servicing, Removal, Installation ..... WP 0057
SERVICING (Part No. 0116-1320 Only) 0057-2
SERVICING (Part No. 0116-1333-01 Only) 0057-2
Removal 0057-2
Figure 1. Main Fuel Pump and Auxiliary Fuel Pump Assembly with Solenoid Valve. 0057-3
Installation 0057-4

Fuel Cooler: Removal, Installation ..... WP 0058
Removal 0058-2
Figure 1. Fuel Cooler (Sheet 1 of 2). 0058-3
Figure 1. Fuel Cooler (Sheet 2 of 2). 0058-4
Installation 0058-4

Water Separator Filter and Bracket: Draining, Replacement, Removal, Installation ..... WP 0059
Draining 0059-2
Filter Element Replacement 0059-2
Figure 1. Water Separator Filter and Bracket 0059-3
Water Separator Filter Element Removal 0059-3
Water Separator Filter Installation 0059-4

Fuel Level Sender: Removal, Test and Inspection, Installation ..... WP 0060
Removal 0060-2
Test and Inspection 0060-2
Figure 1. Fuel Level Sender (Sheet 1 of 2). 0060-3
Figure 1. Fuel Level Sender (Sheet 2 of 2). 0060-4
Installation 0060-4

Fuel Tank: Removal, Repair, Installation ..... WP 0061
Removal 0061-2
Repair 0061-2
Installation 0061-2
Figure 1. Fuel Tank Maintenance 0061-3

Coolant Recovery System: Removal, Installation ..... WP 0062
Removal 0062-2
Installation 0062-2
Figure 1. Coolant Recovery System 0062-3

Surge Tank: Removal, Installation ..... WP 0063
Removal 0063-2
Installation 0063-2
Figure 1. Surge Tank 0063-3

Fan and Fan Guards: Removal, Installation ..... WP 0064
Removal 0064-2
Table 1. WP 0064 Guide. 0064-2
Figure 1. Fan and Fan Guards (Sheet 1 of 3). 0064-3
Figure 1. Fan and Fan Guards (Sheet 2 of 3). 0064-4

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 1. Fan and Fan Guards (Sheet 3 of 3). 0064-5
Installation 0064-6

Coolant Hose Assemblies: Removal, Installation .... WP 0065
Removal 0065-2
Figure 1. Coolant Hose Assemblies (Sheet 1 of 2). 0065-3
Figure 1. Coolant Hose Assemblies (Sheet 2 of 2). 0065-4
Installation 0065-5

Radiator Assembly: Removal, Repair, Installation, Flushing .... WP 0066
Removal 0066-2
Figure 1. Radiator Assembly (Sheet 1 of 2). 0066-3
Figure 1. Radiator Assembly (Sheet 2 of 2). 0066-4
Repair 0066-5
Installation 0066-5
Flushing 0066-6
Cleaning 0066-6

Exhaust System: Removal, Installation .... WP 0067
Removal 0067-2
Figure 1. Exhaust System 0067-2
Installation 0067-3

Crankcase Ventilation Filter: Removal, Installation .... WP 0068
Removal 0068-2
Installation 0068-2
Figure 1. Crankcase Ventilation Filter 0068-2

Air Cleaner Filter: Removal, Inspect, Cleaning, Installation .... WP 0069
Removal 0069-2
Inspect 0069-2
Cleaning 0069-2
Figure 1. Air Cleaner Filter 0069-3
Installation 0069-3

Air Cleaner System: Removal, Installation .... WP 0070
Removal 0070-2
Figure 1. Air Cleaner System (Sheet 1 of 2). 0070-3
Figure 1. Air Cleaner System (Sheet 2 of 2). 0070-4
Installation 0070-4

Alternator: Removal, Installation .... WP 0071
Removal 0071-2
Installation 0071-2
Figure 1. Alternator 0071-3

Belt: Removal, Installation .... WP 0072
Removal 0072-2
Installation 0072-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 1. Belt 0072-3

Starter: Removal, Installation ..... WP 0073
Removal 0073-1
Installation 0073-2
Figure 1. Starter 0073-2

Tensioner: Removal, Installation ..... WP 0074
Removal 0074-2
Installation 0074-2
Figure 1. Tensioner 0074-3

Fan Pulley: Removal, Installation ..... WP 0075
Removal 0075-1
Figure 1. Fan Pulley 0075-2
Installation 0075-3

Water Pump: Removal, Installation ..... WP 0076
Removal 0076-2
Installation 0076-2
Figure 1. Water Pump 0076-3

Fuel Priming Pump: Removal, Installation ..... WP 0077
Removal 0077-2
Installation 0077-2
Figure 1. Fuel Priming Pump 0077-3

Fuel Filter: Removal, Installation ..... WP 0078
Removal 0078-2
Installation 0078-2
Figure 1. Fuel Filter 0078-3

Fuel Filter Base: Removal, Installation ..... WP 0079
Removal 0079-1
Figure 1. Fuel Filter Base 0079-2
Installation 0079-3

Oil Filter Maintenance and Oil Change: Removal, Installation, Oil Sampling ..... WP 0080
Removal 0080-2
Installation 0080-2
Figure 1. Oil Filter Maintenance and Oil Change 0080-3
Oil Sampling 0080-4

Thermostat: Removal, Installation ..... WP 0081
Removal 0081-2
Installation 0081-2
Figure 1. Thermostat 0081-3

Thermostat Housing: Removal, Disassembly, Assembly, Installation ..... WP 0082
Removal 0082-1
Disassembly 0082-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Assembly 0082-2
Installation 0082-2
Figure 1. Thermostat Housing. 0082-3

Engine Control Module: Removal, Installation ..... WP 0083
Removal 0083-2
Installation 0083-2
Figure 1. Engine Control Module 0083-3

Flywheel Housing: Removal, Installation ..... WP 0084
Removal 0084-1
Installation 0084-2
Figure 1. Flywheel Housing 0084-2

Front Cover: Removal, Installation ..... WP 0085
Removal 0085-2
Installation 0085-2
Figure 1. Front Cover 0085-3

Engine Oil Filter Base and Oil Cooler: Removal, Installation ..... WP 0086
Removal 0086-2
Installation 0086-2
Figure 1. Engine Oil Filter Base and Oil Cooler 0086-3

Engine Oil Pan: Removal, Installation ..... WP 0087
Removal 0087-2
Installation 0087-2
Figure 1. Engine Oil Pan 0087-3

Engine Oil Pump: Removal, Installation ..... WP 0088
Removal 0088-1
Installation 0088-1
Figure 1. Engine Oil Pump 0088-2

Unit Injector: Removal, Installation ..... WP 0089
Removal 0089-1
Installation 0089-2
Figure 1. Unit Injector 0089-3

Rocker Shaft and Pushrods: Removal, Disassembly, Assembly, Installation, Valve Lash Check, Valve Lash Adjustment ..... WP 0090
Removal 0090-1
Figure 1. Rocker Shaft and Pushrods Removal and Installation 0090-2
Disassembly 0090-3
Assembly 0090-3
Installation 0090-3
Valve Lash Check 0090-3
Figure 2. Valve Clearance Measurements. 0090-4
Table 1. Crankshaft Positions for Valve Lash Setting. 0090-5
Table 2. Check for Valve Lash. 0090-5

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Valve Lash Adjustment....0090-5
Figure 3. Valve Lash Adjustment....0090-6
Table 3. Valve Lash Settings....0090-6

Cylinder Head and Gasket: Removal, Cleaning, Installation .... WP 0091
Removal 0091-1
Figure 1. Cylinder Head and Gasket 0091-2
Cleaning and Inspection 0091-3
Installation 0091-3

Reprogramming: Reprogramming DVR, Reprogramming GSC .... WP 0092
Reprogramming DVR Parameters for Voltage and Frequency Change....0092-1
Table 1. 100 kW TQG DVR Voltage and Frequency Programming Parameters and Setpoints....0092-1
Reprogramming or Verifying DVR Parameters 0092-2
Table 2. 100 kW TQG DVR Programming Parameters....0092-2
Reprogramming GSC Setpoints for Voltage and Frequency Change 0092-4
Table 3. 100 kW TQG GSC Programming Setpoints. 0092-5
Reprogramming or Verifying GSC Setpoints....0092-6
Table 4. 100 kW OP5-0 Engine/Generator Setpoint Programming. 0092-7
Table 5. OP5-1 Protective Relaying Setpoint Programming. 0092-13
Table 6. OP5-3 Synchronization Setpoint Programming. 0092-18
Table 7. OP6 Spare Input/Output Setpoint Programming. 0092-20
Table 8. OP8 Voltmeter Ammeter Programming. 0092-23

Installation of Generator Set On Trailer: Installation .... WP 0093
Installation 0093-1
Figure 1. Installation of Generator Set On Trailer....0093-2

Preparation for Storage or Shipment .... WP 0094
Short Term Storage 0094-2
Long Term Storage....0094-2
Figure 1. Preparation for Storage or Shipment....0094-3

Torque Limits .... WP 0095
Table 1. Torque Limits....0095-1

Wiring Diagrams .... WP 0096
Figure 1. Engine Sensors (Sheet 1 of 2). 0096-5
Figure 1. Engine Sensors (Sheet 2 of 2). 0096-6
Figure 2. Engine Sensors (Sheet 1 of 3). 0096-7
Figure 2. Engine Sensors (Sheet 2 of 3). 0096-8
Figure 2. Engine Sensors (Sheet 3 of 3). 0096-9
Table 1. Control Panel Wire List. 0096-11
Table 2. Generator Set Harness (Generator, Engine, Control Panel) Wire List. 0096-25
Table 3. ECM to EMCP Harness Wire List. 0096-34
Table 4. Engine Harness Wire List. 0096-39
Table 5. Engine Harness to Unit Injectors Wire List. 0096-43
Table 6. Winterization Control Panel Wire List. 0096-45

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Table 7. Winterization Kit Heater Cable Wire List. 0096-47
Chapter 4 - Sustainment Troubleshooting Procedures
Troubleshooting Index .... WP 0097
Troubleshooting Procedures .... WP 0098
Chapter 5 - Sustainment Maintenance Instructions
Service Upon Receipt .... WP 0099
PMCS Introduction .... WP 0100
General 0100-1
Fluid Leakage 0100-1
Leak Definition for Pmcs 0100-1
Inspection 0100-1
PMCS Column Descriptions 0100-3
PMCS, Including Lubrication Instructions .... WP 0101
Table 1. Sustainment Preventive Maintenance Checks and Services. 0101-1
Generator Maintenance: Disassembly, Cleaning, Assembly .... WP 0102
Disassembly 0102-2
Figure 1. Generator Repair 0102-3
Cleaning 0102-4
Assembly 0102-4
Generator Replacement: Removal, Installation .... WP 0103
Removal 0103-2
Figure 1. Generator Replacement (Sheet 1 of 2). 0103-3
Figure 1. Generator Replacement (Sheet 2 of 2). 0103-4
Installation 0103-5
Engine Replacement: Removal, Installation .... WP 0104
Removal 0104-2
Figure 1. Engine Replacement 0104-3
Installation 0104-4
Engine/Generator Base Assembly: Repair or Replacement .... WP 0105
Repair or Replacement 0105-2
Engine Electrical System: Removal, Installation .... WP 0106
Removal 0106-2
Table 1. WP 0106 Guide. 0106-2
Figure 1. Electrical System (Sheet 1 of 2). 0106-3
Figure 1. Electrical System (Sheet 2 of 2). 0106-4
Installation 0106-5
Valve Cover, Gasket, and Manifold: Removal, Cleaning, Installation .... WP 0107
Removal 0107-1
Figure 1. Valve Cover, Gasket, and Manifold 0107-2
Cleaning 0107-3

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Installation 0107-3

Fuel Transfer Pump/Injection Actuation Pump, and Injection Control Valve: Removal, Disassembly, Assembly, Installation ..... WP 0108
Removal 0108-1
Figure 1. Fuel Transfer Pump 0108-2
Disassembly 0108-3
Assembly 0108-3
Figure 2. Injection Actuation Pump Control Valve 0108-4
Installation 0108-4

Air Inlet Elbow, Heater, and Manifold Cover: Removal, Installation ..... WP 0109
Removal 0109-1
Installation 0109-2
Figure 1. Air Inlet Elbow, Heater, and Manifold Cover 0109-3

Crankshaft Pulley and Damper: Removal, Installation ..... WP 0110
Removal 0110-1
Figure 1. Crankshaft Pulley and Damper 0110-2
Installation 0110-3

Crankshaft Front Seal: Removal, Installation ..... WP 0111
Removal 0111-1
Installation 0111-2
Figure 1. Crankshaft Front Seal 0111-3

Turbocharger: Removal, Installation ..... WP 0112
Removal 0112-1
Installation 0112-2
Figure 1. Turbocharger 0112-3

Exhaust Manifold: Removal, Installation ..... WP 0113
Removal 0113-1
Installation 0113-2
Figure 1. Exhaust Manifold 0113-3

Flywheel: Removal, Installation ..... WP 0114
Removal 0114-1
Installation 0114-2
Figure 1. Flywheel 0114-2

Winterization Heater Control Box Assembly: Removal, Disassembly, Assembly, Installation ..... WP 0115
Removal 0115-1
Figure 1. Winterization Heater Control Box Assembly 0115-2
Disassembly 0115-3
Assembly 0115-3
Installation 0115-4

Winterization Heater Assembly: Removal, Installation ..... WP 0116
Removal 0116-2

TABLE OF CONTENTS - Continued

Page No.
WP Sequence No.

Figure 1. Winterization Heater Assembly 0116-3
Installation 0116-4

Winterization Heater Hoses: Removal, Installation ..... WP 0117
Removal 0117-2
Figure 1. Winterization Heater Hoses (Sheet 1 of 2). 0117-3
Figure 1. Winterization Heater Hoses (Sheet 2 of 2). 0117-4
Installation 0117-5

Winterization Thermostat, Resistors, and Diode: Removal, Installation ..... WP 0118
Removal 0118-2
Installation 0118-2
Figure 1. Winterization Thermostat, Resistors, and Diode 0118-3

Winterization Wiring Harnesses: Removal, Installation ..... WP 0119
Removal 0119-2
Installation 0119-2
Figure 1. Winterization Wiring Harnesses 0119-3

Chapter 6 - Supporting Information

References ..... WP 0120

MAINTENANCE ALLOCATION CHART (MAC) ..... WP 0121

Maintenance Allocation Chart (MAC) ..... WP 0122
Table 1. MAC for Tactical Quiet Generator 100 kW, 50/60 Hz MEP-807A/PU-807A. 0122-1
Table 2. Tools and Test Equipment Requirements for Tactical Quiet Generator 100 kW, 50/60 Hz MEP-807A/PU-807A. 0122-4
Table 3. Remarks for Tactical Quiet Generator 100 kW, 50/60 Hz MEP-807A/PU-807A. 0122-5

Expendable and Durable Items List ..... WP 0123
Table 1. Expendable and Durable Items List. 0123-1

Laminates ..... WP 0124

Glossary

Index

Foldout Figures

FO 1. ..... FP-1
FO 2. ..... FP-3
FO 3. ..... FP-5
FO 4. ..... FP-7
FO 5. ..... FP-9
FO 6. ..... FP-11
FO 7. ..... FP-13
FO 8. ..... FP-15
FO 9. ..... FP-17
FO 10. ..... FP-19
FO 11. ..... FP-21
FO 12. ..... FP-23
FO 13. ..... FP-25
FO 14. ..... FP-27
FO 15. ..... FP-29

How to Use This Manual

This manual contains maintenance instructions for the 100 kW Tactical Quiet Generator (TQG) Skid-Mounted MEP-807A and for the TQG, Trailer-Mounted PU-807A. The skid-mounted TQG can be mounted on a 5-ton trailer, Model XM1061E1 and is designated PU-807A in that configuration. Detailed operation and maintenance for the trailer can be found in TM 9-2330-376-14&P.

This maintenance manual is part of a family of manuals which includes an Operator's Manual (TM 9-6115-729-10) and a Repair Parts and Special Tools Lists (RPSTL) Manual (TM 9-6115-729-24P).

Refer to References work package WP 0120, for a listing of other related manuals.

This manual implements the Army Maintenance Transformation and changes the Maintenance Allocation Chart (MAC) to support Field and Sustainment Maintenance under the new two-level maintenance concept.

WORK PACKAGES

This TM has been organized using the WP format. Each chapter contains a series of WPs rather than sections and paragraphs. Each WP is designed to stand alone as a complete information module; if the user keeps the work packages of this TM in a loose-leaf binder, the user will be able to remove just the WP needed to complete a specific task. Here are some WP features of which the user should be aware.

Each WP is numbered using a four-digit number beginning with WP 0001. WPs are numbered sequentially throughout the TM (ex, WP 0016, WP 0105, etc.). The Table of Contents lists each chapter and WP title as well as all figures and tables contained within each. Figures and tables are numbered sequentially for each WP.

The WP number is located at the top right of each page. It is also located at the bottom of the page with the WP page number included (0001-1 would be page 1 of the General Information WP (WP 0001, General Information)).

Each WP starts on a right-hand page. This is done so the user can remove a single WP from the paper TM if needed for a task. Blank pages are assigned a number, but it appears on the preceding or following page. For example. if page 0001-10 of a WP is blank. page 0001-9 will have the number 0001-9/10 blank; or if page 0001-1 of a WP is blank, page 0001-2 will have the number 0001-1 blank/2.

Each WP containing step-by-step maintenance or troubleshooting procedures will end with the words END OF TASK, and each WP ends with the statement END OF WORK PACKAGE. Think of each WP as a small, stand alone TM.

Typographical conventions are as follows:

[Unload] indicates a soft key or a switch.

[Previous] + [Next] indicates two simultaneous key presses. [+] [-] indicates two sequential key presses.

References to equipment Data and Description Plates are printed as they appear on the equipment whenever possible.

Warnings, Cautions and Notes Definitions

Warnings, cautions, notes, chapter titles, and paragraph headings are printed in bold type.

The following definitions apply to WARNINGS, CAUTIONS and NOTES found throughout this publication. Warning, cautions and notes provide supplemental information. Personnel must understand and apply these warnings, cautions and notes during many phases of operation and maintenance to ensure personnel safety and health and the protection of property. Portions of this information may be repeated in certain chapters of this publication for emphasis.

WARNING

A warning identifies a clear danger to the person doing that procedure.

CAUTION

A caution identifies risk of damage to the equipment.

NOTE

A note highlights essential procedures, conditions, or statements or conveys important instructional data to the user.

CHAPTER OVERVIEW

Table of Contents: The table of contents will help you understand the organization of the manual. The overall table of contents in the front of the manual directs you to the Chapters and lists all of the work packages in the manual with tables and figures identified for each work package. The chapters contain descriptive information, maintenance procedures organized by maintenance level, and supporting data. Each chapter contains its own chapter index that lists all the work packages within the chapter to help you find information. Each chapter is divided into work packages with titles that describe the information or procedure in the work package. An alphabetical index at the end of the manual can also be used to find work packages.

NOTE

The generator end of the TQG is referred to as the REAR of the TQG. The control panel is also located on the generator end (REAR) of the TQG. Figure 1 (Sheets 1-6) in WP 0002 shows where TQG components are located.

Chapter 1 - General Information, Equipment Description and Theory of Operation

Chapter 1 provides an introduction to the 100 kW Tactical Quiet Generator (TQG) Skid-Mounted MEP-807A and for the TQG, Trailer-Mounted PU-807A. It is divided into three work packages, as follows:

General Information. This work package provides general information about this manual and the related forms and records. Instructions are provided for making equipment improvement recommendations. Coverage includes a reference to the TM that contains instructions on destruction of materiel to prevent enemy use. Also, a list of abbreviations and acronyms is provided. Also, a nomenclature cross-reference list is provided as well as a list of abbreviations and acronyms.

Equipment Description and Data. This work package describes capabilities, characteristics, and features. It provides basic equipment data and shows the locations of major components. Descriptions of the major components are also provided.

Theory of Operation. This work package provides functional descriptions of the equipment.

Chapter 2 - Field Troubleshooting Procedures

Chapter 2 covers troubleshooting procedures of the 100 kW Tactical Quiet Generator (TQG) Skid-Mounted MEP-807A and for the TQG, Trailer-Mounted PU-807A to be performed by the field level maintenance. The TQG features electronic troubleshooting that allows you to diagnose problems with the engine and generator by using special indicators and code readouts displayed on the Electronic Modular Control Panel (EMCP).The chapter is divided as follows:

Field Troubleshooting Index. This work package provides a troubleshooting introduction and malfunction/symptom index to direct you to the appropriate troubleshooting procedure at the field maintenance level. Before you begin troubleshooting, read the introduction to troubleshooting WP 0004 carefully and familiarize yourself with the operation and meaning of the codes and indicators. You should also use the Operator Manual, TM 9-6115-729-10, so you know how controls and indicators work.

Field Troubleshooting Procedures. This work package covers troubleshooting procedures and corrective actions that are to be performed at the field maintenance level. WP 0004 contains an overview of the troubleshooting that tells how the Generator Set Control (GSC) indicator lights and Alarm Module lights work and describes the use of Component Identification (CID) codes and Failure Mode Identifier (FMI). It contains directions for viewing the fault log of recorded controller and engine control module (ECM) faults and engine event codes. The WP also explains the use of the Digital Voltage Regulator (DVR) failure codes and indicators.

WP 0005 contains troubleshooting procedures to be followed for dedicated GSC shutdown indicators and fault codes.

WP 0006 contains troubleshooting procedures for SP Fault Codes.

WP 0007 contains troubleshooting procedures for AL Fault Codes.

WP 0008 contains troubleshooting procedures for GSC Fault Codes based on generator set and engine monitoring electronics for identify operating problems. These procedures contain all the CID FMI fault code combinations that you will see displayed on the GSC display and directs you to the appropriate fault isolation procedure.

WP 0009 contains troubleshooting procedures DVR Fault Codes.

WP 0010 contains troubleshooting for generator set failures without fault codes.

WP 0011 tells you how to prepare the TQG for use with the Maintenance Support Device (MSD), if available, for using Caterpillar Electronics Technician (CAT ET) engine diagnostic software. A laptop or SPORT running with MS Windows 2000 or higher can also be used. The WP describes how to load all software required for proper operation of diagnostics software on your computer in a logical sequence. This includes the software for Caterpillar Communications Adapter II that you must preload on your computer before using the diagnostics software. It also includes instructions for loading the CAT ET software and other necessary instructions or documentation onto your computer.

WP 0012 contains troubleshooting procedures using the CAT ET tool for Field level troubleshooting.

Before using the MSD and the CAT ET, software for Caterpillar Communication Adapter II should also be loaded as described in WP 0011. Refer to Caterpillar ServiceTool Hardware and Software/User's Manual Communication Adapter II, Ver 1.93 (1.9-B4) and CD NEHS0758.

Chapter 3 - Field Maintenance

Chapter 3 covers maintenance procedures for the Generator Set that must be performed at field level. Its purpose is to provide you with the information that you need to keep the equipment in good operating condition. Read the INITIAL SETUP section of each maintenance work package carefully before you start any maintenance procedure. Get the tools and supplies listed and the personnel needed.The chapter is divided as follows:

Service Upon Receipt. This work package contains instructions for inspecting and servicing the equipment when it is received. It includes instructions for unpacking the equipment when it is received. The instructions also include unpacking and stowing the basic issue items that accompany the 100 kW Tactical Quiet Generator (TQG) Skid-Mounted MEP-807A and for the TQG, Trailer-Mounted PU-807A.

Field Preventive Maintenance Checks and Services (PMCS) Introduction. This work package provides a detailed explanation of each table entry in the PMCS table along with applicable warnings, cautions and notes prior to starting on the PMCS procedures.

Field Preventive Maintenance Checks and Services (PMCS) Including Lubrication Instructions. This work package contains detailed instructions that the operator must perform before, during, and after preventive maintenance checks and services. Coverage includes all field PMCS for the equipment.

Field Maintenance Procedures. These work packages refer the operator to the preventive maintenance checks and services required by WP 0015.

Preparation for Storage or Shipment. This work package provides information on short-term, intermediate-term, and long-term storage.

Torque Limits. This work package lists standard torque values for bolts and screws used in maintaining the equipment.

Wiring Diagrams. This work package details the wiring in the generator set and is useful in maintaining the equipment.

Chapter 4 - Supporting Information

The chapter is divided as follows:

References. This work package lists all publications referenced in the various chapters of the technical manual. The listing includes the title and document number of each publication.

Maintenance Allocation Chart (MAC) Introduction. This work package explains what is covered in the maintenance allocation chart.

Maintenance Allocation Chart (MAC). This work package has three sections, as follows:

Maintenance Allocation Chart (MAC). Table 1 contains a tabular listing that assigns maintenance functions to specific maintenance levels. It lists the work time needed to perform each maintenance function at the assigned level. It also contains a column that has entries keyed to the tools and equipment listed in Table 2.

Another column has entries keyed to the remarks in Table 3.

Tool and Test Equipment Requirements. Table 2 contains complete identification information for the items referenced in the tools and equipment column of Table 1.

Remarks. Table 3 provides additional information for each entry in the remarks column of Table 2.

Expendable and Durable Items List. This work package lists expendable/durable supplies and materials needed to operate and maintain your equipment. The work package contains two sections, as follows:

Introduction. This section explains the entries in Tables 1.

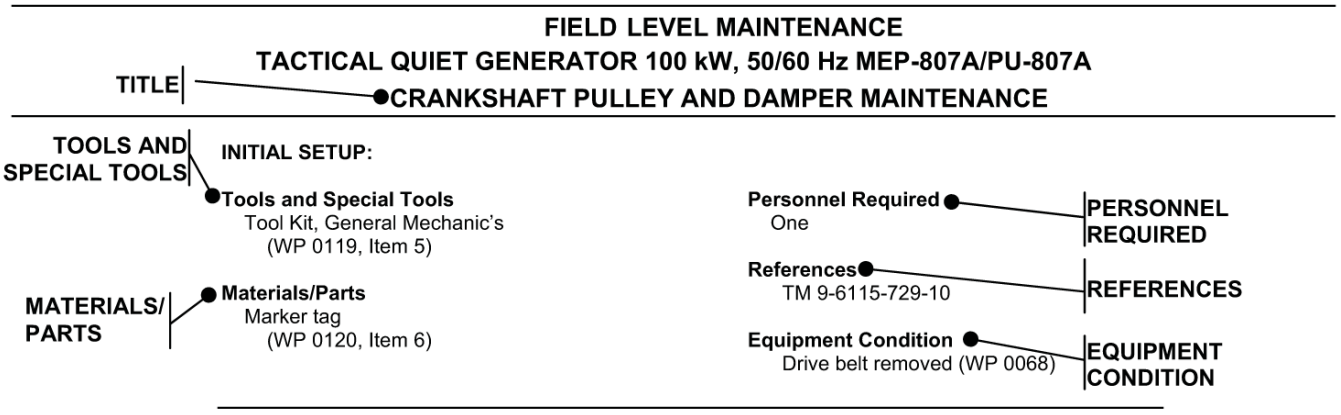
Expendable and Durable Items List. The list indicates the maintenance level that needs each item and identifies the items by National Stock Number (NSN), description, and unit of measure.

Definition of Unusual Terms. This work package lists and defines the terms used in this technical manual that are not listed in the Army Regulation (AR 310-25).

Winterization Kit Maintenance. These work packages contain Field Level Maintenance procedures for the optional winterization kit installation.

Rear Matter

Alphabetical Index and Foldouts. An alphabetical index at the back of this technical manual provides a listing of subjects covered, cross-referenced to the applicable work packages. Also included are Foldout schematics, as well as DA Form 2028s.



LEGEND:

TOOLS AND SPECIAL TOOLS	The tools and equipment needed to do the procedures.
MATERIALS/PARTS	The supplies and parts needed to do the procedures.
PERSONNEL REQUIRED	The personnel needed to do the procedures.
REFERENCES	Other work packages, manuals, and publications needed to do the procedure.
EQUIPMENT CONDITION	The special condition(s) of the equipment or maintenance procedures to be performed before starting the procedure.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special Tools; Test, Measure, and Diagnostic Equipment (TMDE); and support equipment are needed for field maintenance. They are listed in the Repair Parts and Special Tools List (RPSTL), TM 9-6115-729-24P, and in the Maintenance Allocation Chart (MAC) in WP 0122.

COMMON TOOLS AND TEST EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), Common Table of Allowances (CTA) 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), or Army Medical Department Expendable/Durable Items CTA 8-100, as applicable to your unit.

REPAIR PARTS

Repair parts are listed in the TM 9-6115-729-24P.

GENERAL SUPPORT LEVEL MAINTENANCE

These instructions have been moved to Sustainment (NMWR) in accordance with Implementation of Two Level Maintenance.

HOW TO FIX AN EQUIPMENT MALFUNCTION

Determining the Cause

Finding the cause of a malfunction, troubleshooting, is the first step in fixing your equipment and returning it to operation. Follow these simple steps to determine the root of the problem:

1. Turn to the Table of Contents in this manual.
2. Locate "Troubleshooting" under the chapter that covers your level of maintenance. Turn to the page indicated.
3. For field troubleshooting, follow the instructions in the references listed in Chapter 2.

Preparing for a Task

Be sure that you understand the entire maintenance procedure before beginning any maintenance task. Make sure that all parts, materials, and tools are handy. Read all steps before beginning.

Prepare to do the task as follows:

1. Carefully read the entire task before starting. It tells you what you will need and what you have to know to start the task. DO NOT START THE TASK UNTIL:
   a. You know what is needed
   b. You have everything you need
   c. You understand what to do
2. If parts are listed, they can be drawn from technical supply. Before you start the task, check to make sure you can get the needed parts.
3. If expendable/durable supplies or materials are needed, get them before starting the task. Refer to WP 0123 for the correct nomenclature and NSN.

How to Do the Task

Before starting, read the entire task. Be sure that you understand the entire procedure before you begin the task. As you read, remember the following:

1. PAY ATTENTION TO WARNINGS, CAUTIONS, AND NOTES.
2. Use the List of Abbreviations/Acronyms if you do not understand the special abbreviations or unusual terms used in this manual.

3. The following are standard maintenance practices. Instructions about these practices are usually not included in task steps. When standard maintenance practices do not apply, the task steps will tell you.
   a. Tag electrical wiring before disconnecting it.
   b. Discard used preformed packing, retainers, gaskets, cotter pins, lock washers, and similar items. Install new parts to replace the discarded items.
   c. Coat packing before installation, in accordance with the task instructions.
   d. Disassembly procedures describe the disassembly needed for total authorized repair. You may not need to disassemble an item as far as described in the task. Follow the disassembly steps only as far as needed to repair/replace worn or damaged parts.
   e. Clean the assembly, subassembly, or part before inspecting it.
   f. Before installing components having mating surfaces, inspect the mating surfaces to make sure they are in serviceable condition.
   g. Hold the bolt (or screw) head with a wrench (or screwdriver) while tightening or loosening a nut on the bolt (or screw).
   h. Torque to the special torque cited when the task instructions include the words "torque to." Use standard torques at all other times.
   i. When a cotter pin is required, align the cotter pin holes within the allowable torque range.
   j. Inspect for foreign objects after performing maintenance.

CHAPTER 1

FIELD GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

FOR

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

CHAPTER 1

FIELD GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

WORK PACKAGE INDEX

Title	WP Sequence No.
General Information	0001
Equipment Description and Data	0002
Theory of Operation	0003

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

GENERAL INFORMATION

SCOPE

This technical manual (TM) contains instructions for Field Preventive Maintenance Checks and Services (PMCS), maintenance, checks and adjustments, theory of operation, troubleshooting, and corrective maintenance for the 100 kW Tactical Quiet Generator Set, MEP-807A and PU-807A.

Type of Manual

Field and Sustainment Maintenance Manual.

Model Numbers and Equipment Names

Generator Set, Skid Mounted, Tactical Quiet, 100 kW, 50/60 Hz, MEP-807A and Generator Set, Trailer Mounted, Tactical Quiet, 100kW, 50/60 Hz, PU-807A.

Purpose of Equipment

The 100 kW TQG provides 120/208 VAC or 240/416 VAC, 50/60 Hz, 3-phase power for a wide variety of military applications, offering the mobility and operational characteristics demanded by modern armed forces. Operational characteristics include the ability to operate at all possible humidity levels, at ambient temperature levels from -25 to +120 °F (-32 to +49 °C) down to -50 °F (-46 °C) with winterization kit, and at altitudes up to 10,000 feet.

CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS

Refer to the latest issue of DA PAM 25-30 to determine whether there are new additions, changes, or additional publications pertaining to the equipment.

MAINTENANCE FORMS, RECORDS, AND REPORTS

(1) *(Army)* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by (as applicable) DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual; DA PAM 738-751, Functional Users Manual for the Army Maintenance Management Systems - Aviation (TAMMS-A); or AR 700-138, Army Logistics Readiness and Sustainability.

(2) *(Air Force)* Maintenance forms and records used by Air Force personnel are prescribed in AFI 21-101 and the applicable TO 00-20 Series Technical Orders.

(3) *(Marine Corp)* Maintenance forms and records used by Marine Corps personnel are prescribed by TM 4700-15/1."

(4) *(Navy)* Navy users should refer to their service peculiar directives to determine applicable maintenance forms and records to be used.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATION (EIR)

(1) *(Army)* If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. If you have Internet access, the easiest and fastest way to report problems or suggestions is to follow the instructions and links below:

If you have a user's account you can submit the PQDR for ALL CECOM (B16) Warranty, EIR and PQDRs (including those B16 Aviation related) through the Navy's Web Product Quality Deficiency Reporting (PQDR) site, http://www.nslcptsmh.csd.disa.mil/webpqdr/webpqdr.htm. If you do not, either go to EZPQDR, http://www.nslcptsmh.csd.disa.mil/webpqdr/files/ezqpdr.htm, and input your PQDR there or establish a new account. New accounts can be established at the following address: http://www.nslcptsmh.csd.disa.mil/accessforms/uarform.htm.

CECOM (B16) aviation PQDRs will not go to AMCOMs Joint Deficiency Reporting System (JDRS). If AMCOM should get a CECOM aviation PQDR they will re-direct it to the CECOM PQDR Team.

Use the PQDR for Warranties, EIRs and PQDRs. There is a block on the PQDR that can be clicked if it is a Warranty. The originator can still put in the description that they want this investigated as an EIR and then enter what the issue is.

You may also submit your SF 368 (Product Quality Deficiency Report) via email (MONM-AMSELLEODCSCFO@CONUS.ARMY.MIL), facsimile (443-861-6356) or regular mail (call 443-861-6310) for the current mailing address).

We will send you a reply.

(2) *(Air Force)* Air Force personnel are encouraged to submit EIR's in accordance with AFR 900-4.

(3) *(Marine Corps)* QDR shall be reported on SF 368 in accordance with MCO P4855.10, Product Quality Deficiency Report Manual. Submit to Commanding General, Marine Corps Logistics Base (Code 850), Albany, Georgia 31704-5000. A reply will be furnished to you.

(4) *(Navy)* Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

EQUIPMENT DEFICIENCY REPORTING

a. USAF Deficiency Reporting and Investigating System, TO 00-35D-54, Appendix A procedures will be used for electronic submission. Submit mailed SF 368 forms to:

Warner-Robins AFB
WRALC/LGMTC
375 Perry Street
Robins, AFB GA 31098-1865

b. U.S. Marine Corps Units submit all fit, form, or function deficiencies in accordance with standard Product Quality Deficiency Reporting (PQDR) procedures contained in TM 4700-15/1 and MCO 4855.10 to Navy PDREP automated system by going to site http://www.nslcptsmh.navsea.navy.mil/pdrep/pdrep.htm, requesting access and then filling out the PQDR. For additional assistance, e-mail address: mbmatcompqdrs@logcom.usmc.mil. Deployed units only may mail PQDR to:

Marine Corps LogCom Command Element
Attn: Quality Assurance Office (L15)
814 Radford Boulevard, Suite 20330
Albany, Georgia 31704-0330

A reply will be furnished to you.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron.

Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking.

Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking. SF Form 368, Product Quality Deficiency Report should be submitted to the address specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) User's Manual.

For aircraft TMs, this information shall include a reference to TM 1-1500-344-23, volumes 1 through 4 (Cleaning and Corrosion Control).

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

PREPARATION FOR STORAGE OR SHIPMENT

Administrative storage of equipment issued to and used by Army activities will have Preventive Maintenance Checks and Services (PMCS) performed before storing. When removing the equipment from administrative storage, the PMCS checks should be performed to assure operational readiness. Requirements for packaging and administrative storage are contained in TM 9-6115-729-10. Requirements for short and long term storage are in WP 0094.

WARRANTY INFORMATION

This section provides information on the Warranty for generator set components. See Table 1 for list of warranted components (this work package).

NOTE

Check the Inspection Date on the end-item data plate on the generator set. If the Inspection Date is prior to September 2006, the (12) month Warranty period shall begin on August 31, 2006.

NOTE

If the Inspection Date on the data plate is September 2006 or after, the standard (12) month Warranty begins on the date stamped.

1. Warranty service may be obtained through two methods.
   a. (ARMY ONLY) Fill out the preferred warranty claim SF 368, Product Quality Deficiency Report, or fill out a warranty claim per DA PAM 750-8. The DA Form 2407, Maintenance Request, is also acceptable. Mail completed form to Commander, US Army, Communications-Electronics Life Cycle Management Command, ATTN: AMSEL-LC-CCS-G-GN, 1200 Nealis Avenue, Fort Monmouth, New Jersey 07703-5043. At a minimum, the end item NSN, serial number, and date of shipment to the government, and the defective component part number/CAGE must be included in the documentation.
   b. (OTHER SERVICES) For reporting warranty claims, fill out and forward SF 368 on DA Form 2407 to US Army Communications-Electronics Life Cycle Management Command, ATTN: AMSEL-LC-CCS-G-GN, 1200 Nealis Avenue, Fort Monmouth, NJ 07703-5043.
2. Warranty service can be obtained by contacting the actual warranted component manufacturer listed in column 1. Each manufacturer will provide instructions on filing the claim.
3. Troubleshooting should be performed to the level of warranted component, but no further unless directed by the warranted component manufacturer. Troubleshooting to the failed part inside warranted components may invalidate the warranty.
4. There are some components with short warranty periods that may not be listed in Table 1. Warranty coverage may be available for these components. Submit warranty claims in accordance with DA PAM 750-8 to determine if the components are covered.
5. If you have difficulty with or questions about the warranty process, contact your local CECOM LAR or the CECOM Generator Branch, DSN 992-1313, (732) 532-1313.

Manufacturer Warranty Information

Column (1) - MANUFACTURER. This column gives you the name and address of the manufacturer of a component under warranty. Telephone numbers, fax numbers, and internet addresses are listed where available.

Column (2) - COMPONENT UNDER WARRANTY. This column describes the component under warranty with part number (P/N) and vendor part number (VP/N) where available.

Column (3) -WARRANTY PERIOD. This column lists the length of the warranty period.

Table 1. Manufacturer's Warranties for 100 kW Generator Set.

(1) MANUFACTURER	(2) COMPONENT UNDER WARRANTY	(3) WARRANTY PERIOD
Caterpillar, Inc. Defense Products Engine Service Engineer PO Box 470 Mossville, IL 61552-0470 Phone: 309-578-4562 Fax: 309-578-3739 CAGE: 11083	Diesel Engine (P/N: 0116-1110, VP/N: 211-9442) Digital Control System Components GSC+P Controller (P/N: 0116-1201-41, VP/N: 198-9253) Alarm Module (P/N: 0116-1201-34, VP/N: 130-3324)	12 Months
Caterpillar, Inc. - Continued Warranty repairs can also be obtained through any Caterpillar dealer. Nearest dealer can be located at www.cat.com	Digital Voltage Regulator (P/N: 0116-1201-37, VP/N: 155-3832) Load Sharing Module (P/N: 0116-1201-39, VP/N: 161-0797) Transformer (P/N: 0116-1201-32, VP/N: 118-0175) Transformer (P/N: 0116-1201-40, VP/N: 169-4701) Harness Assembly (P/N: 0116-1201-43, VP/N: 212-8737)	12 Months
Marathon Electric P.O. Box 8003 Wausau, WI 54402-8003 Phone: 715-675-8237	Generator (P/N: 0116-1120, VP/N: 431PSL6309)	12 months from date of startup or 18 months from date of shipment whichever period shall expire first.
Signal Transformer 500 Bayview Avenue Inwood, NY 11096-1792 Phone: 516-239-5777	Transformer 1250 VA (P/N: 0116-1257, VP/N: HP1-12)	12 months
Derema Group 46 Acorn Drive Westbrook, CT 06498 Phone 860-399-5669	Switch, Battery Disconnect (P/N: 0116-1298, VP/N: 2304-A)	12 months
Contact Industries Inc. P.O. Box 3086 25 Lex-Industrial Drive Lexington, OH 44904 Phone: 419-884-9788	Contactor, Load (P/N: 0116-1266, VP/N: CT400E-24E4S)	12 months
Madison Company 27 Business Park Drive Branford, CT 06405 Phone: 203-488-4477	Fuel Level Switch (P/N: 0116-1304, VP/N: M3862)	12 months

Table 1. Manufacturer's Warranties for 100 kW Generator Set. - Continued

(1) MANUFACTURER	(2) COMPONENT UNDER WARRANTY	(3) WARRANTY PERIOD
Technology Research Co 5250 140th Avenue North Clearwater, FL 33760 Phone: 727-535-0572 Rwood@TRCI.net	Relay, Overload/Short Circuit (P/N: 0116-1219, VP/N: 19970)	12 months
Modine Manufacturing Co. 1502 S. Country Club Rd. Jefferson City, MO 65109 Phone: 573-893-4848	Radiator Assembly (P/N: 0116-1400, VP/N: 1A20304)	18 months from shipment or 12 months in service
Porobond Products, LLC. 65 Brockett Farm Rd. New Haven, CT 06473 Phone: 601-366-1423	Radiator Assembly (P/N: 0116-1400, VP/N: PB5001)	18 months from shipment or 12 months in service
Parker Hannifin Corporation Racor Division Phone: 209-575-7651 hbrizuela&parker.com	Filter, Crankcase Ventilation (P/N: 0116-1607-01, VP/N: CCV4500-08L)	12 Months
Donaldson Company, Inc. Minneapolis, MN 55440-1299 Phone: 800-374-1374 www.donaldson-filters.com	Muffler, Exhaust (P/N: 0116-1500, VP/N: WOM12-0743) Air Cleaner Assembly (P/N: 0116-1600, VP/N: FTG-11-0103)	36 Months 12 Months

Report all defects to your supervisor, who will take appropriate action. Detailed information about warranties is found in TM 9-6115-729-10.

NOMENCLATURE CROSS REFERENCE LIST

See TM 9-6115-729-24 for nomenclature for common names listed alphabetically with a cross-reference to the official nomenclature (i.e., Maintenance Allocation Chart (MAC), Repair Parts and Special Tools Lists (RPSTL)).

Common Name	Official Nomenclature
100 kW TQG	Generator Set, Skid Mounted Tactical Quiet, 100 kW, 50/60 Hz, MEP-807A Generator Set, Trailer Mounted, Tactical Quiet, 100 kW, 50/60 Hz, PU-807A

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation/Acronym	Name
AAL	Additional Authorization List
AGM	Absorbed Glass Mat
AC	Alternating Current
AFPS	Auxiliary Fuel Pump Switch
AFPR	Auxiliary Fuel Pump Relay
AFPV	Auxiliary Fuel Pump Solenoid Valve

Abbreviation/Acronym	Name
AL	Alarm
AMP	Ampere
AOAP	Army Oil Analysis Program
AR	Ampere Reset
ARS	Air Shut Off Relay
ATB	AC Transformer Box
ATLASS	Asset Tracking Logistics and Supply System
AUX	Auxiliary
BAT	Battery
BDS	Battery Disconnect Switch
BII	Basic Issue Items
BIT	Built-in-Test
BLK	Black
BRT	Brightness
BSS	Battle Short Switch
BTB	Bus Transformer Box
CAGE	Commercial and Government Entity
CAT ET	Caterpillar Electronics Technician
CBR	Chemical, Biological, and Radiological
CCA	Circuit Card Assembly
CCCT	Cross Current Compensation (Droop) Transformer
CCM	Customer Communication Module
CCS	Contractor Control Switch
CCW	Counterclockwise
CDR	Cool Down Relay
CID	Component Identifier
COEI	Components of End Item
CPC	Corrosion Prevention and Control
CPU	Central Processing Unit
CRFF	Diode Field Flash
CT	Current Transformer
CTA	Common Table of Allowances
CTR	Crank Termination Relay
CW	Clockwise
DBHI	Dead Bus Relay High Sensing
DBLO	Dead Bus Relay Low Sensing
DC	Direct Current
DCS	Dead Crank Switch
DESCP	Description
DVR	Digital Voltage Regulator

Abbreviation/Acronym	Name
ECM	Engine Control Module
ECS	Engine Control Switch
EGR	Electronic Governor Relay
EMCP	Electronic Modular Control Panel
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
ESPB	Emergency Stop Pushbutton
FCR	Fuel Control Relay
FMI	Failure Mode Indicator
GFCI	Ground Fault Circuit Interrupter
GFE	Government Furnished Equipment
GFR	Generator Fault Relay
GND	Ground
GSC	Generator Set Control
HEUI	Hydraulic Electronic Unit Injector
Hz	Hertz (cycles per second)
IAPCV	Injection Actuation Pressure Control Valve
IETM	Interactive Electronic Technical Manual
KFF	Relay Field Flash
kPa	KiloPascal
KR	Main Contactor Relay
kVa	Kilovolt-ampere
KVAR	Kilovolt-ampere-reactive
KVARHr	Kilovolt-ampere-reactive hour
kW	Kilowatt
kWh	Kilowatt hour
IAP	Injection Actuation Pressure
JTA	Joint Table of Allowances
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LSM	Load Sharing Module
MAC	Maintenance Allocation Chart
MPU	Magnetic Pickup Unit
MSD	Maintenance Support Device
MTOE	Modified Table of Organization and Equipment
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, and Chemical
NSN	National Stock Number
OL/SC	Overload and Short Circuit Module
OSHA	Occupational Safety and Health Act

Abbreviation/Acronym	Name
PAR	Paralleling Relay
PF	Power Factor
PMCS	Preventive Maintenance Checks and Services
P/N	Part Number
PQDR	Product Quality Deficiency Report
PRMTR	Parameter
PSR	Programmable Spare Relay
PW	Pulse Width
PWM	Pulse Width Modulation
RPM	Revolutions Per Minute
RPSTL	Repair Parts and Special Tools Lists
RR	GSC Run Relay
SCR	Silicon Controlled Rectifier
SDR	Supply Discrepancy Report
SMMS	Starter Motor Magnetic Switch
SMR	Starter Motor Relay
SMS	Sync Mode Switch
SOS	Source of Supply
SP	Spare Input
SR	Slave Receptacle
SRY	Slave Relay
SSP	Speed Setting Potentiometer
TAMMS	The Army Maintenance Management System
TDA	Table of Distribution and Allowances
TDC	Top Dead Center
TDR	Transportation Discrepancy Report
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TPI	Threads per Inch
TQG	Tactical Quiet Generator
ULLS	Unit Level Logistics System
U/M	Unit of Measure
USEPA	U.S. Environmental Protection Agency
VAC	Volts Alternating Current
VDC	Volts Direct Current

QUALITY OF MATERIEL

No information available.

SAFETY, CARE, AND HANDLING

The TQG contains no radioactive components or parts or radioactive material requiring special handling or consideration. The TQG contains no electronic modules or components requiring special handling to protect them from electrostatic discharge **(ESD).**

This manual describes physical and chemical processes that may require the use of chemicals, solvents, paints, or other commercially available material. Users of the manual should obtain the material safety data sheets (Occupational Safety and Health Act (OSHA) Form 20 or equivalent) from the manufacturers or suppliers of materials to be used. Users must be completely familiar with manufacturer/supplier information and adhere to their procedures, recommendations, warnings, and cautions for safe use, handling, storage, and disposal of these materials.

SUPPORTING INFORMATION FOR REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

Repair parts are listed in the Repair Parts and Special Tools List (RPSTL) TM 9-6115-729-24P.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special Tools; Test, Measure, and Diagnostic Equipment (TMDE); and support equipment are needed for Field maintenance. They are listed in the RPSTL, TM 9-6115-729-24P, and in the Maintenance Allocation Chart (MAC) in WP 0122.

COMMON TOOLS AND TEST EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), Common Table of Allowances (CTA) 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), or Army Medical Department Expendable/Durable Items CTA 8-100, as applicable to your unit.

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The 100 kW Tactical Quiet Generator (TQG) is skid-mounted and is designated MEP-807A. When the 100 kW TQG is mounted on a trailer, it is designated PU-807A. The 100 kW TQG consists of a diesel engine that can operate using diesel fuel or aviation fuel, a brushless alternating current (AC) generator, a digital voltage regulator, an electronic governing system, a fuel system, a 24 VDC cranking system, and other devices as required to achieve a complete engine driven generator set. The system uses the Caterpillar 3126B engine and a Marathon generator model DOD 431 FR. The engine is electronically controlled. The electronic control is essential to meeting U.S. Environmental Protection Agency (USEPA) and fuel consumption requirements. All the electrical components and assemblies (including the voltage regulator) that provide the required instrumentation and control functions are contained in the Electronic Modular Control Panel (EMCP) located on the generator end (REAR) of the set. The generator end of the TQG is considered the rear of the generator in the following descriptions. Opening the EMCP and side access panels gives access to all the electrical components and essential engine components. Paralleling receptacles are used to connect the paralleling cable between generator sets of the same family. The generator set family includes a 200 kW TQG. The 200 kW TQG is skid-mounted and is designated MEP-809A. When the 200 kW TQG is mounted on a trailer, it is designated PU-809A. These generator sets use the same control system as the MEP-807A and PU-807A 100 kW TQG and can operate in parallel to share an electrical load.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

Engine. The engine for the 100 kW TQG is the Caterpillar 3126B engine (Figure 1, Sheet 1, Item 4). The engine is electronically controlled. The Engine Control Module (ECM) controls the amount of fuel that is injected by the unit injectors. The EMCP provides frequency (speed) control, controls long and short-term stability, and adjusts to load conditions. High injection pressures help to reduce fuel consumption and emissions. Precise injection timing optimizes engine performance for starting, emissions, noise and fuel consumption.

Air Cleaner Assembly. The air cleaner assembly (Figure 1, Sheet 1, Item 1 and Sheet 5, Item 1 REF) is located on the left side of the engine inside the rear access doors. The air cleaner filters intake air used for engine combustion. The air cleaner is equipped with a restriction indicator (refer to TM 9-6115-729-10).

Muffler. The muffler/exhaust system (Figure 1, Sheet 1, Item 2) and exhaust tubing are connected to the engine exhaust manifold and turbocharger. This system reduces engine exhaust noise. Exhaust gases are exhausted upward from the top of the generator set.

Turbocharger. The turbocharger (Figure 1, Sheet 1, Item 3) is located on the right side of the engine. Powered by engine exhaust gases, the turbocharger compresses air from the air filter to provide pressurized air to the engine for combustion.

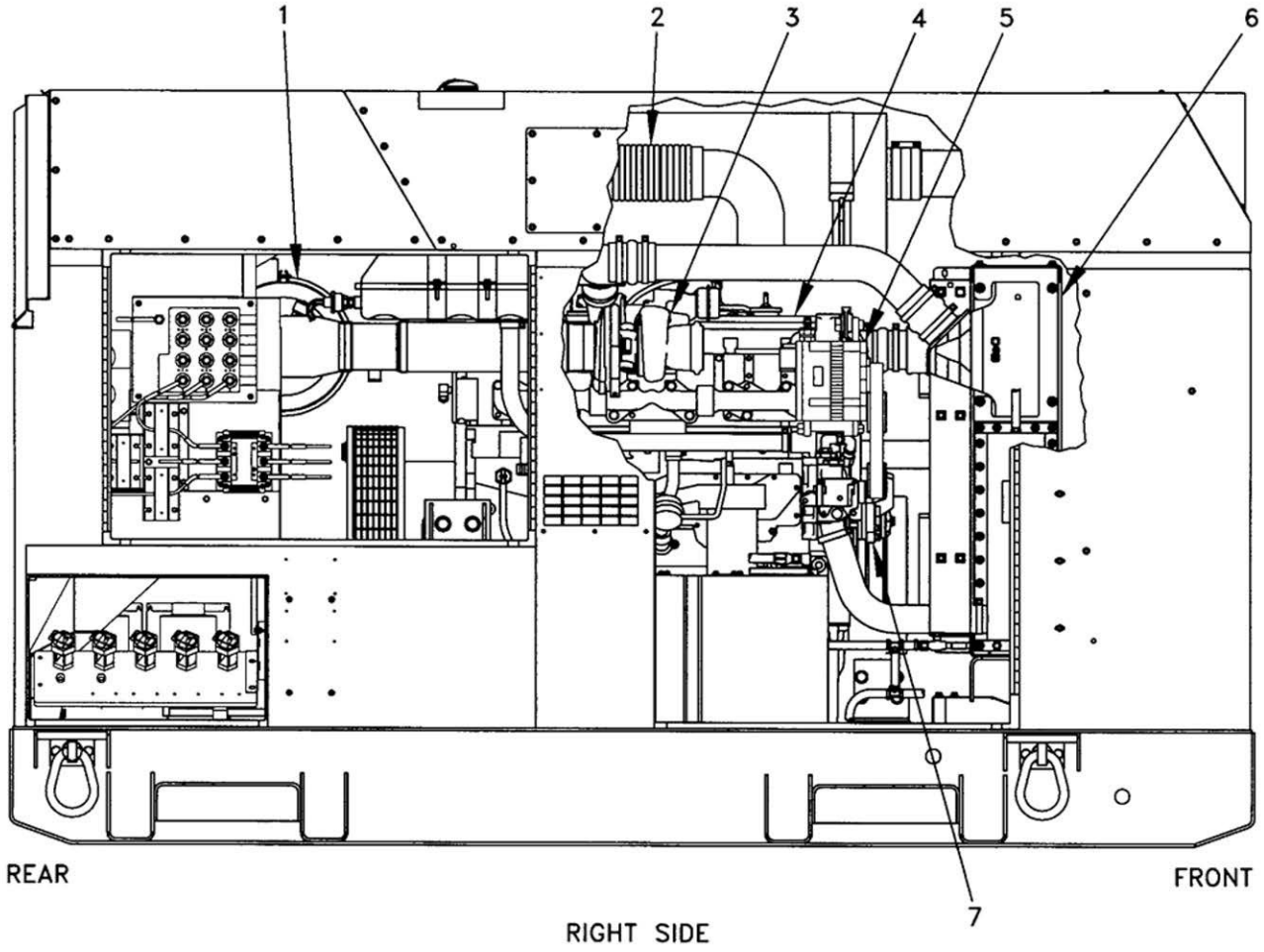


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 1 of 6).

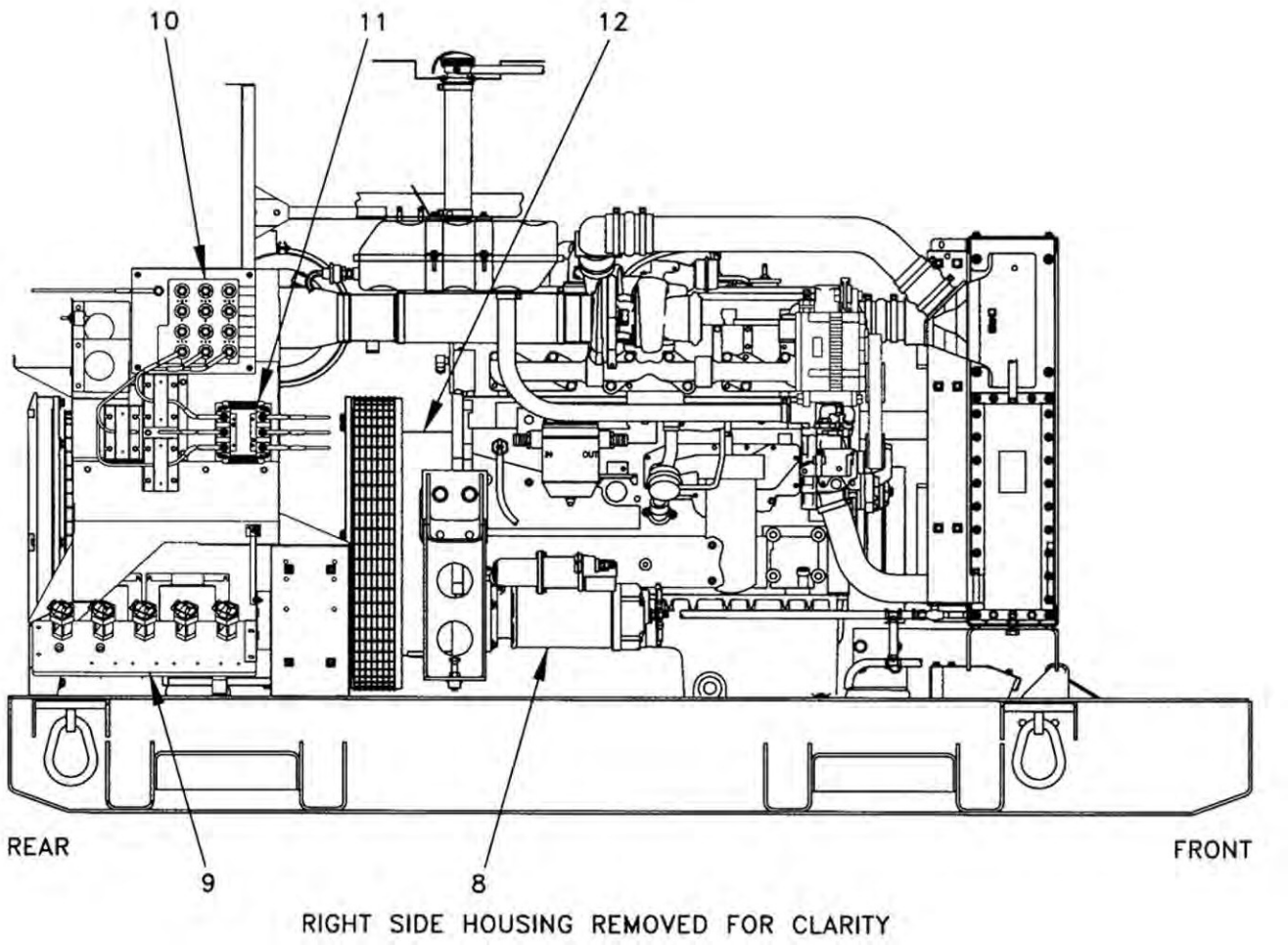


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 2 of 6).

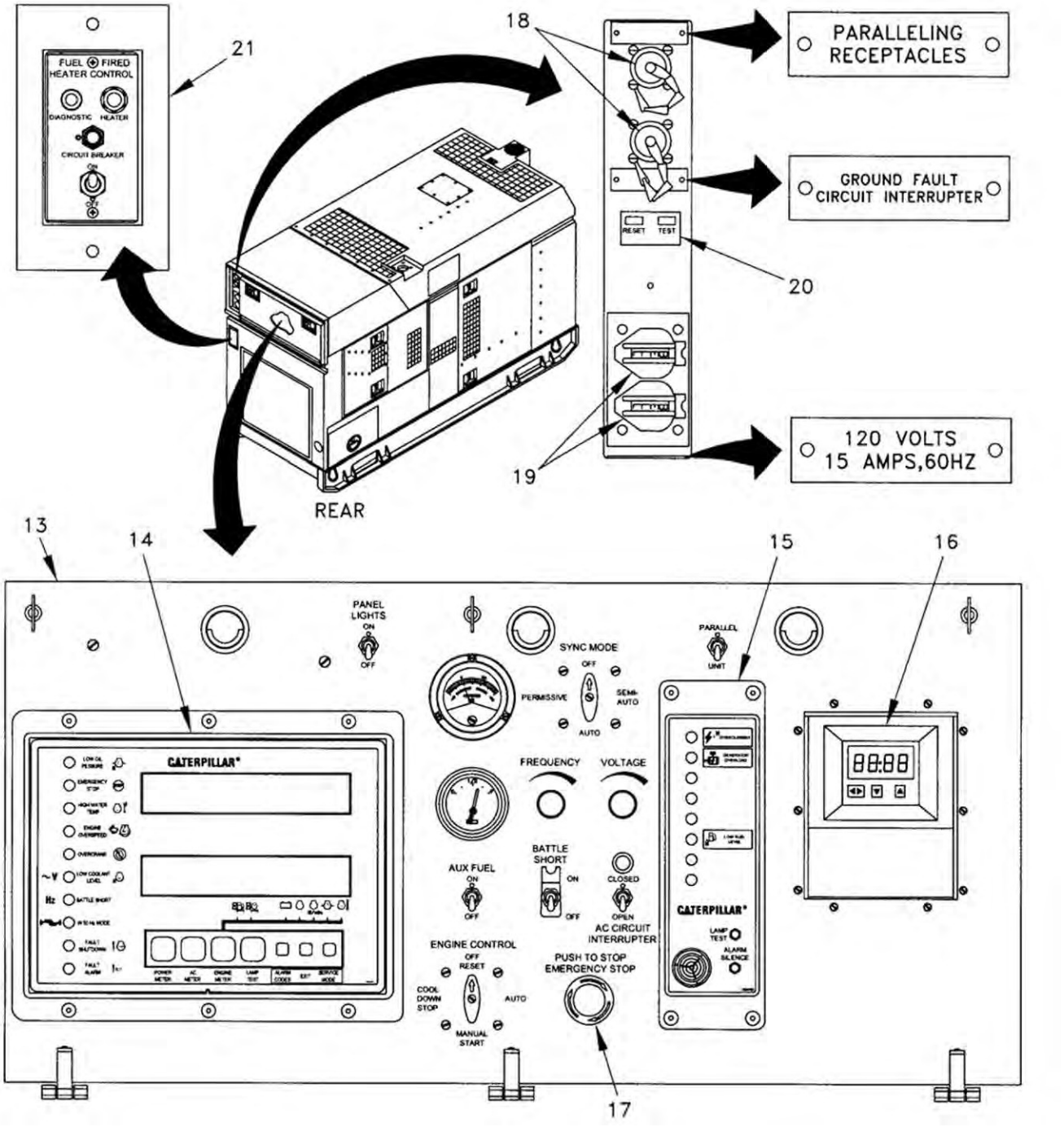


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 3 of 6).

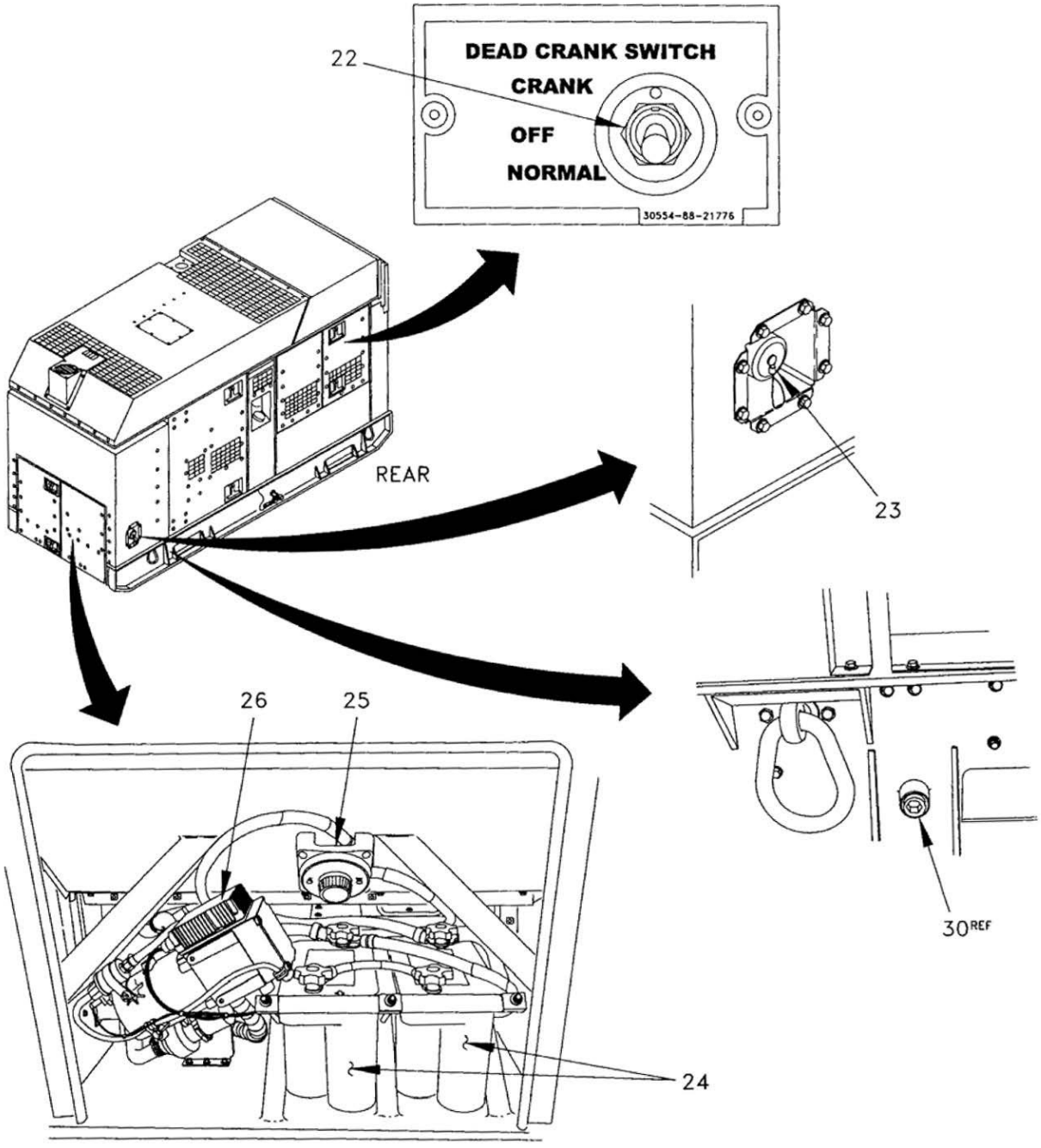


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 4 of 6).

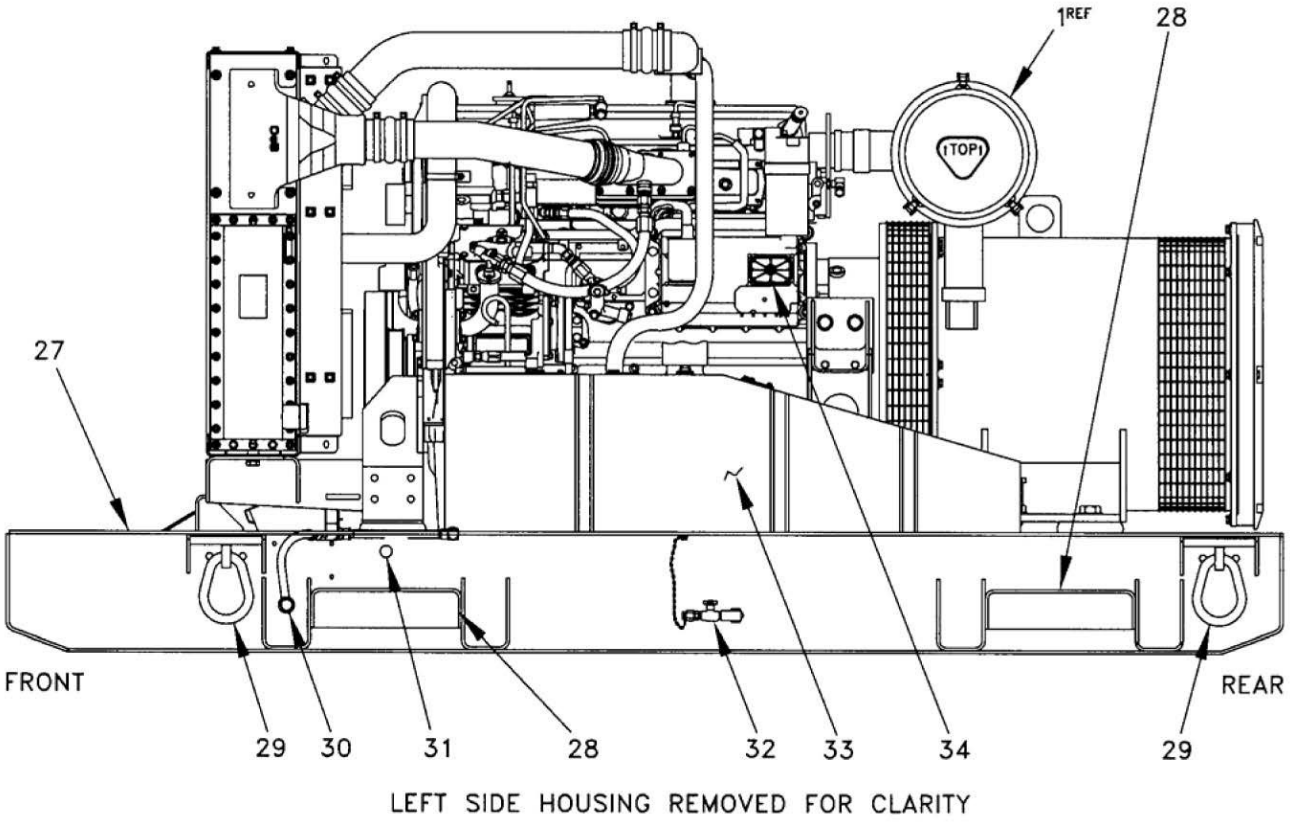


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 5 of 6).

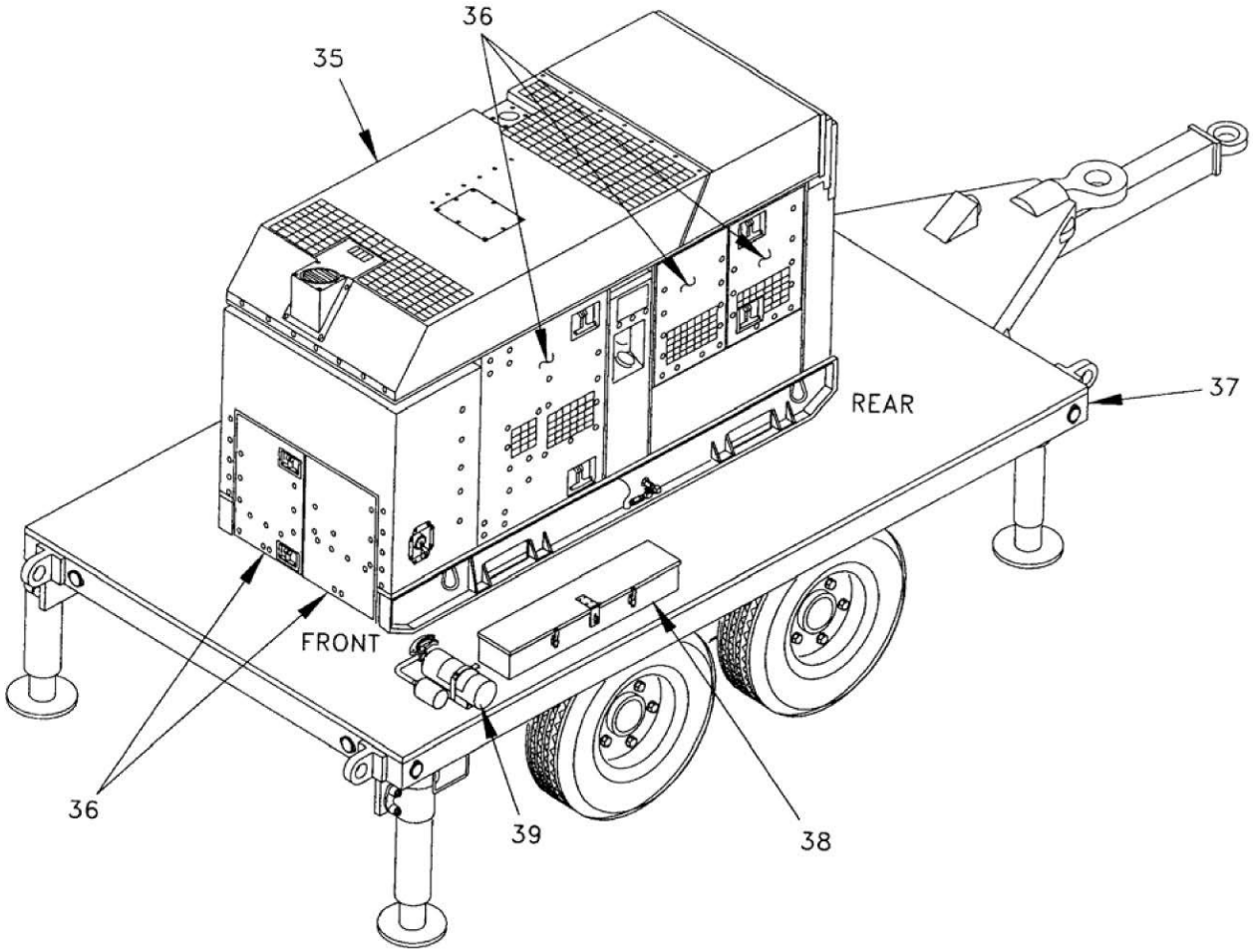


Figure 1. 100 kW Tactical Quiet Generator Location of Components (Sheet 6 of 6).

Alternator. The alternator (Figure 1, Sheet 1, Item 5) is located on the right side of the engine. The alternator maintains the batteries in a state of full charge. The alternator also provides 24 VDC voltage for TQG control circuits and to the NATO slave receptacle. After starting the engine the voltage output is 28±2 VDC.

Radiator. The radiator (Figure 1, Sheet 1, Item 6) located at the front of the TQG eliminates engine heat via circulated coolant and air. The radiator and engine fan are the primary heat exchanger for cooling engine coolant and turbocharged engine intake air.

Water Pump. The water pump (Figure 1, Sheet 1, Item 7) located on the right side of the engine circulates coolant through the engine block and radiator to cool the engine.

Starter. The engine starter motor (Figure 1, Sheet 2, Item 8) is located on the right rear side of the engine. The electric starter engages the flywheel mechanically to start the diesel engine.

Load Board. The load board (Figure 1, Sheet 2, Item 9) connects load cables to the TQG with heavy duty connector lugs and nuts.

Reconnection Board. The reconnection board (Figure 1, Sheet 2, Item 10) is used to change the TQG generator output voltage for different load applications. The TQG can be configured for 120/208 VAC or 240/416 VAC operation for 50 Hz or 60 Hz.

Main Load Contactor. The main load contactor K1 (Figure 1, Sheet 2, Item 11) connects/disconnects generator load output to the load board.

AC Generator. The generator (Figure 1, Sheet 2, Item 12) used in the 100 kW TQG is designed to meet military applications for the TQG. The generator is a brushless, single bearing, rotating rectifier generator. It is close-coupled to the engine via flexible drive disks. Each generator consists of five major components: main stator (armature), main rotor (field), exciter stator (field), exciter rotor (armature), and rotating rectifier assembly.

Electronic Modular Control Panel. The TQG EMCP (Figure 1, Sheet 3, Item 13) contains controls and indicators for monitoring TQG operation. Located at the rear end of the generator set, the EMCP contains the Generator Set Control (GSC) (Figure 1, Sheet 3, Item 14), an alarm module (Figure 1, Sheet 3, Item 15), and a Digital Voltage Regulator (DVR) (Figure 1, Sheet 3, Item 16). EMCP displays and indicators allow the user to monitor all engine and generator functions with alarms and identification of malfunctions. Malfunction/Symptom Indices in Troubleshooting work packages identify the malfunctions. The GSC monitors the output frequency of the generator and controls the engine speed to maintain a constant output frequency, regardless of load. The PUSH TO STOP EMERGENCY STOP pushbutton (Figure 1, Sheet 3, Item 17) shuts down the TQG immediately when it is pushed.

Paralleling Receptacles. The PARALLELING RECEPTACLES panel is located to the left of the EMCP. The paralleling receptacles (Figure 1, Sheet 3, Item 18) are used to connect the paralleling cable between 100/200 kW generator sets of the same family. This 100kW generator set maybe paralleled to another 100kW generator set or paralleled to a 200kW generator set.

Convenience Receptacles . Two convenience receptacles (Figure 1, Sheet 3, Item 19) are located to the left of the EMCP on the PARALLELING RECEPTACLES panel. The receptacles rated 120 VAC, 15A are available at all times during generator operation. The receptacles are protected by a GROUND FAULT CIRCUIT INTERRUPTER (Figure 1, Sheet 3, Item 20) with TEST and RESET functions. The frequency of the output voltage at the convenience receptacle outlets is set by generator frequency and will be 50 Hz or 60 Hz.

Dead Crank Switch. The dead crank switch (Figure 1, Sheet 4, Item 22) is located inside the generator housing at the left rear. During maintenance, the dead crank switch allows the engine to be cranked without starting the engine.

NATO Slave Receptacle. The NATO slave receptacle (Figure 1, Sheet 4, Item 23) is located on the left side (front) of the TQG. It is used for 24 VDC slave starting.

Batteries. Two sealed 12 VDC batteries (Figure 1, Sheet 4, Item 24), located at the front of the generator, are connected in series. The batteries provide 24 VDC power for EMCP controls, engine starting, and to the NATO slave receptacle. These batteries can be disconnected with the Battery Disconnect Switch (Figure 1, Sheet 4, Item 25).

Winterization Kit (Issued to Selected Units Only). The winterization kit consists of a fuel-fired heater (Figure 1, Sheet 4, Item 26) to heat engine coolant. The kit also includes resistor heaters located in EMCP. The fuel-fired heater is controlled with the winterization kit control panel (Figure 1, Sheet 3, Item 21).

Skid Base. The skid base (Figure 1, Sheet 5, Item 27) provides the main structural support for the engine and generator. The skid base consists primarily of two formed side rails, cross members, mounting pads, forklift openings, and a bottom plate. Main cross members complete the primary skid base structure to support the engine and generator mounting pads and vibration isolators and reinforce the fork lift openings (Figure 1, Sheet 5, Item 28). Four 25,000 lb (11,400 kg) capacity LIFT/TIEDOWN rings (Figure 1, Sheet 5, Item 29) are attached to the skid base frame. In addition to supporting the engine generator assembly, housing, battery and other components, the skid base has provisions for engine oil drain (Figure 1, Sheet 5, Item 30), coolant drain (opposite side), a water separator drain (Figure 1, Sheet 5, Item 31), and fuel tank drain (Figure 1, Sheet 5, Item 32). The skid base also serves as a support and protective enclosure for the fuel tank.

Fuel Tank. The fuel tank (Figure 1, Sheet 5, Item 33) is a 66 gallon (250L) molded tank located below the diesel engine between the skid assembly side members.

Engine Control Module. The engine control module (ECM) (Figure 1, Sheet 5, Item 34) monitors most of the engine sensors and controls the amount of fuel that is injected by the unit injectors as well as engine timing functions.

Generator Housing. The housing (Figure 1, Sheet 6, Item 35) is fabricated from sheet steel and attaches directly to mating flanges on the skid base. The housing is thus removable for unscheduled maintenance and engine or generator removal. Access openings and doors (Figure 1, Sheet 6, Item 36) allow engine, generator, and other component servicing. Each side of the rear housing has a set of double doors and the large doors at the front of the housing provide accessibility. The housing structure incorporates acoustic damping foam and internal baffle structures to reduce engine noise. The rugged design of the housing includes reinforced corners and access openings to meet transportability, operational, and handling requirements of a mobile military generator set.

Trailer-mounted Configuration (PU-807A). The skid-mounted TQG can be mounted on a model XM1061 E1 5-ton trailer (Figure 1, Sheet 6, Item 37). In this configuration, the TQG can be towed and positioned as required. In the power unit configuration, the trailermounted TQG has an accessory box (Figure 1, Sheet 6, Item 38) and two fire extinguishers (Figure 1, Sheet 6, Item 39). The TQG skid is bolted directly to the trailer bed and frame.

EQUIPMENT DATA

Table 1 lists equipment data for the 100 kW TQG.

Table 1. 100 kW TQG Equipment Data.

EQUIPMENT	DATA
100 kW Tactical Quiet Generator Set, 50/60 Hz	MEP-807A/PU-807A
Overall length	106 in. (269 cm)
Width	40 in. (102 cm)
Height	65 in. (165 cm)
Weight	
Wet (includes fuel)	6,100 lb (2,767 kg)
Dry	5,500 lb (2,495 kg)
Engine	
Manufacturer	Caterpillar
Model	3126B, serial number BDZ series
Type	Six cylinder, in-line, four cycle, turbocharged diesel
Horsepower	280 hp @ 1,800 RPM (60 Hz)
	233 hp @ 1,500 RPM (50 Hz)
Displacement	442 cu. in. (7.25L)
Valves per cylinder	Three (two inlet, one exhaust)
Valve lash setting (cold engine)	Inlet: 0.015 in. (0.38 mm)
	Exhaust: 0.025 in. (0.64 mm)
Cooling system	
Type	Pressurized radiator and coolant pump
Capacity	38 qt (34.5L)
Normal operating temperature	170 to 200 °F (77 to 93 °C)
Temperature indicating system voltage	24 VDC, range programmable
Lubricating system	
Type	Full flow, circulating pressure
Pump type	Positive displacement gear
Capacity	30 qt (27.3L)
Normal operating pressure	35 to 70 psi (241 to 483 kPa)

Table 1. 100 kW TQG Equipment Data. - Continued

EQUIPMENT	DATA
Fuel system	
Fuel type	DF-1, DF-2, (1-D/2-D), JP5, JP8
Fuel tank capacity	66 gal (250L)
Consumption rate	8 hour tank capacity at full load (8.25 gph)
Auxiliary fuel pump	
Manufacturer	Walbro Corp.
Voltage rating	24 VDC (16 to 30 VDC)
Delivery rate	34 gph at 30 VDC; 17 gph at 18 VDC
Fuel level switch	
Manufacturer	Madison
Type	Float
Model	0116-1303
Voltage	18-32 VDC
Intake air preheater	
Manufacturer	Caterpillar
Model	118-7284
Voltage rating	Thermal switch activated, 24 VDC, 78A
Engine starting system	
Batteries	
Manufacturer	Optima
Voltage	12 VDC, qty 2 (sealed units)
Starter	
Manufacturer	Caterpillar
Model	128-5626
Voltage rating	24 VDC
Drive type	Direct
Alternator	
Manufacturer	Caterpillar
Model	169-3345
Voltage rating	24 VDC, 50A
Drive type	Belt
Generator	
Manufacturer	Marathon
Model	431PSL6300
Type	Alternating current, synchronous, brushless
Load capacity	100 kW at 60 Hz 83 kW at 50 Hz (1,800 RPM) (1,500 RPM)
Current ratings	
120/208 VAC connection	347A at 60 Hz 289A at 50 Hz

Table 1. 100 kW TQG Equipment Data. - Continued

EQUIPMENT	DATA
240/416 VAC connection	174A at 60 Hz 145A at 50 Hz
Power factor	0.8
Cooling	Fan cooled
Drive type	Direct coupling
Duty classification	Continuous
Governing system	
Load measuring unit	
Manufacturer	Caterpillar
Model	161-0797
Engine control module	
Manufacturer	Caterpillar
Model	172-2394
GSC Protective Relay Setpoint Values	
Low oil pressure shutdown	26 psi (179 kPa)
High water (coolant) temperature shutdown	230 °F (110 °C)
Engine overspeed	2,120 RPM
Overcrank (total cycle crank time)	90 seconds
High oil temperature shutdown	253 °F (123 °C)
Overvoltage alarm threshold	125% overvoltage for programmed voltage
Generator overvoltage shutdown threshold	125% of nameplate voltage
Generator undervoltage alarm threshold	82% of programmed voltage
Generator undervoltage shutdown threshold	75% of nameplate voltage
Generator overfrequency alarm threshold	63 Hz for 60 Hz operation; 53 Hz for 50 Hz operation
Generator overfrequency shutdown threshold	66 Hz for 60 Hz operation; 55 Hz for 50 Hz operation
Generator underfrequency alarm threshold	57 Hz for 60 Hz operation; 48 Hz for 50 Hz operation
Generator underfrequency shutdown	57 Hz for 60 Hz operation; 45 Hz for 50 Hz operation
Generator phase overcurrent alarm threshold	160% of nameplate current
Generator total overcurrent alarm threshold	160% of nameplate current
Generator phase overcurrent shutdown threshold	160% of nameplate current
Generator total overcurrent shutdown threshold	160% of nameplate current
Reverse power shutdown	15 to 17%

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

THEORY OF OPERATION

GENERAL

This work package contains functional descriptions of the generator set and explains how TQG functional systems interact with one another.

ENGINE OVERVIEW

The 100 kW TQG is powered by an in-line six cylinder diesel engine. The firing order of the engine is 1-5-3-6-2-4. The engine rotation is counterclockwise when the engine is viewed from the flywheel end (rear) of the engine. The engine uses a turbocharger and an air-to-air aftercooler. The engine cylinders bore is 4.3 inch (110 mm) with stroke of 5.0 inch (127 mm). Total displacement is 442 cu. in. (7.25L). The engine hydraulic electronic unit injector system (HEUI) eliminates mechanical components that are used in a pump-and-line system. The HEUI provides increased control of the timing and increased control of the fuel air mixture. The timing advance is achieved by precise control of the unit injector timing. Adjusting the injection duration controls engine RPM. An engine speed sensor provides information to the Engine Control Module (ECM) for detection of cylinder position and engine RPM. The engine has built-in diagnostics to ensure that all of the components are operating properly. In the event of a system component failure, the operator will be alerted via the Generator Set Control (GSC) component of the TQG Electronic Modular Control Panel (EMCP). Numerical codes of the faulty component or condition are displayed on the GSC. Intermittent faults are logged and stored in the ECM memory.

Engine Control Module

The Engine Control Module (ECM) automatically provides the correct amount of fuel in order to start the engine. The engine control module is integrated with the engine fuel system and the engine air inlet and exhaust system to control the fuel delivery and the injection timing electronically. The electronic control module provides timing control and fuel air ratio control. Injection timing is achieved by the precise control of the injector firing time. Adjusting the injection duration controls engine RPM. ECM energizes unit injector solenoids in order to start the injection of fuel and de-energizes the unit injector solenoids to stop the injection of fuel.

Electronic Components

The engine uses three types of electronic components: input, control, and output. Input-components send variable electrical signals (voltage, frequency, or pulse width (PW)) to the ECM. ECM interprets input signals about the condition, environment, or operation of the TQG. ECM firmware evaluates input data to control engine components such as fuel injector solenoids or to log and relay information to EMCP.

ENGINE SENSORS

Boost Pressure

Boost is defined as the difference between the inlet and outlet pressures of the turbocharger. The atmospheric pressure sensor on the air inlet to the turbocharger is used to reduce smoke emissions at high altitudes and as the reference for calculating turbocharger boost pressure. Boost pressure measurements are used to reduce smoke emissions during acceleration. The outlet pressure sensor is located at the turbocharger outlet and measures pressure from 3 to 49 psi (20 to 340 kPa).

Oil Pressure

The ECM monitors oil pressure following engine start up and may display a low oil pressure alarm diagnostic code. The code will not be logged for 15 seconds following start up. The output of the oil pressure sensor is pulse width modulated. The base frequency is 500 ±150 Hz. The duty cycle varies from 13 to 85% corresponding to 0 to 100 psi (0 to 690 kPa).

Coolant Level Sensor

A sensor in the coolant detects dangerously low levels of coolant in the system. The output of this sensor is connected to the GSC for display and control.

Primary and Backup Engine Speed/Timing Sensors

Two speed/timing sensors determine engine timing. The primary sensor monitors crankshaft rotation; and is used to determine both engine RPM and fuel injection timing. The other sensor senses rotation in the same manner as the first. With these redundant sensors, the probability of a failure shutting down the engine is greatly reduced. All of the timing for fuel injection is based on the output of these sensors. If the primary sensor fails, timing can continue based on the output of the backup sensor.

Fuel Pressure Sensor

The ECM monitors fuel pressure at the fuel pump between 0 and 100 psi (0 and 690 kPa).

Inlet Air Manifold Temperature Sensor

The ECM monitors air manifold inlet temperature and uses this information to adjust ignition timing.

Coolant Temperature Sensor

The coolant temperature is used to determine whether to operate the engine in cold mode and to notify the operator of excessive engine temperature. If the coolant temperature is below 63 °F (17 °C) and the engine is not in the cranking phase of starting, the timing is advanced and fuel delivery is reduced to improve cold engine performance. Cold mode remains active until the coolant temperature rises above 63 °F (17 °C) or until the engine has been running five minutes.

Speed Input

The speed input signal to the ECM is a pulse width modulated control signal, which eliminates the mechanical throttle and governor linkages along with their adjustments. The nominal frequency is 500 ±200 Hz. The pulse width varies from 10 to 90% corresponding to idle and maximum speed of the engine. Signals outside of this range are considered a failure and a fault code is logged.

ENGINE STARTING SYSTEM

The engine starting system (Figure 1) consists of two 12-volt batteries connected in series, a 24 VDC starter, a 24 VDC battery charging alternator, a magnetic pickup (for sensing engine speed) and the related switches and relays required for control of the starting system. The PUSH TO STOP EMERGENCY STOP pushbutton on the EMCP will automatically disable the starting system and shut down the TQG if it is pushed in. For engine cranking, battery power is supplied to the starter motor through the starter solenoid that in turn is controlled by the EMCP. The starter engages the engine flywheel causing the engine to turn over. As the engine accelerates to above idle speed (sensed by the magnetic pickup), the EMCP disengages the starter. Moving the ENGINE CONTROL switch to COOL DOWN/STOP may also stop the starting sequence. The engine may be cranked without starting by engaging the DEAD CRANK SWITCH. The DEAD CRANK SWITCH is a three-position switch. Up position is CRANK, the center position is OFF, and the lower position is NORMAL (operation). With the DEAD CRANK SWITCH in CRANK position, the starter motor is energized without activating any other starting or control function. With the switch in the OFF center position, the system is off. With the switch in NORMAL (operation) position, the TQG may be cranked and started. The belt-driven engine alternator charges the batteries. The battery charging alternator also supplies GSC power. Normal operating indication depends on the state of charge in the batteries. A low charge, such as exists immediately after engine starting, will cause a high reading. Cold outside temperatures make starting the engine difficult. To improve engine starting in cold weather the engine contains a 78A intake air preheater. This heater is described in the discussion of the Air Inlet and Exhaust System. If the batteries are dead or inoperable, external +24 VDC power can be supplied to the TQG via the 24 VDC NATO slave receptacle to start the generator set engine.

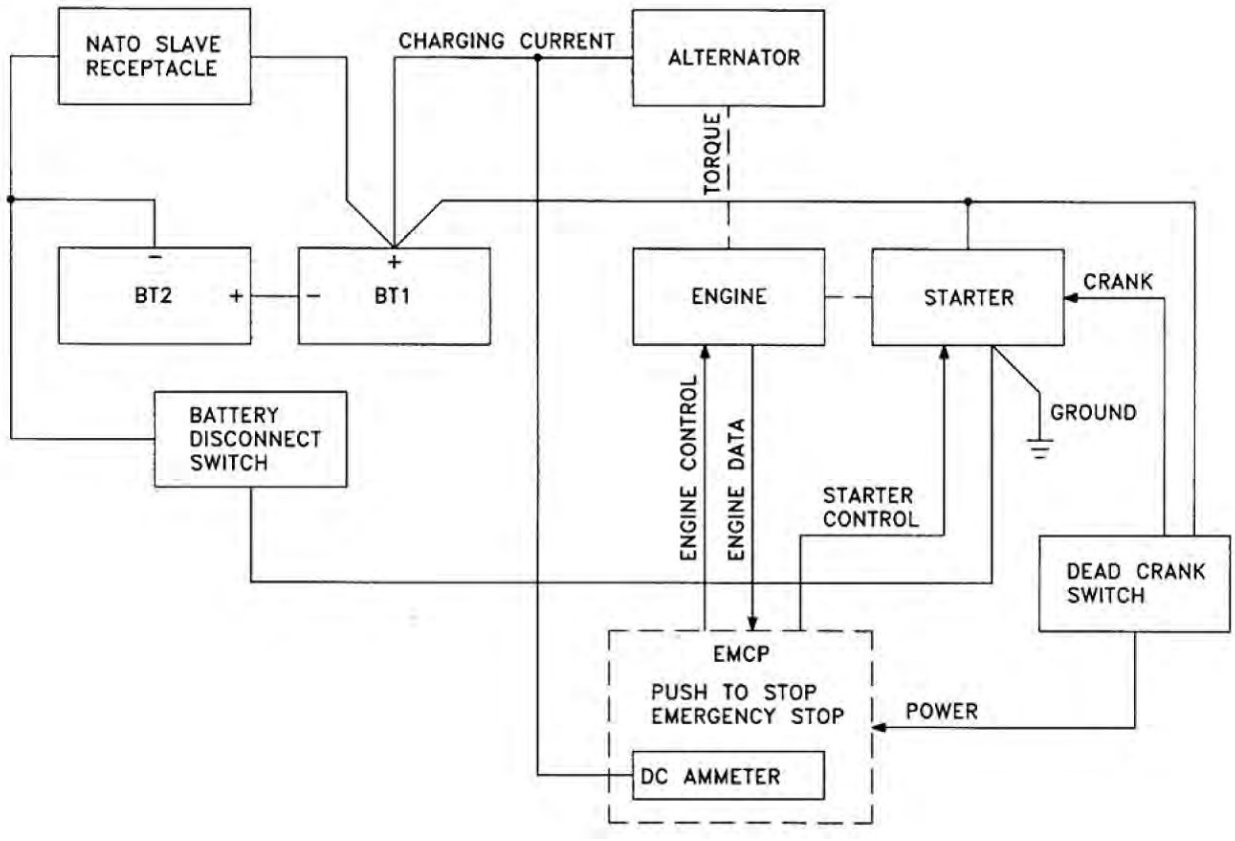


Figure 1. Engine Starting System.

FUEL SYSTEM

The fuel system (Figure 2) consists of hoses, steel injector piping, fuel tank, fuel filter/water separator, fuel transfer pump, injection pump and injectors. Fuel is drawn from the fuel tank by the fuel transfer pump. Fuel passes through a fuel filter/water separator where water and small impurities are removed before arriving at the fuel transfer pump. The fuel is then pushed through the secondary fuel filter that removes even smaller particles from the fuel. The fuel then enters the injector manifold and goes into the injectors which are controlled by the ECM and actuated by a hydraulic injection pump that is part of the high pressure oil system. Through the injectors fuel enters the diesel engine combustion chamber, where it is mixed with air and ignited. The fuel that is not used is cooled and returned to the fuel tank via an excess fuel return line. When the fuel level is low, the fuel level switch will either supply power to the external auxiliary fuel pump for external fuel supply or shut down the TQG to prevent it from completely running out of fuel. If a diesel engine runs out of fuel, it is necessary to fill the fuel filters, purge all air from the lines and pumps, and bleed all injectors. Only hydraulic pressure will open the injectors; air pressure will not.

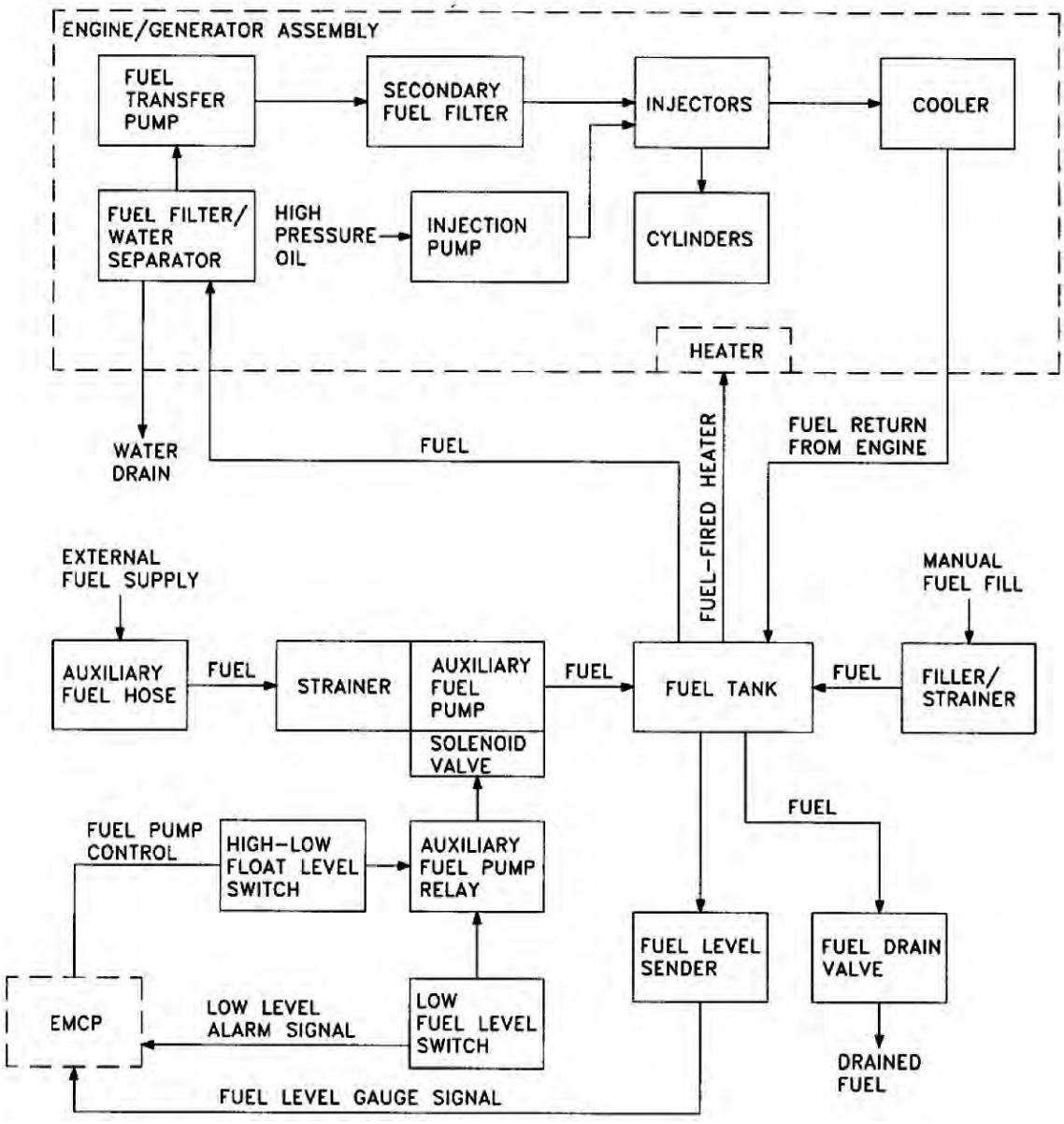


Figure 2. Fuel System.

Auxiliary Fuel System

The auxiliary fuel system consists of an external fuel supply, a fuel hose, a 24 VDC auxiliary fuel pump with strainer and solenoid valve, fuel lines, and an auxiliary fuel pump relay. When the EMCP AUX FUEL switch is ON, the auxiliary fuel pump can transfer fuel from an external fuel supply to the generator fuel tank. The fuel level float in the fuel tank shuts off power to the auxiliary fuel pump via the auxiliary fuel pump relay when the TQG fuel tank is full and reactivates the pump as the level drops. The fuel level indicator on the EMCP indicates the fuel level of the fuel tank from empty (E) to full (F).

HYDRAULIC ELECTRONIC UNIT INJECTOR (HEUI) FUEL SYSTEM

The operation of the HEUI fuel system (Figure 3) is different from mechanically actuated fuel injection systems. The HEUI fuel system requires no mechanical adjustment. Installing different software in the ECM makes changes in performance.

The engine uses an HEUI in each cylinder. A solenoid on each injector controls the amount of fuel delivered by the injector. An engine speed/timing sensor detects top dead center (TDC). All fuel injection is timed off the occurrence of TDC. The ECM determines how much fuel is to be delivered based on the difference between desired and actual speed. The ECM then sets the timing from TDC for each cylinder based on data received from the coolant temperature sensor, inlet air manifold temperature, atmospheric pressure sensor, and turbocharger outlet (boost) pressure sensor. The ECM adjusts timing and fuel delivery for best engine performance, fuel economy, and white smoke control.

The HEUI fuel system uses a hydraulically actuated electronically controlled unit injector. All fuel systems for diesel engines use a plunger and barrel to pump fuel under high pressure into the combustion chamber. Fuel is pumped into the combustion chamber in precise amounts to control engine performance. The HEUI uses engine oil under high pressure to power the plunger rather than a fuel injection pump camshaft lobe to power the plunger. The HEUI uses engine lubrication oil that is pressurized from 870 psi (6 Mpa) to 3,500 psi (24 Mpa) to pump fuel from the injector. The HEUI operates in the same way as a hydraulic cylinder to multiply the force of the high pressure oil. By multiplying the force of the high-pressure oil, the HEUI produces injection pressures that are very high. This multiplication of pressure is achieved by applying the force of high-pressure oil to a piston. The piston is larger than the plunger by approximately six times. The piston pushes on the plunger. The engine lubrication oil under high pressure is called the actuation pressure of the oil. The actuation pressure of the oil generates the injection pressure delivered by the unit injector, increasing the pressure by a factor of six. Low actuation pressures result in low injection pressure of the fuel. During conditions of low speed such as idle and start, low injection pressure is used. High actuation pressure during high idle and acceleration results in high injection pressure of the fuel. The HEUI fuel system provides infinite control of injection pressure.

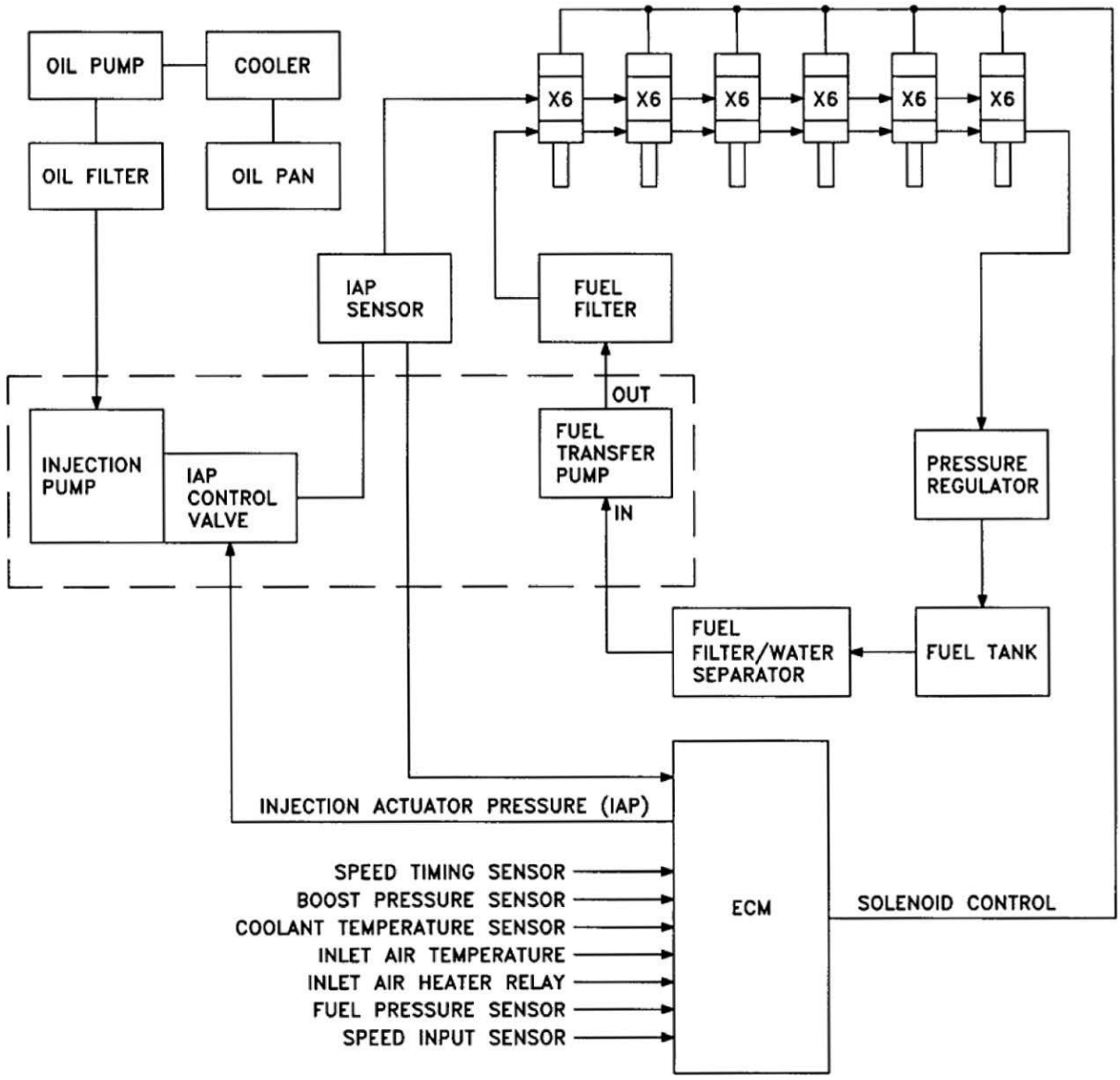


Figure 3. Hydraulic Electronic Unit Injector System.

Electronic Control Module (ECM)

The ECM computer electronically controls engine performance. The ECM uses engine performance data gathered by several sensors to make adjustments to the fuel delivery, injection pressure and injection timing. The ECM contains programmed performance maps (software) to define horsepower, torque curves and RPM. This software is commonly called the personality module. The ECM logs faults of engine performance. The ECM can diagnose problems with itself and the sensors and sensed values input to the module. When a problem is detected, a diagnostic code is generated and sent to the GSC where it is displayed. In most cases, the code is also logged with the engine hour value indicating when the failure occurred. When diagnostic codes are generated, they are referred to as active. They indicate a problem presently exists. These should be serviced first. Diagnostic codes stored in memory are referred to as logged failures. The existence of a logged code does not indicate a current failure. The failure may have occurred some time ago. The logged codes are useful when troubleshooting an intermittent problem. Logged inactive codes require a generic password to clear as described in WP 0004 and WP 0092. Codes not requiring a password are automatically deleted from memory after 100 engine operating hours.

Hydraulic Pump

The hydraulic injection pump (high-pressure oil pump) is located at the left front corner of the engine. The hydraulic pump is a fixed displacement axial piston pump. The hydraulic pump uses a portion of the engine lubrication oil pressurized to the injection actuation pressure required to power the HEUI injectors.

Injection Actuation Pressure (IAP) Control Valve

The injection actuation pressure (IAP) control valve is located on the side of hydraulic pump. Under most conditions, the pump produces excess oil flow. The IAP Control Valve discharges excess pump flow to the drain to control injection actuation pressure to the desired level. The performance maps of ECM contain a desired actuation pressure for every engine operating condition. The ECM sends a control current to the IAP control valve. The control current should make the actual actuation pressure equal to the desired actuation pressure. The IAP control valve is an actuator that converts an electrical signal from ECM to the mechanical control of a spool valve that controls pump outlet pressure.

Fuel Transfer Pump

The fuel transfer pump is mounted on the back of hydraulic pump. The fuel transfer pump draws fuel from the fuel tank. The fuel transfer pump pressurizes the fuel to 65 psi (450 kPa). The pressurized fuel is supplied to injectors. The fuel transfer pump is a spring-loaded, single piston pump. The pump is operated by an off-center bearing on the back of the hydraulic pump shaft. There are two check valves in the fuel transfer pump. The inlet check valve opens to allow fuel from the tank into the pump and closes to prevent fuel leakage back to the fuel tank. The outlet check valve opens to supply fuel to the fuel supply passage in the cylinder head. The fuel supply passage supplies fuel to injectors. The outlet check valve closes to prevent pressurized fuel leakage back through the pump.

Injection Actuation Pressure (IAP) Sensor

IAP sensor is installed in the high-pressure oil manifold. The high-pressure oil manifold supplies actuation oil to power the unit injectors. The IAP sensor monitors injection actuation pressure and sends a continuous voltage signal back to ECM.

HEUI Fuel System Operation

Low Pressure Fuel System

The low pressure fuel system supplies fuel for combustion to injectors, supplies excess fuel flow to cool the unit and to remove air from the system. The low-pressure fuel system consists of fuel tank, filter, transfer pump and pressure regulator. The fuel transfer pump pushes pressurized fuel out of the outlet port and draws new fuel into the inlet port from the fuel tank. Fuel flows from the outlet port of fuel transfer pump to the fuel supply passage in the cylinder head. The fuel supply passage is a drilled hole that begins at the front of the cylinder head and extends to the back of the cylinder head. This passage connects with each unit injector bore to supply fuel to unit injectors. Fuel from the transfer pump flows through the cylinder head to all of the unit injectors. Excess fuel flows out of the back of the cylinder head and into the fuel pressure regulator. The fuel pressure regulator is an orifice and a spring loaded check valve. The orifice restricts flow to pressurize the supply fuel. The spring loaded check valve opens at 5 psi (35 kPa) to allow the fuel which has flowed through the orifice to return to the fuel tank. When the engine is off and no fuel pressure is present, the spring loaded check valve closes. The spring-loaded check valve closes to prevent the fuel in the cylinder head from draining back to the fuel tank.

Injection Actuation System

The injection actuation system supplies high-pressure oil to power HEUI injectors and controls the injection pressure produced by the unit injectors by changing the actuation pressure of the oil. Oil from the engine oil pump supplies the needs of the engine lubrication system and the hydraulic injection pump for the fuel system. Oil drawn from the engine sump is pressurized to the lubrication system oil pressure by the engine oil pump. Oil flows from the engine oil pump through engine oil cooler, through the engine oil filter and then to the main oil gallery. A separate circuit from the main oil gallery directs a portion of the lubrication oil to supply the injection pump.

Oil flows into the inlet port of injection pump and the oil fills the pump reservoir. Oil from the pump reservoir is pressurized in the hydraulic pump and pushed out of the outlet port under high pressure. Oil then flows from the to the high-pressure oil passage in the cylinder head.

The high-pressure oil passage connects with each unit injector bore to supply high-pressure actuation oil to unit injectors. Oil is contained in the high-pressure oil passage until used by the unit injectors. Oil that has been exhausted by the unit injectors is expelled under the valve covers. This oil returns to the crankcase through oil drain holes in the cylinder head. Under most operating conditions, the injection pump is producing excess flow that must be discharged to a drain to control the system pressure. The IAP control valve regulates system pressure by discharging the precise amount of oil to the drain.

The ECM selects the desired actuation pressure based on sensor inputs and performance maps. The ECM sends a control current to the IAP control valve to change the actual actuation pressure. The IAP control valve reacts to the electrical current from the ECM to change the actual actuation pressure by discharging pump flow to the drain. The IAP control valve is an electrically controlled relief valve. The IAP sensor monitors the actual actuation pressure in the high-pressure oil passage and reports by sending a signal voltage to the ECM. The injection actuation pressure control system operates in a cycle. ECM selects the desired actuation pressure and sends an electrical current to the IAP control valve that should produce that pressure. The IAP control valve changes the pressure relief setting, which in turn changes the actual actuation pressure. The IAP sensor monitors the actual actuation pressure and sends a signal voltage back to the ECM. The ECM interprets the signal voltage to calculate the actual actuation pressure and compares the actual actuation pressure to the desired actuation pressure to adjust the electrical current to the IAP control valve. The IAP control valve responds by changing the actual actuation pressure. This closed loop control system is repeated 67 times per seconds.

Most of the high pressure oil flow from injection pump is used to power unit injectors. Excess flow is returned to the drain through the IAP control valve. The excess flow travels through a drilled passage to the front of the pump. Drain oil flows out of the front of the pump over the pump drive gear and flows down the engine front gear train to the sump.

LUBRICATION SYSTEM

The lubrication system (Figure 4) consists of an oil pan, dipstick, pump, cooler, oil pressure sensor, and filter. The oil pan is a reservoir for engine lubricating oil. Engine oil lubricates, cleans, cools, seals, and preserves engine parts. The dipstick indicates oil level in the oil pan. A pump draws oil from the oil pan and through a screen that blocks large objects from entering the oil pump and cooler. The oil then passes through a spin-on type filter where smaller impurities are removed. From the filter, oil enters the engine and is distributed to the engine's internal moving parts through internal passageways. Oil is also supplied externally to the turbocharger and internally to a high pressure hydraulic pump that actuates the fuel injectors. After passing through the engine, the oil returns to the oil pan. The lower GSC display indicates oil pressure sensed by the oil pressure sender in the engine. The engine shuts down automatically and the red LOW OIL PRESSURE indicator on the GSC flashes if the oil pressure drops to 26 psi (179 kPa). The oil level can be checked with the engine running.

Oil Distribution

The engine oil pump is mounted to the bottom of the cylinder block inside the engine oil pan. The engine oil pump pulls oil from engine oil pan and pushes the oil through the passage to the engine oil cooler and filter. The filtered oil then enters the turbocharger oil supply line and main oil gallery. The main oil gallery distributes oil to main bearings, piston cooling jets, and the camshaft bearing. Oil from the main oil gallery exits the front of the block and enters a groove that is cast in the front housing. Oil enters the crankshaft through holes in the bearing surfaces (journals) for the main bearing. Passages connect the bearing surface for the main bearing with the bearing surface for the connecting rod. The front housing passage sends the oil flow in two directions. At the upper end of the passage, oil is directed back into the block and up to cylinder head gallery through passages to the rocker arm mechanism. Internal passages lubricate the oil pump idler gear bearing and camshaft idler gear bearing. Oil passages in the crankshaft send oil from all the main bearings through the connecting rods to the connecting rod bearings. The passages send oil from the camshaft bearing to push rod lifters.

Injection Pump

The injection pump is a gear-driven axial piston pump that increases engine oil pressure from the operating oil pressure to the actuation pressure required by the unit injectors as discussed in the fuel system description above. The IAP valve electronically controls the output pressure of the injection pump.

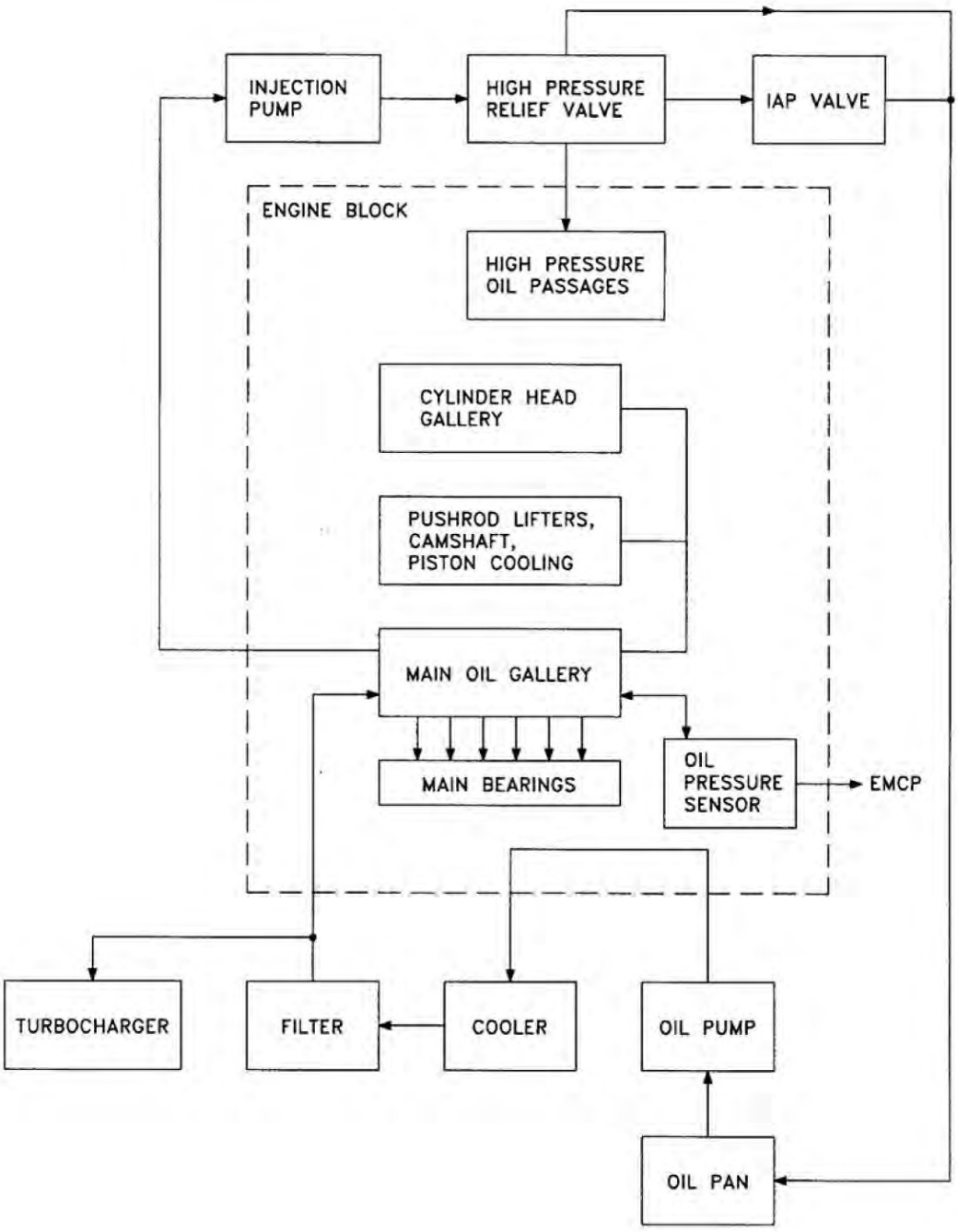


Figure 4. Lubrication System.

High and Low Pressure Systems

The oil circuit consists of a low-pressure circuit and a high-pressure circuit. The low-pressure circuit typically operates at a pressure of 35 psi (240 kPa) to 70 psi (480 kPa). The low pressure circuit provides filtered engine oil to the injection pump. The low pressure circuit also provides filtered engine oil to the engine lubricating system. The high pressure oil system provides actuation oil to the unit injectors, typically operating between 581 psi (4 Mpa) and 3,350 psi (23 Mpa). The high pressure relief valve regulates high pressure in the system. When the oil pressure is at 100 psi (695 kPa) or more, the valve will allow oil to return to engine oil pan. Oil is discharged from the unit injectors under the valve cover so that no return lines are required. After the lubrication is completed, the lubrication oil returns to the engine oil pan.

ENGINE COOLING SYSTEM

The engine cooling system (Figure 5) consists of a radiator, hoses, thermostat, water pump, surge tank and expansion bottle, a belt driven fan, and cooling jackets. The water pump forces coolant through passages (cooling jackets) in the engine block and cylinder head where the coolant absorbs heat from the engine. When the engine reaches normal operating temperature, the thermostat opens and the heated coolant flows through the upper radiator hose assembly into the radiator. The cooling fan circulates air through the radiator where the coolant temperature is reduced. In addition, the fan cools engine and generator set components within the TQG housing by drawing in air from outside the housing through the baffles, circulating the air through the housing and forcing the air through the radiator and out through the housing exhaust vents on the roof. The housing is designed to operate with the doors closed which ensures that the main alternator and other TQG components have access to a good flow of cooling air from outside the generator set. The normal operating temperature of the generator set is 170 to 200 °F (77 to 93 °C). A coolant temperature sensor provides automatic shut down in the event that coolant temperature exceeds 230 °F (110 °C). The TQG engine has a pressurized cooling system equipped with a shunt line. The cooling system can operate safely at temperatures higher than the normal boiling point of water without water pump cavitation. Cavitation is the sudden formation of low-pressure bubbles in liquids by mechanical forces. The formation of air or steam pockets is more difficult within a pressure type cooling system. The shunt line prevents water pump cavitation by providing a constant flow of coolant. The water pump is located on the right side of the cylinder block. The water pump is belt driven from the crankshaft pulley. Coolant can enter the water pump from via the inlet at the bottom of the water pump, through the bypass hose into the top of the water pump, and through the shunt line into the top of the water pump. Coolant from the bottom of the radiator is pulled into the bottom inlet of the pump by impeller rotation. The coolant exits the back of the pump directly into the oil cooler cavity in the engine block. All of the coolant passes through the core of the oil cooler and the coolant enters the cylinder block internal water manifold. The manifold disperses the coolant to water jackets around the cylinder walls. From the cylinder block, the coolant flows into passages in the cylinder head. The passages send the flow around the unit injector sleeves and the inlet and the exhaust passages. The coolant now enters the thermostat housing at the front right side of the cylinder head. The thermostat controls the direction of flow. When the coolant temperature is below the normal operating temperature, the thermostat is closed. The coolant is directed through a bypass hose and into the top inlet of the water pump. When the coolant temperature reaches the normal operating temperature, the thermostat opens. When the thermostat is open, the bypass is closed. Most of the coolant goes through the outlet to the radiator for cooling. The remainder flows through bypass hose and into the water pump. The shunt line extends from the top of the water pump to the surge tank. The shunt line must be routed properly to avoid trapping any air. By providing a constant flow of coolant to the water pump, the shunt line prevents cavitation. The lower GSC display indicates the engine coolant temperature.

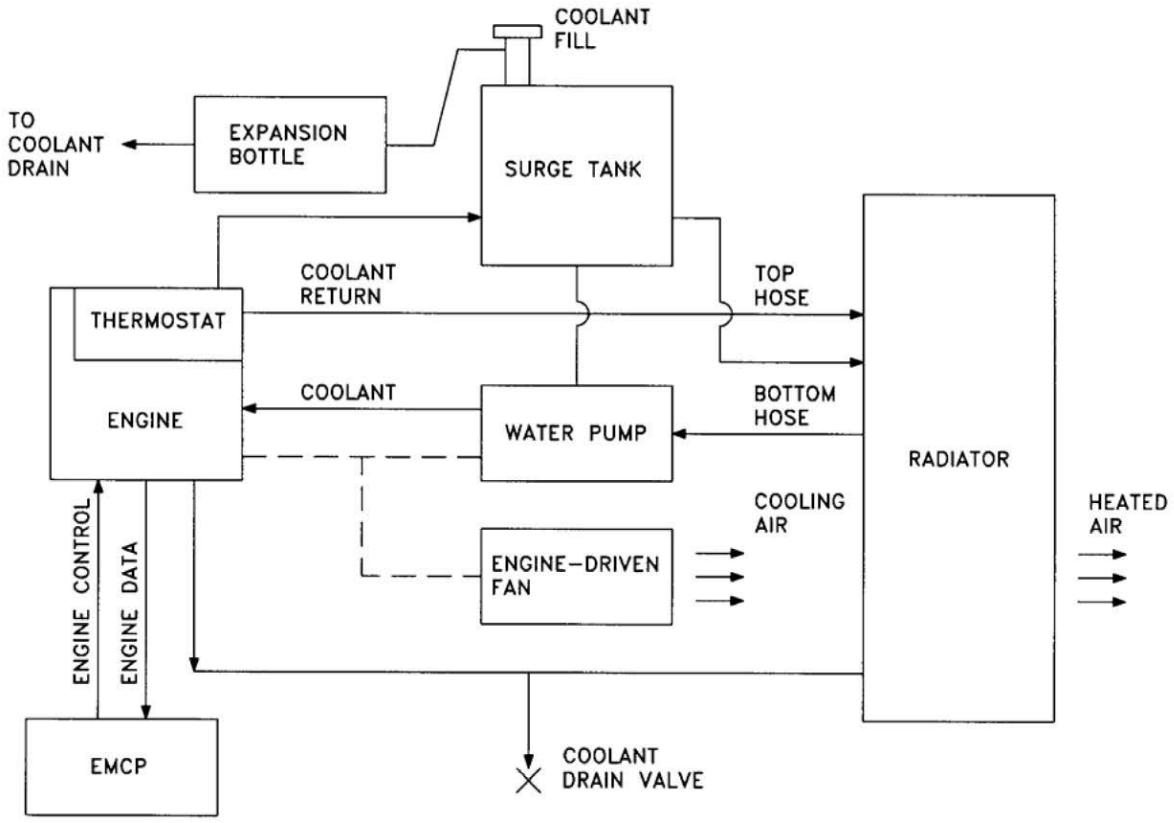


Figure 5. Engine Cooling System.

AIR INLET AND EXHAUST SYSTEM

The air inlet and exhaust system (Figure 6) consists of an air filter assembly, intake manifold, turbocharger, exhaust manifold and muffler. Ambient air is drawn into the air filter assembly where it passes through the filter elements. Airborne dirt is removed and trapped in the elements. Filtered air is drawn out of the air filter assembly through air intake tubes to the turbocharger where it is pressurized and passed through an after cooler coil in the radiator. In cold weather, an inlet air preheater is activated to warm the inlet air. The pressurized inlet air enters the intake manifold to the combustion chambers and mixes with fuel from the fuel injectors. The engine exhaust gases are released into the turbocharger, which is mounted on the exhaust manifold. The exhaust gases drive the turbocharger, forcing large amounts of air into the intake manifold. After passing through the turbocharger, the exhaust gases are channeled into a muffler to deaden the sound. The exhaust gases are vented upward from the generator set housing.

The components of the air inlet and exhaust system control the quality of the air that is available for combustion. These components also control the amount of the air that is available for combustion. Inlet air is pulled through the air cleaner. The inlet air is then compressed and heated by the compressor wheel of the turbocharger to about 300 °F (150 °C). The inlet air is then pushed through the air-to-air after cooler core and the inlet air temperature drops to about 110 °F (43 °C). Cooling the inlet air increases the combustion efficiency which helps to lower fuel consumption and increases horsepower output. The after cooler core is a separate cooler core installed above the core (standard) of the engine radiator. The engine fan moves air at ambient temperature across the after cooler core to cool the turbocharged inlet air. From the after cooler core the air is forced into the cylinder head to fill the inlet ports. The inlet valves control air flow from the inlet port into the cylinder. There are two inlet valves and one exhaust valve for each cylinder. Inlet valves open when the piston moves down on the inlet stroke to pull air into the cylinder. The inlet valves close and the piston begins to move up on the compression stroke. The air in the cylinder is compressed and fuel is injected into the cylinder. The fuel mixes with the air and combustion starts. During the power stroke, the combustion force pushes the piston downward. Then the piston moves upward in the exhaust stroke. During the exhaust stroke, the exhaust valve opens, and the exhaust gases are pushed through the exhaust port into the exhaust manifold. After the piston completes the exhaust stroke, the exhaust valves close and the cycle starts again. Exhaust gases from exhaust manifold enter the turbine side of turbocharger to turn the turbine wheel. The turbine wheel is connected to a shaft, which drives the compressor wheel. Exhaust gases from the turbocharger pass through the exhaust outlet pipe, the muffler and the exhaust stack.

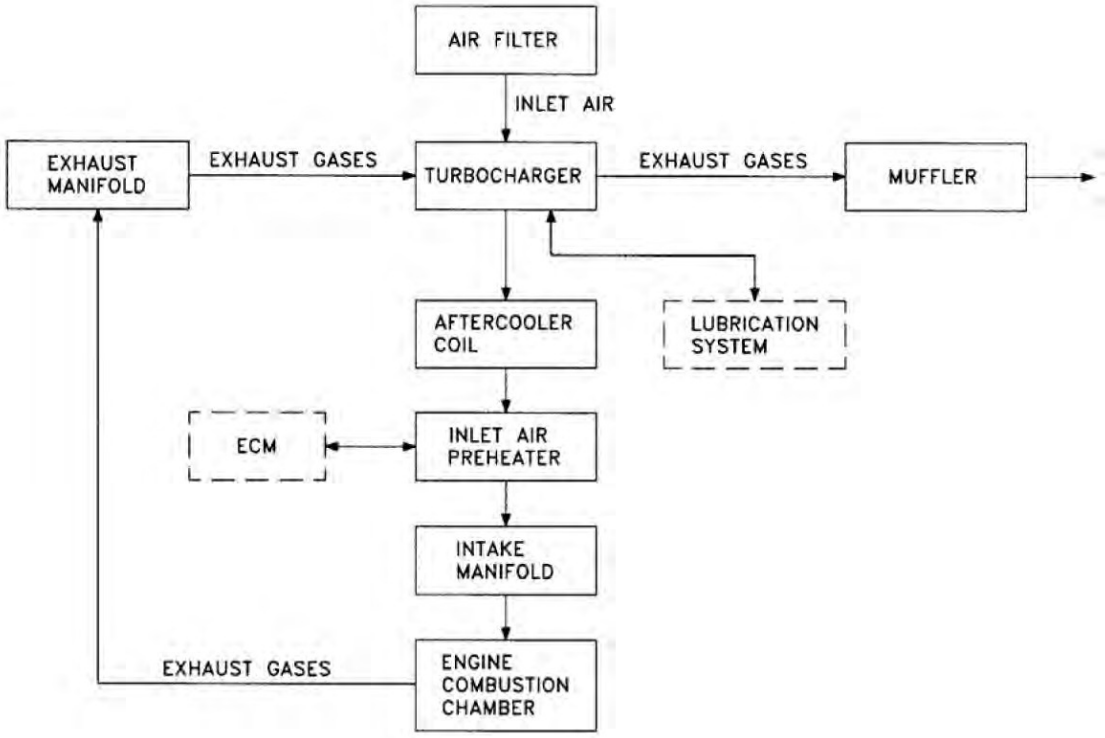


Figure 6. Air Inlet and Exhaust System.

Turbocharger

The turbocharger is installed on the center section of the exhaust manifold. All the exhaust gases from the engine go through the turbocharger. The compressor side of the turbocharger is connected to the after cooler by pipe. The exhaust gases go into the turbine housing through the exhaust inlet. The exhaust gases spin the blades of a turbine wheel that is connected by a shaft to the compressor wheel. The rotation of the compressor wheel pulls clean air from the air filters through the compressor housing air inlet. The compressor wheel blades compress the inlet air. Air compression increases engine power by allowing the engine to burn more air and more fuel during combustion. When the load on the engine increases, more fuel is injected into the cylinders producing more exhaust gases to increase the turbocharger speed. As the compressor wheel turns faster, more air is forced into the cylinders. The increased flow of air gives the engine more power by allowing the engine to burn the additional fuel with greater efficiency. The turbocharger uses engine oil under pressure for lubrication. The oil comes in through an oil inlet port, lubricates turbocharger bearings, and returns through an outlet port to the engine lubrication system.

Inlet Air Preheater

The engines are equipped with an electric heater that is located behind the air inlet elbow. The electric heater functions to aid in starting and to clean up white smoke during start-up. Under the proper conditions, the ECM turns on the electric heater based on jacket water coolant temperature, inlet manifold temperature, and duration. The system can deliver heat for 30 seconds prior to start-up and during cranking of the engine. After the engine has started, the system can deliver heat constantly for 7 minutes, or the system can cycle the heat for 13 minutes. During the heating cycle, the heat is on for 10 seconds and off for 10 seconds. If the air inlet heater malfunctions, the engine will still start and the engine will still run. There may be a concern regarding the amount of white smoke that is present and the need for an alternative starting aid. The engine ECM controls an inlet air heater system to improve the cold starting capability. The ECM measures coolant temperature and controls an air inlet heater relay to apply 24 VDC from the batteries to the heater to preheat the air as necessary. Regardless of temperature, power is applied to the heater for 2 seconds when power is applied to the ECM. If the sum of the coolant temperature and the inlet manifold temperature is less than 109 °F (25 °C), the ECM will turn on the heater for 30 seconds as a preheating cycle. If the operator attempts starting during this preheating cycle, the engine will crank and try to start normally. During engine cranking, if the sum of the coolant temperature and the inlet manifold temperature is less than 109 °F (25 °C), the heater will be turned on. The heater will remain on during cranking. If the engine fails to start, the heater will revert to preheat and the heater will come on for 30 seconds. After the engine has started, if the sum of the coolant temperature and the inlet manifold temperature is less than 109 °F (25 °C), the heater will remain on continuously for 7 minutes. If the same temperature conditions exist afterwards, the heater will remain on for 13 minutes, turning on for 10 seconds and turning off for 10 seconds. After the 13-minute heat cycle, the heater will turn off. If the coolant temperature sensor fails, the heater will activate if the inlet manifold air temperature is less than 50 °F (10 °C). If the inlet manifold temperature sensor fails, the heater will activate if the coolant temperature is less than 104 °F (40 °C). After the engine has been running, if the sum of the coolant temperature and the inlet manifold temperature does not exceed 127 °F (35 °C), the heater will be activated again. The heater will be activated for no more than 20 minutes at a time. The normal current draw of the air inlet heater is 77 to 95 Amps.

AC POWER OUTPUT

The AC output system (Figure 7) consists primarily of the AC generator, the output load terminal board, the voltage reconnection terminal board, the main load contactor and the AC CIRCUIT INTERRUPTER switch on the EMCP. Power created by the AC generator is supplied through the voltage reconnection terminal board and the main load contactor to the output load terminals on the output load terminal board. The voltage reconnection terminal board allows configuration of the generator set for 120/208 volt connections or 240/416 volt connections.

NOTE

The DVR and GSC must be reprogrammed for voltage changes.

The AC CIRCUIT INTERRUPTER switch located on the EMCP closes and opens the main load contactor. This enables or interrupts the power flow between the voltage reconnection terminal board and the output load terminals. The main load contactor is also opened automatically during any of the specified set faults. The Digital Voltage Regulator (DVR) module in the EMCP senses AC generator output voltage and provides excitation voltage to the AC generator to maintain the desired output voltage. The VOLTAGE adjust potentiometer is connected to the DVR to allow minor voltage adjustments. The user can select which output load terminals to monitor for current and voltage measurements with the GSC keypad AC METER key. The values and terminals are indicated on the upper and lower displays. Refer to AC POWER DISTRIBUTION for a more detailed discussion.

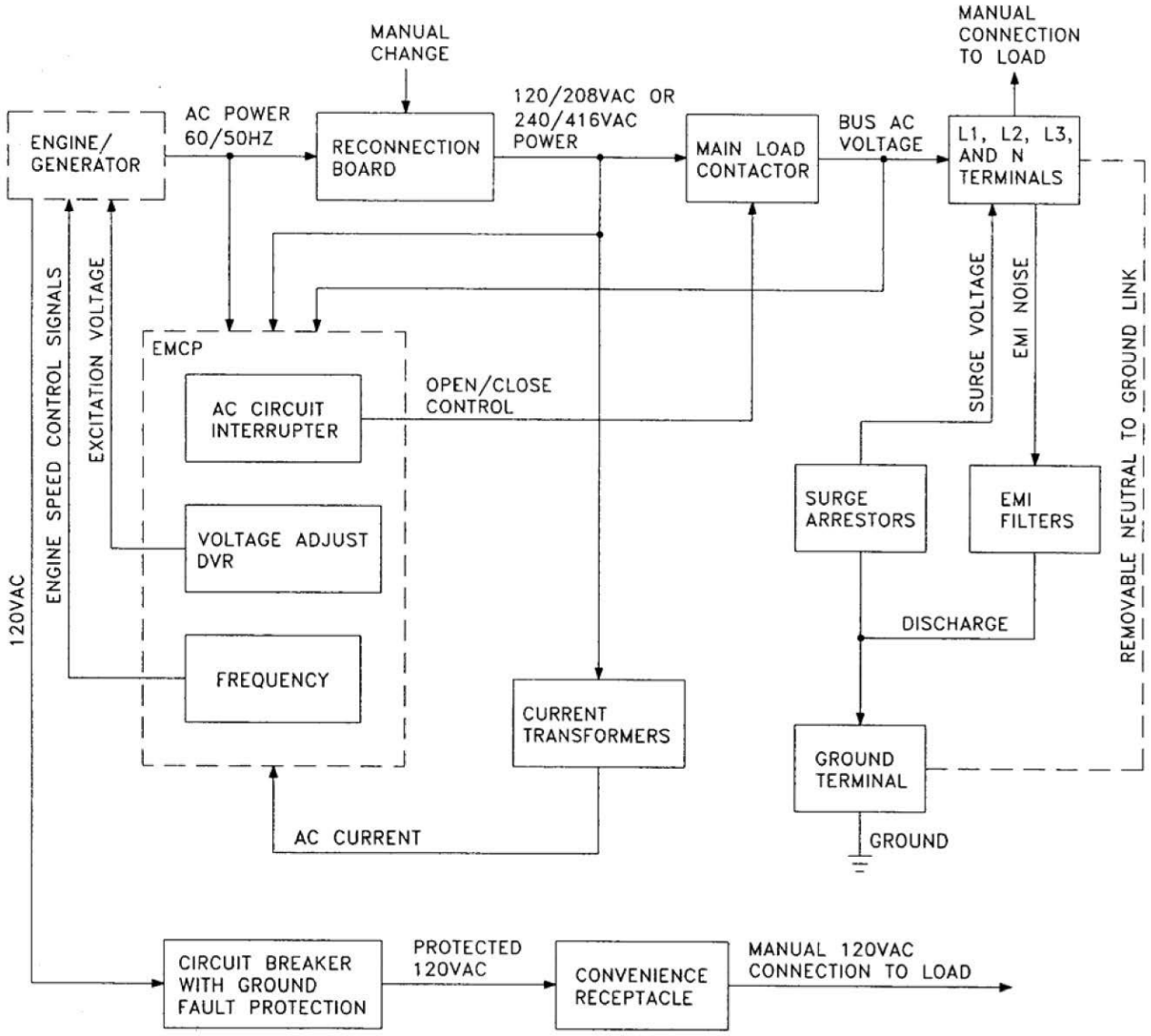


Figure 7. AC Power Output.

DC POWER DISTRIBUTION (FIGURE FO-1, SHEETS 2 AND 3)

The DC battery system (Figure 8) provides 24 VDC for engine starting and TQG control circuits. The two 12 VDC batteries are charged by the engine alternator. The DC AMMETER on the EMCP indicates alternator charging rate. Charge rate is shown from -25 to +50 Amps. Normal operating indication depends on the state of charge in the batteries. A low charge, such as exists immediately after engine starting, will cause a high reading. The battery system includes a manually operated Battery Disconnect Switch to isolate the batteries from the engine. The Battery Disconnect Switch can be used to remove the DC power from the TQG. The batteries connect directly to the 24 VDC NATO slave receptacle.

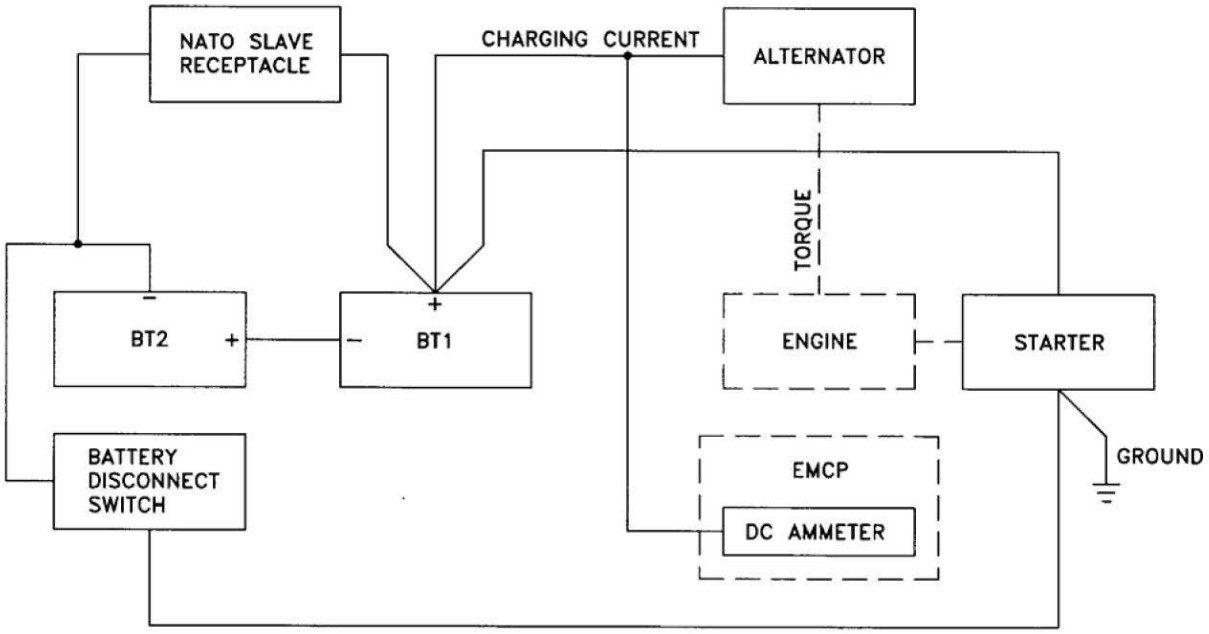


Figure 8. DC Power Distribution.

Batteries

Batteries BT1 and BT2 are 12 VDC batteries connected in series to supply 24 VDC for this system. The DC power distribution system operates on 24 VDC. The Slave Receptacle (SR) is the NATO connector on the generator set. This is useful for charging the batteries and jumping the generator set with another if the batteries become discharged. The Battery Disconnect Switch disconnects the batteries from everything except the slave receptacle. Battery power goes directly to the starter solenoid (Labeled PS (pinion solenoid) on the schematic) for use when cranking or starting the engine. The batteries are connected to the alternator through shunt R4 and circuit breaker CB-5. R4 generates a voltage for the ammeter, which displays the amperage from the alternator when charging the batteries. Battery power is connected to ECM A8 through circuit breaker CB-4 and relay contacts of slave relay (SRY). SRY is energized any time power is applied to the GSC. Battery power goes through D1 to the common of the DEAD CRANK SWITCH. In OFF, battery power is removed from the GSC, DVR, ECM, and Winterization Kit (if supplied). In NORMAL, battery power is applied to the relay module of the GSC through circuit breaker CB1. Power is distributed to the other equipment by the ECS. In CRANK, +24 VDC is applied to the Starter Motor Magnetic Switch (SMMS) relay coil. SMMS connects battery voltage to the starter solenoid through circuit breaker CB-2, causing the engine to crank. Since power is not supplied to the electronics, the engine will not start.

Emergency Stop Push Button

The Emergency Stop Push Button (ESPB) (PUSH TO STOP EMERGENCY STOP on EMCP) is there to stop the generator set in an emergency. When pushed, contacts 3 and 4 ground P7-38, tell the GSC that the switch is pressed. Contacts 1A and 2A remove the ground from the output to the engine controller, which enables the engine to run. This will stop the engine. Contacts 1 and 2 open the circuit between the GSC and relay SMMS so that the GSC will not be able to attempt to crank the engine. When the ECS is set to START, starter motor relay (SMR) A1 K4 is energized. +24 VDC is applied through the ESPB (if it is not pressed) and D2 to relay SMMS which enables the starter and cranks the engine. D2 prevents voltage from the DEAD CRANK SWITCH from applying power to Relay Field Flash (KFF) relay.

Field Flash Relay

Relay A1 K4 also applies +24 VDC to the coil of KFF relay. The contacts of KFF apply the +24 VDC, which is across the coil of KFF, to the generator field coil input (see FO-1, sheet 4) through a 15 Ohm, 25 Watt resistor and diode CRFF (Diode Field Flash). Note that for the acronyms KFF and CRFF, the common reference designators for a relay (K) and a diode (CR) were used. This excitation voltage starts the generator generating voltage. After the process is started, it is self sustaining.

Electronic Governor Relay (EGR) Communications Data Links, MPU, CTR, and GFR

The Electronic Governor Relay (EGR) output of the GSC is connected to the engine controller. P7-21 and 22 are the Communications Data Link between the GSC and the Communication Module (CM). P7-1 and 2 are the inputs from the engine Magnetic Pickup Unit (MPU). This pickup measures speed of rotation of the engine by detecting the starter ring gear teeth. This input is a frequency proportional to engine speed. P7-19 and 20 are the Communications Data Link between the GSC and the electronic control module on the engine. (This is also known as the CAT Data Link.) A1 F1 (Labeled F1 GSC on schematic), and the GSC relay contacts labeled CTR are not used. P7-23 is a low fuel level input from the low fuel level sensor connected to Alarm Module A2 (FO-1, sheet 3). This input is connected to ground when the fuel tank is almost empty. The 10A fuse between RM-34 and RM-7 is A1 F5. The Generator Fault Relay (GFR) K2 in the GSC closes when the GSC detects a generator fault. This energizes the GFR external to the GSC. The contacts for the GFR are used to de-energize K1 and disconnect the load from Generator G1.

Engine Control Switch (ECS)

The ECS consists of two sections. One section consists of pins 1, 2, 3, 4, and 5; the other section consists of pins 6, 7, 8, 9 and 10 of the switch. There is a legend on the schematic that describes which contacts are closed in which positions of the switch. Pins 6 through 10 apply power to the GSC, Overload and Short Circuit (OL/SC) module, and DVR whenever the switch is not in OFF. This allows the OFF position of this switch to reset any alarms that have occurred. Shorting pins RM 1 and RM 2 on the GSC does this. Note the internal relay connections in the GSC between pins RM 1 and RM 2. This is to ensure that power can not be removed from the GSC when the Fuel Control Relay (FCR) A1 K7 is energized (signifying the engine is running) or the Crank Termination Relay (CTR) A1 K3 is active (signifying that the engine is running and the starter can be released). Pins 1 through 5 ground a different input line to the GSC for each position of the switch, telling the GSC what to do.

Power to ECM, DVR, OL/SC, Fuel Gauge, Panel Lights, Winterization Kit

Fuse F10 shown between RM 1 and RM 10 is A1 F10 on the back of the GSC. This connects +24 VDC to pin RM 39 whenever the ENGINE CONTROL switch is in any position other than OFF. Slave Relay (SRY) is connected to RM 39 and is powered up any time the ECS is not in OFF. The contacts of SRY apply +24 VDC from the battery to ECM A8. Power to DVR A3 module also comes from RM 39. Power to the OL/SC module comes from RM 1 through a set of normally closed contacts on relay AR. AR is energized when the LAMP TEST button is pressed on Alarm Module A2. The fuel gauge (FLG) is connected to RM 39 for power. The signal comes from the fuel sending unit (FLSU) in the fuel tank. The panel lights get their power from RM 2, which has power whenever the DEAD CRANK SWITCH is set to NORMAL. Closing the PANEL LIGHT switch (PLS) applies power to the lights.

Power to the optional winterization system is applied whenever the DEAD CRANK SWITCH is set to NORMAL. If the winterization kit is turned on at its control panel, +24 VDC is output to TB5-15. This applies power to the two resistor heaters used to keep the LCD displays in the GSC and the DVR from freezing. There is also a thermally operated switch in the control panel that closes when the temperature falls below -20 ±10 °F (-28.9 ±5.6 °C). This switch applies +24 VDC from TB4-17 to the resistors used to keep the LCD displays in the GSC and the DVR from freezing. Note that this power is only available when the ECS is not in OFF.

Coolant Low Sensor Interface

Pins P7-7, 8, 9, 13, 14, 24, 30, and 31 are connected between the GSC and connector J37. P7-9 is +8 VDC power for the Coolant Low sensor. P7-31 is power return. P7-13 is the Coolant Low signal from the sensor. This sensor detects presence or absence of coolant in the engine and provides an output indicating that the coolant level is dangerously low to allow an operator to add coolant before a forced shutdown occurs.

Load Sharing Module (LSM) A4

The LSM gets an input from the Speed Setting Potentiometer (SSP) (labeled FREQUENCY on the front panel). This signal allows the generator frequency to be adjusted ±10% of nominal. There is a SYNC input on pins 24 and 25 from the GSC. This signal is output on LSM Pins 10 and 11 if this generator is connected to a dead load bus and in AUTO or SEMI-AUTO sync mode. Otherwise, pins 10 and 11 are an input. Pins 10 and 11 are connected to J32 and J33 through contacts on the paralleling relay (PAR). J32 and J33 are the paralleling cable connectors on the rear of the generator set near the control panel. In parallel operation, cables interconnect all of the paralleled generators and these ports are all in parallel. Pins 19 and 20 are a serial communication port to the ECM via J37. Pins 15 and 16 are power and ground respectively.

Alarm Module A2

The alarm module monitors three conditions: Low Fuel, Overload (current), and Short Circuit (OL/SC). The Low Fuel condition is monitored by fuel level switch FL1 in the fuel tank and a set of contacts close when the fuel tank is almost empty. This lights a red lamp on the alarm panel and sounds the alarm buzzer. The lamp will flash at two cycles per second. Pressing the Alarm Silence button on the alarm module will silence the buzzer. This Low Fuel signal is also connected to the GSC at P7-23 (SP-1 input) to notify the GSC that the fuel tank is almost empty. The OL/SC module monitors the Overload and Short Circuit conditions. (The AC Power Distribution discussion describes the module functions.) A set of relay contacts for each condition is input to this panel and each lights a yellow lamp. These conditions do not sound the buzzer. There is a relay coil (AR) connected to the LAMP TEST input/output of the alarm panel. When the LAMP TEST button on the panel is pressed, this relay is energized. The contacts (FO-1, sheet 2) remove power from the OL/SC module when the relay is energized. This resets the output relays and any condition sensed by this module. Power for this module is on pins 1 and 7.

Dead Bus Hi/Lo Inputs

Spare input SP-4 at P7-29 is connected to ground through a set of contacts on DBHI and a set of contacts on DBLO. If there is no voltage on the load bus, DBLO and DBHI will both be de-energized and the contacts used here will both be closed, grounding P7-29. This input is monitored to verify the condition of the load bus. A ground here indicates that there is no voltage on the load bus. This input is compared against the AC voltage monitored at P7-17 and P7-18. If both signals indicate a dead bus, the AUTO mode will close the load contactor onto the dead bus automatically.

BATTLE SHORT Switch (BSS) Input to ECM

One set of contacts on the BSS is connected to the ECM. This is to notify the ECM when the system is in the Battle Short Mode. In this mode, shutdown conditions are locked out except for Short Circuit Over Speed.

Auxiliary Fuel Pump Circuit

The AUX FUEL switch on the control panel is labeled AFPS (Auxiliary Fuel Pump Switch) on the schematic. The ON position is when terminal 1 and 2 are connected together. The OFF position is when terminals 2 and 3 are connected together. When the AUX FUEL switch is ON, fuel level sensors FL2A and FL2B in the fuel tank control the Auxiliary Fuel Pump Relay (AFPR). When the fuel level in the tank gets low, FL2A and FL2B will be closed, applying power to relay AFPR. One set of contacts on AFPR latch, keeping AFPR energized. Another set of contacts on AFPR apply 24 VDC to the auxiliary fuel pump. The auxiliary fuel pump will transfer fuel from an external tank to fill the internal tank in the generator set. As the fuel level raises in the tank, FL2B will open. The pump will continue transferring fuel since a set of contacts on AFPR latches the relay to the ON condition. When the fuel level gets to FL2A, those contacts will open. AFPR will drop out and the transfer pump will stop.

SYNC MODE Switch (SMS)

The SYNC MODE switch has three sections and four positions for the four sync modes: OFF, SEMI-AUTO, AUTO, and PERMISSIVE. OFF is used when not paralleling generator sets, the other modes are for paralleling. The first section controls the AUTO SYNC input to the GSC. The AUTO SYNC input to the GSC is grounded in AUTO and PERMISSIVE modes. When grounded, this input enables the automatic synchronization of Generator G1 with the load bus. The second section controls the SYNC CHECK input to the GSC. The SYNC CHECK input to the GSC is grounded in SEMI-AUTO and PERMISSIVE. When grounded, this input enables the synchroscope function on the GSC. The third section is integrated with the opening and closing of the load contactor K1 and is discussed more fully with K1 operation. Note that SEMI-AUTO and PERMISSIVE are wired together.

Load Contactor K1, K1 Relay (KR), and Contactor Control Switch (CCS), Also Known As AC CIRCUIT INTERRUPTER

Switch Load contactor K1 is controlled by K1 Relay (KR), GSC Run Relay (RR) A1 K5, and GSC Programmable Spare Relay (PSR) A1 K8. GSC PSR (A1 K8) is programmed to close whenever there are no alarm conditions sensed by the GSC. When the ENGINE CONTROL switch (ECS) is placed in START (or in AUTO and a remote start command is received), the GSC closes RR (A1 K5). The fuse labeled F7GSC is actually A1 F6. Note that the GSC checks to be sure there are no faults present prior to closing RR and verifies that all previous faults have been reset, otherwise RR will not be closed. As long as no faults are detected, PSR will also be closed. The cool down relay (CDR) is normally closed and opens at the start of Cool-down Mode. Under these conditions, +24 VDC is connected to relay KR. The SC contacts will be closed unless the OL/SC module detects a short circuit condition. These contacts are reset to closed by turning the ENGINE CONTROL switch to OFF/RESET or pushing the LAMP TEST button on Alarm Module A2. The battle short switch shorts across the next two contacts to disable them in Battle Short Mode. The Generator Fault Relay contacts are normally closed and open when the GSC detects a generator fault condition. The OL contacts will be closed unless the OL/SC module detects an overload condition. These contacts are reset to closed by turning the engine control switch to OFF or pushing the LAMP TEST button on Alarm Module A2.

NOTE

Electrically, if the SYNC MODE switch is in AUTO, it does not matter which position the PARALLEL/ UNIT switch is in.

If the PARALLEL/UNIT switch is set to PARALLEL and SYNC MODE switch set to AUTO, GSC can apply ground to relay KR by grounding the CLOSE BREAKER output. Auxiliary contacts on K1 latch KR on after KR is energized.

If the PARALLEL/UNIT switch is set to PARALLEL and SYNC MODE switch is in SEMI-AUTO or PERMISSIVE, the CLOSE BREAKER output (P7-37) becomes an enable signal. Closing the AC CIRCUIT INTERRUPTER switch will not apply ground to KR unless the GSC has activated the CLOSE BREAKER output. Auxiliary contacts on K1 latches KR on after KR is energized. A set of auxiliary contacts on KR energizes K1. During operation, run relay (RR) A1 K5 is energized until after cool down mode when the GSC opens the electric governor relay (EGR) on the GSC to stop the engine, then RR is opened also. When ENGINE CONTROL is set to COOL DOWN/STOP mode, the GSC spare output at P7-36 is grounded and relay CDR (cool down relay) is energized. The contacts of CDR are in series with relay KR and drop out KR, which drops out K1. The generator set runs for 5 minutes (programmable) and then shuts down the engine by opening the electric governor relay (EGR) on the GSC.

The short circuit (SC) and overload (OL) contacts are part of the OL/SC module. In the event the output current goes above 130% of maximum (overload condition) or 400% of maximum (short circuit condition) the appropriate contacts will open, de-energizing KR and K1. This will disconnect the load. The GSC directly controls the Generator Fault Relay (GFR). If the GSC detects a generator fault, the GFR output energizes the GFR relay and KR and K1 are de-energized, disconnecting the load from Generator G1. The paralleling relay (PAR) is connected to an auxiliary set of contacts on K1 only when the PARALLEL/UNIT switch is in PARALLEL. Contacts on the paralleling relay connect Load Sharing Module (LSM) A4 to the paralleling connectors and hence to the LSM in all other generators in parallel. The press-to-test lamp above the AC Interrupt switch is connected to a set of auxiliary contacts from K1 to indicate when K1 is energized. A line from this connection goes to a spare input of the GSC (P7-25) to tell it that K1 is closed.

AC POWER DISTRIBUTION (FIGURE FO-1, SHEETS 4 AND 5)

Generator G1

Generator G1 is a three phase Y-connected generator with two sets of coils. When these coils are placed in parallel, the generator is capable of 208 VAC phase-to-phase and 120 VAC any phase-to-ground. If connected in series the generator will put out 416 VAC phase-to-phase and 240 VAC any phase-to-ground. The reconnection board does this changeover from series to parallel connection. The reconnection board (FO-1, Sheet 4) is shown pictorially rather that schematically. Note that the references T3, T6, etc. relate to the numbers on the generator output wires. They are labeled 3, 6, etc., correlating with T3, T6, etc. Electrically, T3 is connected to Reconnection Board TB1 terminal labeled 3, T6 is connected to Reconnection Board TB1 terminal labeled 6, etc. There are metal bus bars riveted to Reconnection Board TB1 that short between the generator wires in order to connect the generator coils in parallel for 120/208 mode or in series for 240/416 mode. The bus bars are shown in dotted lines on the schematic. There is also a bus bar connecting terminals labeled 10, 11, 12, and 13. These are all connected to the common wire #10 (Ground) and wire 110 coming in and going out of Reconnection Board TB1.

The output of Reconnection Board TB1 goes through several current transformers, relay K1 (shown as a circuit breaker) and then to the load connection board. The coil of K1 is shown on the DC circuits (FO-1, Sheet 2 and Sheet 3). There are filters and varisters connected between the outputs and chassis ground. A removable jumper on the load connection board connects the chassis ground (which will be externally connected to a grounding rod) and the neutral line out of the generator.

If the PARALLEL/UNIT switch is set to UNIT, setting the AC CIRCUIT INTERRUPTER switch to CLOSED will apply ground to KR, which will close Load Contactor K1, as long as DBHI and DBLO are closed. Auxiliary contacts on K1 latches KR on after KR is energized. DBHI and DBLO are relays on the final generator output (after the load contactor K1) which monitor the output for presence of voltage. If there is no voltage on the load bus, these relay contacts will be closed. If either 208 or 416 VAC are detected by these relays, one or the other contacts will be open and closing of the AC CIRCUIT INTERRUPTER switch will not apply ground to KR. This will inhibit closing the Load Contactor K1. Note that DBHI and DBLO have no affect after KR is latched on.

Digital Voltage Regulator (DVR) A3

DVR A3 monitors the output of the generator G1 prior to Reconnection Board TB1 and regulates the output of the generator according to the parameters programmed into it. The voltage from wires G1-7, G1-8, and G1-9 is connected to the DVR. Also, PT2 measures the voltage between G1-7 and G1-8, divides the voltage in half, and connects this to the DVR. PT3 is the same as PT2, except measures the voltage between G1-8 and G1-9. Fuses F1, F2, and F3 protect PT2 and PT3. Whether the generator is connected for 208 or 416 VAC output, the DVR is monitoring the same voltage. Cross current compensation transformer (CCCT) monitors the current in wire G1-8 and G1-2 from the generator. This total current will not change whether the generator is connected for 208 or 416 VAC output. CCCT generates a voltage across a 1 Ohm resistor A7R2 at a rate of 1.25 VAC per 100A. The voltage across this 1 Ohm resistor is input to the DVR. Rheostat VAR (Voltage Adjust Rheostat) is connected to the DVR to allow the user to adjust the voltage approximately $\pm$ 10%. (This control is labeled VOLTAGE on the front panel.) Power for the DVR comes from the battery (FO-1, Sheet 2 and Sheet 4). The DVR monitors the output voltage from the generator and applies a voltage to the field coil (F+ and F-) on the generator in order to regulate the output voltage of the generator. Essentially, the higher the voltage applied to the field, the higher the output voltage of the generator. The nominal voltage across this coil is 4.6 VDC at no load and approximately 14 VDC at full load. The voltage for the field coil actually comes from the generator output through PT2 and PT3. Because of this, a Field Flash circuit provides an excitation at the initial startup of the generator set to start this process. The connections J and K to the field coil circuit come from the Field Flash circuit (FO-1, Sheet 2). This

circuit provides an initial voltage excitation to the field in order to get an initial output from the generator. Without this excitation the generator will not produce power capable of supplying a load.

Load Sharing Module (LSM) A4

Three current transformers, CT-7, CT-8, and CT-9, monitor the current from the generator and supply input signals to LSM A4 and the overload (O/L) and short circuit (S/C) module. The output of each current transformer goes through a resistance on LSM A4, then through a resistance on the O/L and S/C module. A voltage is generated across the input of each module for control purposes. LSM A4 is also connected to lines G1-7, G1-8, and G1-9 from the generator and monitors the voltage out of Generator G1 before Reconnection Board TB1. The paralleling input (pins 10, 11, and 12) is repeated completely in the DC circuits (FO-1, Sheet 3) and was discussed there. The ISOCHRONOUS/DROOP switch is connected to LSM A4 through an auxiliary set of contacts on relay A4K1.

Ground Fault Circuit Interrupter (GFCI)

The GFCI picks up one phase (G1-9) from Generator G1 before reconnection board TB1 and connects 120 VAC to a standard 2 gang outlet on the rear of the generator set on the paralleling receptacles panel (WP 0002, Figure 1, Sheet 3) next to the control panel. This is for a trouble light or other auxiliary components.

GSC Voltage and Current Monitoring

Three current transformers (CT1, CT2, and CT3) measure the current out of Generator G1 after Reconnection Board TB1. The outputs of these current transformers are connected to three transformers located on AC Transformer Box (ATB) A5. The outputs of these transformers go to the GSC for monitoring Generator G1 output current. Lines G1-1, G1-2, and G1-3 from Generator G1 output after Reconnection Board TB1, are connected to transformers T1, T2, and T3 on ATB A5 through protection fuses. The GSC monitors the outputs of these transformers to monitor the output voltage of Generator G1. Two transformers (T1 and T2) on Bus Transformer Box (BTB) A6 monitor the load bus voltage on the output after Load Contactor K1; and their outputs are connected to the GSC. The inputs are fused for protection.

Dead Bus Low (DBLO) and Dead Bus High (DBHI) Monitoring

Relay DBHI is connected after Load Contactor K1 between L1 and L3 (K1A2 to J31-19 and K1 B2 to J31-8) to monitor for voltage on the load bus (the output of the generator set). DBLO energizes if 208 VAC is present on the load bus. DBHI energizes if 416 VAC is detected on the load bus. R3 reduces the voltage seen by the 230 VAC coil of DBHI so that it will only energize if it sees 416 VAC. DBHI will not energize at 208 VAC. One set of contacts on DBHI is used to remove the 416 VAC from the coil of DBLO in order to protect the coil from excessive voltage. The other contacts for DBLO and DBHI are discussed as part of DC Power Distribution.

Overload and Short Circuit (OL/SC) Module

The OL/SC module gets a current input from current transformers CT-7, CT-8, and CT-9, which are connected before Reconnection Board TB1. This module monitors the output current and provides two sets of relay contacts for overload condition and two relay contacts for short circuit condition. Overload condition is defined as an output current over 130% of the maximum current rating of Generator G1. Short circuit is defined as an output current over 400% of the maximum current rating of Generator G1. The relay outputs of the module latch after a condition has been sensed. Setting ENGINE CONTROL to OFF will reset the latched relays on this module. Also pressing the LAMP TEST button on Alarm Module A2 will reset the relays on this module. An overload or short circuit condition causes an alarm on the alarm module and disconnects the load from Generator G1. The overload condition is disabled in Battle Short mode. The relay contacts and the power input connections for the OL/SC module are shown in the AC circuit, but the use is discussed as part of the DC Power Distribution discussion. In the DC distribution drawing, the OL/SC contacts are separate and labeled O/L and S/C respectively.

ELECTRONIC MODULAR CONTROL PANEL (EMCP)

The Electronic Modular Control Panel (EMCP) incorporates Generator Set Control A1 (GSC), Alarm Module A2, Digital Voltage Regulator (DVR) A3, the Woodward Load Sharing Module (LSM) A4, Resistor Assembly A7, a relay module, panel switches and controls, and various terminal boards.

GENERATOR SET CONTROL (GSC)

GSC Inputs

The GSC (Figure 9) is a microprocessor based control system which accepts programmed values, switch inputs, data from ECM A8, and data from LSM A4 to control the speed of the engine. A constant engine speed maintains the desired output frequency. The GSC inputs to the Central Processing Unit (CPU) include signals from panel controls. Touch pad inputs, ENGINE CONTROL switch settings, SYNC MODE switch setting, and the PUSH TO STOP EMERGENCY STOP switch are included. External signals are input from engine sensors, generator output voltage and current samples, load bus voltage samples and the ECM. LSM A4 interacts with the GSC as well. The touch pad allows entering parameters into the GSC to determine the desired output voltage and frequency, and how the GSC reacts to various stimuli. The touch pad also allows display of all the generator set voltages, currents, and calculated power levels, real and reactive. The generator output voltage, current, and load bus voltage are monitored and can be displayed on the EMCP displays as desired. LSM A4 monitors the load that the generator powers and allows fine tuning of that load sharing via a speed setting potentiometer. The LSM sends a speed correction signal to the GSC in order to fine tune the speed based on the load sharing of the generator. This is utilized primarily when the generator set is in parallel with another generator. Most engine sensors are connected to the engine control unit and their status transmitted to the GSC via the CAT Data Link. One engine speed sensor and a low fuel level sensor are directly connected to the GSC. The engine speed sensor provides positive feedback to the GSC that the engine is operating at the desired speed. The low fuel sensor initiates a controlled shutdown before the engine runs out of fuel. The ENGINE CONTROL switch determines whether the engine is to start, stop, or run. The SYNC MODE switch (called System Mode Switch (SMS) in electrical descriptions) determines the mode of operation with regards to the paralleling capability. The PUSH TO STOP EMERGENCY STOP pushbutton (also called Emergency Stop Push Button (ESPB)) immediately stops the engine and should only be used in an emergency. ECM sends alarm signals to the GSC for any sensors that are directly connected to the ECM.

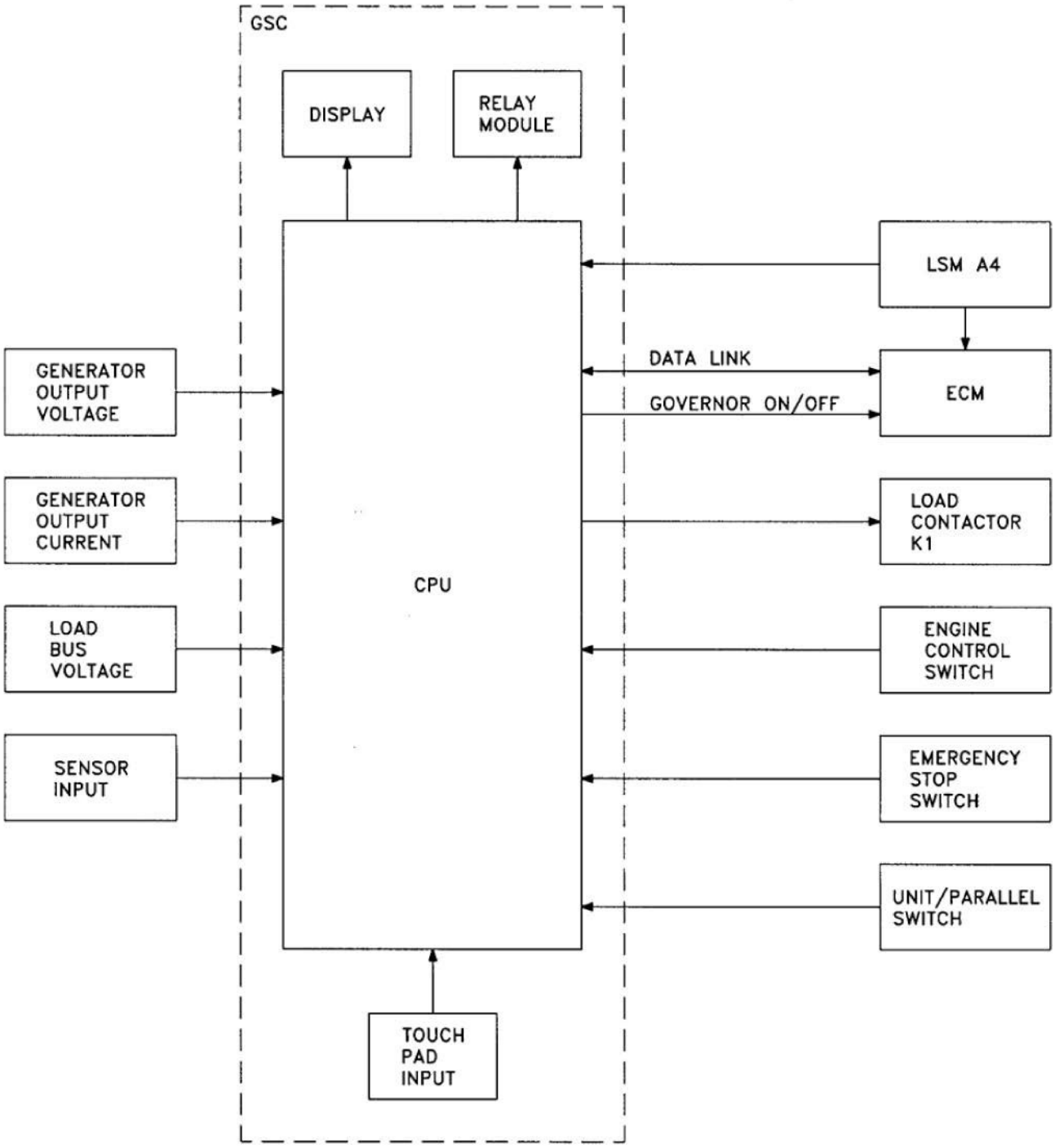


Figure 9. Generator Set Control.

GSC Outputs

The GSC outputs signals to the display, the ECM, Load Contactor K1, and the EMCP relay module. The GSC display consists of an upper display, a lower display, and a column of indicators to the left of the upper and lower displays. The upper display shows the average voltage, frequency, and total current the generator set is putting out. By pressing the AC METER key on the touch pad, the upper display can display: line-to-line voltage,

generator frequency, and current for each phase; voltage line-to-line for all three phases; line current for all three phases at once; or voltage line-neutral for all three phases at once. The upper display is also used to display any fault codes identified by the GSC or by the ECM.

GSC Displays

The GSC lower display is capable of displaying one of the following:

Total Real Power (kW)
Total reactive power (KVAR)
Total apparent power (kVA)
Percentage of rated power (%kW)
Power factor (average)
Total energy output (kW/h)
Total reactive energy output (kVARHr)
Real Power Phase A (kW)
Real Power Phase B (kW)
Real Power Phase C (kW)
Power Factor Phase A
Power Factor Phase B
Power Factor Phase C

The lower display also has a series of arrows pointing downward to symbols printed below the display. These arrows appear in order to indicate alarm conditions sensed by the GSC and/or ECM. The lower display also lights up designations K1, K2, etc to indicate the condition of relays K1 through K8 in the relay module internal to the GSC (Table 1). When a particular symbol appears, the associated relay is energized. This is strictly status and is helpful when troubleshooting. An additional feature of the lower display is that of a synchroscope. When manually synchronizing the generator output to another generator, the phase relationship between the generator and the voltage on the load bus are shown graphically on the lower display. This allows the two systems to be brought in sync before bringing the generator on line.

Table 1. GSC Display Relay Identification.

A1 RELAY	NAME	LIGHTS WHEN
K1	Electronic Governor Relay (EGR)	On whenever ECM is enabled (engine is running). (Output is not used) Internal connection shorts across ENGINE CONTROL switch so that power can not be removed from GSC while engine is running.
K2	Generator Fault Relay (GFR)	On when a generator fault is detected. Engaged to disconnect the load.
K3	Crank Termination Relay (CTR)	On when the engine is running on its own (and the starter should be released). Output is not used.
K4	Starting Motor Relay (SMR)	After ENGINE CONTROL is set to START, K4 is on while starter is cranking. Goes out after 10 seconds or after engine is detected as running. If engine does not start, light goes off for 10 seconds, then comes back on for 10 seconds trying again to start the engine.
K5	Run Relay (RR)	On whenever the engine should be running.
K6	Air Shut Off Relay (ASR)	On during fault shutdowns. Not used.
K7	Fuel Control Relay (FCR)	On when engine should be running. Output not used. Internal connection shorts across ENGINE CONTROL switch so that power can not be removed from GSC while engine is running.
K8	Programmable Spare Relay (PSR)	On when alarm condition occurs that would cause the GSC to disconnect the load.

The column of indicators at the left side of the GSC indicate impending problems or what condition caused a shutdown. The ECM resides on the engine and controls the operation of the engine, such as starting, stopping, speed control through fuel control, ignition timing, and monitors various sensors on the engine. Problems diagnosed by the ECM are sent via the CAT Data Link to the GSC and displayed on the GSC display with an E suffix to identify them as engine diagnosed. The GSC sends a speed control signal and a governor on/off signal to the ECM to control the speed of the engine, which determines the frequency of the output from the generator. The GSC monitors various sensor outputs, plus the ECM sensors to enable or disable connecting the generator to the load via Load Contactor K1. The GSC is also able to disconnect the generator from the load via Load Contactor K1 in the event that the ECM or the GSC detects a failure that would keep the generator set from performing its duty.

The GSC is a multi-purpose controller meant to be interfaced with a wide range of engine types and configurations. The output from the GSC goes to a relay module inside the GSC and these relay outputs are interconnected to the rest of the control system (refer to DC Power Distribution discussion for this interface). There are also spare inputs and outputs described in the DC Power Distribution discussion. One of the purposes of the GSC is to determine when the generator output is synchronized well enough with the voltage on the load bus in order to connect the generator to the load. This can be done automatically or manually with the aid of the synchroscope feature of the GSC.

DIGITAL VOLTAGE REGULATOR (DVR A3) MODULE OPERATION

DVR A3 (Figure 10) is a microprocessor based, digital voltage regulator. The regulator is specifically designed to regulate the output voltage of a generator in an engine/generator set arrangement. The DVR consists of a touch pad, digital display, CPU, voltage and current monitoring circuits and field drive circuits.

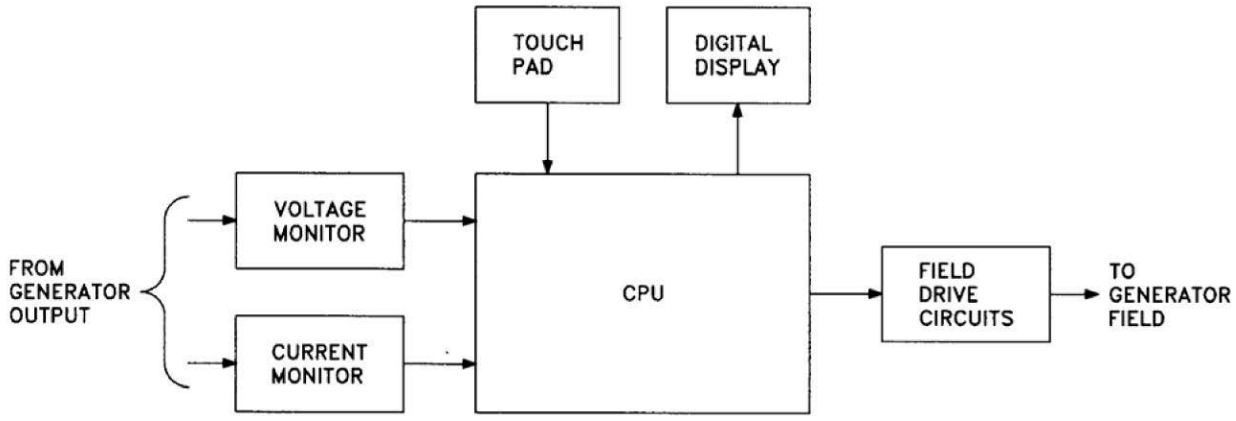


Figure 10. Digital Voltage Regulator.

Touch Pad and Digital Display

The touch pad allows the user to input operating and alarm parameters into the DVR and to check alarm conditions past and present. When power is applied, :01 is displayed. This is the generator output Voltage Parameter. The touch pad allows the user to access the following data, which is displayed on the digital display:

- Voltage
- Frequency
- Current
- Reactive Output Power
- Generator Real Current
- Exciter Field Current
- 3 Phase kVAR
- Hours
- Software ID
- Latest Fault
- Previous Fault

Central Processing Unit (CPU)

The CPU contains the program which monitors generator output voltage and current, determines how much drive current to supply the generator field in order to maintain desired output voltage, and monitors generator operation. Alarm conditions are displayed on the digital display.

Voltage and Current Monitoring Circuits and Field Drive Circuits

The generator output is monitored for voltage and current. This data is input to the CPU where the data is compared to the desired output from the generator. The field drive circuits provide field excitation current for the generator, which regulates the output voltage of the generator.

Startup Profile

The DVR operates under one of two operational profiles. When the DVR senses that the generator is starting to produce voltage, the Startup profile is used. When the output frequency has increased above the knee frequency (programmable), the DVR will switch over to the Loading and Stopping profile.

In the Startup Profile (Figure 11) the DVR will follow a 1:1 V/Hz profile after generator frequency (engine speed) has increased above the under frequency point (parameter :10). This profile continues until the frequency reaches the knee frequency (parameter :06). Once the knee frequency has been reached, the generator will be regulated by the DVR to produce full rated voltage, as set by parameter :01. The DVR then switches to the loading and stopping profile.

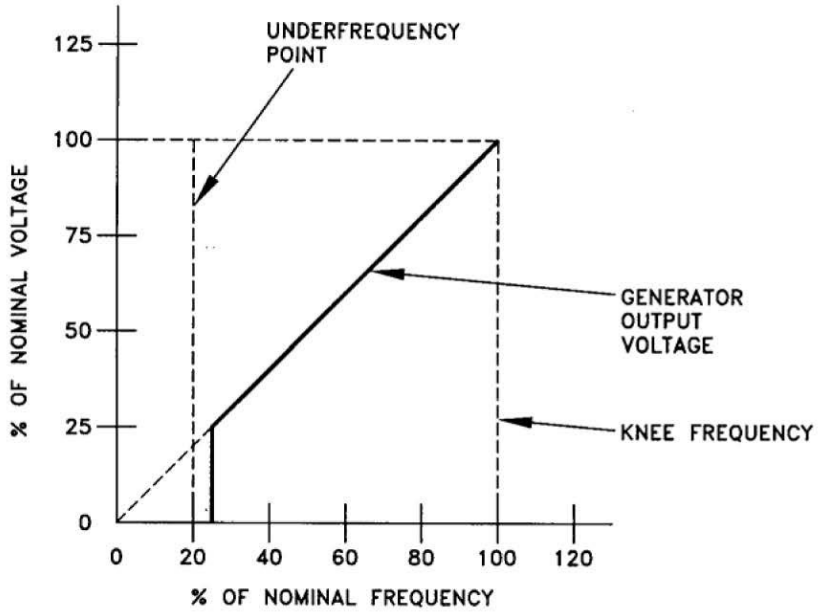


Figure 11. DVR Startup Profile.

Loading and Stopping Profile

Loading. The loading and stopping profile (Figure 12) defines how the DVR will react to a reduction in frequency below the knee frequency. A drop in frequency from the generator is usually due to one of two occurrences: either a heavy load was applied which will take the generator a few seconds to recover from, or the engine driving the generator is shutting down. In either case, the DVR reduces the generator output voltage. The reduction in voltage reduces the power requirement of the load, thus allowing the engine to recover faster for a given increase in load.

The rate at which the DVR reduces the output voltage is called Decreasing V/Hz Slope 1 and is set to 3 V/Hz by parameter :07. This rate is effective when the generator frequency is no more than 5 Hz below the knee frequency.

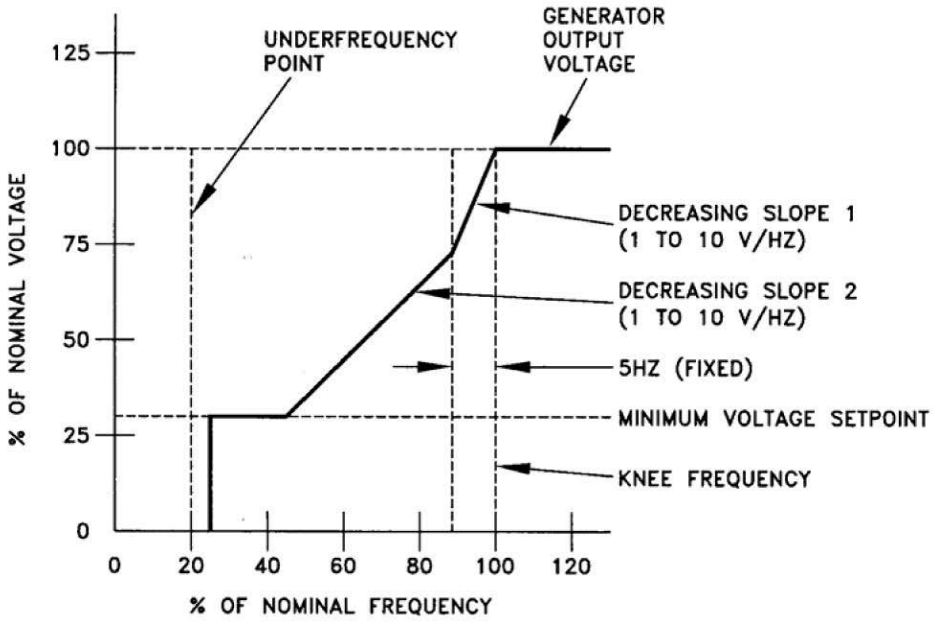


Figure 12. DVR Loading and Stopping Profile.

Stopping. If the frequency drops below 5 Hz below the knee frequency, the generator set is assumed to be shutting down. The DVR will reduce the output voltage further using a parameter called Decreasing V/Hz Slope 2, which is set to 2 V/Hz by parameter :08. This rate is effective until the generator gets to the minimum voltage setpoint (parameter :09). This is the lowest voltage the DVR will attempt to regulate. The voltage will attempt to regulate at this point until the frequency gets to the under frequency point (parameter: 10) at which point the voltage will decrease to a minimum value.

Voltage Droop When Connected In Parallel

When generators are operated in parallel, the engine speed regulator (i.e. GSC via LSM A4) controls the sharing of the real power requirements (kW) of the total system load. The DVR controls the sharing of the reactive power requirements (kVAR) of the total system load. If the output voltage of one generator is set slightly higher than the other(s), it will supply lagging reactive current to the other generators in the group. This current will circulate between the generators, possibly causing ampere overloading. One method of minimizing this effect is to cause an individual generator output to sag, or "droop", in proportion to the lagging reactive current flow from it. As reactive lagging generator output current increases, the DVR will cause the output voltage to droop (voltage will decrease) proportionally. If the measured reactive output current is leading, the output voltage will rise (voltage will increase) proportionally. In either case, this action will reduce the reactive current for better KVAR sharing with other units. The droop percentage (parameter :30) determines how much the generator output voltage will vary for a given amount of reactive current.

LOAD SHARING MODULE (LSM A4) INTERNAL OPERATION

The LSM consists of load power monitoring, load comparator, sync dynamics summer, speed trim summer, pulse width modulation (PWM) output, A4K1 relay, circuits and a power supply for internal circuitry.

Load Power Monitoring

The output of current transformers CT-7, CT-8, and CT-9 is input to the load power monitoring circuit. Each current is multiplied by the voltage monitored at pins 1, 2, and 3 of the LSM to generate voltages proportional to the power in each phase of the output. These voltages are summed and input to a variable gain amplifier. The amplifier can be calibrated, using the load gain potentiometer, to compensate for variations in components. The output of the amplifier is input to the load comparator circuit.

Load Comparator Circuit

The load signal connection to the load comparator circuit on pins 22 and 23 is used for setup only. The load sharing lines input (pins 10 and 11) to the load contactor circuit are connected to the paralleling connectors J32 and J33 in this generator set. Therefore, this point is connected to all other LSM in other generators. This connection is made through J32, J33, the paralleling relay PAR in the generator set, and A4K1 in this module. Refer to DC circuits (FO-1 Sheet 2 and Sheet 3) for interconnections external to LSM. By connecting the load sharing lines of this module to those in other generator sets (via the paralleling cables), the load signal voltage is balanced with the other generator sets connected here. The load comparator circuit has a load gain potentiometer to adjust each generator set load signal so that the load signal voltage of each is the same at full load. This compensates for different CT ratios or different generator set sizes. In droop mode (A4K1 not energized), some of the power signal from the variable gain amplifier is subtracted from the main power signal by the differential amplifier in the load comparator circuit. The setting of the Droop potentiometer (only active in Droop) controls the amount in the load comparator circuit. This reduces engine power according to the droop percentage set by this potentiometer.

Sync Dynamics Summer

The sync input (pins 24 and 25) comes from the GSC and is a ±5 VDC signal developed to control the speed of the engine (and hence the generator). This signal is processed by the sync dynamics circuit and summed with the output of the load comparator circuit.

Speed Trim Summer

The speed trim potentiometer is the FREQUENCY potentiometer on the EMCP and permits manual adjustment of the load or frequency of the generator. This signal is summed with the output of the sync dynamics summer and input to the PWM circuit. The potentiometer can trim the frequency of the generator output approximately 10% above and below nominal in unit mode. In parallel mode, the potentiometer can change the load demand if in droop mode also.

Pulse Width Modulation (PWM) Output

The PWM circuit takes the sum of all the inputs and converts the analog voltage level to a PWM signal for driving Engine Control Module (ECM), setting the engine speed. The frequency is approximately 500 Hz. The duty cycle ranges from 10% for lowest decrease in speed or load, to 90% for maximum increase in speed or load percentage. The duty cycle varies according to the magnitude of difference between the desired load and the actual power generated.

Relay A4K1

Relay A4K1 is energized when the ISOCHRONOUS/DROOP switch is in ISOCHRONOUS and the load contactor is energized. The contacts of A4K1 connect the load sharing input/output to the load comparator circuit. The 24 VDC input from the batteries is converted to a plus and minus power source (+V and -V) and a plus and minus reference supply (+VR and -VR) for the amplifiers in the module. In a non-paralleled condition, or when the ISOCHRONOUS/DROOP switch is in DROOP, the load comparator circuit is not connected to the load sharing lines. A4K1 is open in Droop mode and the external PAR relay disconnects this output from any other generators in Unit mode. In this configuration, the power measured by the load power monitoring circuits are summed with the Sync input from the GSC and the speed trim potentiometer and the PWM output generated from that signal. In a paralleled condition, you must be in isochronous mode in order to connect the load sharing lines to at least one other (possibly more) LSM A4. In this mode, this average load signal of all generator sets in parallel is then summed with the sync input and the speed trim potentiometer input to generate the PWM signal to the ECM. By doing this, the speed loop is biased to divide the load equally between paralleled generator sets.

In a paralleled condition with Droop enabled, the frequency will vary with load. To minimize this, one generator must be in isochronous mode. This generator set maintains the frequency of the system. On the paralleled generator sets in droop mode, the droop percentage set into the LSM by the droop potentiometer and the speed setting determine the load that is carried by the individual generator.

GENERATOR

The generator (Figure 13) is a brushless, self-excited, externally voltage regulated, synchronous AC generator. The generator consists of five major components: the main stator (armature); main rotor (field); exciter stator (field); exciter rotor (armature); and rectifier assembly. The DVR controls generator output. The generator exciter consists of a stationary field and a rotating armature. The DVR applies voltage to the stationary field (exciter stator). The exciter armature generates an AC voltage that is rectified by the rotating rectifier assembly, converting it to a pulsating DC signal. This DC is applied to the main rotor (field). As the generator shaft rotates, the main rotor (field) induces a voltage into the main stator (armature). The main stator's voltage output is sampled and compared to the programmed desired value in the DVR. The exciter field power is increased or decreased in order to regulate the main stator output to the desired value. There are four poles on the generator. There are two + poles and two - poles. During each revolution of the generator, two complete sine waves are produced by the alternating +, -, +, - poles. For 60 Hz operation, the generator shaft will have to turn 60 ÷ 2 revolutions per second (RPS) = 30 RPS. Engine speed is in RPM, therefore 30 RPS x 60 seconds per minute = 1,800 RPM engine speed required for 60 Hz operation. 50 Hz operation is the same process (or 50 ÷ 60 x 1,800 = 1,500 RPM). Note that an excitation is required to get the process started. This excitation, also known as a Field Flash, is described in the DC Power Distribution section. Since there is no permanent magnet structure in the generator assembly, a voltage spike is applied to the exciter field (stator) to ensure that the regulation process gets off to a good start. This generator is built with 2/3 pitch main stator windings and full Amortisseur (damper) windings. These features make the generators suitable for parallel operation when used with the proper voltage and load regulating devices.

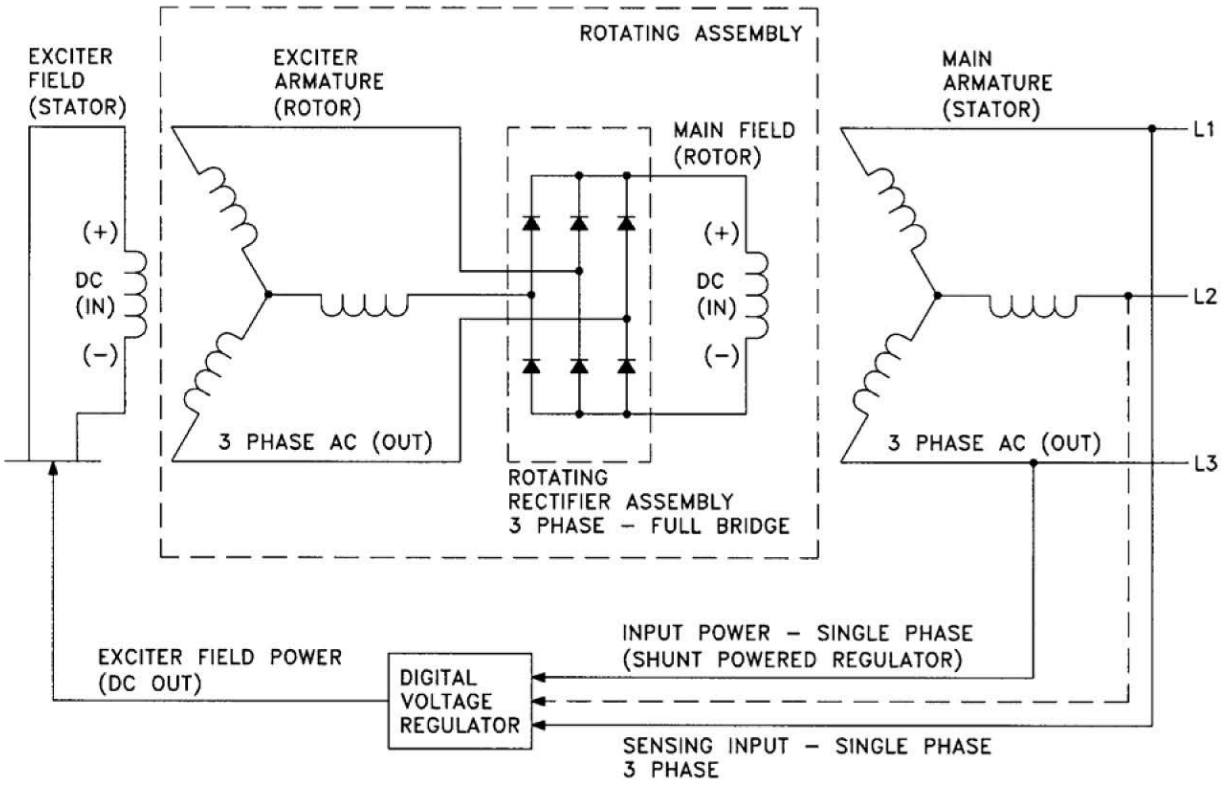


Figure 13. Generator.

WINTERIZATION KIT (FIGURE FO-1, SHEET 6)

There are two components of the winterization kit (Figure 14). One is the LCD display heaters and the other is the fuel-fired coolant water heater and pump. The LCD display heater consists of HTR1 and HTR2. These heaters receive power from one of two directions. There is a thermostatic switch (TS) in the control panel that closes when the temperature falls below -20 ±10 °F (-28.9 ±5.6 °C). This switch applies +24 VDC power to HTR1 and HTR2 in order to keep the liquid crystal displays (LCD) in the GSC and DVR from freezing. Note that this power is only available when the ECS is NOT in OFF. There is also a connection to the winterization control box that will apply power to these resistors any time the winterization system is turned on at the control panel.

The second component of the winterization kit is a fuel-fired coolant water heater and pump. The heater burns fuel from the main fuel tank in order to heat the coolant. The coolant is circulated through the engine in order to prevent it from freezing. When the fuel-fired heater is turned on, an internal combustion blower starts, the water pump begins circulating coolant, and the preheating phase of the glow plug is started. After approximately 60 seconds, the heater fuel pump starts to add fuel to the combustion chamber. The fuel/air mixture ignites. The speed of the air fan increases as well as the fuel pump speed through four stages. Low, Med, High, and Power in order to bring the combustion chamber up to operating temperature.

The glow plug protection circuit has a flame detector, which will restart the heater if no flame is detected. If no flame is detected twice, the heater is shut down and power must be cycled OFF and back ON to restart. The heater continues to operate in the Power mode until either the temperature exceeds 162 °F (72 °C) or 2 hours has elapsed (maximum time allowed in Power mode). The heater then switches between the four modes, as required based on temperature of the coolant (which relates to heat necessary to raise the temperature of the coolant).

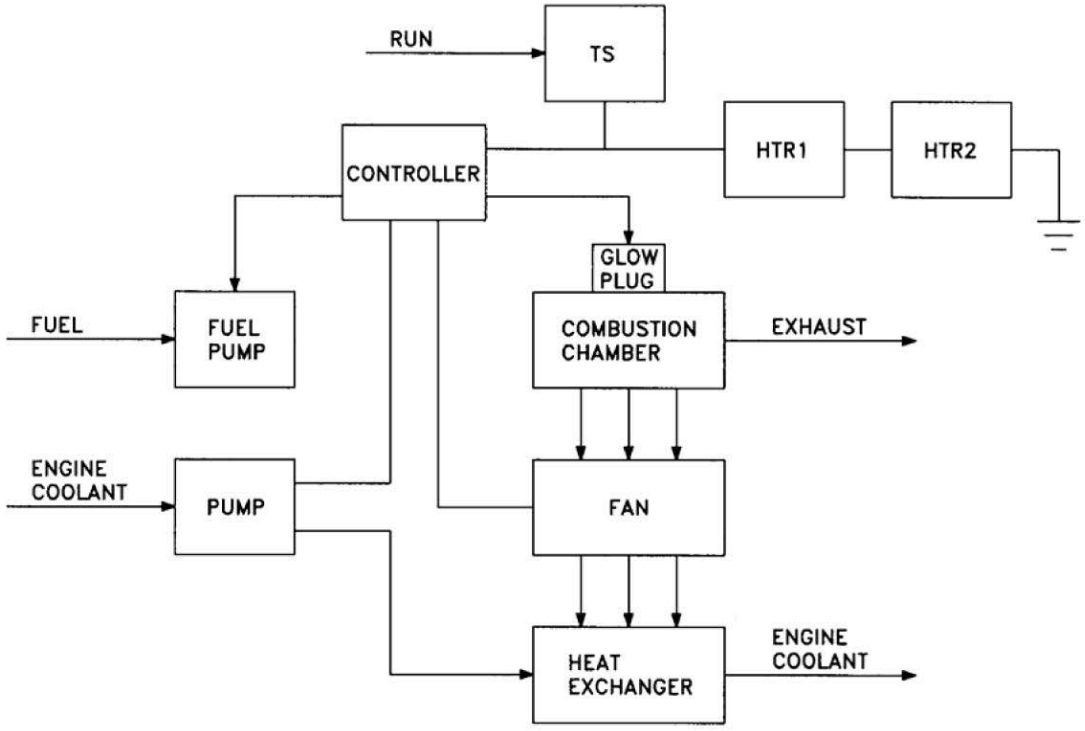


Figure 14. Winterization Kit.

END OF WORK PACKAGE

CHAPTER 2

FIELD TROUBLESHOOTING PROCEDURES

FOR

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

CHAPTER 2

FIELD TROUBLESHOOTING PROCEDURES

WORK PACKAGE INDEX

Title	WP Sequence No.
Troubleshooting Index	0004
Troubleshooting Procedures for GSC Alarm Indicators and Fault Code	0005
Troubleshooting Procedures for SP Fault Code	0006
Troubleshooting Procedures for AL Fault Code	0007
Troubleshooting Procedures for GSC Fault Code	0008
Troubleshooting Procedures for DVR Fault Code	0009
Troubleshooting Procedures for Failures Without a Fault Code	0010
Electronic Technician (ET) Troubleshooting Software Installation	0011
Troubleshooting Procedures Using Electronic Technician (ET)	0012

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING INDEX

MALFUNCTION/SYMPTOM INDEX

The Field level troubleshooting Malfunction/Symptom Index (WP 0004) lists common malfunctions found during Field level maintenance of the 100 kW Tactical Quiet Generator (TQG). Identify the malfunction/symptom that best describes your problem and then turn to the Troubleshooting Procedures (WP 0005 through WP 0012). Follow each step in sequence through the corrective actions listed in the troubleshooting procedures table until a fault is identified and resolved.

NOTE

Before you use troubleshooting procedures, be sure you have performed PMCS.

TROUBLESHOOTING PROCEDURES

The Troubleshooting Procedures (WP 0005 through WP 0012) contain procedures that identify symptoms and malfunctions, that are followed by corrective actions required to return the 100 kW TQG system to normal operation. The troubleshooting procedures cannot list all possible symptoms or malfunctions or the tests and inspections required for corrective action. If a malfunction is not listed or is not corrected by the listed corrective actions, notify your supervisor. Before using troubleshooting be sure you have performed PMCS.

The work package INITIAL SETUP outlines what is needed for the task as well as certain conditions which must be met before starting the task. Don't start a task until the following conditions exist:

1. You understand the task.
2. You understand what you are to do.
3. You understand what is needed to do the work.
4. Ensure that you have the correct manual, all related manuals, and test equipment.

The work package troubleshooting procedures have three divisions: SYMPTOM, MALFUNCTION, and CORRECTIVE ACTION. Note that the SYMPTOMs are first listed in the Malfunction/Symptom Index (see WP 0004).

SYMPTOM: Symptoms are the indication that the generator set is not operating properly or at peak performance. The symptom can be an electronically displayed fault code, an alarm or shutdown of the generator set, a visual observation or a sound. Symptoms tell you that there is a problem.

MALFUNCTION: The malfunctions cause the symptom. In the troubleshooting procedures MALFUNCTIONs are presented in order of the most likely cause for the SYMPTOM. MALFUNCTION troubleshooting procedures should be performed in the order in which they appear.

CORRECTIVE ACTIONs are actions intended to correct the problem. The CORRECTIVE ACTION consists of tests and inspections and any steps you take to isolate the malfunction. A test or inspection leads to a corrective action. These are the “if” statements that tell you what to do when the malfunction is not fixed. For Army, corrective action is accomplished by submitting a DA Form 5988-E to the TAMMS clerk and the clerk processing a job order, with the Field Level maintenance team. For Marine Corps, corrective action is accomplished by submitting a NAVMC 10560. For Air Force, corrective action is accomplished by submitting an AFR 66-1 maintenance reporting form.

Repairable LRUs or secondary repairables (for Marine Corps) shall be turned-in, in accordance with official supply procedures.

TQG TROUBLESHOOTING

The 100 kW TQG set electronics has continuous self-testing capability. Most problems with the generator set will generate a fault code that is displayed on the Generator Set Control (GSC) or the Digital Voltage Regulator (DVR).

The troubleshooting procedures for the 100 kW TQG are broken into eight separate Work Packages (WP):

WP 0005 Troubleshooting Procedures for GSC Alarm Indicators and Fault Code
WP 0006 Troubleshooting Procedures for SP Fault Code
WP 0007 Troubleshooting Procedures for AL Fault Code
WP 0008 Troubleshooting Procedures for GSC Fault Code
WP 0009 Troubleshooting Procedures for DVR Fault Code
WP 0010 Troubleshooting Procedures for Failures Without a Fault Code
WP 0011 Troubleshooting Procedures for Electronic Technician (ET) Troubleshooting Software Installation
WP 0012 Troubleshooting Procedures using Electronic Technician (ET)

Before trying any fault isolation, make note and record all of the fault codes displayed on the GSC and DVR. Also, note and record any fault lamps that are lit on the GSC and the alarm module.

The failure analysis here usually assumes a single fault code indication. Because of extensive self-testing capability, a single failure will often generate multiple fault codes (e.g. a failure of a power supply will generate a failure code for all of the sensors powered up by that power supply). It may be necessary to read through all of the associated fault isolation procedures prior to starting in order to assess the fault location.

The voltages and currents in the 100 kW TQG are dangerous and capable of causing death instantaneously. The engine and generator set are heavy and represent enormous mechanical power. Refer to the WARNING SUMMARY before attempting to troubleshoot system. The following warnings, cautions, and notes should be read and followed during all attempts at troubleshooting.

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when this generator set is in operation. Make sure unit is completely shut down and free of any power source before attempting any repair or maintenance on the unit. Failure to comply can cause injury or death to personnel.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

WARNING

Dangerously high voltage can exist across current transformer (CT) output with engine running. CT could explode if disconnected from load with engine running. Do not disconnect CT with generator rotating. Failure to comply can cause serious injury or death to personnel.

WARNING

Slave receptacle (NATO connector) is electrically live at all times and is unfused. The Battery Disconnect Switch does not remove power from the slave receptacle. NATO slave receptacle has 24 VDC even when Battery Disconnect Switch is set to OFF. This circuit is only dead when the batteries are fully disconnected. Disconnect the batteries before performing maintenance on the slave receptacle. Failure to comply can cause injury or death to personnel.

GSC ALARM INDICATORS AND FAULT CODE TROUBLESHOOTING

For troubleshooting using the fault identification displayed by the GSC you must first note the condition of the various lamps and displayed information on the GSC displays.

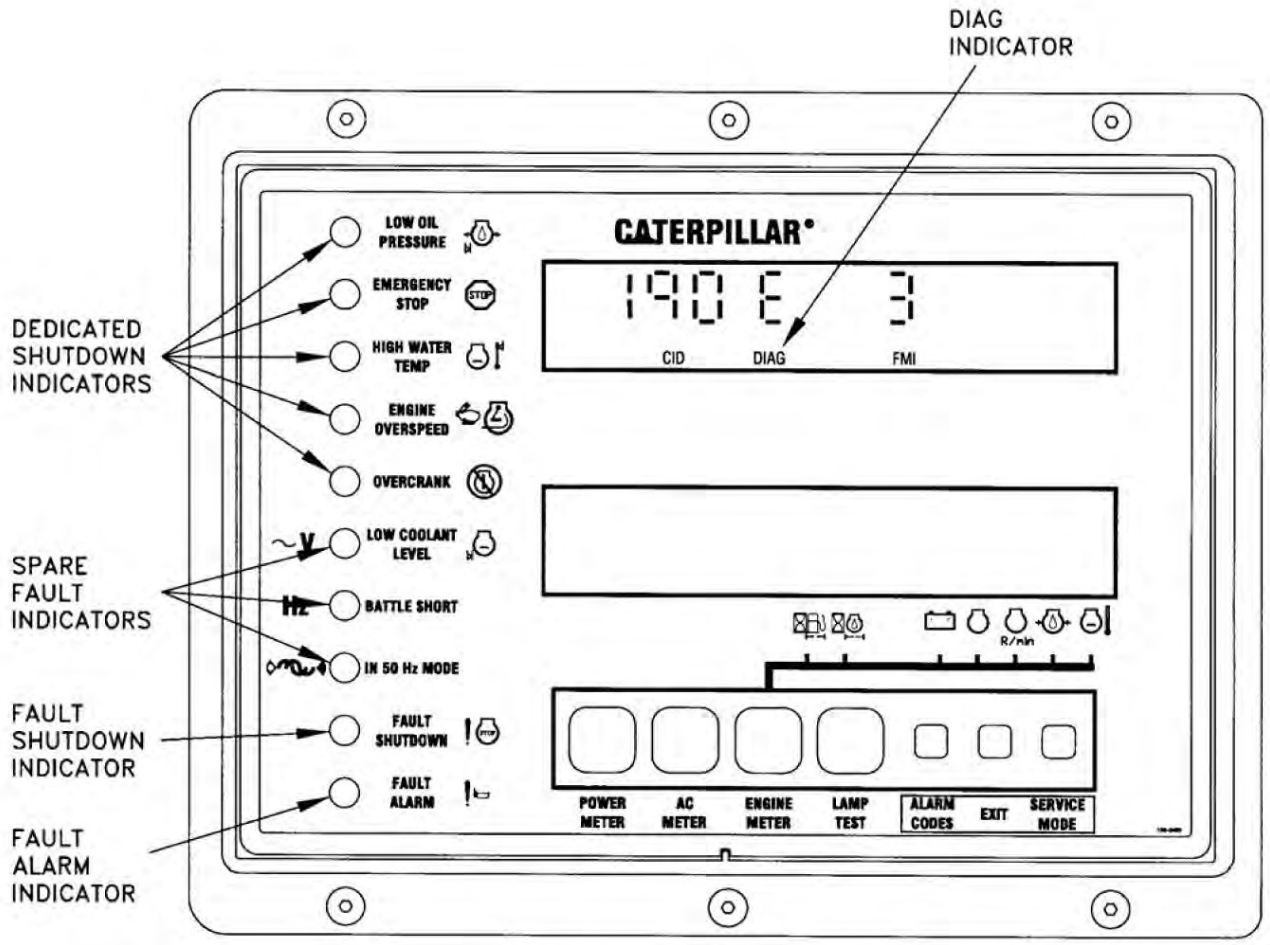


Figure 1. Generator Set Control (GSC) Displays and Dedicated Alarm Indicators.

Dedicated Shutdown Indicators	Starts flashing when alarm condition is detected. Lights continuously after shutdown.
Fault Shutdown Indicator	Flashes to indicate system was shut down due to a fault.

Fault Alarm Indicator	Flashes to indicate an alarm condition. Component Identifier (CID) and Failure Mode Identifier (FMI) codes will be displayed on the upper display to identify what is wrong. The CID identifies the component that has a problem, the FMI describes the nature of the failure.
DIAG Indicator	Flashes while there is an active Alarm condition. The diagnostic code should be displayed.
Spare Fault Indicators	Lights continuously when there is an inactive alarm condition or inactive shutdown condition. The diagnostic code is inactive and the CID and FMI were recorded in the Fault Log. If not lit, there are no diagnostic codes available.

There are two basic types of faults: Active and Inactive. An active fault is one that is occurring now, an inactive fault is a fault that has occurred previously.

GSC diagnostic codes are associated with failed components or circuits that provide information to the GSC or that receive information from the GSC. Each diagnostic code consists of the following:

- A component identifier (CID) code
- A failure mode identifier (FMI) code
- The DIAG indicator lit

Two types of faults have diagnostic codes associated with them: alarm faults and shutdown faults. When a fault occurs that has a diagnostic code associated with it, the DIAG indicator flashes, then the GSC flashes either the fault alarm indicator, or the fault shutdown indicator. For a shutdown fault, the CID and FMI are shown on the upper display immediately. For a fault alarm: the ALARM CODES key must be pressed; then the CID and FMI are shown on the upper display. A flashing DIAG indicator means that the fault is presently active. When the DIAG indicator is on continuously, the fault occurred previously.

Diagnostic Events And Event Codes

The GSC also displays codes for diagnostic events. These event codes are in the same format as the fault codes and they can be active events and may be logged. The Symptom/Malfunction Index and troubleshooting tables show these event codes in sequence with fault codes. Often event codes are related to fault codes and the troubleshooting associated with them. Diagnostic events can be logged in the ENGINE CONTROL Module (ECM) and used to investigate engine malfunctions. Event codes indicate problems with the engine performance and are symptoms to be investigated. They can also relate directly to required maintenance services or actions.

GSC FAULT CODES

Component Identification (CID) Codes

CID codes are displayed on the GSC Upper Display during and after a fault is detected to identify the component that caused the fault. These codes are stored in the GSC fault log. If an E is shown after the CID, the diagnostic code is from the ENGINE CONTROL Module (ECM).

Fault Mode Identification (FMI) Codes

FMI codes are used with the CID codes to describe the type of failure detected. FMI codes are in accordance with SAE practice of J1587 diagnostics. These codes are stored in the GSC fault log.

FMI Code	Description
0	Data is valid but data is above normal operating range
1	Data is valid but data is below normal operating range

FMI Code	Description
2	Erratic, intermittent, or incorrect signal
3	Voltage above normal
4	Voltage below normal
5	Current is below normal or circuit is open
6	Current is above normal or circuit is grounded
7	Improper Mechanical Response
8	Abnormal frequency, pulse width, or period
9	Abnormal Update
10	Abnormal rate of change
11	Failure mode is not identifiable (Mechanical Failure)
12	Failed Component
13	Device is not calibrated

FAULT LOG

The GSC has a fault log to help with troubleshooting of diagnostic codes. Inactive fault codes are recorded in the fault log for viewing later. Also, the number of occurrences is totaled and is shown on the upper display together with the CID and FMI codes. An active alarm fault becomes inactive when the problem is no longer occurring. The ENGINE CONTROL switch (ECS) must be set to OFF/RESET to reset a shutdown fault.

VIEWING FAULT LOG OP1

STEP 1. To view the fault log, set ENGINE CONTROL switch (ECS) to COOL DOWN/STOP.

NOTE

In SERVICE MODE, the buttons on the GSC keypad perform new functions as follows:

POWER METER	is Scroll Right
AC METER	is Scroll Up
ENGINE METER	is Scroll Dowen
LAMP TEST	is Select
ALARM CODES	is Enter

STEP 2. Press SERVICE MODE key on GSC keypad. SERV will be displayed on upper display. OP1 will be displayed on lower display.

STEP 3. Press LAMP TEST key on keypad. If more than one diagnostic code is present, codes will scroll on display. The number of occurrences is shown above the COUNT indicator. The lower display shows value from the hour meter at the first occurrence and the last occurrence of each diagnostic code.

STEP 4. Press LAMP TEST key to stop scrolling.

STEP 5. Press POWER METER key. If more than one count of a diagnostic code is logged, the first occurrence with a corresponding value from the hour meter shows on the lower display.

STEP 6. Press LAMP TEST key. Diagnostic codes continue scrolling.

STEP 7. Press EXIT key. OP1 shows on lower display.

STEP 8. Press EXIT to return display to normal mode.

FAULT LOG CLEARING OP4

OP4 is the option for clearing an inactive fault from the fault log. After a diagnostic fault is investigated and the fault is corrected, the fault should be cleared from the fault log. Clearing the fault log prevents confusion if you are investigating later faults.

NOTE

Service mode cannot be entered when the ENGINE CONTROL switch (ECS) is set to AUTO. An active shutdown indictor will be flashing. Active shutdown indicators must be deactivated in order to access service mode.

STEP 1. Set Battery Disconnect switch to ON.

STEP 2. Set DEAD CRANK SWITCH to NORMAL.

STEP 3. On EMCP, set ENGINE CONTROL switch (ECS) to COOL DOWN/STOP.

NOTE

In SERVICE MODE, the buttons on the GSC keypad perform new functions as follows:

POWER METER	is Scroll Right
AC METER	is Scroll Up
ENGINE METER	is Scroll Dowen
LAMP TEST	is Select
ALARM CODES	is Enter

STEP 4. Press SERVICE MODE key on GSC. SERV will be displayed on upper display. OP1 will be displayed on lower display.

STEP 5. Press AC METER key five times. OP3 will be displayed.

STEP 6. Press the LAMP TEST key. P E _ _ _ _ _ _will be displayed. The left-most underline will be flashing. If an error is made any time during the password entry, P E FAIL will be displayed. Password entry can be restarted by pressing LAMP TEST key.

STEP 7. Press POWER METER key. P E 1 _ _ _ _ will be displayed. The left-most underline will be flashing.

STEP 8. Press ENGINE METER key. P E 1 3 _ _ _ will be displayed. The left-most underline will be flashing.

STEP 9. Press AC METER key. P E 1 3 2 _ _ will be displayed. The left-most underline will be flashing.

STEP 10. Press ENGINE METER key. P E 1 3 2 3 _ will be displayed. The underline will be flashing.

STEP 11. Press POWER METER key. P E 1 3 2 3 1 will be displayed.

STEP 12. Press ALARM CODES key. P E PASS will be displayed.

STEP 13. Press EXIT key. OP4 will be displayed.

STEP 14. Press LAMP TEST. A CID FMI fault code and the number of occurrences will be displayed. Lower display shows hour meter values of the first occurrence of the fault and the last occurrence of the fault.

STEP 15. Press LAMP TEST. The CID FMI fault code, hour meter value, and fault count will flash.

STEP 16. Press and hold ALARM CODES for two seconds.

STEP 17. If there was only one CID FMI fault code, the CID FMI fault that was flashing will disappear and the upper display will be blank except for flashing SERV indicator. OP1 is shown on lower display. Proceed to step 20.

STEP 18. If there is more than one CID FMI fault code, the CID FMI that was flashing disappears. The upper display shows the next CID FMI fault code, fault count, and the hour meter value. Repeat steps 15 through 17 until all faults are erased. The lower display then shows OP4. Proceed to step 20.

STEP 19. Press EXIT key. OP4 will show on lower display.

STEP 20. Press EXIT key. The display will be in normal mode.

TRANSIENT CODES DURING TROUBLESHOOTING

During troubleshooting certain Work Packages may disconnect the harness from the rear of the GSC. This action will cause failure codes unrelated to the actual failure to appear. Clear these created diagnostic codes after the particular fault is corrected and the diagnostic code is cleared. When the harness connector is removed from the GSC, the following diagnostic codes are recorded in a properly operating system.

CID 100 FMI 02 engine oil pressure sensor

CID 110 FMI 02 engine coolant temperature sensor

CID 111 FMI 03 engine coolant level sensor

CID 175 FMI 03 engine oil temperature sensor

CID 190 FMI 03 engine speed sensor

CID 336 FMI 02 ENGINE CONTROL switch

Clear diagnostic codes after the problem is investigated or the problem is corrected. This will avoid confusion during investigation of a future problem. The DIAG indicator is off when all diagnostic codes are cleared from the fault log and no active diagnostic codes exist.

DVR FAULT CODE TROUBLESHOOTING

The DVR will annunciate four types of faults. These are described in detail below.

FAULT CLASSIFICATION	DESCRIPTION
Alarm Fault	Alarm Faults indicate a condition that will not inhibit the function of the DVR and the generator set.Alarm Fault codes are in the 600's range. The generator set will continue to operate at a normal level.
Resetable Shutdown fault	Resetable Shutdown Faults indicate a condition where either DVR or generator set exhibits a degradation of performance. Resetable Shutdown Fault codes are in the 700's range. The generator set continues to operate, but at a reduced level too low to sustain load. Resetting the fault returns the DVR to normal operation. The fault code remains in parameter :92.
Non-resetable Shutdown fault	Non-resetable Shutdown faults indicate a condition where the DVR cannot be safely run. Non-resetable Shutdown Fault codes are in the 800's range. The generator set continues to operate, but at a reduced level too low to sustain load. Setting the ENGINE CONTROL switch to OFF/RESET is required to reset the fault.
Severe fault	Severe faults may indicate the failure of the DVR.

FAULT CLASSIFICATION	DESCRIPTION
	Severe faults occur at power-up or when writing a new value to memory. Severe faults stop the DVR from allowing power generation. The keypad will be disabled. Severe faults cannot be reset. The DVR will have to be replaced. Severe Fault codes are in the 900's range.

Fault codes are stored in Parameters. The following DVR parameters are associated with fault isolation:

Parameter :92 - **Latest fault.** Contains the code for the most recently declared, or current, fault that has occurred after the last fault was reset. It may contain either alarm or shutdown faults.

Parameter :93 - **Previous fault.** Contains the fault code for the previous fault (both alarm and shutdown faults) that were in parameter :92. This parameter may contain an active alarm if an active alarm was present in parameter :92 and a shutdown fault occurred. The alarm code that was in parameter :92 would be moved here and any code that was here is overwritten. When the code in parameter :92 is cleared using the fault clear function (parameter :94), the code is moved here.

Parameter :94 - **Fault Clear.** This parameter acts like a switch to clear fault codes from latest fault parameter :92. The code that was in parameter :92 is moved to parameter :93 (previous fault) overwriting the code that was there and parameter :92 is returned to 0000.

Parameter :96 - **Shutdown Fault Reset.** Acts like a switch to reset an active shutdown fault. This will allow the DVR to begin regulation again and stop the display from flashing the fault code.

When a fault condition occurs, the fault code will flash on the DVR display. Alarm faults must be cleared using parameter :94 before another alarm fault can be declared. A shutdown fault will override an alarm fault, placing its code in the latest fault parameter (:92), and will move the alarm fault code to the previous fault parameter (:93). Parameter codes are retained during power down of the DVR.

To clear a fault, press and hold up arrow key ▲ or down arrow key ▼ to select parameter :94 on the display and press the function key ◀▶. Each time the fault clear function is activated, the display will flash three times, the code that was in parameter :92 (latest fault) is moved to parameter :93 (previous fault) overwriting the code that was there and parameter :92 is returned to 0000. The display will return to parameter :01.

To reset a shutdown fault, press and hold up arrow key ▲ or down arrow key ▼ to select parameter :96 on the display and press the function key ◀▶ . Each time the fault clear function is activated, the display will flash three times, the DVR will begin regulation again, the display will stop flashing, and the display will return to parameter :01.

TROUBLESHOOTING FAILURES WITHOUT A FAULT CODE

For troubleshooting failures without a fault code refer to the malfunction/symptom index in WP 0004.

TROUBLESHOOTING USING MAINTENANCE SUPPORT DEVICE (MSD) AND ELECTRONIC TECHNICIAN (ET) TOOL

The Field level troubleshooting Malfunction/Symptom Index (WP 0004) lists symptoms and malfunctions for troubleshooting diagnostics to be performed for Field maintenance of the 100 kW Tactical Quiet Generator (TQG). Identify the malfunction/symptom and diagnostic procedure that best describes your problem and then if directed, turn to WP 0011 to set up the Electronic Technician (ET) tool and install necessary software. The ET tool allows you to perform engine specific tests for additional diagnostics contained in WP 0012. Follow each step in sequence through the diagnostic tests or inspections listed in the troubleshooting procedures table until a fault is identified and corrected.

TROUBLESHOOTING INDEX

Malfunction/Symptom	Troubleshooting Procedure
AL FAULT CODE	
AL 1 High Coolant Temperature	WP 0007
AL 2 Low Coolant Temperature	WP 0007
AL 3 Low Engine Oil Pressure	WP 0007
AL 4 Fault Detected by Engine ECM	WP 0007
AL 5 Low Engine Coolant Level	WP 0007
AL 7 Generator Over Voltage	WP 0007
AL 8 Generator Under Voltage	WP 0007
AL 9 Generator Over Frequency	WP 0007
AL 10 Generator Under Frequency	WP 0007
AL 11 Generator Reverse Power	WP 0007
AL 12 Phase Over Current	WP 0007
AL 13 Generator Total Over Current	WP 0007
AL 14 Phase A No Voltage Input at GSC input (P7-10)	WP 0007
AL 15 GSC Configuration Error	WP 0007
AL 16 Incorrect Phase Sequence - Paralleling fault code	WP 0007
AL 17 Improper Generator or Bus Voltage - Paralleling fault code	WP 0007
AL 18 Synchronizer Time-out - Paralleling fault code	WP 0007
DVR FAULT CODE	
000 No Fault Present	WP 0009
601 Internal Memory Failure	WP 0009
602 Internal Watchdog Failure	WP 0009
603 Rotating Diode Failure	WP 0009
604 Reverse VAR (Alarm Fault)	WP 0009
701 Undervoltage	WP 0009
702 Overvoltage	WP 0009
703 Overexcitation	WP 0009
704 Reverse VAR (Shutdown Fault)	WP 0009
801 Instantaneous Trip	WP 0009
802 Loss of Sensing	WP 0009
803 Loss of Frequency	WP 0009
901 DVR Memory Failure (Severe Fault)	WP 0009
ELECTRONIC TECHNICIAN (ET) TROUBLESHOOTING	
Air Inlet Heater Circuit Test	WP 0012
Electrical Connectors Wiggle Test	WP 0012
Electrical Power Supply Circuit Test	WP 0012
Engine Timing Sensor Circuit Test	WP 0012
Injection Actuation Pressure Test	WP 0012

TROUBLESHOOTING INDEX - Continued

Malfunction/Symptom	Troubleshooting Procedure
Injection Actuator Pressure Control Valve Circuit Test	WP 0012
Injection Actuation Pressure Sensor Test	WP 0012
Injector Solenoid Circuit Test	WP 0012
Speed Control Test Voltage Measurement Points	WP 0012
Electronic Service Tool (Cat ET) Will Not Communicate With ECM	WP 0012
Engine Timing Sensor Calibrate	WP 0012
Flash Programming	WP 0012
Engine Fuel Pressure Reading	WP 0012
Engine Status	WP 0012
Copy Configuration/ECM Replacement	WP 0012
FAILURES WITHOUT A FAULT CODE	
Starting Motor Remains Engaged	WP 0010
Engine Does Not Shut Down When a Shutdown Fault Occurs or Engine Shuts Down With No GSC Fault Codes	WP 0010
GSC Operation Is Erratic	WP 0010
Display of Voltage on GSC is Zero for One or More Phases	WP 0010
Display of Current on GSC is Zero for One or More Phases	WP 0010
Display of Voltage on GSC is Inaccurate	WP 0010
Display of Current on GSC is Inaccurate	WP 0010
Display of Power on GSC is Inaccurate	WP 0010
Generator Produces No Voltage	WP 0010
Generator Produces Low Voltage Under No Load Condition	WP 0010
Generator Produces Low Voltage When Load is Applied	WP 0010
Generator Produces Fluctuating Voltage	WP 0010
Generator Produces High Voltage	WP 0010
Generator is Overheating	WP 0010
Equipment Runs Normally on Other Source of Power (Utility or Other Generator Set), but Will Not Run on This Generator Set	WP 0010
Undesirable Speed Decrease With Load Increase	WP 0010
Load Sharing Module A4 Erratic Operation	WP 0010
Engine Not Properly Sharing Load With Generator Sets (Parallel Operation)	WP 0010
Engine Will Not Crank (Starter Pinion Engages and Engine Does Not Turn Over)	WP 0010
Engine Cranks But Will Not Start	WP 0010
Engine Misfires, Runs Rough, or is Unstable	WP 0010
Low Power/Poor or No Response to Throttle	WP 0010
Intermittent Engine Shut Downs	WP 0010
Excessive Black Smoke	WP 0010
Excessive White Smoke	WP 0010
Can Not Reach Operating RPM	WP 0010
Poor Acceleration or Response	WP 0010
Poor Fuel Consumption	WP 0010
Engine Stalls at Low RPM	WP 0010

TROUBLESHOOTING INDEX - Continued

Malfunction/Symptom	Troubleshooting Procedure
Auxiliary Fuel Pump Does Not Operate	WP 0010
Engine Runs Out of Fuel With No LOW FUEL LEVEL Alarm	WP 0010
Alternator Does Not Charge Batteries	WP 0010
Coolant in Engine Oil	WP 0010
Coolant Temperature Too High	WP 0010
ECM Will Not Communicate With Other Systems or Display Modules	WP 0010
Engine Oil in Coolant	WP 0010
Engine Oil in Exhaust System	WP 0010
Engine Oil Temperature Too High	WP 0010
Engine Vibration	WP 0010
Excessive Engine Oil Consumption	WP 0010
Excessive Valve Lash	WP 0010
Exhaust Temperature is Too High	WP 0010
Fuel in Engine Oil	WP 0010
Intermittent Low Power or Power Cutout	WP 0010
Low Engine Oil Pressure	WP 0010
Mechanical Noise (Knock) in Engine	WP 0010
Noise Coming From Cylinder	WP 0010
GSC ALARM INDICATORS AND FAULT CODE	
LOW OIL PRESSURE Light	WP 0005
EMERGENCY STOP Light	WP 0005
HIGH WATER TEMP Light	WP 0005
ENGINE OVERSPEED Light	WP 0005
OVERCRANK Light	WP 0005
FAULT SHUTDOWN Light Flashing Red For Shut Down	WP 0005
FAULT ALARM Light Flashing Yellow	WP 0005
No Indicator Lit. DIAG Not On. Fault Codes Displayed	WP 0005
No Indicator Lit. DIAG Not On. No Fault Codes Displayed	WP 0005
GSC FAULT CODE	
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded (Logged), CID 1 E FMI 11 Cylinder 1 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded (Logged), CID 2 E FMI 11 Cylinder 2 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded (Logged), CID 3 E FMI 11 Cylinder 3 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded (Logged), CID 4 E FMI 11 Cylinder 4 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded	WP 0008

TROUBLESHOOTING INDEX - Continued

Malfunction/Symptom	Troubleshooting Procedure
(Logged), CID 5 E FMI 11 Cylinder 5 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	
CID 1 E FMI 06 Cylinder 1 Injector Current is Above Normal or Circuit is Grounded (Logged), CID 6 E FMI 11 Cylinder 6 Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 9 E FMI 02 High Altitude Derate (Active) Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 41 FMI 02 8 Volt Power Supply not Normal Erratic, Intermittent, or Incorrect Signal (Logged), CID 41 FMI 03 8 Volt Power Supply Above Normal Voltage Above Normal (Logged), and CID 41 FMI 04 8 Volt Power Supply Below Normal Voltage Below Normal (Logged)	WP 0008
CID 42 E FMI 11 Injection Actuator Pressure Valve Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 85 E FMI 01 Shutdown Overridden Data is Valid but Data is Below Normal Operating Range (Logged)	WP 0008
CID 91 FMI 08 Throttle Position Sensor Abnormal Frequency, Pulse Width, or Period (Not Logged)	WP 0008
CID 94 FMI 01 Fuel Pressure Sensor Data is Valid but Data is Below Normal Operating Range (Logged), CID 94 FMI 02 Fuel Pressure Sensor Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 94 E FMI 03 Fuel Pressure Sensor Voltage Above Normal (Logged), CID 94 E FMI 04 Fuel Pressure Sensor Voltage Below Normal	WP 0008
CID 96 E FMI 01 High Fuel Pressure Warning Data is Valid but Data is Below Normal Operating Range (Active and Logged)	WP 0008
CID 97 E FMI 01 Derate Overridden Data is Valid but Data is Below Normal Operating Range (Logged)	WP 0008
CID 100 E FMI 02 Oil Pressure Sensor Erratic, Intermittent, or Incorrect Signal (Logged)	WP 0008
CID 100 E FMI 03 Oil Pressure Sensor Voltage Above Normal (Logged), CID 100 E FMI 04 Oil Pressure Sensor Voltage Below Normal	WP 0008
CID 110 E FMI 02 Engine Coolant Temperature Sensor Erratic, Intermittent, or Incorrect Signal (Logged), CID 110 FMI 03 Engine Coolant Temperature Sensor Voltage Above Normal (Logged), CID 110 E FMI 04 Engine Coolant Temperature Sensor Voltage Below Normal (Logged)	WP 0008
CID 111 E FMI 03 Engine Low Coolant Sensor Voltage Above Normal, CID 111 E FMI 04 Engine Low Coolant Sensor Voltage Below Normal	WP 0008
CID 164 E FMI 00 Injection Actuation Pressure System Data is Valid but Data is Above Normal Operating Range (Logged), CID 164 E FMI 02 Injection Actuation Pressure System Erratic, Intermittent, or Incorrect Signal (Logged), CID 164 E FMI 11 Injection Actuation Pressure System Failure Mode is Not Identifiable (Mechanical Failure) (Logged	WP 0008
CID 164 E FMI 03 Injection Actuation Pressure System Voltage Above Normal (Logged), CID 164 E FMI 04 Injection Actuation Pressure System Voltage Below Normal (Logged)	WP 0008
CID 168 E FMI 02 Electrical System Voltage Erratic, Intermittent, or Incorrect Signal, CID 168 E FMI 03 Electrical System Voltage Voltage Above Normal, CID 168 E FMI 04 Electrical System Voltage Voltage Below Normal	WP 0008
CID 169 E FMI 01 Engine Oil Maintenance Required	WP 0008
CID 170 E FMI 01 Fuel Filter Change Required (Active)	WP 0008
CID 172 E FMI 00 Inlet Air Temperature Sensor Data is Valid but Data is Above Normal Operating Range (Logged), CID 172 E FMI 03 Inlet Air Temperature Sensor Voltage Below Normal Voltage Open/ Short to Batt+, CID 172 E FMI 04 Inlet Air Temperature Sensor Voltage Below Normal Voltage Short to Ground, CID 172 E FMI 11 Inlet Air Temperature	WP 0008

TROUBLESHOOTING INDEX - Continued

Malfunction/Symptom	Troubleshooting Procedure
Sensor Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	
CID 175 FMI 02 Engine Oil Temperature Sensor Erratic, Intermittent, or Incorrect Signal (Logged), CID 175 FMI 03 Engine Oil Temperature Sensor Voltage Above Normal Voltage Open/Short to Batt+, CID 175 FMI 04 Engine Oil Temperature Sensor Voltage Below Normal Voltage Short to Ground	WP 0008
CID 190 FMI 02 Magnetic Pickup Unit Erratic, Intermittent, or Incorrect, CID 190 FMI 03 Magnetic Pickup Unit Voltage Above Normal (Logged)	WP 0008
CID 190 E FMI 02 Primary Engine Speed/Timing Sensor Erratic, Intermittent, or Incorrect Signal (Logged), CID 190 E FMI 11 Primary Engine Speed/Timing Sensor Failure Mode is Not Identifiable (Mechanical Failure) (Logged)	WP 0008
CID 248 FMI 09 CAT Data Link Abnormal update	WP 0008
CID 253 E FMI 02 Personality Module Mismatch Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 254 E FMI 12 ECM Self Test Failed Component	WP 0008
CID 261 E FMI 13 Engine Timing Calibration Device is Not Calibrated	WP 0008
CID 262 E FMI 03 5 V Sensor Power Supply Voltage Above Normal, CID 262 E FMI 04 5 V Sensor Power Supply Voltage Below Normal	WP 0008
CID 264 E FMI 03 E-Stop Shutdown Voltage Above Normal (Active)	WP 0008
CID 268 FMI 02 GSC Electronic Control Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 269 FMI 03 GSC 8V Sensor Power Supply Voltage Above Normal, CID 269 FMI 04 GSC 8V Sensor Power Supply Voltage Below Normal	WP 0008
CID 273 FMI 03 Turbo Outlet Pressure Sensor Voltage Above Normal, CID 273 FMI 04 Turbo Outlet Pressure Sensor Voltage Below Normal	WP 0008
CID 274 FMI 02 Atmospheric Pressure Sensor Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 274 FMI 03 Atmospheric Pressure Sensor Voltage Above Normal, CID 274 FMI 04 Atmospheric Pressure Sensor Voltage Below Normal	WP 0008
CID 334 FMI 02 Spare Output (P7-36) Erratic, Intermittent, or Incorrect Signal, CID 334 FMI 03 Spare Output (P7-36) Voltage Above Normal, CID 334 FMI 04 Spare Output (P7-36) Voltage Below Normal	WP 0008
CID 336 E FMI 02 ENGINE CONTROL Switch (ECS) Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 342 E FMI 02 Secondary (Bottom) Engine Speed/Timing Sensor Erratic, Intermittent, or Incorrect Signal (Logged), CID 342 E FMI 11 Secondary (Bottom) Engine Speed/Timing Sensor Failure mode is not identifiable (Mechanical Failure) (Logged)	WP 0008
CID 360 E FMI 01 Low Engine Oil Pressure Warning (Active & Logged) Data is Valid But Data is Below Normal Operating Range, CID 360 E FMI 02 Low Engine Oil Pressure Derate (Active & Logged) Erratic, Intermittent, or Incorrect Signal, CID 360 E FMI 03 Low Engine Oil Pressure Shutdown (Active & Logged) Voltage Above Normal	WP 0008
CID 361 E FMI 01 High Engine Coolant Temperature Warning (Active & Logged) Data is Valid But Data is Below Normal Operating Range, CID 361 E FMI 02 High Engine Coolant Temperature Derate (Active and Logged) Erratic, Intermittent, or Incorrect Signal, CID 361 E FMI 03 High Engine Coolant Temperature Shutdown (Active & Logged) Voltage Above Normal	WP 0008
CID 362 E FMI 01 Overspeed Warning (Active and Logged) Data is Valid But Data is Below Normal Operating Range, CID 362 E FMI 03 Overspeed Shutdown (Active & Logged) Voltage Above Normal	WP 0008
CID 368 E FMI 01 High Inlet Air Temperature Warning (Active and Logged) Data is Valid But Data is Below Normal Operating Range	WP 0008
CID 390 E FMI 01 Fuel Filter Restriction Warning (Active and Logged) Data is Valid But	WP 0008

TROUBLESHOOTING INDEX - Continued

Malfunction/Symptom	Troubleshooting Procedure
Data is Below Normal Operating Range	
CID 391 E FMI 01 Inlet Air Restriction Warning (Active and Logged) Data is Valid But Data is Below Normal Operating Range	WP 0008
CID 441 FMI 12 GSC Engine Governor Relay (EGR) Output Failed Component	WP 0008
CID 442 FMI 12 GSC Generator Fault Relay (GFR) Output Failed Component	WP 0008
CID 443 FMI 12 GSC Crank Termination Relay (CTR) Output Failed Component	WP 0008
CID 444 FMI 12 GSC Starter Motor Relay (SMR) Output Failed Component	WP 0008
CID 445 FMI 12 GSC Run Relay (RR) Output Failed Component	WP 0008
CID 447 FMI 12 GSC Fuel Control Relay (FCR) Output Failed Component	WP 0008
CID 448 FMI 12 GSC Programmable Spare Relay (PSR) Output Failed Component	WP 0008
CID 500 FMI 12 GSC Failed Component	WP 0008
CID 566 FMI 07 Unexpected Shutdown Improper Mechanical Response	WP 0008
CID 590 FMI 09 Engine Electronic Control Module Abnormal Update	WP 0008
CID 617 E FMI 02 Intake Air Heater Erratic, Intermittent, or Incorrect Signal, CID 617 E FMI 05 Intake Air Heater Current is Below Normal or Circuit is Open, CID 617 E FMI 06 Intake Air Heater Current is Above Normal or Circuit is Grounded	WP 0008
CID 770 FMI 09 Customer Communication Module (CCM) Data Link Abnormal Update	WP 0008
CID 858 FMI 02 Close Breaker Output Erratic, Intermittent, or Incorrect Signal, CID 858 FMI 03 Close Breaker Output Voltage Above Normal, CID 858 FMI 04 Close Breaker Output Voltage Below Normal	WP 0008
CID 1038 FMI 02 Speed Adjust 1 Output P7-27 (+) and P7-28 (-) Erratic, Intermittent, or Incorrect Signal, CID 1038 FMI 03 Speed Adjust 1 Output P7-27 (+) and P7-28 (-) Voltage Above Normal, CID 1038 FMI 04 Speed Adjust 1 Output P7-27 (+) and P7-28 (-) Voltage Below Normal	WP 0008
CID 1167 FMI 04 K1 Sense Input (P7-25) Voltage Below Normal	WP 0008
CID 1168 FMI 03 Dead Bus Sense Input (P7-29) Voltage Above Normal	WP 0008
CID 1169 FMI 02 AC Transformer Box (ATB) Sensor Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 1170 FMI 02 Bus Transformer Box (BTB) Sensor Erratic, Intermittent, or Incorrect Signal, CID 1170 FMI 04 Bus Transformer Box (BTB) Sensor Voltage Below Normal, CID 1170 FMI 08 Bus Transformer Box (BTB) Sensor Abnormal frequency, pulse width, or period	WP 0008
CID 1589 E FMI 02 Turbocharger Air Inlet Pressure Sensor Erratic, Intermittent, or Incorrect Signal	WP 0008
CID 1589 E FMI 03 Turbocharger Air Inlet Pressure Sensor Voltage Above Normal, CID 1589 E FMI 04 Turbocharger Air Inlet Pressure Sensor Voltage Below Normal	WP 0008
SP FAULT CODE	
SP 1 Low Fuel Level	WP 0006
SP 2 DVR Fault (WP 0009)	WP 0006
SP 3 Bus Frequency (Paralleling Only)	WP 0006
SP 4 Bus Voltage (Paralleling Only)	WP 0006

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR GSC ALARM INDICATORS AND FAULT CODE

INITIAL SETUP:

Personnel Required
One

References
TM 9-6115-729-10
WP 0006
WP 0007
WP 0008
WP 0010
WP 0092

TROUBLESHOOTING USING DEDICATED SHUTDOWN INDICATORS

The dedicated shutdown indicators identify the system that is responsible for an engine shutdown. The Generator Set Control (GSC) activates the appropriate dedicated shut down fault lamp when the particular fault condition is sensed. The lamp will flash until the GSC shuts the engine down, then the lamp will light continuously. Dedicated shutdowns are not recorded in the GSC fault log.

The GSC dedicated shutdown indicators and their sensors are described in WP 0008.

WARNING

Cooling system operates at high temperature and pressure. Contact with high pressure steam and/or liquids can result in burns and scalding. Shut down generator set, and allow system to cool before performing checks, services, and maintenance. Failure to comply can cause injury or death to personnel.

CAUTION

The dipstick is marked so that the crankcase oil can be checked while engine is stopped or running. Always make sure dipstick is checked. Remove oil filler cap when checking oil with engine running.

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. LOW OIL PRESSURE light

MALFUNCTION

LOW OIL PRESSURE detected by engine. The signal is routed through Engine Control Module (ECM) to GSC.

CORRECTIVE ACTION

STEP 1. Check oil level and perform service per TM 9-6115-729-10.

STEP 2. If fault codes displayed on upper display, troubleshoot per WP 0008.

SYMPTOM

2. EMERGENCY STOP light

MALFUNCTION

Detected when PUSH TO STOP EMERGENCY STOP pushbutton on Electronic Modular Control Panel (EMCP) is pressed. Pressing EMERGENCY STOP disables the control input to the ECM, stopping the engine immediately. EMERGENCY STOP disables the starter circuit so that the GSC can not restart the engine (DEAD CRANK SWITCH can still crank the engine). An input from the EMERGENCY STOP notifies the GSC that the button is pressed.

CORRECTIVE ACTION

STEP 1. Correct emergency situation that caused operator to press EMERGENCY STOP.

STEP 2. If fault codes present on upper display, troubleshoot per WP 0008.

STEP 3. When Tactical Quiet Generator (TQG) is returned to service, continue operations.

SYMPTOM

3. HIGH WATER TEMP light

MALFUNCTION

HIGH WATER TEMP is detected by engine sensor. The signal is routed through ECM to GSC.

CORRECTIVE ACTION

STEP 1. Check coolant level and perform service per TM 9-6115-729-10.

STEP 2. If fault codes displayed on upper display, troubleshoot per WP 0008.

SYMPTOM

4. ENGINE OVERSPEED light

MALFUNCTION

Engine RPM is monitored directly by the GSC using a magnetic pickup unit (MPU) on the engine flywheel. ENGINE OVERSPEED RPM is set by OP5-0, P010.

CORRECTIVE ACTION

STEP 1. If fault codes displayed on upper display, troubleshoot per WP 0008.

STEP 2. If necessary, verify OP5-0, P010 setpoint EMCP programming (WP 0092, Table 4).

SYMPTOM

5. OVERCRANK light

MALFUNCTION

If engine does not start within 90 seconds after setting Engine Control switch (ECS) to MANUAL START (or the remote start contacts are closed with the Engine Control switch (ECS) in AUTO START), GSC declares overcrank condition starting is disabled.

CORRECTIVE ACTION

Correct any displayed faults per WP 0008 or troubleshoot per WP 0008 and WP 0010.

SYMPTOM

6. FAULT SHUTDOWN light flashing red for shut down.

MALFUNCTION

CID and FMI fault codes displayed.

CORRECTIVE ACTION

Troubleshoot displayed CID and FMI codes (WP 0008).

MALFUNCTION

SP1, SP2, SP3, or SP4 displayed. DIAG not on.

CORRECTIVE ACTION

Troubleshoot displayed SP (Spare Input) code (WP 0006).

MALFUNCTION

AL1 through AL8 fault code displayed. DIAG not on.

CORRECTIVE ACTION

Troubleshoot displayed AL code (WP 0007).

SYMPTOM

7. FAULT ALARM light flashing yellow.

MALFUNCTION

CID and FMI fault codes display. Evaluate with dedicated shutdown indicators.

CORRECTIVE ACTION

Troubleshoot CID and FMI codes (WP 0008).

MALFUNCTION

SP1, SP2, SP3, or SP4 displayed. DIAG not on.

CORRECTIVE ACTION

Troubleshoot displayed SP code (WP 0006).

MALFUNCTION

AL1 through AL8 fault code displayed. DIAG not on.

CORRECTIVE ACTION

Troubleshoot displayed AL code (WP 0007).

SYMPTOM

8. No indicator lit. DIAG not on. Fault codes displayed.

MALFUNCTION

CID and FMI codes displayed.

CORRECTIVE ACTION

Troubleshoot displayed CID and FMI codes (WP 0008).

MALFUNCTION

SP1, SP2, SP3, or SP4 displayed.

CORRECTIVE ACTION

Troubleshoot displayed SP code (WP 0006).

MALFUNCTION

AL1 through AL8 fault code displayed.

CORRECTIVE ACTION

Troubleshoot displayed AL code (WP 0007).

SYMPTOM

9. No indicator lit. DIAG not on. No fault codes displayed.

MALFUNCTION

Undiagnosed shutdown.

CORRECTIVE ACTION

Troubleshoot fault without code (WP 0010).

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR SP FAULT CODE

INITIAL SETUP:

Personnel Required
One

References
TM 9-6115-729-10
WP 0009
WP 0010
WP 0092

SP (Spare Input) Fault Codes are associated with four inputs that are considered spare inputs. Spare fault code programming is contained in OP6-0, Protective Relay Programming (see WP 0092, Table 7 for details). These codes are not stored in the GSC fault log. When a spare input fault is detected, the FAULT SHUTDOWN lamp flashes and the corresponding code (SP1, SP2, etc.) is displayed on the upper GSC display. Fault condition on SP 1 and 4 is programmed to shut down the engine immediately.

WARNING

Fuels used in the generator set are flammable. When filling the fuel tank, maintain metal-to-metal contact between filler nozzle and fuel tank opening to eliminate static electrical discharge. Failure to comply can result in flames and possible explosion and cause injury or death to personnel and damage to the generator set.

WARNING

Fuels used in the generator set are flammable. Do not smoke or use open flames when performing maintenance. Failure to comply can result in flames and possible explosion and can cause injury or death to personnel and damage to the generator set.

NOTE

SP1 through SP4 must be evaluated using dedicated shutdown lights, alarm conditions, and available fault codes.

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. SP1

MALFUNCTION

Low Fuel Level.

CORRECTIVE ACTION

STEP 1. Verify if LOW FUEL LEVEL indicator on alarm module is lit.

STEP 2. Verify fuel level on fuel level gage.

STEP 3. If using internal fuel source, perform fuel service and refill TQG per TM 9-6115-729-10.

STEP 4. If using external (auxiliary) source, verify that auxiliary fuel line is connected per TM 9-6115-729-10, and that AUX FUEL pump switch is set to ON.

STEP 5. Verify that external (auxiliary) fuel is present and clean.

STEP 6. If external (auxiliary) fuel is present and clean, troubleshoot auxiliary fuel pump (WP 0010, SYMPTOM 30).

STEP 7. Verify the problem has been resolved.

SYMPTOM

2. SP2

MALFUNCTION

DVR fault (WP 0009).

CORRECTIVE ACTION

STEP 1. Troubleshoot DVR fault per WP 0009.

STEP 2. If no DVR fault codes are displayed or if DVR will not power up, refer to WP 0010, SYMPTOM 9.

STEP 3. Verify the problem has been resolved.

NOTE

SP3 and SP4 active during paralleling only.

SYMPTOM

3. SP3

MALFUNCTION

Bus Frequency Fault (Paralleling Only). When main contactor relay K1 is energized and one or both of the following is true for more than 2 seconds an SP3 fault is announced: The difference in frequency between the generator and the bus is greater than 0.2 Hz. The difference in phase between the generator and the bus is greater than 10 degrees. The GSC will stop synchronization process until the fault is cleared and corrected.

CORRECTIVE ACTION

STEP 1. Verify that no fault codes are listed on upper display.

STEP 2. Verify equipment setup is correct per TM 9-6115-729-10.

STEP 3. Verify equipment setup and parameters for synchronization (WP 0092, Table 6).

STEP 4. Restart generator sets.

STEP 5. Adjust and evaluate operation using synchronization lights per TM 9-6115-729-10.

STEP 6. Operate per TM 9-6115-729-10.

STEP 7. Verify the problem has been resolved.

SYMPTOM

4. SP4

MALFUNCTION

Bus Voltage Fault (Paralleling Only). Input is active when 208 or 416 VAC is detected on the load bus by dead bus relay low sensor (DBLO) or dead bus relay high sensor (DBHI). This input is compared to the reading of the bus. If the voltage of phase A is less than 20% of the rated voltage, it is considered to be dead. If the condition of these measurements is different with regards to presence or absence of bus voltage, a fault is announced.

CORRECTIVE ACTION

STEP 1. Verify that no fault codes are listed on upper display.

STEP 2. Verify equipment setup is correct per TM 9-6115-729-10.

STEP 3. Verify equipment setup and parameters for synchronization (WP 0092, Table 6).

STEP 4. Restart generator sets.

STEP 5. Adjust and evaluate operation using synchronization lights per TM 9-6115-729-10.

STEP 6. Operate per TM 9-6115-729-10.

STEP 7. Verify the problem has been resolved.

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR AL FAULT CODE

INITIAL SETUP:

Personnel Required
One

References
TM 9-6115-729-10
WP 0008
WP 0009
WP 0010
WP 0014
WP 0039
WP 0040
WP 0063
WP 0064
WP 0066
WP 0072
WP 0092

Alarm fault codes are shown on the upper display and consist of specific engine fault codes, protective relay function codes, and paralleling fault codes. Alarm fault codes rely upon programmed setpoints.

Engine fault code programming is contained in OP5-0, engine/generator programming (WP 0092). Protective relay function code programming is contained in OP5-1, protective relay programming (WP 0092). Paralleling fault code programming is contained in OP5-3, synchronization programming (WP 0092).

Alarm fault codes are not stored in the GSC fault log.

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

Dangerously high voltage can exist across current transformer (CT) output with engine running. CT could explode if disconnected from load with engine running. Do not disconnect CT with generator rotating. Failure to comply can cause serious injury or death to personnel.

WARNING

Slave receptacle (NATO connector) is electrically live at all times and is unfused. The Battery Disconnect switch does not remove power from the NATO connector. Use caution when connecting or disconnecting cable(s) to the NATO connector to prevent damage to equipment. Use caution when troubleshooting this circuit. This circuit is only dead when the batteries are fully disconnected. Failure to comply can cause serious injury or death to personnel.

WARNING

Cooling system operates at high temperature and pressure. Contact with high pressure steam and/or liquids can result in burns and scalding. Shut down generator set, and allow system to cool before performing checks, services, and maintenance. Failure to comply can cause injury or death to personnel.

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. AL 1

MALFUNCTION

High Coolant Temperature

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL1 appears on upper display. Check setpoints per WP 0092. Verify GSC OP5-0 setpoint P015 (WP 0092, Table 4).

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record. If fault codes displayed, troubleshoot per WP 0008.

STEP 5. On EMCP set ENGINE CONTROL switch to OFF/RESET. Battery Disconnect switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 6. Open right side engine access door and check coolant level in coolant recovery (overflow) bottle. If required, replace coolant per TM 9-6115-729-10.

STEP 7. Inspect coolant system lines for leaks per PMCS (WP 0014).

STEP 8. Inspect engine for damaged fan. Inspect alternator and water pump belts. Check water pump belt tension and tighten, if required.

a. If fan damaged, repair per WP 0064.

b. If required, replace alternator or water pump belts (WP 0072).

STEP 9. Inspect radiator for obstructions or blockage. Remove obstructions or blockage if present.

STEP 10. Inspect radiator for damage. If radiator damaged, repair or replace (WP 0066).

STEP 11. Verify the problem has been resolved.

SYMPTOM

2. AL 2

MALFUNCTION

Low Coolant Temperature

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL2 appears on upper display.

NOTE

This fault will be displayed if the coolant temperature is below 70 °F (programmable by setpoint P016), and may occur for a short time after start up.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

a. If fault codes displayed, troubleshoot per fault code (WP 0008).

b. Verify setpoint P016 (WP 0092, Table 4).

STEP 5. Verify the problem has been resolved.

CAUTION

The dipstick is marked so that the crankcase oil can be checked while engine is stopped or running. Remove oil filler cap when checking oil with engine running.

SYMPTOM

3. AL 3

MALFUNCTION

Low Engine Oil Pressure
Low engine operating speed can cause this alarm code. Note and record engine speed for reference.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL3 appears on upper display.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

STEP 5. Check engine oil level and service engine if oil is low per TM 9-6115-729-10.

STEP 6. If fault codes displayed, troubleshoot per fault code (WP 0008).

STEP 7. Verify setpoints P013 or P014 (WP 0092, Table 4).

STEP 8. Verify the problem has been resolved.

SYMPTOM

4. AL 4

MALFUNCTION

Fault Detected by Engine ECM

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL4 appears on upper display.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record. Troubleshoot per displayed fault codes (WP 0008).

STEP 5. Verify the problem has been resolved.

SYMPTOM

5. AL 5

MALFUNCTION

Low Engine Coolant Level

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL5 appears on upper display.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

STEP 5. Inspect coolant system lines for leaks.

STEP 6. Inspect engine coolant system per PMCS (WP 0014).

STEP 7. Open right engine access door and check engine coolant level in coolant recovery (overflow) bottle. Check if coolant is low and service surge tank (WP 0063).

STEP 8. STEP 8 Troubleshoot per displayed fault codes and WP 0008.

STEP 9. Verify the problem has been resolved.

SYMPTOM

6. AL 7

MALFUNCTION

Generator Over Voltage

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL7 appears on upper display.

STEP 4. Verify if any faults are displayed on DVR. Check set points (WP 0092, Table 2).

STEP 5. If overvoltage 702 present, go to WP 0009, SYMPTOM 7 and troubleshoot.

STEP 6. Verify that the problem has been resolved.

STEP 7. Troubleshoot per WP 0008, SYMPTOM 65, CID 1169 FMI 02.

STEP 8. Verify if any fault codes displayed and record.

STEP 9. If problem has not been resolved, troubleshoot per WP 0008.

STEP 10. Verify that the problem has been resolved.

SYMPTOM

7. AL 8

MALFUNCTION

Generator Under Voltage

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL8 appears on upper display. Go to WP 0009, SYMPTOM 6 and troubleshoot.

STEP 4. Verify if any faults are displayed on DVR. Check set points (WP 0092, Table 2).

a. If no DVR fault codes are displayed, check ATB fuses (FO-1, Sheet 5).

b. If DVR fault code 701 is present, troubleshoot per WP 0009, SYMPTOM 6.

STEP 5. Verify that the problem has been resolved.

STEP 6. Troubleshoot per WP 0008, SYMPTOM 65, CID 1169 FMI 02.

STEP 7. Verify if any fault codes displayed and record.

STEP 8. If problem has not been resolved, troubleshoot per WP 0008.

STEP 9. Verify that the problem has been resolved.

SYMPTOM

8. AL 9

MALFUNCTION

Generator Over Frequency

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL9 appears on upper display.

STEP 4. Turn the FREQUENCY ADJUST POTENTIONMETER counterclockwise to reduce frequency.

STEP 5. Verify if any fault codes or engine fault codes are displayed on upper display and record.

a. Verify OP5-0 engine/generator setpoints (WP 0092, Table 4).

b. Troubleshoot fault codes and WP 0008, CID 362 E FMI 01.

STEP 6. Verify the problem has been resolved.

SYMPTOM

9. AL 10

MALFUNCTION

Generator Under Frequency

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL10 appears on upper display.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

STEP 5. Troubleshoot per WP 0010, SYMPTOM 26, Engine Cannot Reach Operating RPM.

STEP 6. Verify the problem has been resolved.

NOTE

This alarm code should occur only when the generator sets are operated in parallel mode.

SYMPTOM

10. AL 11

MALFUNCTION

Generator Reverse Power

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Battery Disconnect switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Verify that paralleling cables are securely connected between generator sets to be paralleled.

STEP 3. Verify that load cables are connected observing proper phase polarity.

STEP 4. Verify that generator sets are set for same output voltage.

STEP 5. Parallel generator sets in accordance with TM 9-6115-729-10.

a. Verify the problem has been resolved.

b. If problem remains, verify if any fault codes or engine fault codes are displayed on GSC upper display and record.

STEP 6. Troubleshoot per displayed fault codes and WP 0008.

STEP 7. Verify protective relay function code disabled by setpoint P125 (WP 0092).

STEP 8. Enable protective relay function code setpoint P125 (WP 0092, Table 5).

STEP 9. Verify the problem has been resolved.

SYMPTOM

11. AL 12

MALFUNCTION

Phase Over Current

CORRECTIVE ACTION

STEP 1. Verify that generator set load is properly balanced between each of the three phases and that the generator set is not overloaded.

STEP 2. Verify that problem is resolved.

STEP 3. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 4. On GSC keypad, press ALARM CODES.

STEP 5. Verify AL12 appears on upper display.

STEP 6. Verify OP5-1 setpoints P128 through P137 (WP 0092, Table 5).
a. If setpoints are changed, verify that the problem has been resolved.
b. If setpoints are not changed, verify if any fault codes or engine fault codes are displayed on GSC upper display and record.
STEP 7. Troubleshoot per displayed fault codes and WP 0008.
STEP 8. Verify the problem has been resolved.
STEP 9. If not, replace Overload/Short Circuit Module (WP 0040, Table 1).

SYMPTOM

12. AL 13

MALFUNCTION

Generator Total Over Current

CORRECTIVE ACTION

STEP 1. Verify that generator set load is properly balanced between each of the three phases and that the generator set is not overloaded.
STEP 2. Verify that problem is resolved.
STEP 3. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.
STEP 4. On GSC keypad, press ALARM CODES.
STEP 5. Verify AL13 appears on upper display.
STEP 6. Verify OP5-1 setpoints P128 through P137 (WP 0092, Table 5).
a. If setpoints are changed, verify that the problem has been resolved.
b. If setpoints are not changed, verify if any fault codes or engine fault codes are displayed on GSC upper display and record.
STEP 7. Troubleshoot per displayed fault codes and WP 0008.
STEP 8. Verify the problem has been resolved.
STEP 9. If not, replace Overload/Short Circuit Module (WP 0040, Table 1).

SYMPTOM

13. AL 14

MALFUNCTION

Phase A No Voltage Input at GSC input (P7-10)

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.
STEP 2. On GSC keypad, press ALARM CODES.
STEP 3. Verify AL14 appears on upper display. Check setpoints per WP 0092.
STEP 4. Troubleshoot A5F1 on ATB A5 per WP 0010, SYMPTOM 4.
STEP 5. If indicated, replace A5F1 on back of ATB A5 (WP 0040).
a. Verify the problem has been resolved.
b. If not, replace ATB A5 (WP 0040, Table 1).
STEP 6. Verify that problem has been resolved. If not, replace the GSC (WP 0039).
STEP 7. Verify the problem has been resolved.

SYMPTOM

14. AL 15

MALFUNCTION

GSC Configuration Error

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On GSC keypad, press ALARM CODES.

STEP 3. Verify AL15 appears on upper display. Check setpoints per WP 0092, Table 3 and Table 5.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

a. Troubleshoot per displayed fault codes and WP 0008.

b. On EMCP set ENGINE CONTROL switch to MANUAL START.

c. Verify that engine speed rpm is for correct output frequency by pressing ENGINE METER key on GSC.
1,800 RPM for 60 Hz
1,500 RPM for 50 Hz

STEP 5. Verify the problem has been resolved

NOTE

This alarm code should occur only when the generator sets are operated in parallel mode.

SYMPTOM

15. AL 16

MALFUNCTION

Incorrect Phase Sequence - Paralleling fault code

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Battery Disconnect switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Verify that paralleling cables are securely connected between generator sets to be paralleled.

STEP 3. Verify that load cables are connected observing proper phase polarity.

STEP 4. Verify that generator sets are set for same output voltage.

STEP 5. Parallel generator sets per TM 9-6115-729-10.

a. Verify the problem has been resolved.

b. If problem remains, verify if any fault codes or engine fault codes are displayed on GSC upper display and record.

STEP 6. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 7. On GSC keypad, press ALARM CODES.

STEP 8. Verify AL16 appears on upper display. Check setpoints per WP 0092.

STEP 9. Verify if any fault codes or engine fault codes are displayed on upper display and record.

a. On EMCP set SYNC MODE switch to OFF.

b. Troubleshoot per displayed fault codes and WP 0008.

STEP 10. Verify the problem has been resolved.

NOTE

This alarm code should occur only when the generator sets are operated in parallel mode.

SYMPTOM

16. AL 17

MALFUNCTION

Improper Generator or Bus Voltage - Paralleling fault code

CORRECTIVE ACTION

STEP 1. On generator set GSC displays, check the voltages on for both generator sets and record output voltages for all phases. All phases should be the same for both generator sets.

STEP 2. On EMCP of both generator sets, set ENGINE CONTROL switch to OFF/RESET. Battery Disconnect switch to OFF; DEAD CRANK SWITCH to OFF.

STEP 3. Check both generator sets and verify that all cables are connected properly and all load terminal connections are tight per TM 9-6115-729-10.

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to connect or disconnect load cables while the generator set is running. Failure to comply can cause injury or death to personnel.

WARNING

Slave receptacle (NATO connector) is electrically live at all times and is unfused. The Battery Disconnect switch does not remove power from the NATO connector. Use caution when connecting or disconnecting cable(s) to the NATO connector to prevent damage to equipment. Use caution when troubleshooting this circuit. This circuit is only dead when the batteries are fully disconnected. Failure to comply can cause serious injury or death to personnel.

STEP 4. Parallel generator sets per TM 9-6115-729-10.

STEP 5. Verify the problem has been resolved.

STEP 6. If problem remains, set AC CIRCUIT INTERRUPTER switch on GSC to OPEN.

a. On generator set #1, set AC CIRCUIT INTERRUPTER switch on GSC to CLOSED.

b. Measure voltage at output load terminal lugs and record.

c. On generator set #1, set AC CIRCUIT INTERRUPTER switch on GSC to OPEN.

d. On generator set #2, set AC CIRCUIT INTERRUPTER switch on GSC to CLOSED.

e. Measure voltage at output load terminal lugs and record.

f. On generator set #2, set AC CIRCUIT INTERRUPTER switch on GSC to OPEN.

STEP 7. If voltages at output load terminal lugs are different, adjust generator set voltages equal to each other.

STEP 8. Parallel generator sets per TM 9-6115-729-10.

STEP 9. Verify the problem has been resolved.

STEP 10. If not resolved, check wiring at LSM A4.

STEP 11. If wiring at LSM A4 is good, replace LSM A4 (WP 0040, Table 1).

NOTE

This alarm code should occur only when the generator sets are operated in parallel mode.

SYMPTOM

17. AL 18

MALFUNCTION

Synchronizer Time-out - Paralleling fault code

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. On keypad, press ALARM CODES.

STEP 3. Verify AL18 appears on upper display. Check setpoints per WP 0092.

STEP 4. Verify if any fault codes or engine fault codes are displayed on upper display and record.

STEP 5. Troubleshoot per displayed fault codes and WP 0008.

STEP 6. On EMCP set SYNC MODE switch to OFF.

STEP 7. Check all paralleling connections to load per TM 9-6115-729-10.

STEP 8. Verify the problem has been resolved.

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR GSC FAULT CODE

INITIAL SETUP:

Tools and Special Tools
Multimeter

Personnel Required
One

References
FO-1
FO-2
FO-3
FO-4
TM 9-6115-729-10
WP 0007
WP 0008
WP 0010
WP 0012
WP 0015
WP 0021
WP 0035
WP 0039
WP 0040
WP 0042
WP 0059
WP 0069
WP 0070
WP 0072
WP 0078
WP 0083
WP 0092
WP 0096
WP 0106
WP 0109
WP 0115

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

WARNING

Ensure that the engine cannot be started while maintenance is being performed. (ENGINE CONTROL switch set to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.) Failure to comply can cause injury or death to personnel.

NOTE

CID 1 through 6 is for the unit fuel injectors in cylinders 1 through 6 respectively. The ECM is capable of detecting the following conditions:

Open circuit in injector wiring

Open circuit in the internal wiring of the injector

Short to ground

Injector internal short circuit

Short to B+

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. CID 1 E FMI 06
   CID 1 E FMI 11

MALFUNCTION

Cylinder 1.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 and ENG-P1 on engine harness (FO-2, Sheet 1).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on the engine harness (ENG-P2 connector to ENG-P1 connector) and the fuel injector harness (ENG-J300 connector to fuel injectors) for abrasion and pinch points (WP 0096). Repair the connectors or wiring and/or replace the connectors or wiring, if necessary (WP 0096).

STEP 5. Perform Injector Solenoid Test (WP 0012, SYMPTOM 8).

STEP 6. Verify the problem is resolved.

SYMPTOM

2. CID 1 E FMI 06
   CID 2 E FMI 11

MALFUNCTION

Cylinder 2.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

Perform Steps in SYMPTOM 1.

SYMPTOM

3. CID 1 E FMI 06
   CID 3 E FMI 11

MALFUNCTION

Cylinder 3.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

Perform Steps in SYMPTOM 1.

SYMPTOM

4. CID 1 E FMI 06
   CID 4 E FMI 11

MALFUNCTION

Cylinder 4.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

Perform Steps in SYMPTOM 1.

SYMPTOM

5. CID 1 E FMI 06
   CID 5 E FMI 11

MALFUNCTION

Cylinder 5.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

Perform Steps in SYMPTOM 1.

SYMPTOM

6. CID 1 E FMI 06
   CID 6 E FMI 11

MALFUNCTION

Cylinder 6.
FMI 06 - Injector Current Fault.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

Perform Steps in SYMPTOM 1.

SYMPTOM

7. CID 9 E FMI 02

MALFUNCTION

High Altitude Degradation.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
Event Code. Engine power lowered because of altitude. Higher the altitude, the lower the air density. Clean dense air is needed for efficient combustion.

CORRECTIVE ACTION

Check for related alarm codes or fault codes and troubleshoot (WP 0007 and/or WP 0008).

NOTE

Pins 4 (+) and 5 (-) of ECM connector J2 is an 8 VDC supply. This is supplied by the ECM for an accelerator pedal control when this engine is used in a truck. This supply is not used on the generator set.

SYMPTOM

8. CID 41 FMI 02
   CID 41 FMI 03
   CID 41 FMI 04 (Not Applicable)

MALFUNCTION

8 Volt Power Supply not Normal.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Inspect wiring at ECM connector J2.

a. Repair or replace wiring, as required (WP 0096).

b. If wiring is not defective, replace ECM (WP 0083).

STEP 2. Verify the problem is resolved.

SYMPTOM

9. CID 42 E FMI 11

MALFUNCTION

Injection actuator pressure valve.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 and ENG-P3 on engine harness (FO-2, Sheet 1).

STEP 3. Conduct an appropriate pull test on the wires in the ENG-P2 and ENG-P3 connectors to ensure the wires are tight and secure.

STEP 4. Check the wires on the engine harness for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 5. Verify the problem is resolved.

STEP 6. If not, disconnect engine harness connector ENG-P3 from injection actuation pressure (IAP) control valve connector (WP 0096 Figure 1, Sheet 1, and FO-2, Sheet 1).

STEP 7. Measure resistance between pins of IAP control valve connector (WP 0096, Figure 2, Sheet 2). Measurement should be between 6.5 and 10.5 Ohms. Record the value. If the resistance is not between 6.5 and 10.5 Ohms, replace IAP control valve (WP 0109). Verify the problem has been resolved.

STEP 8. Reconnect ENG-P3 to IAP control valve connector.

STEP 9. Verify the problem is resolved.

STEP 10. If not, disconnect P2 of engine harness (FO-2, Sheet 1) from ECM.

STEP 11. Measure resistance between terminals ENG-P2-61 (IAPCV signal) and ENG-P2- 62

(IAPCV return). Resistance should be within two (2) Ohms of the value measured in TEST STEP 6. Repair and/or replace the connectors and/or wiring (WP 0096). Verify the problem is resolved.

STEP 12. If not, disconnect engine harness connector ENG-P3 from IAP control valve connector.

STEP 13. Measure resistance from engine harness connector ENG-P2-61 to all other terminals in ENG-P2, the engine ground stud, and all terminals on the ECM to EMCP harness connector ENG-P1. The resistance measurements should be open. Repair and/or replace the wiring and/or connectors, if necessary.

STEP 14. Disconnect ECM to EMCP harness ENG-P1 from ECM J1. Measure resistance from engine harness connector ENG-P2-62 to all other terminals in ENG-P2, the engine ground stud, and all terminals on the ECM to EMCP harness connector ENG-P1. The resistance measurements should be open. Repair and/or replace the connectors and/or wiring (WP 0096).

STEP 15. Verify the problem is resolved.

STEP 16. If not, reconnect engine harness connectors ENG-P2 and ENG-P3. Reconnect ECM to EMCP harness connector P1 and retest. If CID 42 E FMI 11 is still present on the GSC, perform Injection Actuation Pressure Control Valve Circuit Test (WP 0012, SYMPTOM 6).

STEP 17. If the problem is not resolved, replace the ECM (WP 0083). Retest after the ECM has been replaced.

STEP 18. Verify the problem is resolved.

SYMPTOM

10. CID 85 E FMI 01

MALFUNCTION

Shutdown Overridden.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Red FAULT ALARM indicator flashes on GSC has detected a shutdown fault which was overridden (Battle Short).

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Verify the Battle Short Switch is set to OFF.

STEP 3. Press ALARM CODES on GSC keypad.

STEP 4. Verify associated alarm codes and fault codes and troubleshoot (WP 0007 and/or WP 0008).

SYMPTOM

11. CID 91 FMI 08

MALFUNCTION

Throttle Position Signal.
FMI 08 - Abnormal Frequency, Pulse Width, or Period.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connector ENG-P1 on ECM to EMCP harness (FO-2, Sheet 2). Inspect connector ENG-P300 on ECM to ENG-P300 harness (FO-2, Sheet 1).

STEP 3. Conduct an appropriate pull test on wires to ensure wires are tight and secure.

STEP 4. Check the wires on the ECM to EMCP harness for abrasion and pinch points (WP 0096).

Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 5. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 6. Measure 24±3 VDC between terminal 15 (+) and terminal 16 (-) on LSMA4 (FO-4, Sheet 2). If 24±3 VDC is not measured between terminal 15 (+) and terminal 16 (-) on the LSMA4, perform Speed Control Test (WP 0012, SYMPTOM 9, STEP 3).

STEP 7. Verify the problem is resolved.

STEP 8. If 24±3 VDC is measured between terminal 15 (+) and terminal 16 (-) on LSM A4 (FO-4, Sheet 2), refer to WP 0012, SYMPTOM 9, STEP 3.

a. On EMCP, turn ENGINE CONTROL switch to MANUAL START.

b. Measure DC voltage between LSM A4 terminals 19 (+) and 20 (-). Measurement should be 3.1 VDC @ 60 Hz at not load. If not, adjust speed trim potentiometer to bring signal to 3.1 VDC and generator frequency to 60 Hz.

c. If Pulse Width Modulation (PWM) output of LSM A4 is low and/or cannot be adjusted to 3.1 VDC, check speed trim potentiometer connections and test speed trim potentiometer resistance. If speed trim potentiometer is OK, replace LSM A4 (WP 0040).

STEP 9. Verify the problem is resolved.

SYMPTOM

12. CID 94 FMI 01
CID 94 FMI 02

MALFUNCTION

Fuel pressure sensor.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Disconnect engine harness connector ENG-P17 from fuel pressure sensor (WP 0096, Figure 1, Sheet 1 and FO-2, Sheet 1).

STEP 3. Measure voltage between ENG-P17-A (+) and ENG-P17-B (-) of harness connector (WP 0096, Figure 2, Sheet 1).

a. If voltage is not present, repair or replace harness (WP 0096). Verify the problem has been resolved.

b. If repairing wiring does not resolve fault, replace the fuel pressure sensor (WP 0106). Verify the problem has been resolved.

c. If voltage is not present between ENG-P17-A (+) and ENG-P17-B (-) proceed to STEP 3d.

d. Remove ENG-P2 from ECM and verify continuity between ENG-P17-C and ENG-P2-16 per FO-2, Sheet 1.

(1) If continuity is not present, repair or replace harness (WP 0096). Verify the problem has been resolved.

(2) If the problem is not resolved, replace ECM (WP 0083).

STEP 4. Verify the problem is resolved.

NOTE

This procedure is used for FMI codes 03 and 04 for all pressure sensors.

SYMPTOM

13. CID 94 E FMI 03
    CID 94 E FMI 04

MALFUNCTION

Fuel pressure sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096) as necessary.

STEP 5. If necessary, disconnect the harness connectors, for the fuel pressure sensor, engine oil pressure sensor, injection actuation sensor, turbo outlet pressure sensor, atmospheric pressure sensor, and turbo inlet pressure sensor.

STEP 6. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 7. Measure 5.0±0.2 VDC between terminals A (supply) and B (return) at each sensor connector.

a. If 5.0±0.2 VDC is not measured on all sensor connectors, remove ENG-P2 from ECM J2. Check for 5.0±0.2 VDC on the pins for the bad sensor reading (WP 0096 and FO-2 Sheet 1). Verify continuity of the signal wire (pin C) for the suspect sensor connector.

b. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is set to OFF. If the voltage was present, repair/replace the ECM J2 engine harness (WP 0115) as necessary.

c. Reconnect all of the sensor connectors.

d. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP. Retest the system.

e. If the problem is not resolved, proceed to STEP 8.

STEP 8. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 9. Disconnect the defective sensor connector.

a. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

b. Check for a 03 diagnostic code.

c. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF. DEAD CRANK SWITCH is set to OFF.

d. Connect a jumper wire and connect to pins B and C of the bad sensor connector.

e. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

f. Check for a 04 diagnostic code. If the correct code is present, the ECM is working OK. Replace the defective sensor (WP 0106).

g. If the diagnostic code remains 03, proceed to STEP 10.

STEP 10. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF. DEAD CRANK SWITCH is set to OFF. Remove the jumper wire.

STEP 11. Replace the ECM (WP 0083) and retest the system. Verify the problem is resolved.

SYMPTOM

14. CID 96 E FMI 01

MALFUNCTION

High Fuel pressure Warning.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Indicates that sensor detects a fuel system backup to cause high pressure warning.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for associated alarm code and fault code and troubleshoot (WP 0007 and/or WP 0008).

STEP 4. If no fault code, inspect fuel filter and fuel/water separator per PMCS (WP 0015) and perform service as required.

SYMPTOM

15. CID 97 E FMI 01

MALFUNCTION

Derate Overridden.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Engine derate overridden. Verify presence of fault.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for logged fault code, troubleshoot, and correct (WP 0007 and/or WP 0008).

STEP 4. Verify the problem is resolved.

NOTE

The following failure indicates that GSC is unable to receive valid data about oil pressure from ECM.

SYMPTOM

16. CID 100 E FMI 02

MALFUNCTION

Oil pressure sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the

ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Disconnect ENG-P2 from ECM J2, ENG-P15 from the oil pressure sensor, and ENG-P17 from the fuel pressure sensor. Verify continuity from ENG-P15-A to ENG-P17-A and ENG-P2-41. Verify continuity from ENG-P15-B to ENG-P17-B and ENG-P2-42. Verify continuity from ENG-P15-C to ENG-P2-24.

STEP 5. Check the wires on both ENG-P1 and ENG-P2 harnesses for abrasion and pinch points (WP 0096).

STEP 6. If necessary, repair and/or replace the connectors and/or wiring (WP 0096).

STEP 7. Disconnect the harness connectors, for the fuel pressure sensor, engine oil pressure sensor, injection actuation sensor, turbo outlet pressure sensor, atmospheric pressure sensor, and turbo inlet pressure sensor.

STEP 8. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 9. Measure 5.0±0.2 VDC between terminals A (supply) and B (return) at each sensor connector. If 5.0±0.2 VDC is not measured on all sensor connectors, perform Electrical Connectors Wiggle Test (WP 0012, SYMPTOM 2).

STEP 10. If the problem is not resolved, replace the oil pressure sensor (WP 0106).

STEP 11. Retest the system. Verify that the problem has been cleared.

STEP 12. If the problem has not been resolved, replace ECM (WP 0083).

STEP 13. Retest the system and verify the problem has been resolved.

NOTE

The following failure is usually a broken wire, or a frayed wire shorting to an adjacent wire or to ground.

SYMPTOM

17. CID 100 E FMI 03
CID 100 E FMI 04

MALFUNCTION

Oil pressure sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

Troubleshoot oil pressure sensor using Steps in SYMPTOM 13.

NOTE

This failure indicates that GSC is unable to receive any valid data about the coolant temperature from the ECM.

SYMPTOM

18. CID 110 E FMI 02
CID 110 E FMI 03
CID 110 E FMI 04

MALFUNCTION

Engine coolant temperature sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.

FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096).

STEP 5. Disconnect engine harness connector ENG-P6 from engine coolant temperature sensor (WP 0096, Figure 1, Sheet 1, and FO-2, Sheet 1).

STEP 6. Connect a new sensor to engine harness connector ENG-P6, but do not install the sensor into the engine.

STEP 7. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Battery Disconnect Switch is ON; DEAD CRANK SWITCH is set to NORMAL.

STEP 8. On GSC keypad, press GSC ALARM CODES button.

a. If the fault has cleared, replace engine coolant temperature sensor (WP 0106).

b. If the fault has not cleared, continue with STEP 9.

STEP 9. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 10. Remove engine harness connector ENG-P6 from the new sensor. Leave ENG-P6 disconnected.

a. Use a jumper wire long enough to reach from engine harness connector ENG-P6-1 to the engine ground stud.

b. Install jumper wire onto ENG-P6-1.

STEP 11. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Battery Disconnect Switch is ON; DEAD CRANK SWITCH is set to NORMAL.

STEP 12. On GSC keypad, press GSC ALARM CODES button.

a. Verify a diagnostic code 03 appears.

b. Short the jumper wire (ENG-P6-1) to the engine ground.

c. Verify a diagnostic code 04 appears. This verifies the ECM is working properly.

STEP 13. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 14. Remove the jumper wire and connect all wires and connectors.

a. If a diagnostic code 03 and/or a diagnostic code 04 did not appear in STEP 13, repair or replace the engine harness.

b. Verify the problem has been resolved.

STEP 15. If the problem is not resolved, replace ECM (WP 0083).

STEP 16. Verify the problem is resolved.

NOTE

The engine low coolant sensor is powered by 8 VDC from the GSC. When coolant is present at the sensor, a logic low (near zero volts) is sent to the GSC. When coolant is not present at the sensor, a logic high is sent to the GSC.

SYMPTOM

19. CID 111 E FMI 03
    CID 111 E FMI 04

MALFUNCTION

Engine low coolant sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Disconnect ECM to EMCP harness connector ENG-P16 from low coolant sensor (WP 0096, Figure 1 sheet 2, and FO-2, Sheet 2).

STEP 3. Measure the voltage on the ECM to EMCP harness connector between ENGP16- A (+) and ENG-P16-B (-). Also measure the voltage between ENG-P16-C (+) and ENG-P16-B (-).
If the voltage between ENG-P16-A (+) and ENG-P16-B (-) is not 7.5 to 8.5 VDC or voltage between ENG-P16-C (+) and ENG-P16-B (-) is not 2.0 to 3.0 VDC, repair or replace ECM to EMCP harness (WP 0096).

STEP 4. If repairing or replacing the ECM to EMCP harness does not correct the problem, replace the engine low coolant sensor (WP 0106).

STEP 5. If replacing the engine low coolant sensor does not correct the problem, proceed to STEP 6.

STEP 6. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 7. Disconnect the defective sensor connector.

a. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

b. Check for a 03 diagnostic code.

c. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF. DEAD CRANK SWITCH is set to OFF.

d. Connect a jumper wire and connect to pins B and C of the bad sensor connector.

e. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP turn the ENGINE CONTROL switch to COOL DOWN/STOP.

f. Check for a 04 diagnostic code. If the correct code is present, the ECM is working OK. Replace the defective sensor (WP 0106).

g. If the diagnostic code remains 03, proceed to STEP 8.

STEP 8. Switch is OFF. DEAD CRANK SWITCH is set to OFF. Remove the jumper wire.

STEP 9. Replace the GSC (WP 0039) and retest the system.

STEP 10. Verify the problem has been resolved.

CAUTION

The dipstick is marked so that the crankcase oil can be checked while engine is stopped or running. Remove oil filler cap when checking oil with engine running.

NOTE

The following codes indicate that ECM detected an injection actuation pressure above 3,500 psi (24,000 kPa). This condition indicates a mechanical problem. The engine may be low on power. The problem may only exist at operating temperature. Additional testing can be accomplished using the Cat ET. Troubleshoot these codes first.

CID 42 FMI 11 (injection actuation pressure control valve driver fault)
CID 164 FMI 02 (injection actuation pressure erratic)
CID 164 FMI 03 (injection actuation pressure open circuit)
CID 164 FMI 04 (injection actuation pressure short circuit)

SYMPTOM

20. CID 164 E FMI 00
CID 164 E FMI 02
CID 164 E FMI 11

MALFUNCTION

Injection actuation pressure system.
FMI 00 - Data is Valid but Data is Above Normal Operating Range.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Check the engine oil level.

a. Check the engine oil level and perform service per TM 9-6115-729-10.

b. If the engine oil level is low add oil to the engine.

c. Set the Battery Disconnect Switch is ON and the DEAD CRANK SWITCH to NORMAL. On EMCP, turn ENGINE CONTROL switch to MANUAL START.

(1) If the engine starts, check for active codes.

(2) If diagnostic code has cleared, the problem is resolved.

(3) If the diagnostic code is still present, proceed to STEP 3.

STEP 3. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 4. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 5. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 6. Check the wires on both harnesses for abrasion and pinch points (WP 0096). If necessary, repair and/or replace the connectors and/or wiring (WP 0096).

STEP 7. Disconnect the harness connectors, for the fuel pressure sensor, engine oil pressure sensor, injection actuation sensor, turbo outlet pressure sensor, atmospheric pressure sensor, and turbo inlet pressure sensor.

STEP 8. On EMCP, turn ENGINE CONTROL switch to COOL DOWN/STOP. Battery Disconnect Switch is ON. DEAD CRANK SWITCH is set to NORMAL.

STEP 9. Measure 5.0±0.2 VDC between terminals A (supply) and B (return) at each sensor connector. If 5.0 ± 0.2 VDC is not measured on all sensor connectors, repair/replace ECM J2 engine harness (WP 0096).

STEP 10. If the problem is not resolved, perform the Injection Actuation Pressure Test (WP 0012,

SYMPTOM 5). Perform sections of the test that match the failure codes.

STEP 11. If the problem is not resolved, replace ECM (WP 0083).

STEP 12. Verify the diagnostic code has been cleared.

NOTE

The ECM detected one of the following conditions:

Injection actuation pressure with the engine shut down

Substantial difference between actual and desired pressure

Change in injection actuation pressure was not consistent with change in sensor current

SYMPTOM

21. CID 164 E FMI 03
    CID 164 E FMI 04

MALFUNCTION

Injection actuation pressure system.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

Troubleshoot injector actuation pressure sensor using Steps in SYMPTOM 13.

SYMPTOM

22. CID 168 E FMI 02
    CID 168 E FMI 03
    CID 168 E FMI 04

MALFUNCTION

Electrical system voltage.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 5. Perform Electrical Power Supply Test (WP 0012, SYMPTOM 3).

STEP 6. Verify the problem has been resolved.

SYMPTOM

23. CID 169 E FMI 01

MALFUNCTION

Engine oil maintenance required.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Engine oil change is required.

CORRECTIVE ACTION

STEP 1. Perform engine oil and filter change (WP 0080).

STEP 2. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP, turn ENGINE CONTROL switch to COOL DOWN/ STOP.

STEP 3. Reset CATSW2 after oil filter and oil are changed.

STEP 4. Record engine oil maintenance.

STEP 5. Verify the fault code has cleared.

SYMPTOM

24. CID 170 E FMI 01

MALFUNCTION

Fuel filter change required.
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Inspect fuel filter for leaks, proper mounting, cracks, damage, or missing parts and change fuel filter.

CORRECTIVE ACTION

STEP 1. STEP 1 Perform fuel filter change (WP 0078).

STEP 2. Set Battery Disconnect Switch to ON; Set DEAD CRANK SWITCH to NORMAL. On EMCP, turn ENGINE CONTROL switch to COOL DOWN/ STOP.

STEP 3. Reset CATSW1 after fuel filter change.

STEP 4. Record fuel filter maintenance.

STEP 5. Verify the fault code has cleared.

NOTE

The following codes are generated when the air manifold temperature sensor sees a temperature greater than 194 °F (90 °C) for 2 seconds or longer (FMI 00); or greater than 228 °F (109 °C) (FMI 11) for 2 seconds or longer. This problem is often caused by one of the following:

Incorrect fuel injection timing,
Low air inlet system pressure,
Restriction in air inlet

SYMPTOM

25. CID 172 E FMI 00
CID 172 E FMI 03
CID 172 E FMI 04
CID 172 E FMI 11

MALFUNCTION

Inlet air temperature sensor.
FMI 00 - Data is Valid but Data is Above Normal Operating Range.

FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. Inspect and service air cleaner per TM 9-6115-729-10.

STEP 2. If air cleaner required service, verify the fault code has cleared. If not continue to the next step.

STEP 3. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 4. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 5. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 6. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 7. Disconnect engine harness connector ENG-P7 from inlet air temperature sensor (WP 0096, Figure 1, Sheet 1, and FO-2, Sheet 1).

a. Use a jumper wire long enough to reach from engine harness connector ENG-P7-1 to the engine ground stud.

b. Install jumper wire onto ENG-P7-1.

STEP 8. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 9. On GSC keypad, press GSC ALARM CODES button.

a. Verify a diagnostic code 03 appears.

b. Short the jumper wire (ENG-P7-1) to the engine ground.

c. Verify a diagnostic code 04 appears. This verifies the ECM is working properly.

STEP 10. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 11. Remove the jumper wire and connect all wires and connectors. If a diagnostic code 03 and/or a diagnostic code 04 did not appear in STEP 9, use a DVM to verify the wiring between ENG-P7-1 to ENG-P2-35 and between ENG-P7-2 to ENG-P2-18, P6-2, and P18-2. Repair or replace the engine harness (WP 0096) as necessary.

STEP 12. If the problem is not resolved, replace intake manifold air temperature sensor (WP 0106).

STEP 13. Verify the problem is resolved. If not, replace ECM (WP 0083).

STEP 14. Verify the fault code has cleared.

NOTE

The engine oil temperature sensor is read by the ECM and the information sent to the GSC via the CAT data link (ENG-P1 to ENG-P37).

SYMPTOM

26. CID 175 FMI 02
CID 175 FMI 03
CID 175 FMI 04

MALFUNCTION

Engine oil temperature sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.

FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 5. Disconnect engine harness connector ENG-P18 from oil temperature sensor (WP 0096, Figure 1, Sheet 1, and FO-2, Sheet 1).

a. Fabricate a jumper wire long enough to reach from engine harness connector ENG-P18-1 to the engine ground stud.

b. Install jumper wire onto ENG-P18-1.

STEP 6. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 7. On GSC keypad, press GSC ALARM CODES button.

a. Verify a diagnostic code 03 appears.

b. Short the jumper wire (ENG-P18-1) to the engine ground.

c. Verify a diagnostic code 04 appears. This verifies the ECM is working properly.

STEP 8. Turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 9. Remove the jumper wire and connect all wires and connectors. If a diagnostic code 03 and/or a diagnostic code 04 did not appear in STEP 13, use a DVM to verify the wiring between ENG-P18-1 to ENG-P2-34 and between ENG-P7-2 to ENG-P2-18, P6-2, and P18-2. Repair or replace the engine harness (WP 0096) as necessary.

STEP 10. If the problem is not resolved, replace the oil temperature sensor (WP 0106).

STEP 11. Verify the problem is resolved. If not, replace the ECM (WP 0083).

STEP 12. Verify the problem has been resolved.

NOTE

The magnetic pickup unit (MPU) on this engine is located at the rear of the engine on the flywheel housing.

SYMPTOM

27. CID 190 FMI 02
CID 190 FMI 03

MALFUNCTION

Loss of engine speed signal.
Magnetic pickup unit (engine speed sensor).
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET.

STEP 2. Disconnect connector ENG-P14 from the magnetic pickup unit (MPU) (WP 0096, Figure 2, Sheet 2, and FO-2, Sheet 2).

STEP 3. Measure MPU resistance.

a. If resistance is not 100 to 350 Ohms, replace the MPU (WP 0106).

b. If resistance is correct, set DVM to AC volts. Turn DEAD CRANK SWITCH to CRANK. Measure 2 to 3 VAC on ENG J14-1 to ENG J14-2 (MPU pigtail connector). Turn DEAD CRANK SWITCH to NORMAL.

(1) If voltage measurement is not OK, adjust the MPU (WP 0106). Verify the problem is resolved. If not, the MPU is damaged or it is not functioning. Replace the magnetic pickup unit (WP 0021). Verify the problem is resolved.

(2) If the voltage measurement is OK, the MPU is functioning OK.

(3) Reconnect ENG-P14 to MPU.

STEP 4. Disconnect ENG-P37 from the back of the EMCP. Measure resistance between ENG-P37-1 and ENG-P37-2. Resistance should be 100 to 350 Ohms.

a. If resistance is not 100 to 350 Ohms, troubleshoot wiring harness between ENG-P37 of EMCP and ENG-P14 (WP 0096). Repair as necessary (WP 0096). Verify the problem has been resolved.

b. If the problem has not been resolved, troubleshoot wiring between EMCP J37-1 to GSC P7-1 and EMCP J37-2 to GSC P7-2. Repair as necessary (WP 0096). Verify the problem has been resolved.

c. If the problem has not been resolved, check all GSC fuses (FO-4, Sheets 3 and 5).

d. If GSC fuses are OK, replace GSC (WP 0039).

NOTE

The primary engine timing sensor on this engine is the top crankshaft timing sensor.

SYMPTOM

28. CID 190 E FMI 02
CID 190 E FMI 11

MALFUNCTION

Loss of engine speed signal.
Primary engine timing sensor.
FMI 01 - Erratic, Intermittent, or Incorrect Signal.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Disconnect connector ENG-P4 from the top (primary) engine timing sensor (FO-2, Sheet 1). The sensor connector has a wire clip that must be removed in order to disconnect the connector from the sensor.

STEP 3. Measure engine timing sensor resistance.

a. If resistance is not 75 to 230 Ohms, replace engine timing sensor assembly (both the primary and secondary timing sensors are contained in the engine timing sensor assembly) (WP 0106).

b. If resistance is correct, inspect and adjust engine timing (WP 0012, SYMPTOM 11).

c. Verify the problem has been resolved. If not, continue to the next step.

STEP 4. If the problem is not resolved, remove and inspect the sensor assembly (WP 0012, SYMPTOM 4, Steps 6a through 6f).

a. If sensor is damaged, replace and adjust sensor assembly (WP 0106, WP 0012, SYMPTOM 4). Verify the problem is resolved.

b. If the sensor does not appear to be damaged, reinstall sensor assembly.

STEP 5. Disconnect ENG-P2 from the ECM J2 (WP 0096, Figure 2, Sheet 3 and FO-2, Sheet 1).

STEP 6. Inspect engine harness and verify continuity between ENG-P4-A and ENG-P2-49 and between ENG-P4-B and ENG-P2-48 (FO-2, Sheet 1).

a. If open or shorted, repair or replace engine harness (WP 0096), as necessary.

b. Verify the problem has been resolved. If not, replace the ECM (WP 0083).

STEP 7. Verify the problem has been resolved.

SYMPTOM

29. CID 248 FMI 09

MALFUNCTION

CAT Data Link.
FMI 09 - Abnormal Update.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Disconnect ENG-P1 from ECM.

STEP 3. Verify continuity between CDC P7-E and ENG P1-9 and between CDC P7-D and ENG P1-8 (FO-4, Sheet 1, FO-2, Sheet 2, WP 0096, Figure 2, Sheet 3).

a. Repair or replace harness, as required (WP 0096).

b. If the problem is not resolved, continue to STEP 4.

STEP 4. Perform Electronic Service Tool (Cat ET) will not communicate with ECM (WP 0012, SYMPTOM 10).

STEP 5. Verify the problem has been resolved.

NOTE

This code indicates that a customer or system parameter has not been programmed, or the code in the personality module in the ECM does not match the code for the ECM. The engine may be limited in horsepower or speed.

SYMPTOM

30. CID 253 E FMI 02

MALFUNCTION

Personality Module Mismatch.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. On EMCP, turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Verify the flash file in the ECM (WP 0012, SYMPTOM 12). If flash file is incorrect, load correct flash file into the ECM.

STEP 3. If the problem is not resolved, replace ECM (WP 0083). Load correct flash file into ECM (WP 0012, SYMPTOM 12).

STEP 4. Verify the problem is resolved.

NOTE

This fault code indicates that the ECM has detected an internal power supply or memory problem that can not be repaired.

SYMPTOM

31. CID 254 E FMI 12

MALFUNCTION

ECM Self Test.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. If the ECM fails Self Test, replace ECM (WP 0083).

STEP 2. Load correct flash file into new ECM (WP 0012, SYMPTOM12).

STEP 3. Verify the ECM passes Self Test.

SYMPTOM

32. CID 261 E FMI 13

MALFUNCTION

Engine Timing Calibration.
FMI 13 - Device is not Calibrated.

CORRECTIVE ACTION

Perform Engine Timing Calibration (WP 0012, SYMPTOM 11).

NOTE

These failures are caused by either a failed sensor or a problem with the wiring.

SYMPTOM

33. CID 262 E FMI 03
CID 262 E FMI 04

MALFUNCTION

5 V Sensor Power Supply.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect connectors ENG-P2 on the engine harness (FO-2, Sheet 1) and ENG-P1 on the ECM to EMCP Harness (FO-2, Sheet 2).

STEP 3. Conduct an appropriate pull test on wires in the ENG-P2 and ENG-P1 connectors to ensure wires are tight and secure.

STEP 4. Check the wires on both harnesses for abrasion and pinch points (WP 0096). Repair and/or replace the connectors and/or wiring (WP 0096), as necessary.

STEP 5. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. On EMCP, turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 6. Check for FMI 03 and/or FMI 04 failure modes with associated fault codes CID 94 and CID 100 simultaneously or CID 164, CID 273, and CID 274 simultaneously. Perform the following Steps if any of the fault codes are active.

a. If found, go to STEP 7 and troubleshoot engine wiring harness. Check for opens or shorts in the sensors common wires.

b. If not found, proceed to STEP 8.

STEP 7. Troubleshoot engine wiring harness per WP 0096, Figure FO-2, Sheets 1 and 2.

a. Disconnect engine wiring harness connectors ENG-P1 and ENG-P2 and the connectors to sensors listed in STEP 8.

b. Check continuity between ENG-P1 and ENG-P2 and all sensors identified in STEP 8.

c. If wires all have continuity, reconnect all sensor connectors, ENG-P1 and ENG-P2. Proceed to STEP 8.

d. If continuity is not found, repair or replace wiring harness as necessary per WP 0096.

e. Reconnect all sensors, ENG-P1 and ENG-P2 and verify is the problem still exists. If so, proceed to STEP 8.

STEP 8. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Disconnect the following sensors one at a time, while observing the GSC (WP 0096, Figure 1).

a. Engine oil pressure sensor.

b. Turbo outlet pressure sensor.

c. Fuel pressure sensor.

d. Injection actuation pressure sensor.

e. Atmospheric pressure sensor.

f. Turbo inlet pressure sensor.

STEP 9. Switch to OFF; and DEAD CRANK SWITCH to OFF.

STEP 10. If the diagnostic code deactivated after a particular sensor was disconnected, replace the sensor causing the fault. Reconnect sensors.

STEP 11. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Verify if problem still exists.

a. If faults still exist and not all the sensors have been disconnected; go back to STEP 8.

b. If all sensors have been disconnected and fault remains active, go to STEP 12.

STEP 12. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 13. If STEP 7 was not performed earlier, Troubleshooting wiring harness per STEP 7, a, b, d, and e.

STEP 14. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Check for fault code. If the fault code has not cleared, continue to STEP 15. If the fault code has cleared, the problem has been resolved.

STEP 15. If problem still exists, replace the ECM (WP 0083).

STEP 16. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP. Verify fault code has cleared.

SYMPTOM

34. CID 264 E FMI 03

MALFUNCTION

E-Stop Shutdown.
FMI 03 - Voltage Above Normal.
Event Code. Red EMERGENCY STOP indicator on GSC flashes when PUSH TO STOP EMERGENCY STOP pushbutton is pressed on control panel. Engine shuts down and does not start until

pushbutton is pulled out and ENGINE CONTROL switch is set to OFF/RESET and back to MANUAL START.

CORRECTIVE ACTION

STEP 1. Determine reason for emergency stop situation.

a. Correct emergency stop condition.

b. Reset emergency stop switch to the OFF position.

c. Verify the fault has cleared. If not proceed to the next step.

d. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Check for an open circuit between the following test points (FO-1, Sheet 2; FO-2, Sheet 1):

a. GSC A1-13 to PB3-14.

b. Terminal 1A on the Emergency Stop switch and Terminal 2A on the Emergency Stop switch.

c. Terminal TB3-14 and Terminal 1A on the Emergency Stop switch.

d. Terminal 2A on the Emergency Stop switch and the Battery Disconnect Switch.

e. Terminal 27 of the ENG-P37 harness connector and Terminal TB3-14.

f. ECM connector ENG-P1-23 and Terminal 27 of the engine harness connector.

STEP 3. If an open circuit is detected between any of the test points, repair the wiring and/or replace damaged components.

STEP 4. Check each connection for corrosion.

STEP 5. Ensure all wires are properly crimped and/or tightened (WP 0096).

STEP 6. Verify the problem has been resolved.

NOTE

The GSC displays a CID 0268 FMI 02 when the setpoint data is invalid or the setpoint data is out of range. After displaying this code, the GSC sets the affected setpoint(s) to the default value(s).

SYMPTOM

35. CID 268 FMI 02

MALFUNCTION

GSC Electronic Control.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF (to reset the GSC).

STEP 2. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 3. Verify the problem has been resolved. If not, check for other fault codes. Troubleshoot and resolve as required.

STEP 4. Verify all programmable setpoints in the GSC (WP 0092).

STEP 5. If the problem is not resolved, reprogram the GSC setpoints (WP 0092).

STEP 6. If reprogramming the GSC does not resolve the fault, replace the GSC (WP 0039).

STEP 7. Verify the problem has been resolved.

NOTE

If the sensor power supply is detected to be greater than 8.5 VDC or less than 7.5 VDC, this fault code will appear.

SYMPTOM

36. CID 269 FMI 03
CID 269 FMI 04

MALFUNCTION

GSC 8V Sensor Power Supply.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF. Reset GSC.

STEP 2. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 3. Observe fault codes on GSC.

a. Disconnect low coolant sensor connector ENG-P16. Using DVM, measure voltage between ENG-P16-A and ENG-P16-B. If voltage is between 7.5 and 8.5 VDC go to STEP 3 d. If voltage is above 8.5 VDC or below 7.5 VDC go to STEP 3 b.

b. Inspect wiring and check continuity of wiring on ECM to EMCP harness between GSC ENG-P37 and low coolant sensor connector ENG-P16 (WP 0096). Repair as necessary (WP 0096).

c. If wiring harness was repaired, verify the problem has been resolved.

d. Verify all programmable setpoints in the GSC (WP 0083).

e. If fault still appears on GSC, replace the GSC (WP 0039).

STEP 4. Verify the problem has been resolved.

SYMPTOM

37. CID 273 FMI 03
CID 273 FMI 04

MALFUNCTION

Turbo Outlet Pressure Sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

Troubleshoot turbo outlet pressure sensor using Steps in SYMPTOM 13.

SYMPTOM

38. CID 274 FMI 02

MALFUNCTION

Atmospheric Pressure Sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect wiring and verify continuity between engine harness ENG-P2 and atmospheric pressure sensor connector ENG-P11 per FO-2, Sheet 1. Repair or replace engine harness wiring (WP 0096), as necessary.

STEP 3. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 4. Check for an active 02 diagnostic code. If the fault has not been resolved, replace atmospheric pressure sensor (WP 0106).

STEP 5. If replacing sensor does not resolve fault, replace ECM (WP 0083).

STEP 6. Verify the problem has been resolved.

SYMPTOM

39. CID 274 FMI 03
CID 274 FMI 04

MALFUNCTION

Atmospheric Pressure Sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

Troubleshoot atmospheric pressure sensor using Steps in SYMPTOM 13.

SYMPTOM

40. CID 334 FMI 02
CID 334 FMI 03
CID 334 FMI 04

MALFUNCTION

Cool Down Circuit (P7-36).
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Measure voltage between cool down relay (CDR) pin 13 (+) and TB3-1 (-) per FO-4, Sheets 2 and 4.

a. If voltage is not approximately 24 VDC (battery voltage), repair or replace control box harness (WP 0040). Verify the problem has been resolved.

b. If harness is good, replace relay CDR (WP 0040). Verify the problem has been resolved.

c. If harness repair does not resolve fault and CDR is good, check all GSC fuses (FO-4, Sheets 3 and 5).

d. If GSC fuses are OK, continue with STEP 3.

STEP 3. Turn the ENGINE CONTROL switch to MANUAL START and allow engine to accelerate to operating speed.

STEP 4. After the engine has run for approximately 3 minutes, turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 5. Measure voltage between cool down relay (CDR) pin 13 (+) and GSC P7-36 (-) for voltage of less than 1.0 VDC, per FO-4, Sheets 1, 2, and 4.

STEP 6. If voltage is not less than 1.0 VDC, replace GSC (WP 0035).

STEP 7. Verify the problem has been resolved.

NOTE

A fault code is generated if none of the GSC inputs from the ENGINE CONTROL switch are connected to ground, or if more than one input is grounded.

SYMPTOM

41. CID 336 FMI 02

MALFUNCTION

ENGINE CONTROL Switch.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect the harness between ENGINE CONTROL switch and the GSC per FO-4, Sheets 1, 4, and 5. Look for broken and shorted wires. Repair or replace control box harness, as required (WP 0042 and WP 0096).

STEP 3. Verify continuity of ENGINE CONTROL switch in accordance with FO-1, Sheet 2.

a. If ENGINE CONTROL switch defective, replace ENGINE CONTROL switch (WP 0039).

b. If ENGINE CONTROL switch is good, check all GSC fuses (FO-4, Sheets 3 and 5).

c. If GSC fuses are OK, replace GSC (WP 0039).

STEP 4. Verify the problem has been resolved.

NOTE

The secondary engine timing sensor on this engine is the bottom crankshaft timing sensor.

SYMPTOM

42. CID 342 E FMI 02
CID 342 E FMI 11

MALFUNCTION

Secondary (bottom) Engine Timing Sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 11 - Failure Mode is not Identifiable (Mechanical Failure).

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Disconnect engine harness connector ENG-P5 from the secondary (bottom) engine timing sensor (WP 0096, Figure 2, Sheet 1, and FO-2, Sheet 1). The sensor connector has a wire clip that must be removed in order to disconnect the connector from the sensor.

STEP 3. Measure engine timing sensor resistance.

a. If resistance is not 600 to 1,800 Ohms, replace engine timing sensor (WP 0106).

b. If resistance is correct, inspect and adjust engine timing (WP 0012, SYMPTOM 11).

c. If sensor damaged, replace and adjust sensor (WP 0106, WP 0012, SYMPTOM 4).

STEP 4. Disconnect engine harness connector ENG-P2 from ECM J2 (WP 0096, Figure 2, Sheet 3, and FO-2, Sheet 1).

STEP 5. Connect ENG-P5 to secondary (bottom) engine timing sensor.

STEP 6. Inspect engine harness and measure continuity between ENG-P2-58 and ENG-P2-59 (WP 0096, Figure 2, Sheet 3). Measurement should be approximately the same as in STEP 2b. If open or shorted, repair or replace engine harness (WP 0096), as necessary.

STEP 7. Verify the problem has been resolved.

SYMPTOM

43. CID 360 E FMI 01
CID 360 E FMI 02
CID 360 E FMI 03

MALFUNCTION

Low Engine Oil Pressure Warning (Active & Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
Event Code. Red LOW OIL PRESSURE indicator flashes when oil pressure drops below the programmed low oil pressure setpoints. Engine shuts down and does not start until fault is corrected.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check oil level and perform service per TM 9-6115-729-10.

STEP 4. Verify the fault code has been cleared.

STEP 5. Verify all alarm and fault codes.

a. If CID 100 is active, troubleshoot engine oil pressure sensor per WP 0008, SYMPTOM 17.

b. Troubleshoot other alarm and fault codes, as necessary.

STEP 6. Verify all programmable setpoints (WP 0092).

STEP 7. Verify the fault code has been cleared.

SYMPTOM

44. CID 361 E FMI 01
CID 361 E FMI 02
CID 361 E FMI 03

MALFUNCTION

High Engine Coolant Temperature Warning (Active & Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
Event Code. Red HIGH WATER TEMP indicator on GSC flashes when coolant temperature rises above programmed setpoints.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Verify associated alarm and fault code and troubleshoot (WP 0007 and/or WP 0008).

a. If CID 110 is active, troubleshoot per WP 0008, SYMPTOM 18.

b. Troubleshoot all other alarm and fault codes per WP 0007 and WP 0008.

STEP 4. Verify all programmable setpoints (WP 0092).

STEP 5. Open right side engine access door and check coolant level in coolant recovery (overflow) bottle.

STEP 6. If required service coolant per TM 9-6115-729-10.

STEP 7. Inspect coolant system lines and radiator for leaks per PMCS (WP 0015).

STEP 8. Inspect fan and alternator and water pump belt per PMCS (WP 0015 and WP 0072). Check water pump belt tension. Correct if necessary.

STEP 9. If required, replace water pump belt (WP 0072).

STEP 10. Verify the problem has been resolved.

SYMPTOM

45. CID 362 E FMI 01
CID 362 E FMI 03

MALFUNCTION

Overspeed Warning (Active and Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
FMI 03 - Voltage Above Normal.
Red ENGINE OVERSPEED indicator flashes when engine speed rises above programmed setpoint for engine overspeed.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for associated alarm code and fault code and troubleshoot (WP 0007 and/or WP 0008).

a. If CID 190 is active, troubleshoot per WP 0008, SYMPTOM 27.

b. Troubleshoot all alarm and fault codes per WP 0007 and WP 0008.

c. Check programmable setpoint P010 (WP 0092, Table 4).

STEP 4. Correct faults and resume normal generator operations

SYMPTOM

46. CID 368 E FMI 01

MALFUNCTION

High Inlet Air Temperature Warning (Active and Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
FMI 03 - Voltage Above Normal.
Event Code. Inlet air manifold temperature sensor detected temperature outside of normal operating range. This input affects ignition timing.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for associated alarm code and fault code and troubleshoot (WP 0007 and/or WP 0008).

a. If CID 172 is active, troubleshoot per WP 0007, SYMPTOM 25.

b. Troubleshoot all alarm and fault codes per WP 0007 and WP 0008.

STEP 4. Correct faults and resume normal generator operations.

SYMPTOM

47. CID 390 E FMI 01

MALFUNCTION

Fuel Filter Restriction Warning (Active and Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Indicates that sensor detects a fuel system restriction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for associated alarm code and fault code and troubleshoot (WP 0007 and/or WP 0008).

a. If CID 94 is active, troubleshoot per WP 0008, SYMPTOMS 12 and 13.

b. Troubleshoot all alarm and fault codes per WP 0007 and WP 0008.

STEP 4. If no fault code, inspect fuel filter and fuel water/separator per PMCS (WP 0015, WP 0059 and WP 0078) and perform service as directed.

SYMPTOM

48. CID 391 E FMI 01

MALFUNCTION

Inlet Air Restriction Warning (Active and Logged).
FMI 01 - Data is Valid but Data is Below Normal Operating Range.
Event Code. Indicates that sensor detects inlet air restriction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Press ALARM CODES on GSC keypad.

STEP 3. Check for associated alarm code and fault code and troubleshoot (WP 0007 and/or WP 0008).

a. If CID 1589 is active, troubleshoot per WP 0008, SYMPTOMS 67 and 68.

b. Troubleshoot all alarm and fault codes per WP 0007 and WP 0008.

STEP 4. If no fault code, inspect air inlets (WP 0069 and WP 0070).

STEP 5. Remove debris or obstructions and perform service as directed.

STEP 6. Verify the problem has been resolved.

NOTE

When the GSC activates the EGR, K1 is displayed on the GSC lower display.

SYMPTOM

49. CID 441 FMI 12

MALFUNCTION

GSC Engine Governor Relay (EGR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Verify that GSC relay module A1-13 is connected to ground A1-28 when the PUSH TO STOP EMERGENCY STOP pushbutton (ESPB) is pulled out per FO-4, Sheet 5.

a. Repair or replace control box harness between ESPB and GSC (WP 0042 and WP 0096), as necessary.

b. If harness is good, replace ESPB (WP 0040).

STEP 3. Verify continuity of wiring between GSC pins A1-13 and A1-14 (RM-13 and RM-14) and the ECM per FO-4, Sheets 1 and 5, FO-1, Sheet 2.

a. Repair or replace harness between GSC and ECM (WP 0096), as necessary.

b. Verify harness is good. If so, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039). Verify the problem has been resolved. If not, proceed to the next step.

c. If harness is good and GSC is good, replace ECM (WP 0083).

STEP 4. Verify the problem has been resolved.

SYMPTOM

50. CID 442 FMI 12

MALFUNCTION

GSC Generator Fault Relay (GFR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Remove fuse A1F5 from rear of GSC.

STEP 3. Check fuse A1F5.

a. If fuse is bad, replace fuse A1F5.

b. If fuse is good, repair or replace wiring harness (WP 0096), as necessary.

c. If wiring is good, proceed to the next step.

STEP 4. Disconnect wire(s) from GSC relay module A1-22 per FO-4, Sheet 5.

STEP 5. On GSC relay module measure resistance between A1-7 and A1-22. Record measured resistance.

STEP 6. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 7. Push in PUSH TO STOP EMERGENCY STOP pushbutton.

STEP 8. Measure resistance between A1-7 and A1-22. If resistance is not less than 5 Ohms or not greater than 5,000 Ohms measured in STEP 5, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 9. Reinstall fuse A1F5 and reconnect wire(s) to GSC A1-22.

STEP 10. Verify the problem has been resolved.

NOTE

An internal set of CTR contacts short between pins A1-1 and A1-2 on the GSC to maintain power at pin A1-2 if ENGINE CONTROL switch were to be placed in COOL DOWN/STOP position with the engine running. When active GSC CTR output will display K3 on GSC lower display.

SYMPTOM

51. CID 443 FMI 12

MALFUNCTION

GSC Crank Termination Relay (CTR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Check fuse A1F10 on GSC. Replace if necessary.

STEP 2. Verify the problem has been resolved. If not, proceed to the next step.

STEP 3. Check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 4. Verify the problem is resolved.

NOTE

When active GSC SMR output displays K4 GSC lower display. SYMPTOM

SYMPTOM

52. CID 444 FMI 12

MALFUNCTION

GSC Starter Motor Relay (SMR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Remove fuse A1F4 from rear of GSC.

STEP 3. Check fuse A1F4.

a. If fuse is bad, replace fuse A1F4. Verify the problem has been resolved.

b. If fuse is good, repair or replace wiring harness (WP 0096, Table 1 and Table 2, and WP 0042), as necessary.

c. If wiring is good, remove fuse A1F4 and proceed to the next step.

STEP 4. Disconnect wire(s) from GSC relay module A1-18 per FO-4, Sheet 5.

STEP 5. On relay module, measure resistance between A1-6 and A1-18. Record resistance measurement.

STEP 6. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to MANUAL START.

NOTE

Measurement must be made before the total cycle crank time of 90 seconds (setpoint P017 WP 0092) is exceeded.

STEP 7. Quickly measure resistance between A1-6 and A1-18. If resistance not less than 5 Ohms or the resistance was not greater than 5,000 Ohms measured in STEP 5, check all GSC

fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 8. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 9. Reinstall fuse A1F4 and reconnect wire(s) to GSC A1-18.

STEP 10. Verify the problem has been resolved.

NOTE

When active GSC RR output displays K5 on GSC lower display.

SYMPTOM

53. CID 445 FMI 12

MALFUNCTION

GSC Run Relay (RR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Remove fuse A1F6 from rear of GSC.

STEP 3. Check fuse A1F6.

a. If fuse is bad, replace A1F6. Verify the problem has been resolved.

b. If fuse is not bad, repair or replace wiring harness (WP 0096 Table 1 and Table 2 and WP 0042).

c. If wiring is good, remove fuse A1F6 and proceed to the next step.

STEP 4. Disconnect wire(s) from GSC relay module A1-24 per FO-4, Sheet 5.

STEP 5. Measure the resistance between relay module A1-8 and A1-24. Resistance should be greater than 5,000 Ohms. Make a note of resistance measurement.

STEP 6. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to ON. Turn ENGINE CONTROL switch to MANUAL START.

STEP 7. Measure the resistance between A1-8 and A1-24. If resistance not less than 5 Ohms or the resistance was not greater than 5,000 Ohms, in STEP 5, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 8. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 9. Reinstall fuse A1F6 and reconnect wire(s) to GSC A1-24.

STEP 10. Verify the problem has been resolved.

NOTE

When the GSC activates the FCR, K7 is displayed on GSC lower display. An internal set of FCR contacts short between Relay Module pins A1-1 and A1-2 on the GSC to maintain power at A1-2 if the ENGINE CONTROL switch is placed in COOL DOWN/STOP position with the engine running.

SYMPTOM

54. CID 447 FMI 12

MALFUNCTION

GSC Fuel Control Relay (FCR) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Check fuse A1F10 on GSC. Replace fuse if bad.

STEP 2. Verify the problem has been resolved. If not, proceed to the next step.

STEP 3. Check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 4. Verify the problem has been resolved.

NOTE

The programmable spare relays (PSR1 and PSR2) are used for activating customer equipment. PSR1 is normally closed while PSR2 is normally open.

SYMPTOM

55. CID 448 FMI 12

MALFUNCTION

GSC Programmable Spare Relays (PSR1 and PSR2) Output.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Remove fuse A1F8 and A1F9 from rear of GSC.

STEP 3. Check fuse A1F8 and A1F9.

a. If fuse is bad, replace A1F8 and/or A1F9. Verify the problem has been resolved.

b. If fuse is not bad, repair or replace wiring harness (WP 0096 Table 1 and Table 2 and WP 0042) as necessary. Verify the problem has been resolved.

c. If wiring is good, proceed to the next step.

STEP 4. Disconnect wire(s) from GSC relay module (RM) A1-26 per FO-4, Sheet 5.

STEP 5. On the GSC relay module, measure resistance between RM-25 and RM-11. Resistance should be greater than 5,000 Ohms. Measure resistance between RM-26 and RM-10. Resistance should be less than 5 Ohms.

STEP 6. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to MANUAL START.

STEP 7. Measure resistance between RM-25 and RM-11. Resistance should be less than 5 Ohms. Measure resistance between RM-26 and RM-10. Resistance should be greater than 5,000 Ohms.

STEP 8. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 9. If any of the measurements fail, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 10. Reinstall fuse A1F8 and A1F9 and reconnect wire(s) to GSC A1-26.

STEP 11. Verify the problem has been resolved.

NOTE

The following fault code means the GSC is unable to measure the AC voltage and AC current. The engine remains able to start and run. This diagnostic code will be shown even when ENGINE CONTROL switch is set to OFF/RESET.

SYMPTOM

56. CID 500 FMI 12

MALFUNCTION

GSC.
FMI 12 - Failed Component.

CORRECTIVE ACTION

STEP 1. Check fuses A5F1, A5F2, and A5F3. Replace if bad.

STEP 2. Verify the problem has been resolved.

STEP 3. Verify the wiring on the A5 module (WP 0096).

STEP 4. Verify the problem has been resolved.

STEP 5. Verify connector A5-P1 is not loose or damaged (WP 0096).

STEP 6. Verify the problem has been resolved.

STEP 7. Verify setpoints (WP 0092, Table 8).

STEP 8. Verify the problem has been resolved.

STEP 9. Check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 10. Verify the problem has been resolved.

NOTE

This fault code means the GSC did not control the engine shutdown. The GSC detected that engine speed dropped from rated speed to 0 RPM when the GSC has not called for a shutdown. The GSC has determined that there is no engine speed sensor fault that would explain the engine shutdown. The engine is disabled from running or starting.

SYMPTOM

57. CID 566 FMI 07

MALFUNCTION

Unexpected Shutdown.
FMI 07 - Improper Mechanical Response.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Check fuel level and quality.

a. If fuel tank is empty, fill tank per TM 9-6115-729-10.

b. If fuel quality is suspect, drain and replace fuel.

STEP 3. Inspect fuel filter. If fuel filter is clogged, replace fuel filter (WP 0078).

STEP 4. Inspect air filter. If air filter is clogged, replace air filter (WP 0069).

STEP 5. Check fuses A1F2 and A1F10 per FO-4, Sheet 5. If fuse is bad, replace fuse.

STEP 6. Refer to engine troubleshooting if there is an obvious engine problem. Troubleshooting without Fault Codes (WP 0010).

STEP 7. Verify the problem has been resolved.

NOTE

This fault code means the ECM has stopped responding to the periodic requests for information from the GSC.

SYMPTOM

58. CID 590 FMI 09

MALFUNCTION

Engine Electronic Control Module.
FMI 09 - Abnormal Update.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Verify continuity between GSC P7-19 and ECM ENG-P1-8 and between GSC P7-20 and ECM ENG-P1-9 per FO-4, Sheet 1 and FO-2, Sheet 2.

a. Repair or replace harness, as required (WP 0096).

b. If harness is good, check all GSC fuses (FO-4, Sheets 3 and 5).

c. If GSC fuses are OK, replace GSC (WP 0039).

d. If replacing GSC does not correct fault, replace ECM (WP 0083).

STEP 3. Verify the problem has been resolved.

NOTE

The intake air heater output from the ECM controls the air inlet heater relay attached to the engine. This failure code is usually due to a relay coil open or shorted, or a problem with the harness.

SYMPTOM

59. CID 617 E FMI 02
CID 617 E FMI 05
CID 617 E FMI 06

MALFUNCTION

Intake Air Heater.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 05 - Current is Below Normal or Circuit is Open.
FMI 06 - Current is Above Normal or Circuit is Grounded.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect engine harness wiring between intake air heater relay connector ENGP101 and ECM connector ENG-P2 per FO-2, Sheet 1.

STEP 3. Repair or replace engine harness wiring (WP 0096), as necessary.

STEP 4. If wiring repair does not resolve fault, perform Air Inlet Heater Circuit Test (WP 0012, SYMPTOM 1).

STEP 5. Verify the problem has been resolved

NOTE

This fault code means the GSC detected a short to B+ or B- on one of the lines (P7-21 and P7-22) of the CCM data link. The CCM output is not used.

SYMPTOM

60. CID 770 FMI 09

MALFUNCTION

Customer Communication Module (CCM) Data Link.
FMI 09 - Abnormal Update.

CORRECTIVE ACTION

STEP 1. Troubleshoot data link per WP 0012, SYMPTOM 10.

STEP 2. If the problem is not resolved, replace ECM (WP 0083).

STEP 3. Verify the problem has been resolved.

NOTE

If the close breaker output (P7-37) voltage is detected to be above or below normal, this fault code will appear. This fault occurs only in AUTO PARALLEL mode.

SYMPTOM

61. CID 858 FMI 02
CID 858 FMI 03
CID 858 FMI 04

MALFUNCTION

Close Breaker Output.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. In control box, locate wire between SYNC MODE switch (SMS) pin 11 and P7-37 per FO-4 sheet 1 and FO-1 sheet 3.

STEP 3. Disconnect wire from SMS pin 11 and measure voltage at end of wire.

a. If voltage is not 5.2 $\pm$1.0 VDC, repair or replace control box harness (WP 0096 and WP 0042), as necessary. Verify the problem has been resolved.

b. If the problem has not been resolved, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 4. Verify the problem has been resolved.

NOTE

This output varies from +5 VDC to -5 VDC and is sent to load sharing module A4 to generate the signal sent to the engine controller to set and control the speed of the engine. If the synchronization is disabled, the output will be approximately 0 VDC. Set two generators in parallel mode per TM9-6115-729-10. Generator set A will be the test unit (with the fault) and generator set B will be the load unit.

SYMPTOM

62. CID 1038 FMI 02
CID 1038 FMI 03
CID 1038 FMI 04

MALFUNCTION

Speed Adjust 1 Output P7-27 (+) and P7-28 (-).
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF on generator set A. Set SYNC MODE switch to OFF.

STEP 2. Disconnect wire from LSM A4-24 per FO-4, Sheet 2, on generator set A.

STEP 3. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP, on generator set A.

STEP 4. Measure the voltage on the end of the wire (A4-24+) with respect to A4-25.

a. If voltage not 0 ±1 VDC, repair or replace harness (WP 0042 and WP 0096), as necessary.

b. If harness is good continue to next step.

STEP 5. On both generator sets, set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to MANUAL START. Set SYNCH switch to SEMI-AUTOMATIC. Close load contactor on generator set B.

STEP 6. Adjust the engine speed so the frequency, on generator set A is 1 Hz higher than what is on the load bus (generator set B).

STEP 7. Allow the voltage to stabilize.

STEP 8. Measure the voltage on the end of the wire (A4-24+) with respect to A4-25.

a. If voltage not -4 VDC to -6 VDC, repair or replace harness (WP 0040 and WP 0096), as necessary.

b. If harness is good and voltages are bad, check all GSC fuses (FO-4, Sheets 3 and 5).

STEP 9. Adjust the engine speed so the frequency is 1 Hz lower than what is on the load bus.

STEP 10. Allow voltage to stabilize.

STEP 11. Measure voltage on the end of the wire (A4-24+) with respect to A4-25.

a. If voltage not 4 VDC to 6 VDC, repair or replace harness (WP 0042).

b. If voltages are good, replace LSM A4 (WP 0040).

c. If harness is good and voltages are bad, replace GSC (WP 0039).

STEP 12. Verify the problem has been resolved.

NOTE

This failure is displayed when main contactor K1 is closed (input is grounded) and one or both of the following are true:

The difference in frequency between the generator and the bus is greater than 0.2 Hz.

The difference in phase between the generator and the bus is greater than 10 degrees.

When the above conditions are true for more than 2 seconds, the fault will occur. The GSC will then stop the synchronization process until the fault is cleared and corrected.

SYMPTOM

63. CID 1167 FMI 04

MALFUNCTION

K1 Sense Input (P7-25).
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Disconnect wire at TB3-12 leading to P7-25 per FO-4, Sheet 4.

STEP 3. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 4. Measure voltage on end of wire (TB3-12 +) with respect to TB3-1 (-). Record measured voltage.

STEP 5. Check A6 BTB fuses (FO-1, Sheet 5). Replace if necessary. Verify wiring for A6 BTB (FO-1, Sheet 5). Repair if necessary (WP 0096).

STEP 6. Turn the ENGINE CONTROL switch to MANUAL START.

STEP 7. Adjust engine speed so the generator frequency is more than 0.2 Hz different (high or low) than what is on the load bus.

STEP 8. Perform the Permissive Paralleling Procedure. TM 9-6115-729-10.

STEP 9. Ensure the Synchroscope is present on the GSC display.

STEP 10. Touch the loose end of the disconnected wire to TB3-1 (Ground).

a. If fault CID 1167 FMI 04 is displayed on the GSC, repair or replace harness (WP 0042 and WP 0096).

b. If fault is not displayed or if voltage measured in STEP 4 was not 9.5 to 11.5 VDC, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 11. Verify the problem has been resolved.

NOTE

This input is high when the bus is live. Input status is compared to reading of bus voltage at P7-17 and P7-18. If the status of the voltage measurements is different than the dead bus sense input with regards to presence or absence of bus voltage a fault is announced.

SYMPTOM

64. CID 1168 FMI 03

MALFUNCTION

Dead Bus Sense Input (P7-29).
FMI 03 - Voltage Above Normal.

CORRECTIVE ACTION

STEP 1. On EMCP, set the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Disconnect wire from relay DBHI pin 2 per FO-4, Sheet 2.

STEP 3. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 4. Measure the voltage on end of the wire (DBHI-2 +) with respect to relay DBLO pin 4 (-).

a. If voltage is not 9.5 to 11.5 VDC, repair or replace wiring between GSC and DBHI (WP 0042).

b. If wiring is good, check all GSC fuses (FO-4, Sheets 3 and 5).

STEP 5. On EMCP, set the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 6. Reconnect wire to relay DBHI-2.

STEP 7. Ensure that load bus is dead.

STEP 8. Disconnect the wire from relay DBHI-10.

STEP 9. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP, set the ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 10. Measure the voltage on relay DBHI-10 (+) with respect to relay DBLO-4 (-).

a. If voltage is not 9.5 to 11.5 VDC, replace relay DBHI (WP 0040).

b. If DBHI is good, repair or replace harness, as required (WP 0040 and WP 0096).

c. If harness is good, replace relay DBLO (WP 0040).

STEP 11. Verify the problem has been resolved. If the problem has not been resolved, replace GSC (WP 0039).

STEP 12. Verify the problem has been resolved.

WARNING

Slave receptacle (NATO connector) is electrically live at all times and is unfused. The Battery Disconnect switch does not remove power from the NATO connector. Use caution when connecting or disconnecting cable(s) to the NATO connector to prevent damage to equipment. Use caution when troubleshooting this circuit. This circuit is only dead when the batteries are fully disconnected. Failure to comply can cause serious injury or death to personnel.

SYMPTOM

65. CID 1169 FMI 02

MALFUNCTION

AC Transformer Box (ATB) Sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to MANUAL START.

STEP 3. Using the GSC, note the values of voltages by phase and record.

a. Turn the ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

b. Check fuses A5F1 through A5F3 on ATB A5 and replace, as required (WP 0040). Verify the problem is resolved. If fuses are good, replace ATB A5 (WP 0040) and continue to the next step.

c. If voltages were not within 5% of the desired values and within 5% of each other, repair or replace generator harness between GSC and ATB A5 per FO-4, Sheet 3 (WP 0096). Verify the problem is resolved. If not proceed to the next step.

d. If voltages were not within 5% of the desired values and within 5% of each other, repair or replace generator harness between generator output and ATB A5 per FO-4, Sheet 3 and FO-3, Sheet 2 (WP 0096). Verify the problem is resolved. If not proceed to the next step.

e. If ATB A5 is good, continue to next step.

STEP 4. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to MANUAL START.

STEP 5. Read Line to N voltages for all three phases on GSC and record

STEP 6. Measure the voltages at TB1 between terminal 10 and terminals 1, 2 & 3, and record.

STEP 7. Measure the voltages between TB1, terminal 10 and A5F1, A5F2, and A5F3. Record voltages.

STEP 8. If voltages do not match, troubleshoot wiring harness (WP 0096) between TB1 and A5. Repair or replace wiring harness as necessary.

STEP 9. Compare voltages between GSC control panel reading and A5. If they match, troubleshoot wiring harness between TB1 and GSC for loose connection, corrosions, and broken wires. Repair and replace, as necessary (WP 0096).

STEP 10. If GSC voltage and A5 voltage do not match, check continuity of wires between A5P1 and GSCP7 (FO-1, Sheet 5).

STEP 11. If continuity is present, replace A5 module (WP 0040).

STEP 12. Verify that problem is resolved. If problem still exists, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 13. Verify the problem is resolved.

NOTE

The bus transformer box isolates and reduces the load bus voltages for use by the GSC. The GSC uses the reduced value of L1 (Phase A) to determine the voltage level on the load bus. The GSC uses the reduced value of L3 (Phase C) to measure the frequency of the voltage on the load bus.

SYMPTOM

66. CID 1170 FMI 02
CID 1170 FMI 04
CID 1170 FMI 08

MALFUNCTION

Bus Transformer Box (BTB) Sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.
FMI 04 - Voltage Below Normal.
FMI 08 - Abnormal Frequency, Pulse Width, or Period.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to OFF.

STEP 2. Check BTB A6 fuses A6F1 and A6F2 per FO-4, Sheet 3. Replace BTB A6 fuses, as required (WP 0040).

STEP 3. Remove BTB A6 fuses A6F1 and A6F2. Measure resistance between wires B11 and B12 connected to A6 fuse block. Resistance should be 2,140 + / - 400 Ohms. If not, replace A6 (WP 0040).

STEP 4. If A6 is replaced, verify that problem is resolved.

STEP 5. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. Turn the ENGINE CONTROL switch to MANUAL START. Set the GSC to display L to L voltage. Adjust voltage to 208 voltage.

STEP 6. Measure and record voltage between A6B21 and A6F1 and between A6B21 and A6F2.

STEP 7. Measure voltage at Load output terminal board, TB2, between terminals L0 and L1 and between L0 and L3. Record voltages.

STEP 8. If voltage is not same as generator output, repair or replace harness between BTB A6

and generator output per FO-4 sheet 3 and FO-3 sheet 2 (WP 0096).

STEP 9. Measure voltage between A6J1-A and A6J1-B per FO-4 sheet 5. Value should be the same as the value in step 4 divided by 15: (208 VAC = 14 VAC) (416 VAC = 28 VAC).

a. If voltage is zero, replace A6 (WP 0040).

b. If voltage is correct, check continuity between A6P1-A and P7-17 and between A6P1-B to P7-18 (WP 0040).

c. If continuity is not present, repair or replace wiring harness as necessary (WP 0096). Verify that problem has been resolved.

d. If problem is not resolved, check all GSC fuses (FO-4, Sheets 3 and 5). If GSC fuses are OK, replace GSC (WP 0039).

STEP 10. Verify the problem is resolved.

SYMPTOM

67. CID 1589 E FMI 02

MALFUNCTION

Turbocharger Air Inlet Pressure Sensor.
FMI 02 - Erratic, Intermittent, or Incorrect Signal.

CORRECTIVE ACTION

STEP 1. On EMCP, turn ENGINE CONTROL switch to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.

STEP 2. Inspect wiring and verify continuity between engine harness ENG-P2 and turbo air inlet pressure sensor connector ENG-P11 per FO-2, Sheet 1. Repair or replace engine harness wiring (WP 0096) as necessary.

STEP 3. Set Battery Disconnect Switch to ON, Set DEAD CRANK SWITCH to NORMAL. Turn ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 4. Check for an active 02 diagnostic code. If the fault has not been resolved, replace turbo air inlet pressure sensor (WP 0106).

STEP 5. If replacing sensor does not resolve fault, replace ECM (WP 0083).

STEP 6. Verify the problem has been resolved.

SYMPTOM

68. CID 1589 E FMI 03
CID 1589 E FMI 04

MALFUNCTION

Turbocharger Air Inlet Pressure Sensor.
FMI 03 - Voltage Above Normal.
FMI 04 - Voltage Below Normal.

CORRECTIVE ACTION

Troubleshoot turbocharger air inlet pressure sensor using Steps in SYMPTOM 13.

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR DVR FAULT CODE

INITIAL SETUP:

Personnel Required
One

References
FO-1
FO-3
FO-4
TM 9-6115-729-10
WP 0005
WP 0010
WP 0011
WP 0039
WP 0040
WP 0042
WP 0048
WP 0051
WP 0053
WP 0092
WP 0096
WP 0102
WP 0103
WP 0115

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when the generator set is in operation. Never attempt to start or maintain the generator set unless it is properly grounded. Failure to comply can cause injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

WARNING

Ensure that the engine cannot be started while maintenance is being performed. (ENGINE CONTROL switch set to OFF/RESET. Battery Disconnect Switch is OFF; DEAD CRANK SWITCH is OFF.) Failure to comply can cause injury or death to personnel.

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. Code 000 No Fault Present

MALFUNCTION

None

CORRECTIVE ACTION

None

NOTE

This fault signifies that the internal memory failed during a read operation.

SYMPTOM

2. Code 601

MALFUNCTION

Internal Memory Failure

CORRECTIVE ACTION

STEP 1. Set the ENGINE CONTROL switch to OFF/RESET to reset the fault (WP 0005).

STEP 2. Set Battery Disconnect Switch to ON. Set DEAD CRANK Switch to NORMAL. Set the ENGINE CONTROL switch to COOL DOWN/ STOP.

STEP 3. Check all parameters between :01 and :38 (WP 0092).

a. If fault reoccurs periodically, may be indication of failing battery. Check for related failures and correct. Check for battery error codes on GSC. Codes displaying FMI 04 indicate low voltage. Check batteries (WP 0048).

b. If the problem has not been resolved, check for additional DVR fault codes. Correct any fault codes. Verify the problem has been resolved.

c. If the problem has not been resolved, memory is failing in the DVR. Replace the DVR (WP 0040).

STEP 4. Verify the problem is resolved.

NOTE

The watchdog is a circuit that monitors the computer to be sure it can not go off line. This failure indicates that the computer went off line and was reset by the watchdog circuit. This failure can occur during engine cranking if battery voltage dips too low.

SYMPTOM

3. Code 602

MALFUNCTION

Internal Watchdog Failure.

CORRECTIVE ACTION

STEP 1. Measure voltage at B+ and B- terminals on front of DVR while starting generator set.

a. If voltage is less than 18 VDC, go to step 2.

b. If voltage is greater than 18 VDC, replace DVR (WP 0040).

STEP 2. Inspect battery connections for corrosion or loose connections per FO-4, sheet 3. Clean and tighten connections.

STEP 3. Inspect battery connections on TB3, terminals 1-10 and TB4, terminals 17-20 for corrosion or loose connections. Clean and tighten connections.

STEP 4. Inspect battery connections B+ and B- on rear of Generator Set Control (GSC) for corrosion or loose connections. Clean and tighten connections.

STEP 5. Inspect battery connections B+ and B- on front of DVR for corrosion and loose connections. Clean and tighten connections.

STEP 6. Measure voltage drop across resistor assembly A7 CB1 per FO-4, sheet 4. If voltage drop is not less than 0.1 VDC, replace CB1 (WP 0040).

STEP 7. Troubleshoot charging system per alternator does not charge batteries system troubleshooting procedure (WP 0010, SYMPTOM 23).

STEP 8. If the problem is not resolved, replace DVR (WP 0040).

STEP 9. Verify the problem is resolved.

SYMPTOM

4. Code 603

MALFUNCTION

Rotating Diode Defective

CORRECTIVE ACTION

STEP 1. Check DVR parameter 19 in accordance with WP 0092.

STEP 2. Disconnect wire from DVR A3F1 and check continuity between A3F1 and TB5-2. If continuity does not exist, repair or replace wiring harness as necessary (WP 0096).

STEP 3. Verify that G1F1 is connected to TB5 terminal 2 and G1F2 is connected to TB5 terminal 1.

STEP 4. Disconnect wire from DVR A3 terminal F2. Check continuity between A3F2 and TB1-5 terminal 1. If continuity does not exist, repair or replace wiring harness as necessary (WP 0096).

STEP 5. If continuity exists, replace rotating diodes (WP 0102).

STEP 6. If replacing rotating diodes does not resolve the problem, troubleshoot and repair main generator (G1).

WARNING

Dangerously high voltage can exist across current transformer (CT) output with engine running. CT could explode if disconnected from load with engine running. Do not disconnect CT with generator rotating. Failure to comply can cause serious injury or death to personnel.

NOTE

The DVR detected a 0.4 per unit or greater leading reactive power for a time greater than the value entered in reverse VAR trip time (parameter :20). This fault shuts down the DVR and removes excitation from the field. This function is only active if parameter :21 is set to 2. This function is inactive if parameter :22 is set to 1.

SYMPTOM

5. Code 604

MALFUNCTION

Reverse VAR (Alarm Fault)

CORRECTIVE ACTION

STEP 1. Two connections reversed could cause this fault. Verify current transformer CCCT and voltage inputs from PT2, PT3, and DVR terminals 20, 22, and 24 are connected per FO-3 and FO-4.

STEP 2. Retrieve and verify all DVR parameters (WP 0092). Record :04 (generator rated current) and :05 (current transformer output at rated output current) values.

STEP 3. On EMCP set ENGINE CONTROL switch to MANUAL START.

STEP 4. Connect load at 25 to 50% of rated load. Use 0.8 power factor inductive load, if possible.

STEP 5. On GSC measure current in phase B. Record value.

STEP 6. Measure AC voltage between terminals A3-5 and A3-6 of DVR per FO-4, sheet 3. Record value.

a. The voltage measured, divided by the value in parameter :05 should be roughly equal to the measured current divided by parameter :04.

b. If not approximately the same, replace DVR (WP 0040).

STEP 7. Fault code could have been caused by a fault of the load.

a. If problem recurs and fault can not be traced to load, replace DVR (WP 0040).

b. If the problem is not resolved, refer to generator maintenance (WP 0102) or generator replacement (WP 0103).

STEP 8. Verify the problem is resolved.

NOTE

The DVR detected that the generator voltage has been less than the under voltage trip point (parameter :13) for more than the amount of time specified by the under voltage trip time (parameter :14). This alarm is disabled during the start-up profile.

SYMPTOM

6. Code 701

MALFUNCTION

Undervoltage

CORRECTIVE ACTION

STEP 1. Adjust VOLTAGE adjust potentiometer on control panel clockwise to increase voltage.

STEP 2. If paralleled to other generator sets, check VOLTAGE adjust setting on each set.

STEP 3. Start generator set and verify that problem has been resolved.

STEP 4. If problem is not resolved, perform Voltage Adjust Potentiometer Test (WP 0039).

STEP 5. Measure battery voltage at B+ and B- terminals on DVR per FO-4, sheet 3. Voltage should be 18 to 32 VDC.

STEP 6. Verify that correct DVR parameters are entered (WP 0092) and that parameters match the reconnection board position (WP 0011). Enter proper parameters (WP 0092). Verify parameters after entry.

STEP 7. With generator set running, measure AC voltage between pins A3-26 and A3-28, A3-28 and A3-30, and A3-26 and A3-30 per FO-4, sheet 3.

STEP 8. If voltages are not between 95 to 120 VAC at all three locations, shut down generator set.

STEP 9. Check fuses F1-10A, F2-10A, F3-10A and replace defective fuses.

a. Open fuse holder F1, F2, and F3.

b. Check resistance, F1-1 to F2-1, F2-1 to F3-1, and F3-1 to F1-1. Resistance should be less than 1 ohm. If open or above 1 ohm, troubleshoot wires between F12, F2, and F3 to TB1 and alternator.

c. Check resistance, F1-2 to F2-2, F2-2 to F3-2, and F3-2 to F1-1. Resistance should be between 0.2 to 0.4 Ohms. If open or above 0.4 Ohms, troubleshoot wires between F12, F2, and F3 and transformer PT2 and PT3, and transformer primary winding, PT2, PT3 before removing wires from A3-26, A3-28, and A3-30.

STEP 10. Check resistance, A3-26 to A3-28; A3-28 to A3-30, and A3-30 to A3-26. Resistance

should be between 0.2 and 2.0 Ohms. If open or above 2 Ohms, troubleshoot secondary winding of PT2 and PT3 and wires between A3-26, A3-28 and A3-30 to PT2 and PT3.

STEP 11. Measure AC voltage between pins A3-20 and A3-22, A3-22 and A3-24, and A3-20 and A3-24.

STEP 12. Voltages should be the same and at the proper ratio to the output voltage in accordance with parameter :02. If not, test generator (WP 0102).

STEP 13. If the problem is not resolved, replace DVR (WP 0040).

STEP 14. Verify the problem is resolved.

NOTE

The DVR detected that the generator voltage has been more than the overvoltage trip point (parameter :11) for more than the amount of time specified by the overvoltage trip time (parameter :12).

SYMPTOM

7. Code 702

MALFUNCTION

Overvoltage

CORRECTIVE ACTION

STEP 1. Adjust VOLTAGE adjust potentiometer on control panel counterclockwise to reduce voltage.

STEP 2. If paralleled to other generator sets, check voltage setting on other sets.

STEP 3. Start generator set and verify that problem has been resolved.

STEP 4. If problem not resolved, perform Voltage Adjust Potentiometer Test (WP 0039).

STEP 5. Verify that correct parameters are entered in DVR and that parameters match the reconnection board position (WP 0092).

STEP 6. Enter proper parameters (WP 0092). Verify parameters after entry.

STEP 7. With generator set running, measure AC voltage between pins A3-26 and A3-28, A3-28 and A3-30, and A3-26 and A3-30 per FO-4, sheet 3.

STEP 8. If voltages not 95 to 120 VAC at all three locations, shut down generator set.

STEP 9. Check fuses F1-10A, F2-10A, F3-10A and replace defective fuses.

a. Open fuse holder F1, F2, and F3.

b. Check resistance, F1-1 to F2-1, F2-1 to F3-1, and F3-1 to F1-1. Resistance should be less than 1 ohm. If open or above 1 ohm, troubleshoot wires between F12, F2, and F3 to TB1 and alternator.

c. Check resistance, F1-2 to F2-2, F2-2 to F3-2, and F3-2 to F1-1. Resistance should be between 0.2 to 0.4 Ohms. If open or above 0.4 Ohms, troubleshoot wires between F12, F2, and F3 and transformer PT2 and PT3, and transformer primary winding, PT2, PT3 before removing wires from A3-26, A3-28, and A3-30.

STEP 10. Check resistance, A3-26 to a3-28; A3-28 to A3-30, and A3-30 to A3-26. Resistance should be between 0.2 and 2.0 Ohms. If open or above 2 Ohms, troubleshoot secondary winding of PT2 and PT3 and wires between A3-26, A3-28 and A3-30 to PT2 and PT3.

STEP 11. Measure AC voltage between pins A3-20 and A3-22, A3-22 and A3-24, and A3-20 and A3-24.

STEP 12. Voltages should be the same and at the proper ratio to the output voltage in accordance with parameter :02. If not, test generator (WP 0102).

STEP 13. If the problem is not resolved, replace DVR (WP 0040).

SYMPTOM

8. Code 703

MALFUNCTION

Overexcitation

CORRECTIVE ACTION

STEP 1. If operating in parallel, re-parallel the generator sets in accordance with TM 9-6115-729-10.

STEP 2. Start generator set and verify that problem has been resolved with no load.

STEP 3. If the problem does not exist with no load, verify that generator set is not overloaded. Reduce load below rated generator set load.

STEP 4. Inspect wiring between TB1 and terminals A3-20, A3-22, and A3-24 of DVR per FO-3 and FO-4.

STEP 5. Repair or replace wiring (WP 0096).

STEP 6. Check DVR A3 parameters (WP 0092).

STEP 7. If the problem exists with no load, replace DVR (WP 0040).

STEP 8. Test generator G1 (WP 0102). Repair or replace as required (WP 0102 or WP 0103).

STEP 9. Verify the problem is resolved.

WARNING

Dangerously high voltage can exist across current transformer (CT) output with engine running. CT could explode if disconnected from load with engine running. Do not disconnect CT with generator rotating. Failure to comply can cause serious injury or death to personnel.

NOTE

The DVR detected a 0.4 per unit or greater leading reactive power for a time greater than the value entered in reverse VAR trip time (parameter :20). This fault shuts down the DVR and removes excitation from the field. This function is only active if parameter :21 is set to 2. This function is inactive if parameter :22 is set to 1.

SYMPTOM

9. Code 704

MALFUNCTION

Reverse VAR (Shutdown Fault)

CORRECTIVE ACTION

STEP 1. Verify current transformer CCCT and voltage inputs from PT2, PT3, and DVR terminals 20, 22, and 24 are connected per FO-3 and FO-4.

STEP 2. Two connections reversed could cause this fault. Connect per schematic and wiring diagram FO-4.

STEP 3. Retrieve and verify all DVR parameters (WP 0092). Record :04 (generator rated current) and :05 (current transformer output at rated output current) values.

STEP 4. On EMCP set ENGINE CONTROL switch to MANUAL START.

STEP 5. Connect load at 25% to 50% of rated load. Use 0.8 power factor inductive load, if possible.

STEP 6. On GSC measure current in phase B. Record value.

STEP 7. Measure AC voltage between terminals A3-5 and A3-6 of DVR per FO-4, sheet 3. Record

value.

a. The voltage measured, divided by the value in parameter :05 should be roughly equal to the measured current divided by parameter :04.

b. If not approximately the same, replace DVR (WP 0040).

STEP 8. Fault code could have been caused by a fault of the load. If the problem is not resolved, refer to generator repair (WP 0102) or replacement (WP 0103).

STEP 9. Verify the problem is resolved.

NOTE

The DVR detected that the exciter field current was greater than approximately 28 Amps. The DVR shut off the exciter field current.

SYMPTOM

10. Code 801

MALFUNCTION

Instantaneous Trip

CORRECTIVE ACTION

STEP 1. On keypad, press ALARM CODES and check GSC related codes. Resolve as required.

STEP 2. Disconnect wire from DVR, A3, and Terminal F2. Measure resistance between disconnected wire and F1.

a. If resistance is less than 4 Ohms, troubleshoot exciter circuit between F1, F2, and exciter windings (WP 0096). Repair or replace wiring harness as necessary.

b. Test exciter windings (WP 0102). Repair or replace Generator G1 as necessary.

c. If resistance is 4 Ohms or greater, replace DVR (WP 0040).

STEP 3. Verify the problem is resolved.

NOTE

The DVR detects that one of the sense inputs is open or shorted to another input.

SYMPTOM

11. Code 802

MALFUNCTION

Loss of Sensing

CORRECTIVE ACTION

STEP 1. Inspect wiring and verify continuity between TB1 and terminals A3-20, A3-22, and A3-24 of DVR per FO-3 and FO-4.

a. Repair or replace wiring (WP 0042 and WP 0096) as necessary.

b. If the problem is not resolved, replace the DVR (WP 0040).

STEP 2. Verify the problem is resolved.

NOTE

The DVR detects that there is no AC frequency present for 200 mS while the measured voltage is greater than 50% of nominal.

SYMPTOM

12. Code 803

MALFUNCTION

Loss of Frequency

CORRECTIVE ACTION

STEP 1. Check fuses F1, F2, or F3 per FO-1, sheet 4 and FO-3, sheet 1.

STEP 2. Replace fuses F1, F2, or F3, as required (WP 0053).

STEP 3. Troubleshoot wiring harness.

a. Check and repair wiring between PT2, PT3 and DVR, as required (WP 0096).

b. Check and repair wiring between PT2, PT3, and fuses F1, F2, and F3, as required (WP 0096).

c. Check and repair wiring between fuses (F1, F2, and F3) and generator, as required (WP 0096).

d. Remove fuses F1, F2, and F3. Measure resistance between F1 terminal 2 and F2 terminal 2. If not 0.3 ±0.1 Ohms, replace transformer PT2 (WP 0051).

e. Measure resistance between F2 terminal 2 and F3 terminal 2. If not 0.3 ±0.1 Ohms, replace transformer PT3 (WP 0051).

f. Measure resistance between F3 terminal 2 and F1 terminal 2. If not 0.6 ±0.1 Ohms, check all connections on transformers (WP 0051).

g. Measure resistance between J31-5 and J31-6. If not 0.3 ±0.1 Ohms, replace PT2 (WP 0051).

h. Measure resistance between J31-6 and J31-7. If not 0.3 ±0.1 Ohms, replace PT3 (WP 0051).

i. On EMCP, set ENGINE CONTROL switch to OFF/RESET to clear bus fault.

STEP 4. Install fuses F1, F2, and F3 (WP 0053).

STEP 5. Start generator set and measure AC voltage between pins A3-26 and A3-28, A3- 28 and A3-30, and A3-26 and A3-30. Verify 95 to 120 VAC present at all three locations.

STEP 6. If voltages not present, repair or replace generator (WP 0102 or WP 0103).

STEP 7. Measure AC voltage between pins A3-20 and A3-22, A3-22 and A3-24, and A3-20 and A3-24. Verify 190 to 240 VAC present at all three locations.

a. Repair wiring between DVR and generator (WP 0042 and WP 0096).

b. If the problem is not resolved, replace the DVR (WP 0040).

STEP 8. Verify the problem is resolved.

SYMPTOM

13. Code 901

MALFUNCTION

DVR Memory Failure (Severe Fault).

CORRECTIVE ACTION

STEP 1. Try to change and store a new parameter value in the DVR (WP 0092).

STEP 2. If code 901 is still present, replace the DVR (WP 0040).

STEP 3. Verify the problem is resolved.

END OF WORK PACKAGE

FIELD MAINTENANCE

TACTICAL QUIET GENERATOR 100 kW, 50/60 Hz MEP-807A/PU-807A

TROUBLESHOOTING PROCEDURES FOR FAILURES WITHOUT A FAULT CODE

INITIAL SETUP:

Tools and Special Tools
Connector/Adapter 3Y-2888
Engine Pressure Group IU-5470
Multimeter 146-4080
O-ring Seal 3J-1907
Temperature Adapter 6V-9130

Personnel Required
One

References
TM 9-6115-729-10
WP 0007 - WP 0009
WP 0011 - WP 0013
WP 0015
WP 0019
WP 0039 - WP 0042
WP 0045 - WP 0050
WP 0053 - WP 0055
WP 0057
WP 0059
WP 0062
WP 0065 - WP 0073
WP 0076
WP 0078
WP 0081
WP 0083
WP 0086
WP 0088 - WP 0092
WP 0096
WP 0102 - WP 0104
WP 0106 - WP 0110
WP 0112
WP 0115 - WP 0117
WP 0119

WARNING

Metal jewelry will conduct electricity. All jewelry can become entangled in generator set components. Remove all jewelry when working on generator set. Failure to comply can cause injury or death to personnel by electrocution.

WARNING

High voltage is produced when this generator set is in operation. Make sure unit is completely shut down and free of any power source before attempting any repair or maintenance on the unit. Failure to comply can cause injury or death to personnel.

WARNING

DC voltages are present at generator set electrical components even with generator set shut down. Avoid shorting any positive with ground/negative. Failure to comply can cause injury to personnel and damage to equipment.

TROUBLESHOOTING PROCEDURE(S)

SYMPTOM

1. Starting Motor Remains Engaged.

MALFUNCTION

Setpoints Incorrect.

CORRECTIVE ACTION

STEP 1. On electronic modular control panel (EMCP) set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Disconnect cable connector ENG-P3 from injection actuator pump (IAP) control valve (Figure 1).

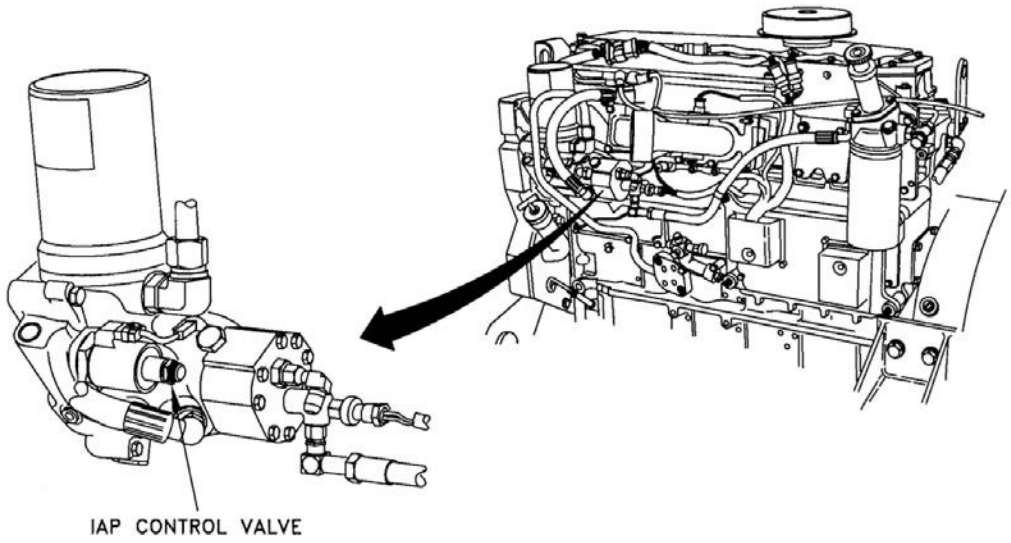


Figure 1. IAP Control Valve Location.

STEP 3. Carefully disconnect one of the push on terminal connectors from the starter motor magnetic switch (SMMS) relay (Figure 2).

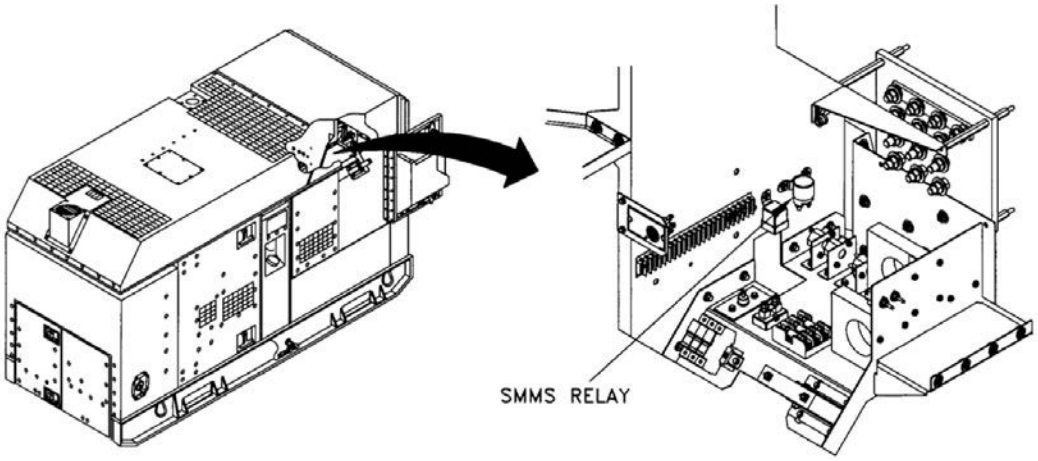


Figure 2. SMMS Relay Location.

STEP 4. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On electronic modular control panel (EMCP) set ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 5. If engine cranks, replace SMMS (WP 0053).

STEP 6. If engine does not crank, view and note value of setpoints P011 (Crank terminate speed), P017 (Total cycle crank time), and P018 (Cycle crank time) refer to WP 0092.

STEP 7. Compare setpoints and reprogram, as required (WP 0092).

STEP 8. Verify the problem has been resolved.

MALFUNCTION

Starting Motor Control Circuitry Malfunction (Engine will not crank).

CORRECTIVE ACTION

STEP 1. Disconnect ENG-P3 from connector (FO-2 sheet 1).

STEP 2. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to CRANK.

STEP 3. If engine cranks, proceed to Step 18.

STEP 4. If engine does not crank, check for 24 VDC at each terminal of CB-2 and ground.

STEP 5. If voltages are not present, replace CB-2 (WP 0053).

STEP 6. Check for 24 VDC at each terminal of R4 shunt and ground.

STEP 7. If voltages are not present, replace R4 shunt.

STEP 8. Check for 24 VDC at each terminal of diode D1 and ground.

STEP 9. If voltages are not present, replace diode D1 (PW 0053).

STEP 10. With DEAD CRANK SWITCH in CRANK position, check for 24 VDC at terminal 3 of the starter motor magnetic switch (SMMS) relay and ground.

STEP 11. If voltage present, check for ground at terminal 4 of the SMMS relay.

STEP 12. If voltage is not present, check for 24 VDC at TB5-5 and ground.

STEP 13. If voltage present, check wiring or replace Battery Disconnect Switch (WP 0049).

STEP 14. If voltage is not present, check wiring or replace DEAD CRANK SWITCH (WP 0053).

STEP 15. Check for 24 VDC at pinion solenoid terminals (23A10 (+) wire and black jumper wire (-)).

NOTE

It may be necessary to remove cover from pinion solenoid to access solenoid terminals.

STEP 16. If voltage is not present, check wiring or replace SMMS relay (WP 0053).

STEP 17. If voltage is present, check cable at starter or replace starter (WP 0073).

NOTE

When completing CID 444 FMI 12 (WP 0008) do not reinstall fuse A1F4.

STEP 18. On EMCP set ENGINE CONTROL switch to START. If engine does not crank, go to Generator Set Control (GSC) fault isolation for CID 444 FMI 12 (WP 0008).

STEP 19. Set ENGINE CONTROL switch to START observing the following conditions:

a. Engine crank indicator K4 will appear on lower display of GSC for the time duration (in seconds) described by setpoint P017.

b. Engine crank indicator K4 will extinguish for the same duration.

c. Engine crank indicator K4 will appear again for the P017 duration.

d. Cycle will cease when time exceeds P018 duration (in seconds).

STEP 20. If engine crank indicator K4 does not appear and extinguish properly, replace GSC (WP 0039).

STEP 21. Verify the problem has been resolved.

SYMPTOM

2. Engine Does Not Shut Down When A Shutdown Fault Occurs or Engine Shuts Down with No GSC Fault Codes.

MALFUNCTION

Setpoint Programming Error.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. View and record value of all GSC setpoints. If setpoints viewed do not agree with programmed data, reprogram setpoints (WP 0092).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Unresolved Diagnostic Codes.

CORRECTIVE ACTION

Check for active diagnostic codes and correct malfunctions as required per WP 0007 and WP 0008.

MALFUNCTION

GSC Relay Module Malfunction.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. Check if the yellow fault alarm indicator is on continuously. This alarm indicates that the GSC has been programmed to override the normal shutdown signal. Reprogram the setpoints that could override the shutdown signal (WP 0092).

STEP 3. Check if the red fault shutdown indicator is flashing. If this alarm indicator is off, the GSC has been programmed to override the normal shutdown signal. Reprogram the setpoints that could override the shutdown signal (WP 0092).

STEP 4. Check that the K1 symbol is displayed on the GSC display. If the K1 symbol is present, repeat this entire procedure to verify fault, replace GSC (WP 0039).

STEP 5. With engine running, remove wire from GSC relay module (RM) A1-13 (FO-4, Sheet 5).

STEP 6. If engine does not stop running, shut down system by other means.

a. On EMCP press the PRESS TO STOP EMERGENCY STOP pushbutton.

b. Set DEAD CRANK SWITCH to OFF.

c. Set Battery Disconnect Switch to OFF.

STEP 7. Verify continuity of harness between GSC A1-13 and engine control module (ECM) ENG-P1-23 and A1-14 and ENG-P1-40 (FO-2, Sheet 2).

a. Repair or replace harness as required (WP 0042 and WP 0096).

b. If harness is good, replace ECM (WP 0083).

STEP 8. Verify the problem has been resolved.

NOTE

GSC fault shutdown indicator flashes at four to five times per second. GSC displays may not be responding. GSC does not respond to any position of the ECS. This is an internal fault of the GSC which may be temporary or permanent. This condition may also be caused by severe electromagnetic fields or radio frequency interference (RFI).

SYMPTOM

3. GSC Operation Is Erratic.

MALFUNCTION

Red Fault Shutdown Indicator Flashing.

CORRECTIVE ACTION

STEP 1. With the engine running, on EMCP set ENGINE CONTROL switch to OFF/RESET.

a. If GSC does not power down, set DEAD CRANK SWITCH to OFF, then back to NORMAL.

b. If GSC does not power down, press EMERGENCY STOP button. Set the Battery Disconnect Switch to OFF and the DEAD CRANK SWITCH to OFF.

STEP 2. Replace GSC (WP 0039).

STEP 3. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 4. If GSC powers up normally, verify all programmed parameters (WP 0092) and retry system.

STEP 5. Verify the problem has been resolved.

NOTE

Zero volts or zero amperes is showing on the GSC display for one or more AC phases while the generator set is running and the load is connected. Separate fault isolation is provided for zero voltage and zero current readings.

SYMPTOM

4. Display of Voltage on GSC is Zero for One or More Phases.

MALFUNCTION

GSC Malfunction.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check fuses A5F1, A5F2, and A5F3 on AC transformer box (ATB) A5 (FO-4, Sheet 3). Replace fuses, as required (WP 0040, Table 1).

STEP 3. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START. Do not connect a load.

NOTE

Voltage should correspond with reconfiguration board settings line-to-line.

STEP 4. Measure the line-to-line voltage between the fuses on ATB A5. If voltages are not correct, repair or replace wiring between generator and ATB A5 (WP 0042 and WP 0096).

STEP 5. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 6. Disconnect P7 from rear of GSC (FO-4, Sheet 1).

a. Measure resistance between P7-16 to P7-10. If resistance is not 6 to 8 Ohms, check wiring or replace ATB A5 (WP 0040, Table 1).

b. Measure resistance between P7-16 to P7-11. If resistance is not 6 to 8 Ohms, check wiring or replace ATB A5 (WP 0040, Table 1).

c. Measure resistance between P7-16 to P7-12. If resistance is not 6 to 8 Ohms, check wiring or replace ATB A5 (WP 0040, Table 1).

STEP 7. Reconnect P7 to rear of GSC (FO-4, Sheet 1).

STEP 8. Remove A5F1, A5F2 and A5F3 fuses from ATB A5.

a. Measure resistance between A5F1 and A5F2 on A5 side. If resistance is not 2100 ± 100 Ohms, replace ATB A5 (WP 0040, Table 1).

b. Measure resistance between A5F2 and A5F3 on A5 side. If resistance is not 2100 ± 100 Ohms, replace ATB A5 (WP 0040, Table 1).

c. Measure resistance between A5F1 and A5F3 on A5 side. If resistance is not 2100 ± 100 Ohms, replace ATB A5 (WP 0040, Table 1).

STEP 9. If ATB A5 is good, replace GSC (WP 0039).

STEP 10. Verify the problem has been resolved.

SYMPTOM

5. Display of Current on GSC is Zero for One or More Phases.

MALFUNCTION

GSC Malfunction.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Tag and disconnect wire 151B16 from ATB A5 terminal TBC-51 (leave wire disconnected until finished troubleshooting) (FO-4, Sheet 3).

STEP 3. Measure resistance between end of wire and terminal TBC-50. If resistance is not less than 1 ohm, check wiring and/or replace CT1 (WP 0050).

STEP 4. Tag and disconnect wire 152B16 from terminal TBC-52.

STEP 5. Measure resistance between end of wire and terminal TBC-50. If resistance is not less than 1 ohm, check wiring and/or replace CT2 (WP 0050).

STEP 6. Tag and disconnect wire 153B16 from terminal TBC-53.

STEP 7. Measure resistance between end of wire and terminal TBC-50. If resistance is not less than 1 ohm, check wiring and/or replace CT3 (WP 0050).

STEP 8. Measure resistance between ATB A5 terminals A5 TBC-51 and TBC-50. If resistance is not less than 1 ohm, replace ATB A5 (WP 0040, Table 1).

STEP 9. Measure resistance between ATB A5 terminals A5 TBC-52 and TBC-50. If resistance is not less than 1 ohm, replace ATB A5 (WP 0040, Table 1).

STEP 10. Measure resistance between ATB A5 terminals A5 TBC-53 and TBC-50.

a. If resistance not less than 1 ohm, replace ATB A5 (WP 0040, Table 1).

b. If ATB A5 is good, replace GSC (WP 0039).

STEP 11. Disconnect P7 from rear of GSC (FO-4, Sheet 1).

STEP 12. Measure resistance between pins P7-4 and P7-16.

a. If resistance is not 100 to 140 Ohms, repair or replace wiring (WP 0042).

b. If wiring is good, replace ATB A5 (WP 0040, Table 1).

STEP 13. Measure resistance between pins P7-5 and P7-16.

a. If resistance is not 100 to 140 Ohms, repair or replace wiring (WP 0042).

b. If wiring is good, replace ATB A5 (WP 0040, Table 1).

STEP 14. Measure resistance between pins P7-6 and P7-16.

a. If resistance is not 100 to 140 Ohms, repair or replace wiring (WP 0042).

b. If wiring is good, replace ATB A5 (WP 0040, Table 1).

STEP 15. Verify the problem has been resolved.

SYMPTOM

6. Display of Voltage on GSC is Inaccurate.

MALFUNCTION

Setpoint Incorrect.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. View and record value of setpoint P020. If value does not agree with programmed setpoint, reprogram GSC (WP 0092).

STEP 3. View and record value of setpoints in OP8 (WP 0092).

STEP 4. Open EMCP and record value of bar code setpoints located on AC transformer box A5.

a. If OP8 values do not agree with bar code setpoints marked on ATB A5, reprogram GSC (WP 0092).

b. If setpoints agree, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OF. Set DEAD CRANK SWITCH to OFF.

c. Replace GSC (WP 0039).

STEP 5. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 6. View and record value of setpoints in OP10.

a. a. If value does not agree with programmed setpoint, reprogram GSC (WP 0092).

b. Retest the system.

STEP 7. Verify the problem has been resolved.

SYMPTOM

7. Display of Current on GSC is Inaccurate.

MALFUNCTION

Setpoint Incorrect.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. View and record value of setpoint P021. If value does not agree with programmed setpoint, reprogram GSC (WP 0092).

STEP 3. View and record value of setpoints in OP8 (WP 0092).

STEP 4. Open EMCP and record value of bar code setpoints located on ATB A5.

a. If values of OP8 setpoints do not agree with bar code setpoints marked on ATB A5, reprogram GSC (WP 0092).

b. If setpoints agree, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OF. Set DEAD CRANK SWITCH to OFF.

c. Replace GSC (WP 0039).

STEP 5. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 6. View and record value of setpoints in OP8.

a. If value does not agree with programmed setpoint, reprogram GSC (WP 0092).

b. Retest the system.

STEP 7. Verify the problem has been resolved.

SYMPTOM

8. Display of Power on GSC is Inaccurate.

MALFUNCTION

Setpoint Incorrect.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. Verify setpoints per WP 0092. If voltage and current readings are accurate, power will be accurate unless the polarity of one or more of the current transformers is incorrect. Carefully check all connections (FO-3, Sheet 2).

STEP 3. If connections are correct, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 4. Replace GSC (WP 0039).

STEP 5. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 6. Retest the system.

STEP 7. Verify the problem has been resolved.

WARNING

High voltages may be present at the generator terminals when the unit is rotating. Tools, equipment, clothing, and your body must be kept clear of rotating parts and electrical connections. Special precautions must be taken during troubleshooting since protective covers and safety devices may be removed or disabled to gain access and perform tests. Be extremely careful. Failure to comply can cause serious injury or death to personnel.

SYMPTOM

9. Generator Produces No Voltage or Voltage Builds Up Then Drops to Zero.

MALFUNCTION

DVR malfunction.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check fuse A1F4 and replace as required.

STEP 3. Connect DC voltmeter to relay field flash (KFF), pins 8 (+) and 5 (-) (FO-4, Sheet 2).

STEP 4. Set DEAD CRANK SWITCH to NORMAL and ENGINE CONTROL switch to MANUAL START. Engine should crank.

STEP 5. If +24 VDC battery voltage is not indicated on voltmeter, check DC voltage between relay KFF-14 (+) and 13 (-).

. If 24 VDC is present, replace relay KFF (WP 0040, Table 1).

. If 24 VDC is not present, check for 24 VDC at GSC RM-18 (+) and ground with ENGINE CONTROL switch set to MANUAL START.

(1) If 24 VDC is present, repair wiring between RM-18 and relay KFF-14.

(2) If 24 VDC is not present, replace GSC (WP 0039).

STEP 6. Set ENGINE CONTROL switch to OFF/RESET.

STEP 7. Connect DC voltmeter to digital voltage regulator (DVR) pins A3-F1 (+) and A3-F2 (-) (FO-4, Sheet 3).

STEP 8. Set ENGINE CONTROL switch to MANUAL START. Engine should crank.

a. If +9 to +16 VDC is not indicated on voltmeter, replace diode CRFF (WP 0040, Table 1).

b. If diode is good, replace 15 ohm 25W resistor on resistor assembly A7 (WP 0041).

STEP 9. Allow engine to start and verify generator is rotating at or near proper speed.

STEP 10. Measure DC generator excitation voltage at DVR pins A3-F1 (+) and A3-F2 (-).

a. If voltage is less than +9 VDC, replace DVR (WP 0040, Table 1).

b. If voltage is greater than +15 VDC, replace generator (WP 0103).

STEP 11. Verify the problem has been resolved.

SYMPTOM

10. Generator Produces Low Voltage Under No Load Condition.

MALFUNCTION

DVR Malfunction.

CORRECTIVE ACTION

STEP 1. Check for DVR fault codes.

a. If DVR fault codes are present, troubleshoot DVR (WP 0009).

b. If DVR fault codes are not present, proceed to Step 2.

STEP 2. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to MANUAL START.

STEP 3. Check generator output at load connection board with a voltmeter.

a. If output is not the same as programmed value, reprogram DVR (WP 0092).

b. If reprogramming does not hold, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

c. Replace DVR (WP 0040, Table 1).

STEP 4. Inspect all generator connections for corrosion or loose connections. Clean and repair connections, as required.

STEP 5. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On

EMCP set ENGINE CONTROL switch to MANUAL START.

STEP 6. Measure voltage at DVR B+ and B- terminals (FO-4, Sheet 3).

a. If voltage not 18 to 32 VDC, check power wiring between DVR and GSC. Repair or replace as required (WP 0042).

b. Refer to troubleshooting procedures for GSC CID 168 E FMI 04 (WP 0008).

STEP 7. Check parameters programmed into DVR.

a. a. If parameters are not correct, reprogram DVR (WP 0092).

b. If the problem is not resolved, replace generator (WP 0103).

STEP 8. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to MANUAL START.

STEP 9. Check engine speed using GSC or tachometer. RPM should be: 1,800 RPM (60 Hz) 1,500 RPM (50 Hz).

a. Verify GSC is set for 50 or 60 Hz operation. If not, reprogram GSC and verify reprogramming (WP 0092).

b. Reprogram DVR (WP 0092).

c. If programming is correct or will not verify, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

d. Replace GSC (WP 0039).

STEP 10. Verify the problem has been resolved.

CAUTION

If low voltage occurs when load is first connected, excessive motor-starting currents in load may be the fault. Compressor starting currents may be too great for generator set. Air conditioner, refrigerator, and freezer compressor motors often require 5 to 10 times their rated current during start-up. If all of these loads are started at the same time, generator overload is possible.

SYMPTOM

11. Generator Produces Low Voltage When Load is Applied.

MALFUNCTION

DVR Malfunction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Monitor current at instant of load connection. Current should be less than rated current and the same in each leg.

STEP 3. If current is too close to rated current, generator is being overloaded. Reduce load or add another generator set in parallel.

STEP 4. Check current in each leg of output.

STEP 5. If current is not equal in all legs, selectively turn off loads until balanced.

STEP 6. Reconfigure loads as necessary or check for load failure.

STEP 7. Measure voltage at load connection terminals. Measure voltage at load.

STEP 8. If voltage drop from generator to load is more than 10%, increase wire size between generator set and load.

STEP 9. Check DVR parameter :30 (droop percentage). Voltage should not drop lower than the droop percentage will allow.

a. If output goes lower than the droop percentage allows, on EMCP set ENGINE

CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

b. Replace DVR (WP 0040, Table 1) and retest system.

c. If DVR replacement does not resolve problem, replace generator (WP 0103).

STEP 10. Verify the problem has been resolved.

SYMPTOM

12. Generator Produces Fluctuating Voltage.

MALFUNCTION

DVR Malfunction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check current in each leg of output. Current should be much less than rated current and the same in each leg.

STEP 3. If current is too close to rated current, generator is overloaded. Reduce load or add generator set in parallel.

STEP 4. If current is not equal in all legs selectively turn off loads until balanced.

STEP 5. Reconfigure loads as necessary or check for load failure.

STEP 6. Check engine speed using tachometer: 1,800 RPM (60 Hz) and stable. 1,500 RPM (50 Hz) and stable.

STEP 7. If engine speed follows voltage fluctuations, go to: Engine Misfires, Runs Rough, or is Unstable (SYMPTOM 21).

STEP 8. Check load(s) for fluctuations.

a. Disconnect one load at a time until unstable load is determined.

b. Repair or replace unstable load, or reconfigure system to accommodate load.

c. If all loads are stable, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

d. Replace DVR (WP 0040, Table 1) and retest system.

e. If DVR replacement does not resolve problem, replace generator (WP 0103).

STEP 9. Verify the problem has been resolved.

SYMPTOM

13. Generator Produces High Voltage.

MALFUNCTION

DVR Malfunction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check VOLTAGE adjust potentiometer.

a. Adjust VOLTAGE potentiometer for lower voltage, as required.

b. If adjusting VAR will not lower voltage, test VAR by disconnecting VAR wires from DVR and testing resistance of VAR circuit and VAR.

STEP 3. Check voltage at load connection terminals.

a. Check programming of GSC and DVR for the position of the reconnection board (WP

0092 and WP 0013).

b. Reprogram as required (WP 0092).

STEP 4. Verify load connections. Reconfigure load connections for the desired voltage (WP 0011) and (TM 9-6115-729-10).

STEP 5. Check power factor of load. If not close to 1.0, excessive leading power factor (capacitive load) can cause voltage to climb out of control. Reconfigure load.

a. If the problem is not resolved, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

b. Replace DVR (WP 0040, Table 1) and retest system.

STEP 6. Verify the problem has been resolved.

SYMPTOM

14. Generator is Overheating.

MALFUNCTION

Excessive Generator Load.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check ventilation screens. Unclog screens, as required.

STEP 3. Check ambient temperature. Improve ventilation, or reduce load.

STEP 4. Check temperature of air at intake. Improve ventilation, or reduce load.

STEP 5. Check current in each leg of output.

a. If not less than rated current, reduce load.

b. Add a generator set in parallel.

c. If load is unbalanced, reconfigure load to improve balance from leg to leg.

STEP 6. Verify the problem has been resolved.

SYMPTOM

15. Equipment Runs Normally on Other Source of Power (Utility or Other Generator Set), but Will Not Run on This Generator Set.

MALFUNCTION

Improper Load.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Verify output of generator set is proper voltage and frequency ±10%. Reset GSC and DVR parameters to obtain desired output (WP 0092, Table 2).

STEP 3. Check nameplates of load equipment to verify generator set output programming is correct for device(s). Delete load or reset GSC and DVR parameters to obtain desired output (WP 0092, Table 2).

NOTE

Analyze load. Excessive silicon controlled rectifier (SCR) (Thyristor) equipment connected to generator set may distort waveform and equipment that will not run may be more sensitive to waveform distortion than most. Example of SCR equipment would be anything with a variable speed drive 1/4 HP or more. Lamp dimmers are also a source of the kind of noise that creates problems with other equipment.

STEP 4. Disconnect SCR equipment and see if that improves operation.

STEP 5. May need isolation transformer for SCR or sensitive equipment to prevent distortion on the generator output.

STEP 6. Verify the problem has been resolved.

SYMPTOM

16. Undesirable Speed Decrease With Load Increase.

MALFUNCTION

Improper Engine Operation.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. On resistor assembly A7 verify position of ISOCHRONOUS/DROOP switch TM 9-6115-729-10 and FO-4, Sheet 5.

STEP 3. If in DROOP mode, go to Step 4.

STEP 4. On load resistor assembly A7 measure continuity between A7-2 and A7-1 (FO-4, Sheet 4). There should be no continuity. If continuity exists, replace ISOCHRONOUS/DROOP switch (WP 0041).

STEP 5. If ISOCHRONOUS/DROOP switch is good, keep switch in DROOP and go to Step 10.

STEP 6. Place ISOCHRONOUS/Droop Switch in ISOCHRONOUS mode.

STEP 7. On load resistor assembly A7 measure continuity between A7-2 and A7-1 (FO-4, Sheet 4). There should be continuity. If continuity does NOT exist, replace ISOCHRONOUS/DROOP switch (WP 0041). If ISOCHRONOUS/DROOP switch is good, go to Step 8.

STEP 8. Disconnect wires from LSM A4-13 (137A18), and LSM A4-14 (139A18). Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START. On EMCP set Contactor Control Switch (CCS) to Close. Verify AC Circuit Interrupter Lamp is illuminated.

STEP 9. Check for continuity between LSM A4 wires 137A18 and 139A18.

a. If continuity is present, proceed to Step 10.

b. If continuity is not present, replace main load contactor K1 (WP 0047).

STEP 10. Reconnect wire 137A18 to LSM A4-13; reconnect wire 139A18 to LSM A4-14. Operate set in ISOCHRONOUS mode. Apply load.

a. Problem caused by improper engine operation. Engine may not be developing enough horsepower.

b. Go to: Low Power/Poor or No Response to Throttle (SYMPTOM 22).

STEP 11. STEP 11. Set ISOCHRONOUS/DROOP switch to DROOP.

STEP 12. Note position of droop potentiometer on LSM A4.

STEP 13. Rotate potentiometer counterclockwise (decrease droop percentage). Retest set. If problem still exists go to Step 13a.

a. Problem caused by improper engine operation. Engine may not be developing enough horsepower.

b. Go to: Low Power/Poor or No Response to Throttle (SYMPTOM 22).

STEP 14. Verify the problem has been resolved.

NOTE

Problems, which look like load sharing problems when generator sets are operated in parallel, are often caused by erratic operation of one of the DVR units.

SYMPTOM

17. Load Sharing Module (LSM) A4 Erratic Operation.

MALFUNCTION

Load Gain Adjustment.

CORRECTIVE ACTION

STEP 1. Disconnect generator set completely from load.

STEP 2. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 3. Operate independently with load.

STEP 4. Verify operation of DVR.

a. If DVR operation is incorrect, on EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

b. Troubleshoot DVR (WP 0009).

STEP 5. Perform the load gain adjustment procedure except set the voltage to 3.0 VDC instead of 6 VDC. Adjust LSM A4 load gain (WP 0040, Table 1).

STEP 6. Verify the problem has been resolved.

SYMPTOM

18. Engine Not Properly Sharing Load With Other Generator Sets (Parallel Operation).

MALFUNCTION

Load Sharing Module Malfunction.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Apply full load to generator set.

STEP 3. Measure voltage LSM A4-22 (+) and A4-23 (-) (FO-4, Sheet 2). If voltage not +6.0 VDC $\pm$ 1.0 VDC at full load, perform LSM A4 load gain adjustment (WP 0039) of each generator set running isochronously not paralleled.

STEP 4. Check frequency setting of all units when off line with no load. If not identical, readjust frequency settings to be identical.

STEP 5. On resistor assembly A7 Verify position of ISOCHRONOUS/DROOP switch TM 9-6115-729-10 and FO-4, Sheet 5.

STEP 6. If in DROOP mode, go to Step 7.

STEP 7. On load resistor assembly A7 measure continuity between A7-2 and A7-1 (FO-4, Sheet 4). There should be no continuity. If continuity exists, replace ISOCHRONOUS/DROOP switch (WP 0041).

STEP 8. If ISOCHRONOUS/DROOP switch is good, keep switch in DROOP and go to Step 14.

STEP 9. Place ISOCHRONOUS/Droop Switch in ISOCHRONOUS mode.

STEP 10. On load resistor assembly A7 measure continuity between A7-2 and A7-1 (FO-4, Sheet 4). There should be continuity. If continuity does NOT exist, replace ISOCHRONOUS/DROOP switch (WP 0041). If ISOCHRONOUS/DROOP switch is good, go to Step 11.

STEP 11. Disconnect wires from LSM A4-13 (137A18,) and LSM A4-14 (139A18.) Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START. On EMCP set Contactor Control Switch (CCS) to CLOSE. Verify AC Circuit Interrupter Lamp is illuminated.

STEP 12. Check for continuity between LSM A4 wires 137A18 and 139A18.

a. If continuity is present, proceed to Step 13.

b. If continuity is not present, replace main load contactor K1 (WP 0047).

STEP 13. Reconnect wire 137A18 to LSM A4-13; reconnect wire 139A18 to LSM A4-14. Operate set in ISOCHRONOUS mode. Apply load.

a. Problem caused by improper engine operation. Engine may not be developing enough horsepower.

b. Go to: Low Power/Poor or No Response to Throttle (SYMPTOM 22).

STEP 14. Set ISOCHRONOUS/DROOP switch to DROOP.

STEP 15. Note position of droop potentiometer on LSM A4.

STEP 16. Rotate potentiometer counterclockwise (decrease droop percentage). Retest set. If problem still exists go to Step 13a.

a. Problem caused by improper engine operation. Engine may not be developing enough horsepower.

b. Go to: Low Power/Poor or No Response to Throttle (SYMPTOM 22)

STEP 17. Verify the problem has been resolved.

WARNING

Batteries give off a flammable gas. Do not smoke or use open flame when performing maintenance. Failure to comply can cause injury or death to personnel and equipment damage due to flames and explosion.

WARNING

Lifting batteries from the battery tray can cause back strain. Ensure proper lifting techniques are used when lifting batteries. Failure to comply can cause serious personal injury.

WARNING

Battery acid can cause burns to unprotected skin. Wear protective gloves and safety goggles. Failure to comply can cause injury to personnel.

WARNING

When disconnecting or removing batteries, disconnect the negative lead that connects directly to the grounding stud first: Disconnect the negative end of the interconnection cable next. When installing batteries, reverse the connection sequence. Failure to comply can cause serious injury to personnel.

SYMPTOM

19. Engine Will Not Crank (Starter Pinion Engages and Engine Does Not Turn Over).

MALFUNCTION

Starter Motor Defective.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP.

STEP 2. Check battery voltage on GSC display.

a. If battery voltage is 22 VDC or greater, proceed to Step 5.

b. If battery voltage is less than 22 VDC, proceed to Step 3.

STEP 3. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 4. Inspect cables between battery, Battery Disconnect Switch, and starter solenoid (FO-1, Sheet 2).

a. Clean and tighten cable ends, as required.

b. Replace cable(s), as required (WP 0045).

WARNING

NATO connector has 24 VDC battery voltage available continuously. Use caution when connecting DVM to NATO connector.

STEP 5. Connect DVM to NATO connector bottom terminal (+) and top terminal (-).

CAUTION

Crank engine only for a few seconds, long enough to read DVM, or damage to batteries or starting motor may result.

STEP 6. Set DEAD CRANK SWITCH to CRANK and monitor voltage displayed on DVM.

a. If battery voltage is 18 VDC or greater, charge batteries and proceed to Step 7.

b. If battery voltage is 16 VDC or less, replace batteries (WP 0048).

STEP 7. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 8. Bench-test starting motor. If motor fails replace starter (WP 0073).

STEP 9. Verify free movement of generator. If generator does not turn freely, replace generator G1 (WP 0103).

STEP 10. Verify timing bolt was not left in flywheel after setting valve lash. If timing bolt was left in flywheel, remove pin (WP 0090).

STEP 11. Remove the injectors and check for fluid in the cylinders (hydraulic cylinder lock). Remove fluid from cylinder (WP 0089).

STEP 12. Remove and disassemble engine accessories that can lock up the engine (oil pump WP 0088 or fuel transfer pump WP 0108).

STEP 13. If the problem is not resolved, replace the engine (WP 0104).

STEP 14. Verify the problem has been resolved.

SYMPTOM

20. Engine Cranks but Will Not Start.

MALFUNCTION

Fuel Delivery Problem.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check for a fuel supply problem and verify fuel pressure (WP 0012, SYMPTOM 13).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Engine Timing Incorrect.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. Verify engine speed during cranking using GSC readout of engine speed.

a. If speed is not greater than 50 RPM during cranking, perform load test on batteries. Check batteries and cables as required. Replace as required (WP 0046).

b. If batteries are good, replace starter (WP 0073).

STEP 3. Inspect and adjust engine timing sensors.

a. Inspect sensors and adjust if good (WP 0012).

b. If sensors are damaged, replace/adjust sensors (WP 0012).

STEP 4. Perform Engine Timing Sensor Calibration (WP 0012, SYMPTOM 11). Replace defective injector (WP 0089), if necessary.

STEP 5. Verify the problem has been resolved.

MALFUNCTION

Personality Module Mismatch.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check for correct installation of ECM to EMCP harness connector ENG-P1 to ECM J1 and of engine harness connector ENG-P1 to ECM J2 (cables plugged in to ECM) (FO-2, Sheet 1 and Sheet 2) and (WP 0096, Figure 2, Sheet 3). Plug connectors in securely.

STEP 3. Check engine harness timing sensor connectors ENG-P4 and ENG-P5 and unit injector connector ENG-P300/J300. Plug connectors in securely.

STEP 4. Verify that CID 0253 FMI 02 personality module mismatch is not displayed on the GSC. If the ECM has a problem with the internal personality module, the engine will crank, but will not start. Replace ECM (WP 0083).

STEP 5. Verify the problem has been resolved.

MALFUNCTION

Inlet Air Heater Malfunction.

CORRECTIVE ACTION

STEP 1. If cold temperatures have not occurred, proceed to: Personality Module Mismatch MALFUNCTION, SYMPTOM 20.

STEP 2. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 3. Feel intake air heater.

STEP 4. If heater is not warm, measure voltage across heater (FO-2, Sheet 1).

a. If voltage is +24 VDC, replace heater (WP 0109).

b. If voltage is 0 VDC, measure voltage across coil of air intake heater relay.

c. If voltage is +24 VDC, replace relay (WP 0109).

d. If voltage is not +24 VDC, check harness between ECM and relay and repair or replace as required (WP 0096).

e. If harness is good, replace ECM (WP 0083).

STEP 5. Verify the problem has been resolved.

MALFUNCTION

Winterization Kit Malfunction.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. If fuel-fired heater was on, check wiring and continuity between winterization kit control panel and fuel-fired heater (FO-1, Sheet 6).

a. Repair or replace wiring harness (WP 0119 and WP 0096).

b. Inspect and repair or replace heater hoses (WP 0117).

c. Repair or replace heater control box (WP 0115).

d. Replace fuel-fired heater (WP 0116).

STEP 3. Check for presence of congealed fuel (wax). If congealed fuel is found, drain tank and replace fuel (TM 9-6115-729-10) and fuel filters (WP 0059 and WP 0078).

STEP 4. Verify the problem has been resolved.

WARNING

Cooling system operates at high temperature and pressure. Contact with high pressure steam and/or liquids can result in burns and scalding. Shut down generator set, and allow system to cool before performing checks, services, and maintenance. Failure to comply can cause injury or death to personnel.

WARNING

When running, generator set engine has hot metal surfaces that will burn flesh on contact. Shut down generator set, and allow engine to cool before performing checks, services, and maintenance. Wear gloves and additional protective clothing as required. Failure to comply can cause injury or death to personnel.

SYMPTOM

21. Engine Misfires, Runs Rough, or is Unstable.

MALFUNCTION

Fuel Supply Problem.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Verify fuel quality. If fuel is not clean or if signs of wax are present, drain and replace fuel (TM 9-6115-729-10).

STEP 3. Check for a fuel supply problem and verify fuel pressure WP 0012, SYMPTOM 13).

STEP 4. If no fuel supply problem is found, engine has an internal problem. Replace the engine (WP 0104).

STEP 5. Verify the problem has been resolved.

MALFUNCTION

Inlet Air or Exhaust Restrictions.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check for dirty or clogged air filters. Replace air filters (WP 0069).

STEP 3. Check exhaust system for restrictions. Repair or replace components, as required (WP 0067).

STEP 4. Verify the problem has been resolved.

MALFUNCTION

Electrical Connections Faulty.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. Check DC voltage at slave relay (SRY) pin 87 (+) with respect to 86 (-) (FO-2, Sheet 2).

a. If voltage is not +24 VDC, measure voltage at SRY pin 30 (+) with respect to 86 (-).

b. If voltage is +24 VDC, measure SRY pin 85 (+) with respect to 86 (-).

c. If voltage is +24 VDC, replace SRY (WP 0040, Table 1).

d. If voltage is not +24 VDC, replace GSC (WP 0039).

e. If voltage at SRY pin 30 is not +24 VDC, measure voltage across CB-4.

f. If voltage is greater than +0.2 VDC, replace CB-4 (WP 0053).

g. Verify voltage at batteries. Recharge or replace batteries as required (WP 0048).

STEP 3. Check for correct installation of ECM to EMCP harness connector ENG-P1 to ECM J1 and of engine harness connector ENG-P2 to ECM J2 (cables plugged in to ECM) (FO-2, Sheet 1 and Sheet 2) and (WP 0096, Figure 2, Sheet 3). Plug connectors in securely and torque the ENG-P1/J1 and ENG-P2/J2 connectors to 55 lb•in (6.2 N•m).

STEP 4. Check engine harness timing sensor connectors ENG-P4 and ENG-P5 and unit injector connector ENG-P300/J300. Plug connectors in securely.

STEP 5. Verify connections between LSM pins A4-19 and A4-20 and the ECM input pins ENG-P1-5 and ENG-P1-66 (FO-4, Sheet 2 and FO-3, Sheets 1 and 2). Look specifically for intermittent connections (FO-2, Sheet 1). Repair or replace wiring, as required (WP 0042 and WP 0096).

STEP 6. Verify the problem has been resolved.

MALFUNCTION

ECM May Not Be Leaving Cold Mode Operation.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check coolant temperature using GSC.

a. Coolant temperature should start at ambient temperature and rise above 64 °F (17 °C) as the engine warms up.

b. If GSC temperature reading does not increase properly, replace coolant temperature sensor (WP 0106).

c. If engine does not warm up, replace engine coolant temperature thermostat(s) (WP 0081).

STEP 3. Verify the problem has been resolved.

WARNING

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WARNING

When running, generator set engine has hot metal surfaces that will burn flesh on contact. Shut down generator set, and allow engine to cool before performing checks, services, and maintenance. Wear gloves and additional protective clothing as required. Failure to comply can cause injury or death to personnel.

SYMPTOM

22. Low Power/Poor or No Response to Throttle.

MALFUNCTION

Programmed Parameters Incorrect.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to COOL DOWN/STOP. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL.

STEP 2. Check all programmed parameters on GSC and DVR, and verify that they are correct for the voltage selected by the reconnection board. Reprogram parameters, as required (WP 0092).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Fuel Supply Problems.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Verify fuel quality. If fuel is not clean or if signs of wax are present, drain and replace fuel and filters (WP 0059 and WP 0078).

STEP 3. Check air inlet turbo pipes and exhaust for restrictions and leaks.

a. Remove restrictions.

b. Clean air filters (WP 0069).

c. Repair air leaks found (WP 0070).

STEP 4. Check for a fuel supply problem and verify fuel pressure (WP 0012, SYMPTOM 13).

STEP 5. If no fuel supply problem is found, engine has an internal problem. Replace the engine (WP 0104).

STEP 6. Verify the problem has been resolved.

MALFUNCTION

ECM May Not Be Leaving Cold Mode Operation.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check coolant temperature using GSC.

a. Coolant temperature should start at ambient temperature and rise above 64 °F (17 °C) as the engine warms up.

b. If GSC temperature reading does not increase properly, replace coolant temperature sensor (WP 0106).

c. If engine does not warm up, replace engine coolant temperature thermostat(s) (WP 0081).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Harness Connections Faulty.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check for correct installation of ECM to EMCP harness connector ENG-P1 to ECM J1 and of engine harness connector ENG-P2 to ECM J2 (cables plugged in to ECM) (FO-2, Sheet 1 and Sheet 2). Plug connectors in and torque the ENGP1/ J1 and ENG-P2/J2 connectors to 55 lb•in (6.2 N•m).

STEP 3. Check engine harness timing sensor connectors ENG-P4 and ENG-P5 and unit injector connector ENG-P300/J300. Plug connectors in securely.

STEP 4. Verify connections between LSM pins A4-19 and A4-20 and the ECM input pins ENG-P1-5 and ENG-P1-66 (FO-4, Sheet 2 and FO-3, Sheets 1 and 2). Look specifically for intermittent connections (FO-2, Sheet 1). Repair or replace wiring, as required (WP 0042 and WP 0096).

STEP 5. Verify the problem has been resolved.

NOTE

Use the following procedure whether the engine shuts down completely and had to be restarted or if it falters and does not require restarting. If problem occurs only after engine is warmed up and disappears after engine cools down, problem may be circuit breakers overheating. Check carefully for hot spots and repair or replace, as required.

SYMPTOM

23. Intermittent Engine Shut Downs.

MALFUNCTION

Electrical Connections Faulty.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check for correct installation of ECM to EMCP harness connector ENG-P1 to ECM J1 and of engine harness connector ENG-P2 to ECM J2 (cables plugged in to ECM) (FO-2, Sheet 1 and Sheet 2, and WP 0096, figure 2, Sheet 3). Plug connectors in and torque the ENG-P1/J1 and ENG-P2/J2 connectors to 55 in•lbs (6.2 N•m).

STEP 3. Check engine harness timing sensor connectors ENG-P4 and ENG-P5 and unit injector connector ENG-P300/J300. Plug connectors in securely.

STEP 4. Verify connections between LSM pins A4-19 and A4-20 and the ECM input pins ENG-P1-5 and ENG-P1-66 (FO-4, Sheet 2 and FO-3, Sheets 1 and 2). Look specifically for intermittent connections. Repair or replace wiring, as required (WP 0042 and WP 0096).

STEP 5. Refer to: Low Power/Poor or No Response to Throttle SYMPTOM 22.

STEP 6. Check load. Verify load is not causing problem. Replace or reconfigure load.

STEP 7. Verify the problem has been resolved.

WARNING

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WARNING

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SYMPTOM

24. Excessive Black Smoke.

MALFUNCTION

Air Inlet Problem.

CORRECTIVE ACTION

STEP 1. Check the air inlet and exhaust for restrictions and leaks.

a. Check for a restriction in the air inlet. Inspect and clear the obstruction.

b. Clean or replace air inlet filter (WP 0069).

c. Repair any air leaks in the air inlet system (WP 0070).

d. Check for loose clamps or broken expansion joints on all pipes between the turbocharger and air-to-air after cooler and between the air-to-air after cooler and engine intake manifold.

e. If there are no problems with the air inlet system, replace failed atmospheric or air inlet pressure sensor (WP 0106).

STEP 2. Check for failed turbocharger. Repair or replace turbocharger as required (WP 0112).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Engine Timing.

CORRECTIVE ACTION

STEP 1. Inspect/adjust engine timing sensors.

a. Inspect sensors and install and adjust if good (WP 0012).

b. If sensors are damaged, replace and adjust sensors (WP 0106).

STEP 2. Check valve adjustment.

a. Readjust valves, as required (WP 0090).

b. If any valves cannot be adjusted to specifications, replace the cylinder head (WP 0090).

STEP 3. Check proper timing orientation between crankshaft and camshaft drive gears.

STEP 4. Verify the problem has been resolved.

MALFUNCTION

Fuel Supply Problem.

CORRECTIVE ACTION

STEP 1. Check for a fuel supply problem and verify fuel pressure (WP 0012, SYMPTOM 13).

STEP 2. Verify the problem has been resolved.

SYMPTOM

25. Excessive White Smoke.

MALFUNCTION

Engine Temperature Low.

CORRECTIVE ACTION

STEP 1. Set Battery Disconnect Switch to ON. Set DEAD CRANK SWITCH to NORMAL. On EMCP set ENGINE CONTROL switch to START.

STEP 2. Check coolant temperature using GSC. (ECM may not be leaving cold mode operation.)

a. Coolant temperature should start at ambient temperature and rise above 64 °F (17 °C) as the engine warms up.

b. If GSC temperature reading does not increase properly, replace coolant temperature sensor (WP 0106).

c. If engine does not warm up, replace engine coolant temperature thermostat(s) (WP 0081).

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Engine Timing.

CORRECTIVE ACTION

STEP 1. Inspect/adjust engine timing sensors.

a. Inspect sensors and adjust if good (WP 0106).

b. If sensors are damaged, replace and adjust sensors (WP 0106).

STEP 2. Check proper orientation between crankshaft and camshaft drive gears.

STEP 3. Verify the problem has been resolved.

MALFUNCTION

Fuel Supply Problem.

CORRECTIVE ACTION

STEP 1. Check for a fuel supply problem and verify fuel pressure (WP 0012, SYMPTOM 13).

STEP 2. Verify the problem has been resolved.

MALFUNCTION

Coolant Leak.

CORRECTIVE ACTION

Coolant leakage into the cylinder or exhaust system can produce symptoms similar to white smoke emissions from unburned fuel. Replace the engine (WP 0104).

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WARNING

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SYMPTOM

26. Can Not Reach Operating Engine RPM.

MALFUNCTION

Unresolved Codes.

CORRECTIVE ACTION

Check for fault codes that could cause degraded engine performance.

MALFUNCTION

Fuel Supply Problem.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check the fuel lines for restriction, collapsed lines, and pinched lines (WP 0015).

STEP 3. Check the fuel tank for foreign objects or debris which may block the fuel lines (TM 9-6115-729-10).

STEP 4. Prime the fuel system if any of the following have been performed.

a. Replacement of the fuel filters (WP 0059 and WP 0078).

b. Service on the low pressure fuel supply circuit.

c. Replacement of unit (fuel) injectors (WP 0089).

STEP 5. Purge air from the low pressure fuel supply circuit.

STEP 6. Check the fuel pressure after the fuel filter while the engine is being cranked (WP 0012, SYMPTOM 14). Perform Steps for SYMPTOM 20, MALFUNCTION Fuel Delivery Problem.

a. If the fuel pressure is low, replace the fuel filters (WP 0059 and WP 0078).

b. If the fuel pressure is still low, check the following items.

(1) Fuel transfer pump (WP 0108).

(2) Fuel transfer pump coupling (WP 0108).

(3) Fuel pressure regulating valve (WP 0108).

STEP 7. Perform Injector Solenoid Test and Cylinder Cutout Test (WP 0012, SYMPTOM 8).

STEP 8. Verify the problem has been resolved.

MALFUNCTION

Insufficient Inlet Air.

CORRECTIVE ACTION

STEP 1. On EMCP set ENGINE CONTROL switch to OFF/RESET. Set Battery Disconnect Switch to OFF. Set DEAD CRANK SWITCH to OFF.

STEP 2. Check air filters for dirty or clogged filters. Replace air filters (WP 0069).

STEP 3. Check exhaust system for restrictions. Remove restrictions (WP 0067).

STEP 4. Verify the problem has been resolved.