

**DIAGNOSTIC
REPAIR
MANUAL**



50 Hz and 60 Hz Liquid-Cooled Product
with Evolution™ or Nexus™ Control



Applicable Models Include:

150 kW and Below
Evolution/Nexus Controlled
Liquid-Cooled Gaseous/Diesel Units

STANDBY GENERATORS

Safety

Throughout this publication and on tags and decals affixed to the generator, DANGER, WARNING, and CAUTION blocks are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Their definitions are as follows:



DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

(000001)



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

(000002)



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

(000003)

NOTE: Notes provide additional information important to a procedure or component.

These safety alerts cannot eliminate the hazards they indicate. Observing safety precautions and strict compliance with the special instructions while performing the action or service are essential to preventing accidents.

Read This Manual Thoroughly

This diagnostic manual has been written and published by Generac to aid dealer technicians and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures for these products, or like or similar products manufactured and marketed by Generac, and that they have been trained in the recommended servicing procedures for these products, including the use of common hand tools and any special Generac tools or tools from other suppliers.

Generac could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a procedure or tool not recommended by Generac must first satisfy themselves that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication.

When working on these products, remember that the electrical system and engine ignition system are capable of violent and damaging short circuits or severe electrical shocks. If you intend to perform work where electrical terminals could be grounded or touched, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings of the engine are exposed during service, they should be covered to prevent accidental entry of foreign material. Entry of such materials will result in extensive damage when the engine is started.

During any maintenance procedure, replacement fasteners must have the same measurements and strength as the fasteners that were removed. Metric bolts and nuts have numbers that indicate their strength. Customary bolts use radial lines to indicate strength while most customary nuts do not have strength markings. Mismatched or incorrect fasteners can cause damage, malfunction and possible injury.

Replacement Parts

When servicing this equipment, it is extremely important that all components be properly installed and tightened. If improperly installed and tightened, sparks could ignite fuel vapors from fuel system leaks.

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Section 1.1 Generator Basics

Introduction

This diagnostic repair manual has been prepared especially for the purpose of familiarizing service personnel with the testing, troubleshooting, and repair of 150 kW and below generator systems with the Evolution or Nexus™ Controllers.

The information in this manual is accurate based on products produced at the time of publication. The manufacturer reserves the right to make technical updates, corrections, and product revisions at any time without notice.

The manual has been divided into several Sections. Each Section consists of two or more Subsections.

It is not the manufacturers intent to provide detailed disassembly and reassembly instructions in this manual. It is the manufacturers intent to:

- Provide the service technician with an understanding of how the various assemblies and systems work.
- Assist the technician in finding the cause of malfunctions.
- Expedite repair of the equipment.

Sections

Section 1—Provides the basic understanding of the generator as well as basic installation information and operating instructions.

Section 2—Provides the troubleshooting and diagnostic testing procedure for brushed and brushless alternators.

Section 3—Provides the troubleshooting and diagnostic testing procedure for engine related problems and the Nexus™ Controller.

Section 4—Provides basic adjustments and wireless remote troubleshooting.

Section 5—Illustrates all of the electrical and wiring diagrams for the various kW ranges.

Data Plate

A data plate affixed to the generator contains important information pertaining to the unit, including model number, serial number, amperage rating, and voltage rating. The information from this data plate may be required when requesting information, ordering parts, etc.

005415

Figure 1-1. A Typical Data Plate (Older)

005416

Figure 1-2. Typical Data Plate (Newer)

Rotor And Stator Resistance Tables

Nexus Rotor And Stator Resistance Tables

Unit	Exciter Field	Exciter Armature
70 kW	5.59 to 6.17 Ohms	0.388 to 0.525 Ohms
80 kW	5.59 to 6.17 Ohms	0.940 to 1.272 Ohms
100 kW	5.59 to 6.17 Ohms	0.388 to 0.525 Ohms
130 kW	5.59 to 6.17 Ohms	0.388 to 0.525 Ohms
150 kW	5.59 to 6.17 Ohms	1.023 to 1.189 Ohms

Rotors	Resistance
22 kW 1-Phase 4 Pole 1800 RPM	6.81 Ohms
22 kW 3-Phase 4 Pole 1800 RPM	6.46 Ohms
25 kW 1-Phase 2 Pole 3600 RPM	5.94 to 6.90 Ohms
25 kW 3-Phase 2 Pole 3600 RPM	5.94 to 6.90 Ohms
27 kW 1-Phase 4 Pole 1800 RPM	7.80 Ohms
27 kW 3-Phase 4 Pole 1800 RPM	7.56 Ohms
30 kW 1-Phase 2 Pole 3600 RPM	6.77 to 7.87 Ohms
30 kW 3-Phase 2 Pole 3600 RPM	6.77 to 7.87 Ohms
36 kW 1-Phase 4 Pole 1800 RPM	7.7 to 8.5 Ohms
36 kW 3-Phase 4 Pole 1800 RPM	7.7 to 8.5 Ohms
45 kW 1-Phase 2 Pole 3600 RPM	4.6 to 5.1 Ohms
45 kW 3-Phase 2 Pole 3600 RPM	4.6 to 5.1 Ohms
48 kW 1-Phase 4 Pole 1800 RPM	8.7 to 9.7 Ohms
48 kW 3-Phase 4 Pole 1800 RPM	9.1 to 10.1 Ohms
60 kW 1-Phase 2 Pole 3600 RPM	5.2 to 5.7 Ohms
60 kW 3-Phase 2 Pole 3600 RPM	5.2 to 5.7 Ohms
70 kW 1-Phase 4 Pole 1800 RPM	1.32 to 1.46 Ohms
70 kW 3-Phase 4 Pole 1800 RPM	1.32 to 1.46 Ohms
80 kW 1-Phase 2 Pole 3600 RPM	5.8 to 6.4 Ohms
80 kW 3-Phase 2 Pole 3600 RPM	5.8 to 6.4 Ohms
100 kW 1-Phase 4 Pole 2300 RPM	1.54 to 1.70 Ohms
100 kW 3-Phase 4 Pole 2300 RPM	1.59 to 1.76 Ohms
130 kW 1-Phase 4 Pole 3000 RPM	2.04 to 2.20 Ohms
130 kW 3-Phase 4 Pole 3000 RPM	2.09 to 2.31 Ohms
150 kW 1-Phase 2 Pole 3600 RPM	8.2 to 9.1 Ohms
150 kW 3-Phase 2 Pole 3600 RPM	8.2 to 9.1 Ohms

Stator	Wires 11 & 22	Wires 33 & 44	Wires 2 & 6
22 kW 1-Phase 120/240	0.0586 to 0.0680 Ohms	0.0586 to 0.0680 Ohms	0.7073 to 0.8221 Ohms
25 kW 1-Phase 120/240	0.0370 to 0.0431 Ohms	0.0370 to 0.0431 Ohms	0.380 to 0.442 Ohms
27 kW 1-Phase 120/240	0.0427 to 0.0497 Ohms	0.0427 to 0.0497 Ohms	0.6615 to 0.7687 Ohms
30 kW 1-Phase 120/240	0.0297 to 0.0347 Ohms	0.0297 to 0.0347 Ohms	0.363 to 0.421 Ohms
36 kW 1-Phase 120/240	0.0384 to 0.0424 Ohms	0.0384 to 0.0424 Ohms	0.602 to 0.665 Ohms
45 kW 1-Phase 120/240	0.0610 to 0.0674 Ohms	0.0610 to 0.0674 Ohms	0.633 to 0.699 Ohms
48 kW 1-Phase 120/240	0.0281 to 0.0311 Ohms	0.0281 to 0.0311 Ohms	0.6289 to 0.6951 Ohms
60 kW 1-Phase 120/240	0.0371 to 0.0410 Ohms	0.0371 to 0.0410 Ohms	0.496 to 0.548 Ohms
70 kW 1-Phase 120/240	0.0276 to 0.0305 Ohms	0.0276 to 0.0305 Ohms	0.3987 to 0.4633 Ohms
80 kW 1-Phase 120/240	0.0218 to 0.0241 Ohms	0.2633 to 0.3059 Ohms	0.2633 to 0.3059 Ohms
100 kW 1-Phase 120/240	0.0196 to 0.0217 Ohms	0.0196 to 0.0217 Ohms	0.4330 to 0.4786 Ohms
130 kW 1-Phase 120/240	0.0126 to 0.0138 Ohms	0.0126 to 0.0138 Ohms	0.3456 to 0.4018 Ohms
150 kW 1-Phase 120/240	0.0090 to 0.0100 Ohms	0.0090 to 0.0100 Ohms	0.2648 to 0.3078 Ohms

Nexus Rotor And Stator Resistance Tables

Stator	Wires S1 & S4	Wires S3 & S6	Wires S2 & S5	Wires 2 & 6
22 kW 3-Phase 120/208	0.0636 to 0.0740 Ohms	0.0636 to 0.0740 Ohms	0.0636 to 0.0740 Ohms	0.8381 to 0.9741 Ohms
25 kW 3-Phase 120/208	0.0411 to 0.0477 Ohms	0.0411 to 0.0477 Ohms	0.0411 to 0.0477 Ohms	0.704 to 0.818 Ohms
27 kW 3-Phase 120/208	0.0497 to 0.0577 Ohms	0.0497 to 0.0577 Ohms	0.0497 to 0.0577 Ohms	0.8692 to 1.0102 Ohms
30 kW 3-Phase 120/208	0.0309 to 0.0359 Ohms	0.0309 to 0.0359 Ohms	0.0309 to 0.0359 Ohms	0.728 to 0.846 Ohms
36 kW 3-Phase 120/208	0.0331 to 0.0365 Ohms	0.0331 to 0.0365 Ohms	0.0331 to 0.0365 Ohms	1.095 to 1.210 Ohms
36 kW 3-Phase 277/480	0.1723 to 0.1904 Ohms	0.1723 to 0.1904 Ohms	0.1723 to 0.1904 Ohms	1.095 to 1.210 Ohms
45 kW 3-Phase 120/208	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.759 to 0.839 Ohms
45 kW 3-Phase 277/480	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.655 to 0.724 Ohms
48 kW 3-Phase 120/208	0.0289 to 0.0319 Ohms	0.0289 to 0.0319 Ohms	0.0289 to 0.0319 Ohms	1.078 to 1.192 Ohms
48 kW 3-Phase 277/480	0.1343 to 0.1485 Ohms	0.1343 to 0.1485 Ohms	0.1343 to 0.1485 Ohms	1.078 to 1.192 Ohms
60 kW 3-Phase 120/208	0.0185 to 0.0205 Ohms	0.0185 to 0.0205 Ohms	0.0185 to 0.0205 Ohms	0.637 to 0.704 Ohms
60 kW 3-Phase 277/480	0.0918 to 0.1015 Ohms	0.0918 to 0.1015 Ohms	0.0918 to 0.1015 Ohms	0.637 to 0.704 Ohms
70 kW 3-Phase 120/208	0.0134 to 0.0148 Ohms	0.0134 to 0.0148 Ohms	0.0134 to 0.0148 Ohms	0.514 to 0.568 Ohms
70 kW 3-Phase 277/480	0.0647 to 0.0716 Ohms	0.0647 to 0.0716 Ohms	0.0647 to 0.0716 Ohms	0.514 to 0.568 Ohms
80 kW 3-Phase 120/208	0.0218 to 0.0241 Ohms	0.0218 to 0.0241 Ohms	0.0218 to 0.0241 Ohms	0.319 to 0.353 Ohms
80 kW 3-Phase 277/480	0.0563 to 0.0623 Ohms	0.0563 to 0.0623 Ohms	0.0563 to 0.0623 Ohms	0.319 to 0.353 Ohms
100 kW 3-Phase 120/208	0.0254 to 0.0281 Ohms	0.0254 to 0.0281 Ohms	0.0254 to 0.0281 Ohms	0.515 to 0.569 Ohms
100 kW 3-Phase 277/480	0.0787 to 0.0870 Ohms	0.0787 to 0.0870 Ohms	0.0787 to 0.0870 Ohms	0.504 to 0.557 Ohms
130 kW 3-Phase 120/208	0.0127 to 0.0141 Ohms	0.0127 to 0.0141 Ohms	0.0127 to 0.0141 Ohms	0.518 to 0.572 Ohms
130 kW 3-Phase 277/480	0.0154 to 0.0170 Ohms	0.0154 to 0.0170 Ohms	0.0154 to 0.0170 Ohms	0.518 to 0.572 Ohms
150 kW 3-Phase 120/208	0.0102 to 0.0112 Ohms	0.0102 to 0.0112 Ohms	0.0102 to 0.0112 Ohms	0.353 to 0.390 Ohms
150 kW 3-Phase 277/480	0.0196 to 0.0216 Ohms	0.0196 to 0.0216 Ohms	0.0196 to 0.0216 Ohms	0.317 to 0.350 Ohms

Stator	Wires S1 & 00	Wires S4 & 00	Wires S3 & S6	Wires S2 & S5	Wires 2 & 6
22 kW 3-Phase 120/240	0.1247 to 0.1449 Ohms	0.1247 to 0.1449 Ohms	0.2425 to 0.2819 Ohms	0.2425 to 0.2819 Ohms	0.8381 to 0.9741 Ohms
25 kW 3-Phase 120/240	0.0837 to 0.0925 Ohms	0.0837 to 0.0925 Ohms	0.1642 to 0.1814 Ohms	0.1642 to 0.1814 Ohms	0.704 to 0.818 Ohm
27 kW 3-Phase 120/240	0.1005 to 0.1169 Ohms	0.1005 to 0.1169 Ohms	0.1942 to 0.2257 Ohms	0.1942 to 0.2257 Ohms	0.8692 to 1.0102 Ohms
30 kW 3-Phase 120/240	0.0609 to 0.0707 Ohms	0.0609 to 0.0707 Ohms	0.1188 to 0.1380 Ohms	0.1188 to 0.1380 Ohms	0.728 to 0.846 Ohms
36 kW 3-Phase 120/240	0.0639 to 0.0707 Ohms	0.0639 to 0.0707 Ohms	0.1244 to 0.1375 Ohms	0.1244 to 0.1375 Ohms	1.095 to 1.210 Ohms
45 kW 3-Phase 120/240	0.0610 to 0.0674 Ohms	0.0610 to 0.0674 Ohms	0.1186 to 0.1310 Ohms	0.1186 to 0.1310 Ohms	0.759 to 0.830 Ohms
48 kW 3-Phase 120/240	0.0555 to 0.0613 Ohms	0.0555 to 0.0613 Ohms	0.1075 to 0.1189 Ohms	0.1075 to 0.1189 Ohms	1.078 to 1.192 Ohms
60 kW 3-Phase 120/240	0.0405 to 0.0447 Ohms	0.0405 to 0.0447 Ohms	0.0775 to 0.0857 Ohms	0.0775 to 0.0857 Ohms	0.637 to 0.704 Ohms
70 kW 3-Phase 120/240	0.0257 to 0.0285 Ohms	0.0257 to 0.0285 Ohms	0.0480 to 0.0530 Ohms	0.0480 to 0.0530 Ohms	0.514 to 0.568 Ohms
80 kW 3-Phase 120/240	0.0218 to 0.0240 Ohms	0.0218 to 0.0240 Ohms	0.0397 to 0.0439 Ohms	0.0397 to 0.0439 Ohms	0.319 to 0.353 Ohms
100 kW 3-Phase 120/240	0.0255 to 0.0281 Ohms	0.0255 to 0.0281 Ohms	0.0255 to 0.0281 Ohms	0.0255 to 0.0281 Ohms	0.515 to 0.569 Ohms
130 kW 3-Phase 120/240	0.0127 to 0.0141 Ohms	0.0127 to 0.0141 Ohms	0.0127 to 0.0141 Ohms	0.0127 to 0.0141 Ohms	0.518 to 0.572 Ohms
150 kW 3-Phase 120/240	0.0179 to 0.0197 Ohms	0.0179 to 0.0197 Ohms	0.0179 to 0.0197 Ohms	0.0179 to 0.0197 Ohms	0.353 to 0.390 Ohms

Evolution Rotor And Stator Resistance Tables

Rotors	Resistance
22 kW 1-Phase 4P 1800RPM	6.81 Ohms
22 kW 3-Phase 4P 1800RPM	6.46 Ohms
25 kW 1-Phase 2P 3600RPM	6.12 to 7.11 Ohms
25 kW 3-Phase 2P 3600RPM	5.94 to 6.90 Ohms
27 kW 1-Phase 4P 1800RPM	7.80 Ohms
27 kW 3-Phase 4P 1800RPM	7.56 Ohms
30 kW 1-Phase 2P 3600RPM	7.02 to 8.16 Ohms
30 kW 3-Phase 2P 3600RPM	6.77 to 7.87 Ohms
32 kW 1-Phase 4P 1800RPM	7.9 to 9.2 Ohms
32 kW 3-Phase 4P 1800RPM	7.7 to 8.5 Ohms
36kW 1-Phase 2P 3600RPM	4.9 to 5.7 Ohms
36kW 3-Phase 2P 3600RPM	4.6 to 5.1 Ohms
38 kW 1-Phase 4P 1800RPM	7.9 to 9.2 Ohms
38 kW 3-Phase 4P 1800RPM	7.7 to 8.5 Ohms
45 kW 1-Phase 2P 3600RPM	5.4 to 6.3 Ohms
45 kW 3-Phase 2P 3600RPM	4.6 to 5.1 Ohms
48 kW 1-Phase 4P 1800RPM	8.9 to 10.3 Ohms
48 kW 3-Phase 4P 1800RPM	9.1 to 10.1 Ohms
60 kW 1-Phase 2P 3600RPM	5.4 to 6.3 Ohms
60 kW 3-Phase 2P 3600RPM	5.2 to 5.7 Ohms

Stator	Wires 11 & 22	Wires 33 & 44	Wires 2 & 6
22 kW 1-Phase 120/240V	0.0586 to 0.0680 Ohms	0.0586 to 0.0680 Ohms	0.7073 to 0.8221 Ohms
25 kW 1-Phase 120/240V	0.0351 to 0.0409 Ohms	0.0351 to 0.0409 Ohms	0.3807 to 0.4424 Ohms
27 kW 1-Phase 120/240V	0.0427 to 0.0497 Ohms	0.0427 to 0.0497 Ohms	0.6615 to 0.7687 Ohms
30 kW 1-Phase 120/240V	0.0346 to 0.0402 Ohms	0.0346 to 0.0402 Ohms	0.3915 to 0.4550 Ohms
32 kW 1-Phase 120/240V	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	0.7401 to 0.8602 Ohms
36 kW 1-Phase 120/240V	0.0427 to 0.0497 Ohms	0.0427 to 0.0497 Ohms	0.3662 to 0.4256 Ohms
38 kW 1-Phase 120/240V	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	0.7401 to 0.8602 Ohms
45 kW 1-Phase 120/240V	0.0287 to 0.0333 Ohms	0.0287 to 0.0333 Ohms	0.3493 to 0.4060 Ohms
48 kW 1-Phase 120/240V	0.0248 to 0.0288 Ohms	0.0248 to 0.0288 Ohms	0.8631 to 1.0031 Ohms
60 kW 1-Phase 120/240V	0.0287 to 0.0333 Ohms	0.0287 to 0.0333 Ohms	0.3493 to 0.4060 Ohms

Stator	Wires S1 & S4	Wires S3 & S6	Wires S2 & S5	Wires 2 & 6
22 kW 3-Phase 120/208V	0.0621 to 0.0721 Ohms	0.0621 to 0.0721 Ohms	0.0621 to 0.0721 Ohms	0.8381 to 0.9741 Ohms
25 kW 3-Phase 120/208V	0.0411 to 0.0477 Ohms	0.0411 to 0.0477 Ohms	0.0411 to 0.0477 Ohms	0.704 to 0.818 Ohms
27 kW 3-Phase 120/208V	0.0497 to 0.0577 Ohms	0.0497 to 0.0577 Ohms	0.0497 to 0.0577 Ohms	0.8692 to 1.0102 Ohms
30 kW 3-Phase 120/208V	0.0309 to 0.0359 Ohms	0.0309 to 0.0359 Ohms	0.0309 to 0.0359 Ohms	0.728 to 0.846 Ohms
32 kW 3-Phase 120/208V	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	1.1220 to 1.3040 Ohms
32 kW 3-Phase 277/480V	0.1623 to 0.1887 Ohms	0.1623 to 0.1887 Ohms	0.1623 to 0.1887 Ohms	1.1220 to 1.3040 Ohms
36 kW 1-Phase 120/208V	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.759 to 0.839 Ohms
36 kW 1-Phase 277/480V	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.655 to 0.724 Ohms
38 kW 1-Phase 120/208V	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	0.0312 to 0.0362 Ohms	1.1220 to 1.3040 Ohms
38 kW 1-Phase 277/480V	0.1623 to 0.1887 Ohms	0.1623 to 0.1887 Ohms	0.1623 to 0.1887 Ohms	1.1220 to 1.3040 Ohms
45 kW 1-Phase 120/208V	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.0316 to 0.0350 Ohms	0.759 to 0.839 Ohms
45 kW 1-Phase 277/480V	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.1572 to 0.1738 Ohms	0.655 to 0.724 Ohms
48 kW 1-Phase 120/208V	0.0273 to 0.0317 Ohms	0.0273 to 0.0317 Ohms	0.0273 to 0.0317 Ohms	1.1165 to 1.2975 Ohms
48 kW 1-Phase 277/480V	0.1607 to 0.1867 Ohms	0.1607 to 0.1867 Ohms	0.1607 to 0.1867 Ohms	1.3634 to 1.5846 Ohms
60 kW 1-Phase 120/208V	0.0185 to 0.0205 Ohms	0.0185 to 0.0205 Ohms	0.0185 to 0.0205 Ohms	0.637 to 0.704 Ohms
60 kW 1-Phase 277/480V	0.0918 to 0.1015 Ohms	0.0918 to 0.1015 Ohms	0.0918 to 0.1015 Ohms	0.637 to 0.704 Ohms

Evolution Rotor And Stator Resistance Tables

Stator	Wires S1 & 00	Wires S4 & 00	Wires S1 & S4	Wires S3 & S6	Wires S2 & S5	Wires 2 & 6
22 kW 3-Phase 120/240V	0.1188 to 0.1381 Ohms	0.1188 to 0.1381 Ohms	0.2300 to 0.2673 Ohms	0.2300 to 0.2673 Ohms	0.2300 to 0.2673 Ohms	0.8381 to 0.9741 Ohms
25 kW 3-Phase 120/240V	0.0837 to 0.0925 Ohms	0.0837 to 0.0925 Ohms	0.1642 to 0.1814 Ohms	0.1642 to 0.1814 Ohms	0.1642 to 0.1814 Ohms	0.704 to 0.818 Ohms
27 kW 3-Phase 120/240V	0.1005 to 0.1169 Ohms	0.1005 to 0.1169 Ohms	0.1942 to 0.2257 Ohms	0.1942 to 0.2257 Ohms	0.1942 to 0.2257 Ohms	0.8692 to 1.0102 Ohms
30 kW 3-Phase 120/240V	0.0609 to 0.0707 Ohms	0.0609 to 0.0707 Ohms	0.1188 to 0.1380 Ohms	0.1188 to 0.1380 Ohms	0.1188 to 0.1380 Ohms	0.728 to 0.846 Ohms
32 kW 3-Phase 120/240V	0.0603 to 0.0701 Ohms	0.0603 to 0.0701 Ohms	0.1172 to 0.1363 Ohms	0.1172 to 0.1363 Ohms	0.1172 to 0.1363 Ohms	1.1220 to 1.3040 Ohms
36 kW 3-Phase 120/240V	0.0610 to 0.0674 Ohms	0.0610 to 0.0674 Ohms	0.1186 to 0.1310 Ohms	0.1186 to 0.1310 Ohms	0.1186 to 0.1310 Ohms	0.759 to 0.839 Ohms
38 kW 3-Phase 120/240V	0.0603 to 0.0701 Ohms	0.0603 to 0.0701 Ohms	0.1172 to 0.1363 Ohms	0.1172 to 0.1363 Ohms	0.1172 to 0.1363 Ohms	1.1220 to 1.3040 Ohms
45 kW 3-Phase 120/240V	0.0610 to 0.0674 Ohms	0.0610 to 0.0674 Ohms	0.1186 to 0.1310 Ohms	0.1186 to 0.1310 Ohms	0.1186 to 0.1310 Ohms	0.759 to 0.839 Ohms
48 kW 3-Phase 120/240V	0.0525 to 0.0611 Ohms	0.0525 to 0.0611 Ohms	0.1017 to 0.1182 Ohms	0.1017 to 0.1182 Ohms	0.1017 to 0.1182 Ohms	1.1165 to 1.2975 Ohms
60 kW 3-Phase 120/240V	0.0405 to 0.0447 Ohms	0.0405 to 0.0447 Ohms	0.0775 to 0.0857 Ohms	0.0775 to 0.0857 Ohms	0.0775 to 0.0857 Ohms	0.637 to 0.704 Ohms

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Section 1.2 Fuel Maintenance and Reconfiguring

Introduction

It is the responsibility of the installer to verify that the generator installation was performed properly. A careful inspection must be performed when the installation is complete. Strictly comply with all applicable codes, standards, and regulations pertaining to such installations. Strictly comply with regulations established by the Occupational Safety and Health Administration (OSHA).

Prior to initial startup of the unit, the installer must verify that the generator has been properly prepared for use. This includes the following:

- An adequate supply of the correct fuel must be available for generator operation.
- The engine must be properly serviced with the recommended oil.
- If using liquid propane (LP), use only the “vapor withdrawal” system. This type of system uses the vapors formed above the liquid fuel in the storage tank.
- The engine cooling system must be properly serviced with the recommended coolant.

Fuel Maintenance

Always treat diesel fuel for long term storage. Use the approved fuel additive and water abatement material. Test stored fuel every 90 days and provide additional treatment if required. Periodically check and dry abatement material as necessary.

- When natural gas is used as a fuel, it should be rated at least 1000 BTU's per cubic foot.
- When LP (propane) gas is used as a fuel, it should be rated at a minimum of 2520 BTU's per cubic foot.

Reconfiguring the Fuel System

IMPORTANT NOTE: Reconfiguring or modifying a fuel system that is equipped with a catalytic converter is punishable under federal law.

NOTE: All gaseous models not equipped with a catalyst are eligible for field fuel conversion.

The fuel system and control panel (refer to the installation drawing for location) must be reconfigured before the generator can be operated using a LP fuel source.

Refer to the appropriate owner's manual for unit specific conversion information.

Control Panel

FUEL TYPE is a secure option in the controller. Refer to *Evolution Menu System Navigation* or *Nexus Menu System Navigation* for *Security Access*.

IMPORTANT NOTE: It is required to configure the control panel for the correct fuel type when converting the fuel regulator from one fuel type to the other.

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Section 1.3 Testing, Cleaning, and Drying

Visual Inspection

Perform a thorough visual inspection before testing or troubleshooting an alternator. Remove the access covers and look closely for any obvious problems. Look for the following:

- Burned or broken wires, broken wire connectors, damaged mounting brackets, etc.
- Loose or frayed wiring insulation, loose or dirty connections.
- Check that all wiring is well clear of rotating parts.
- Verify that the generator's voltage output matches utility voltage.
- Look for foreign objects, loose nuts, bolts, and other fasteners.
- Clean the area around the generator. Clear away paper, leaves, snow, and other objects that might blow against the generator and obstruct air flow.
- Verify that the generator is properly connected for the current rated voltage, especially on new installations.

Measuring Voltages



▲ DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

The technician will be required to measure both AC and DC voltages when troubleshooting and testing the generator set. Measurement of voltage requires that the user be thoroughly familiar with the meter being used for such tests. Consult the instruction manual for the meter being used.

When measuring voltage, it is best to connect the meter test leads to the terminals being tested while the generator is shut down or while power to those terminals is turned off.

DANGER: Do not attempt to read power voltages while standing on wet or damp ground, or while hands or feet are wet. The use of insulative rubber mats to stand on while testing is recommended. **(Partially alert 000129)**

Measuring Current

Alternating current (AC) can be measured with a clamp-on ammeter. Most clamp-on ammeters will not measure direct current (DC). Load current readings should never exceed the generator's data plate rating for continuous operation. However, momentary surges in load current may be encountered when starting electric motors.

On 1-phase generators, the data plate generally lists rated line-to-line and line-to-neutral current.

Measuring Resistance

The resistance (in ohms) of generator stator and rotor windings can be measured using an ohmmeter or an accurate digital multimeter (DMM).

The resistance of some windings is extremely low. Some readings are so low that a meter capable of reading in the "milliohms" range would be required. Many meters will simply read CONTINUITY. However, a standard digital multimeter (DMM) may be used to test for continuity, or for a shorted or grounded condition.

Insulation Resistance

The insulation resistances of stator and rotor windings are a measurement of the integrity of the insulating material that separates the electrical windings from the generator steel core. This resistance can degrade over time or due to contaminants such as dust, dirt, oil, grease, and especially moisture. In most cases, failures of stator and rotor windings are due to a break down in the insulation. In many cases, a low insulation resistance is caused by moisture that collects while the generator is shut down. Problems caused by moisture buildup on the windings can usually be corrected by drying the windings. Cleaning and drying the windings can usually eliminate dirt and moisture that has built up in the generator windings.

The Megohmmeter

A megohmmeter consists of a meter calibrated in megohms and a power supply.

IMPORTANT NOTE: When testing stators and rotors, set the megohmmeter to 500 volts and apply voltage for a maximum of one second. Follow the megohmmeter manufacturer's instructions carefully. Do not exceed 500 volts or apply voltage longer than one second. Megohmmeter HIGH voltages could cause damage to other components on the generator. Take the proper precautions before testing.

Stator Insulation Tests

Introduction

Units with liquid-cooled engine and 1-phase stator windings are equipped with:

- Dual stator AC power windings*
- An excitation or DPE winding

Stator winding insulation tests consist of:

- testing all windings to ground,

- testing between isolated windings,
- testing between parallel windings.

Figure 1-3 represents the various stator AC output leads on 1 and 3-phase units with liquid-cooled engines.

* 3-phase units will have 3 stator AC power windings.

Test All Windings To Ground

1. Disconnect and isolate all stator leads.
2. Make sure all wire terminal ends are completely isolated from frame ground.
3. Connect the black tester probe to a clean frame ground on the stator can. Test each stator lead by

connecting the red test probe to the terminal end of each stator lead. Then, proceed as follows:

- a. Turn the switch OFF.
- b. Turn the tester switch ON and record the resistance indicated by the megger. After one second, turn the tester switch OFF.
- c. Repeat a and b for each lead.

If the resistance indicated is below the minimum resistance, clean and dry the stator. Then repeat the test. If resistance continues to be low during the second test, replace the stator assembly.

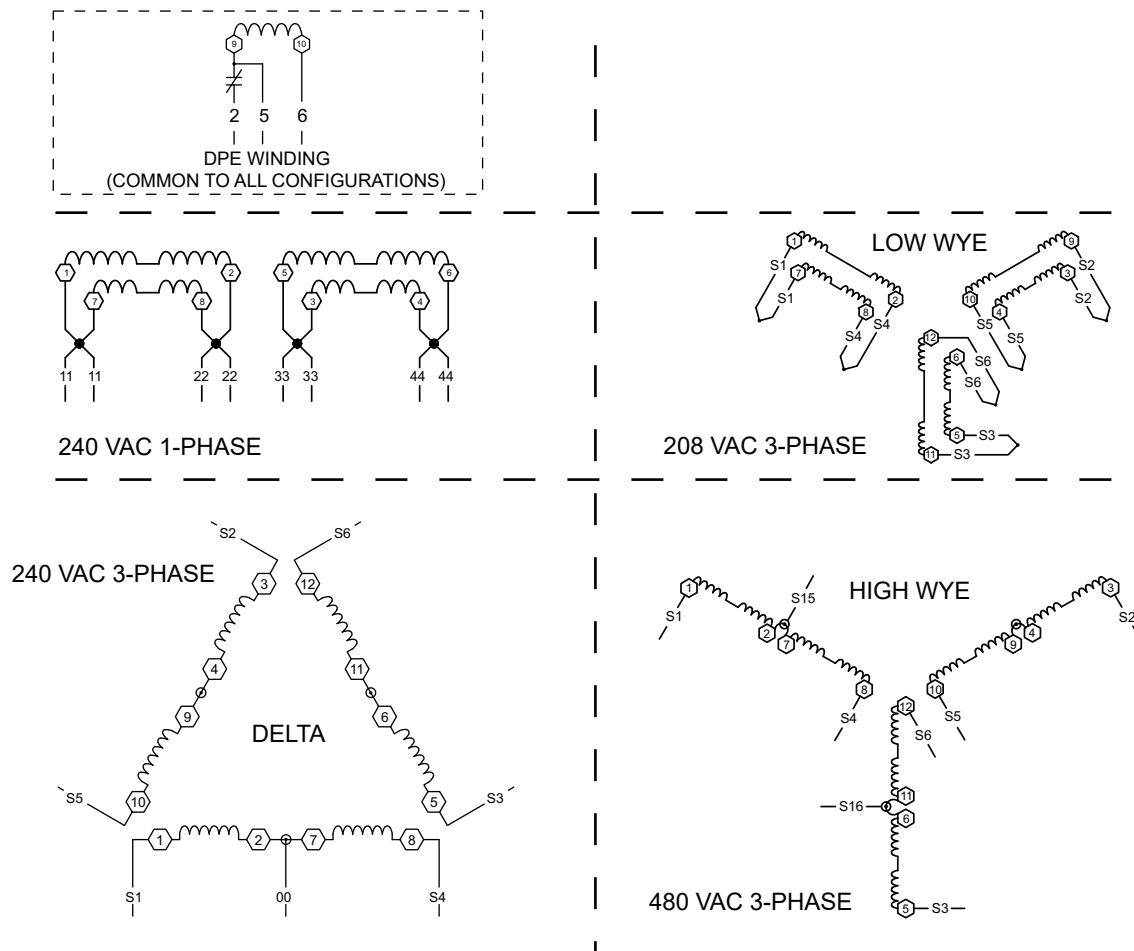


Figure 1-3. Stator Winding Leads (Liquid-Cooled Units)

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Test Between Isolated Windings

Each winding consists of two leads. Use the matrix below as an aid in connecting and testing all windings.

1. Connect red and black probes of the megohmmeter according to the matrix.
2. Isolate all lead ends from each other. Be sure that the leads at the other ends of the winding being tested do not touch each other or ground.
3. Turn the megohmmeter switch ON and record the resistance indicated by the megohmmeter.
4. Wait one second while observing the resistance lamp. **DO NOT EXCEED ONE SECOND.** After one second, turn the tester switch OFF.

Example: Connect the red test probe to stator lead 2, the black probe to stator lead 11. Then, repeat steps 2–4. Repeat for each pair of leads as shown in the matrix.

Lead	1-Phase	3-Phase
Red	2	2
Black	11	S1
Red	2	2
Black	33	S3
Red	11	2
Black	33	S5
Red		S1
Black		S3
Red		S1
Black		S5
Red		S3
Black		S5

If the resistance indicated during any of the tests does not meet the minimum resistance during any one second test, the stator should be cleaned and dried. After cleaning and drying, repeat the test. If the resistance indicated during the second test does not meet the minimum values, replace the stator assembly.

Testing Rotor Insulation



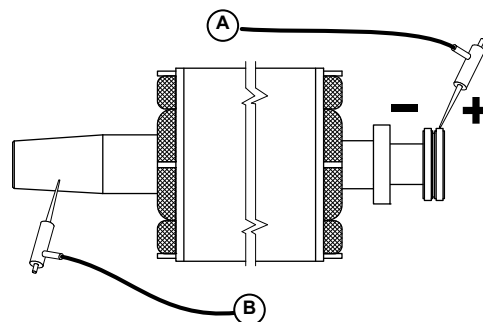
Equipment damage. Disconnect and isolate all winding leads. High megohmmeter voltages could cause equipment damage.

(000332)

Before attempting to test rotor insulation, remove the brush leads completely from the brushes or remove the brush holders completely. The rotor must be completely isolated from other components before starting the test.

1. Connect the red tester lead to the positive (+) slip ring (nearest the rotor bearing).
2. Connect the black tester probe to a clean frame ground, such as a clean metal part of the rotor.
3. Turn the tester switch OFF.
4. Turn the tester switch ON and measure and record the resistance indicated.
5. Observe the megohmmeter, then turn the tester switch OFF. **DO NOT APPLY VOLTAGE LONGER THAN ONE SECOND.**

If any resistance was indicated during the one second test, clean and dry the rotor. After cleaning and drying, repeat the insulation breakdown test. If breakdown lamp comes on during the second test, replace the rotor assembly.



A.Red Test Lead
B.Black Test Lead

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Figure 1-4. Testing Rotor Insulation

Apply a voltage of 500 volts across each rotor slip ring separately, and a clean frame ground (i.e. the rotor shaft).

IMPORTANT NOTE: When testing stators and rotors, set megohmmeter to 500 volts and apply voltage for a maximum of one second. Follow the megohmmeter manufacturers instructions carefully. Do not exceed 500 volts or apply voltage longer than 1 second. Megohmmeter HIGH voltages could cause damage to other components on the generator. Take the proper precautions before testing. **(first written in the Megohmmeter introduction heading)**

**Rotor Minimum Insulation Resistance:
1.5 Megohms**

Cleaning the Generator



Equipment damage. Never spray water to clean unit. Do not introduce water into generator windings, terminals, or fuel system during the cleaning process. Doing so will result in equipment damage. (000325a)

Caked or greasy dirt may be loosened with a soft brush or a damp cloth. A vacuum system may be used to clean up loosened dirt. Dust and dirt may also be removed using dry, low-pressure air of 25 psi (172.3 kPa) maximum.

Drying the Generator

Procedure

1. Open the generator main circuit breaker.

NOTE: Generator should have no electrical loads applied while drying.

2. Disconnect all wires so that the alternator is completely disconnected.
3. Provide an external source to blow warm, dry air through the generator interior (around the rotor and stator windings).

NOTE: Do not exceed 185 °F (85 °C).

4. Connect stator lead.
5. Start the generator and let it run for two or three hours.
6. Shut down the generator and repeat the insulation resistance tests.

Section 1.4 Evolution Menu System Navigation

Control Panel

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

NOTE: The control panel is intended for use by qualified service personnel only.

NOTE: To prevent possible injury that might occur during sudden starts, always set the control panel to OFF and remove the control panel fuse before working on or around the generator or transfer switch. For added security, place a DO NOT OPERATE tag or placard on both the control panel and transfer switch.

The control panel is located behind the viewing window at the rear of the unit.

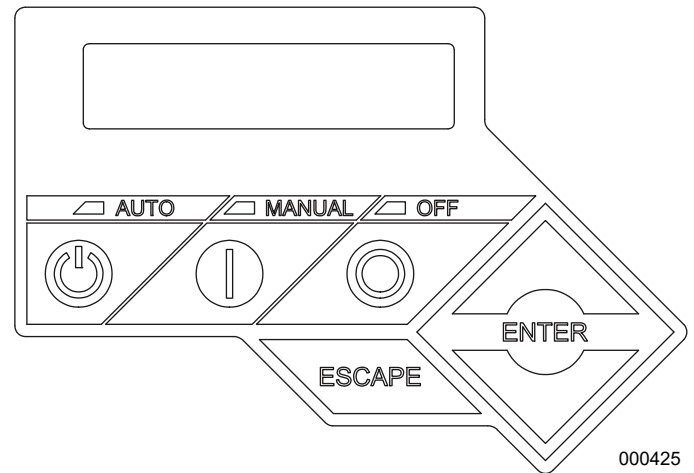


Figure 1-5. Generator Control Panel

AUTO/MANUAL/OFF Keypad

Feature	Description
AUTO	Press key to activate fully automatic operation. Green LED above key illuminates to confirm that system is in AUTO mode. Transfer to standby power occurs if utility power fails. Functionality of exercise timer is enabled, if set.
MANUAL	Press key to crank and start engine. Blue LED above key illuminates to confirm that system is in MANUAL mode. Transfer to standby power occurs if utility power fails. Functionality of exercise timer is disabled.
OFF	Press key to shut down engine, if running. Red LED above key illuminates to confirm that system is in OFF mode. Transfer to standby power does not occur if utility power fails.

LCD Screen and Navigation Keypad

Feature	Description
System Menus	
HOME Screen	The system returns to the home screen if no key is pressed within five minutes. The screen normally displays a status message, such as ready to run (AUTO mode) or switched to OFF (OFF mode), and the total hours of protection. If an active alarm/warning condition occurs, the associated alarm/warning message is displayed. To clear the alarm/warning message, press OFF on the control panel keypad followed by the ENTER key. In the event of multiple alarms/warnings, the next message is then displayed. The highest priority alarm is always displayed first.
MAIN MENU	Enables the operator to navigate the software using the up/down arrows, ENTER, and ESCAPE keys. The main menu can be accessed from any sub menu by consecutively pressing the ESCAPE key. Each time the ESCAPE key is pressed, the preceding menu is displayed. The main menu is reached when the system, date/time, battery, and sub menus are displayed.

Feature	Description
OFF	Press key to shut down engine, if running. Red LED above key illuminates to confirm that system is in OFF mode. Transfer to standby power does not occur if utility power fails.
Navigation Keys	
ESCAPE Key	Used to abort a routine or back up the preceding menu.
ENTER Key	Used to make a selection or save an entry.
Arrow Keys	Used to move forward or backward from menu to menu or to scroll forward and or backward (increment or decrement) through available selections.

Alarm/Warning Conditions

The owner/operator is alerted to alarm and/or warning conditions via the control panel LCD screen. All alarm conditions cause the generator to shut down. The warning messages alert the operator to conditions that do not disable the unit or require immediate correction.

The possible alarm/warning messages are listed below.

Alarm Messages		
High Engine Temperature	Controller Fault	Low Fuel
Low Oil Pressure	Governor Fault	Ruptured Basin
Overcrank	Wiring Error	Fuse Problem
Overspeed	Over Voltage	Overload
Rpm Sense Loss	Under Voltage	
Underspeed	Canbus Error	

Warning Messages		
Low Battery	Battery Problem	USB Warning
Exercise Set Error	Charger Warning	Download Failure
Low Fuel	Charger Missing AC	
Fuel Pressure	SEEPROM ABUSE	

NOTE: Unless properly trained to correct and clear alarm/warning conditions, contact an Independent Authorized Service Dealer (IASD) or trained service technician.

Security Access

Certain parameters within the EDIT menu on the controller are available only with a security access code. Security access codes are broken into two levels. Level I is used primarily during installation. Level II is for IASD's only, and allows a technician to program and setup a panel.

Entering Security Code

Use the panel keypad and press the buttons in the following order starting from the main menu:

Level I:

▲, ▲, ESC, ▼, ▲, ESC, ▲

Level II:

ESC, ▲, ▲, ▼, ▼, ESC, ESC

Extended EDIT Menu Options:

Items in bold are additional options available with each security access.

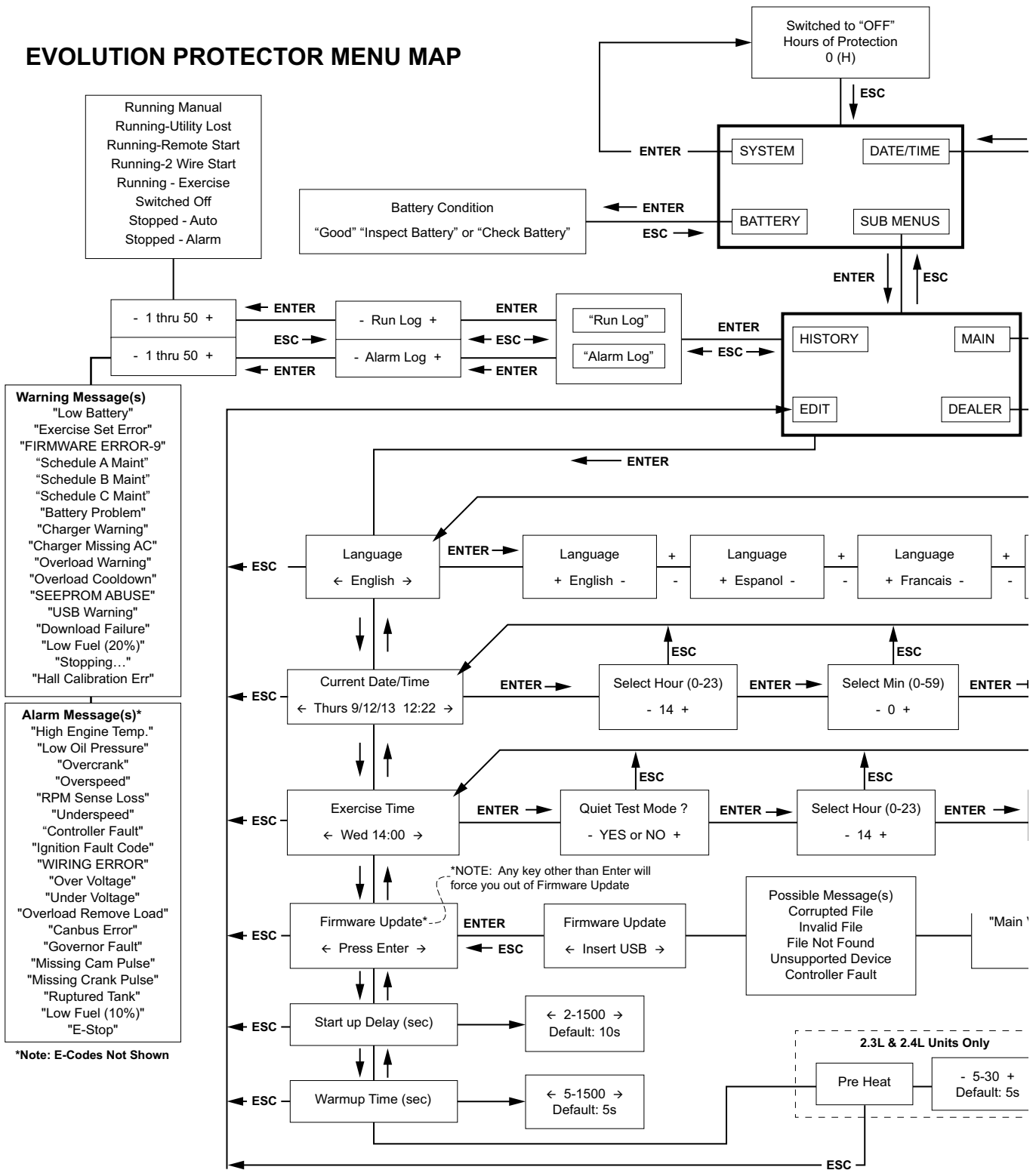
NOTE: Level II security code will grant access to all of Level I items.

Level and Level III: See menu map.

Programming

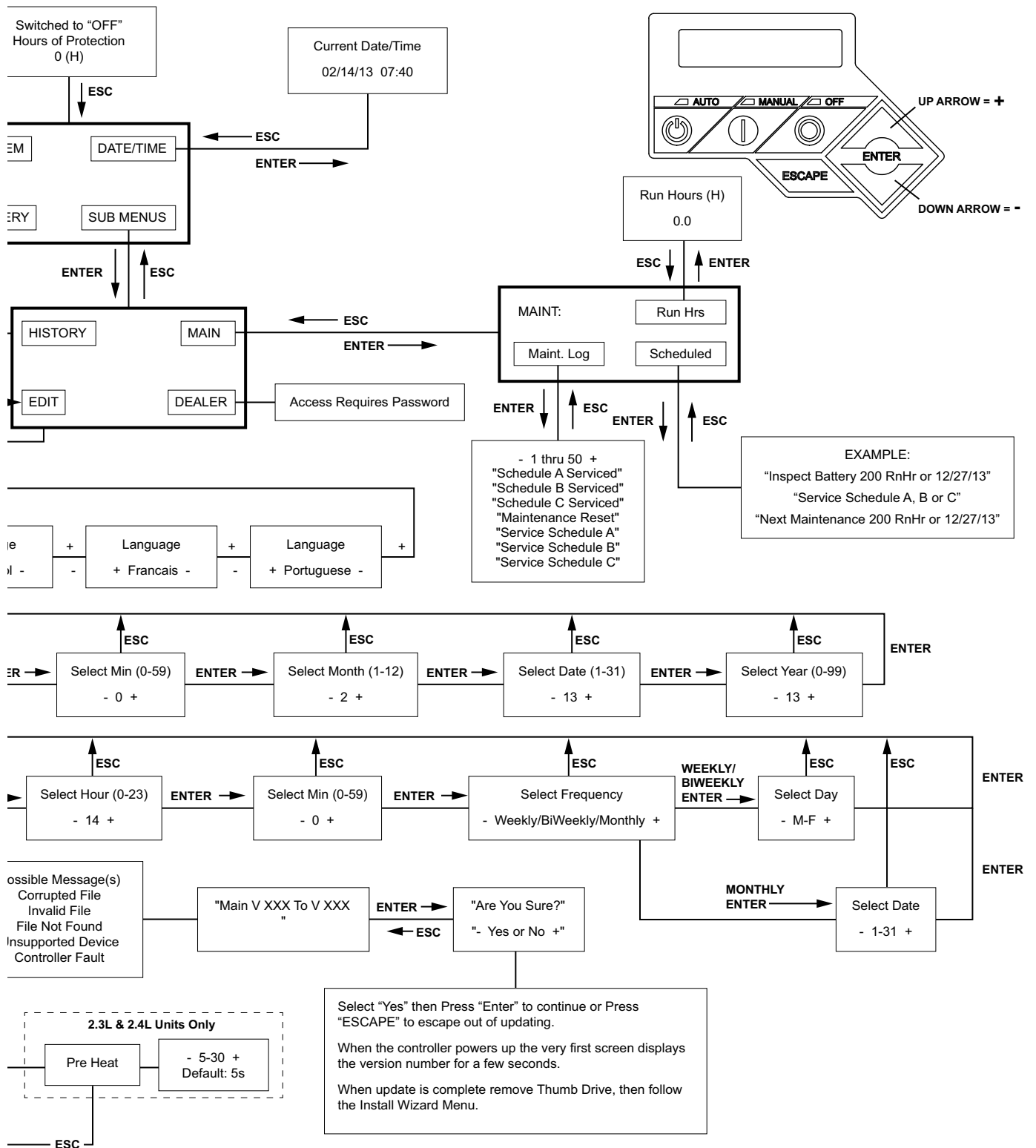
Each model of engine and voltage requires a unique set of parameters to ensure proper operation of the unit. These parameters are programmed using the V code and parameter group settings within the EDIT menu after a Level II security code has been entered. Refer to Section 4.1 ***Generator Adjustments*** for the procedure on programming the panel. Refer to Section 4.1 ***Generator Adjustments*** for V code and parameters groups. These settings are also available using the latest version of SIB10-11-NALL downloaded from GENservice.

EVOLUTION PROTECTOR MENU MAP



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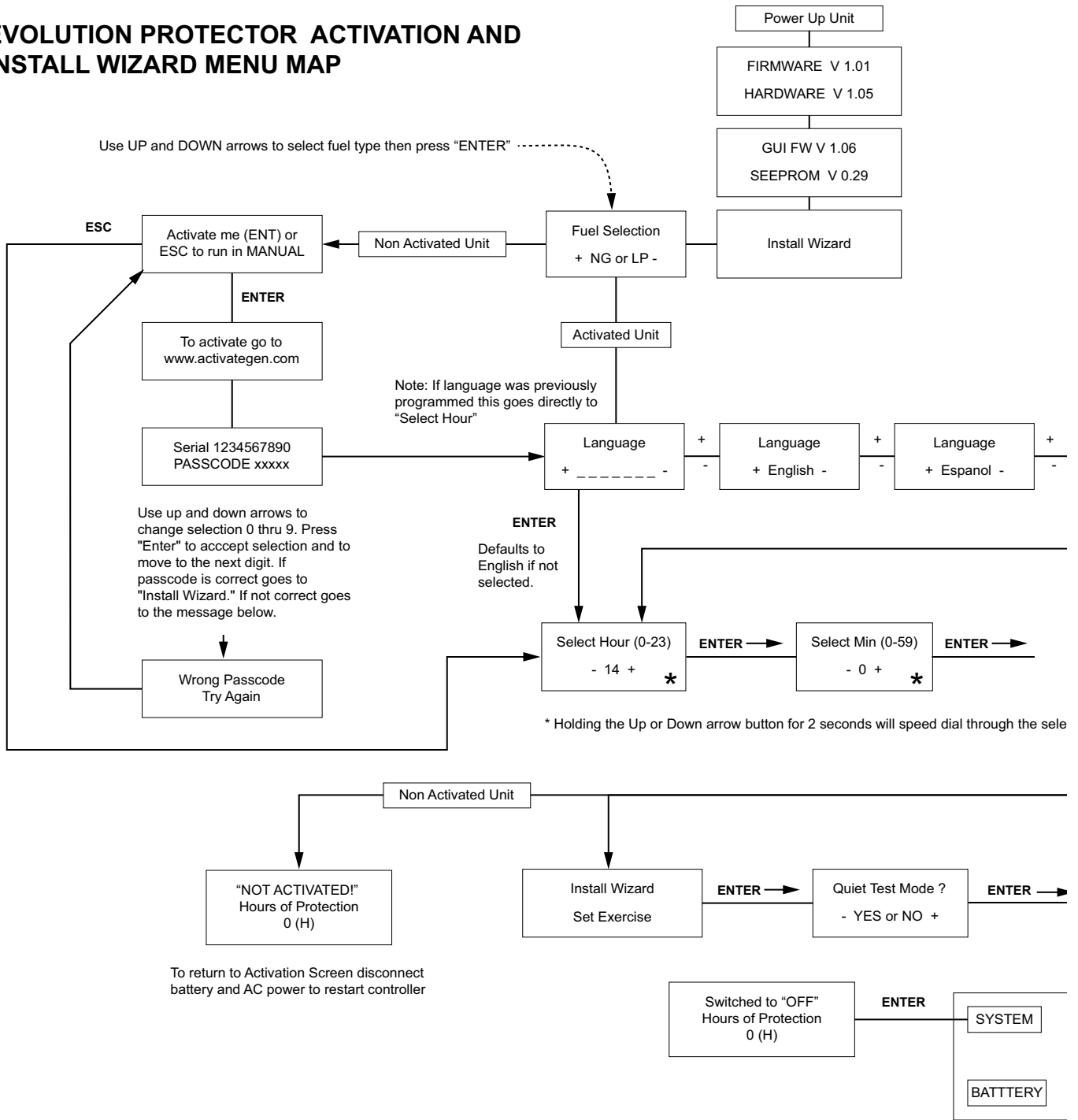
Figure 3-6. Main Menu Map



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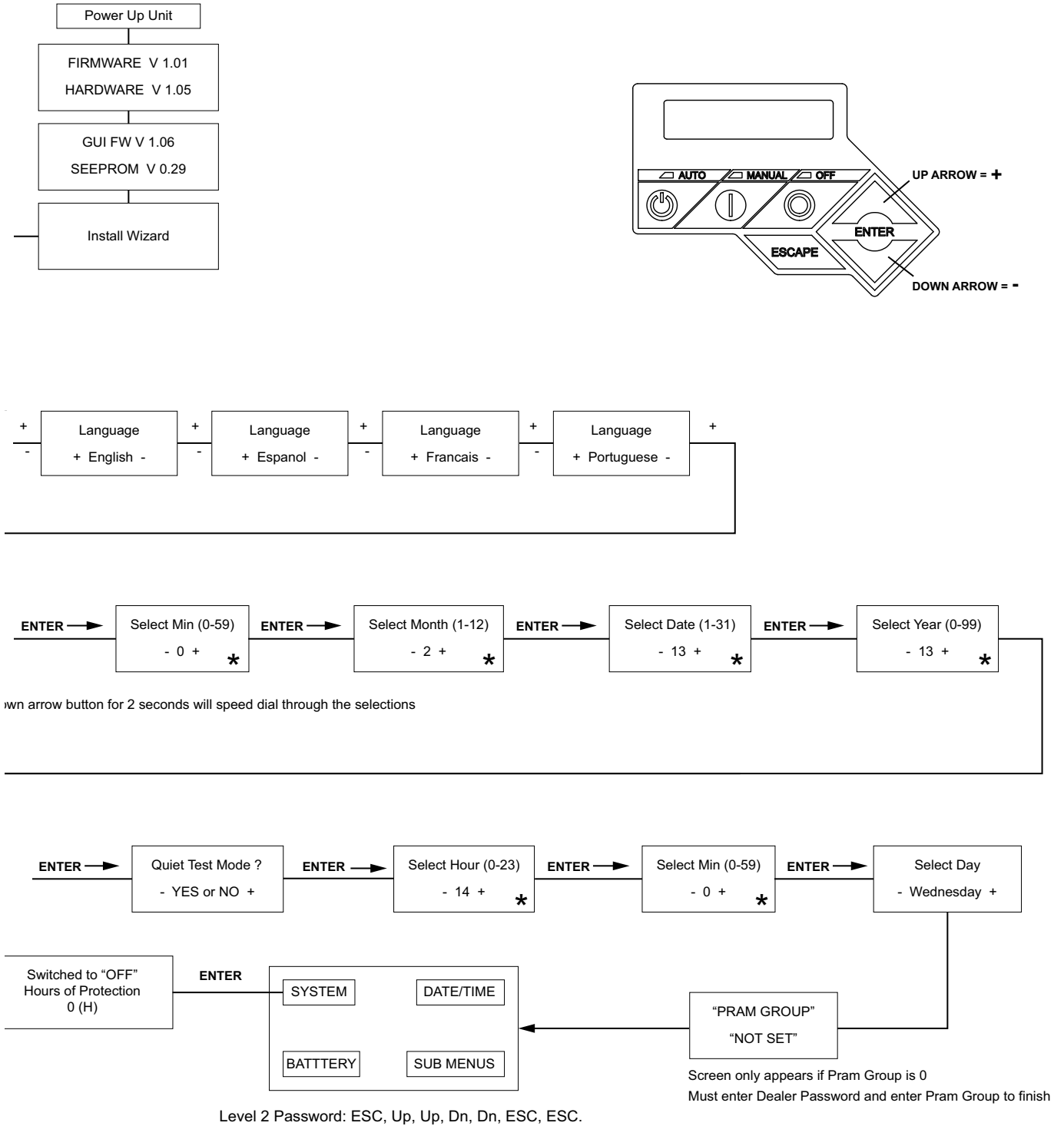
Figure 3-7. Main Menu Map

EVOLUTION PROTECTOR ACTIVATION AND INSTALL WIZARD MENU MAP



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Figure 3-8. Activation and Install Wizard Menu Map



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Figure 3-9. Activation and Install Wizard Menu Map

EVOLUTION PROTECTOR FIRMWARE MENU MAP

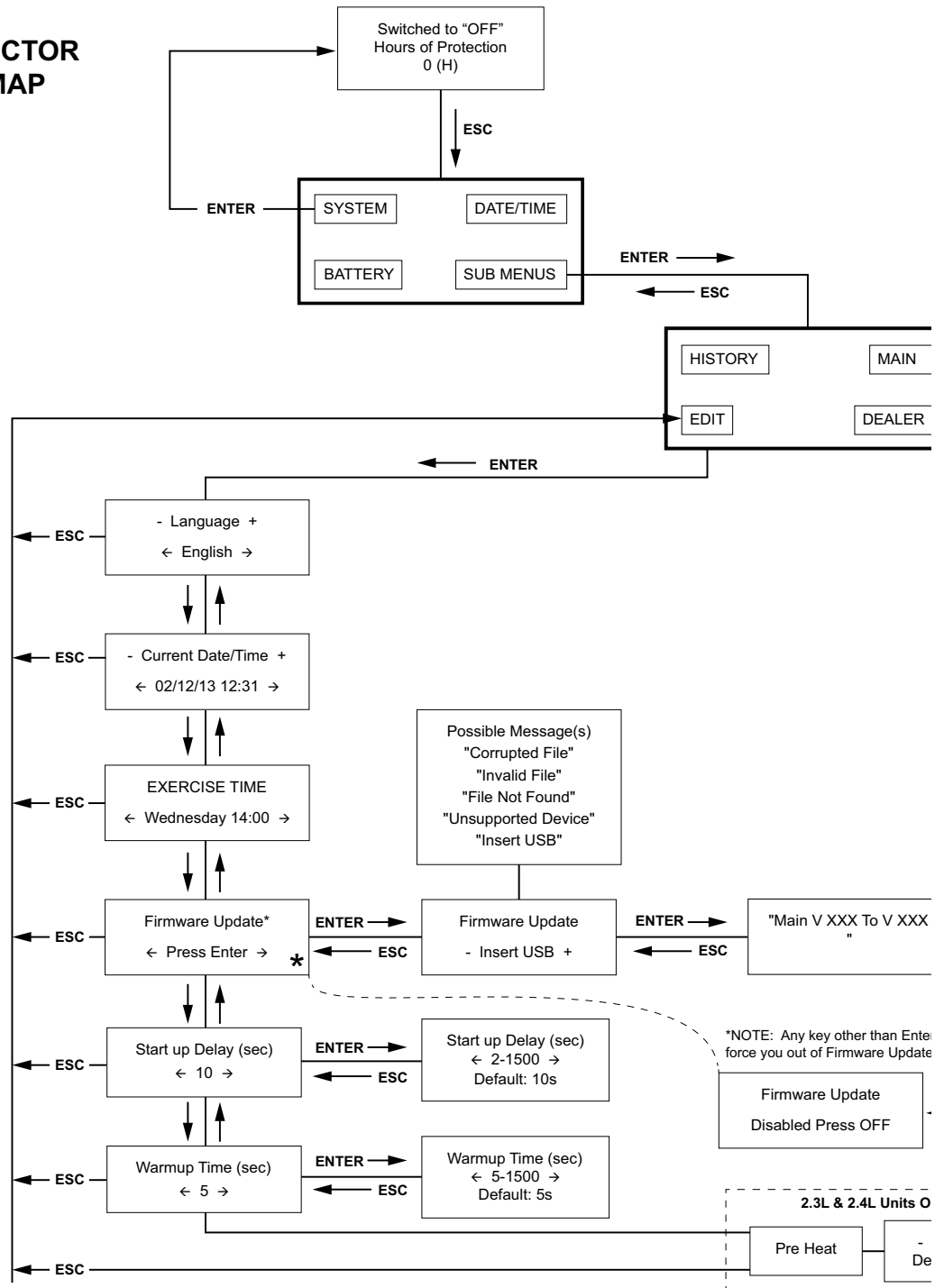


Figure 3-10. Firmware Menu Map

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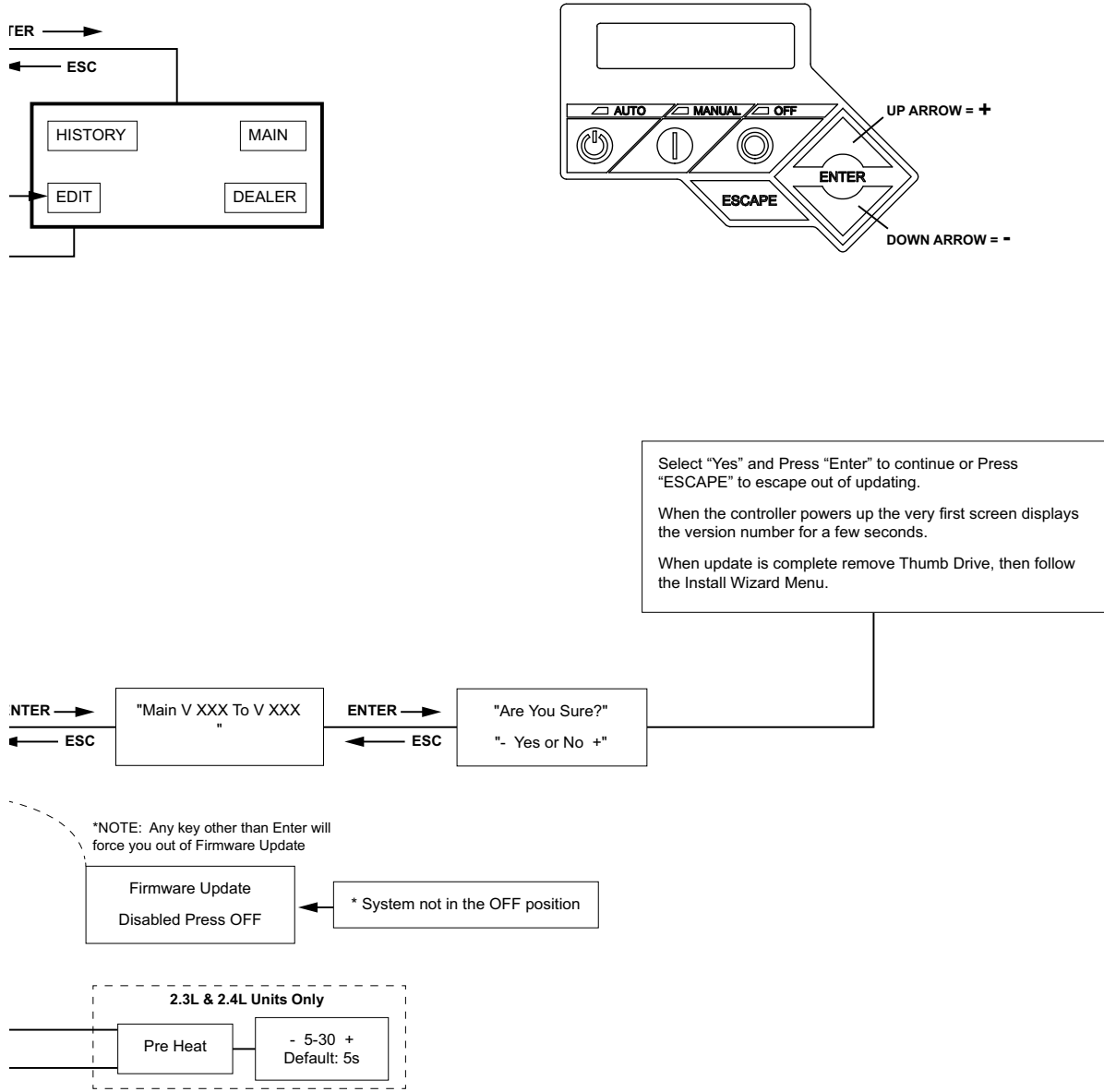


Figure 3-11. Firmware Menu Map

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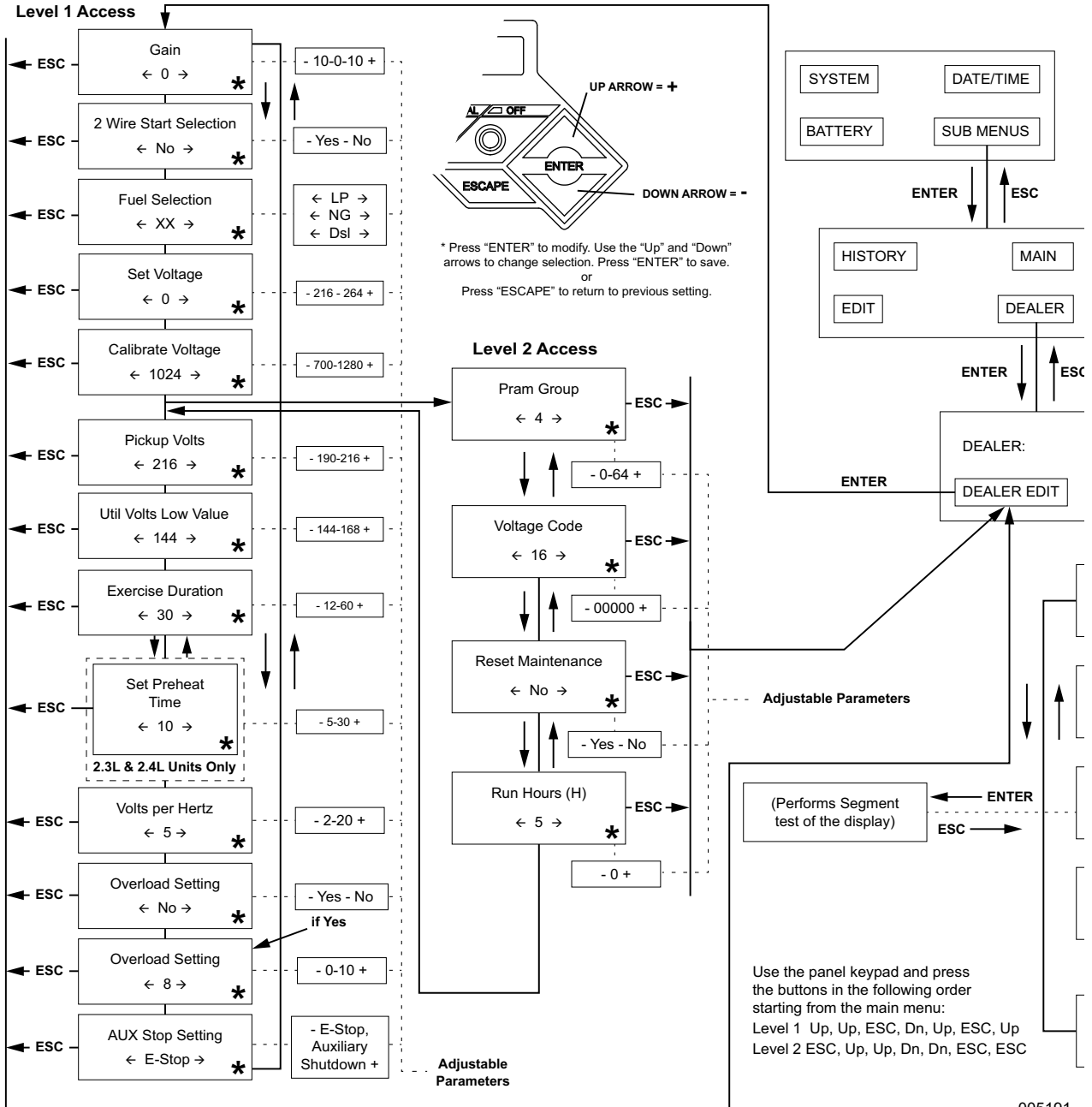
EVOLUTION PROTECTOR DEALER ACCESS MENU MAP

MAIN DISPLAY

Switched to "OFF"
Hours of Protection
0 (H)

Note: Unit needs to be activated to access the Dealer Menu.

To access Dealer Menu enter Password from MAIN DISPLAY:
Level 1 Up, Up, ESC, Dn, Up, ESC, Up.
Level 2 ESC, Up, Up, Dn, Dn, ESC, ESC.
After entering Password Select "SUB MENU" then "DEALER"



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Figure 3-12. Dealer Menu Map

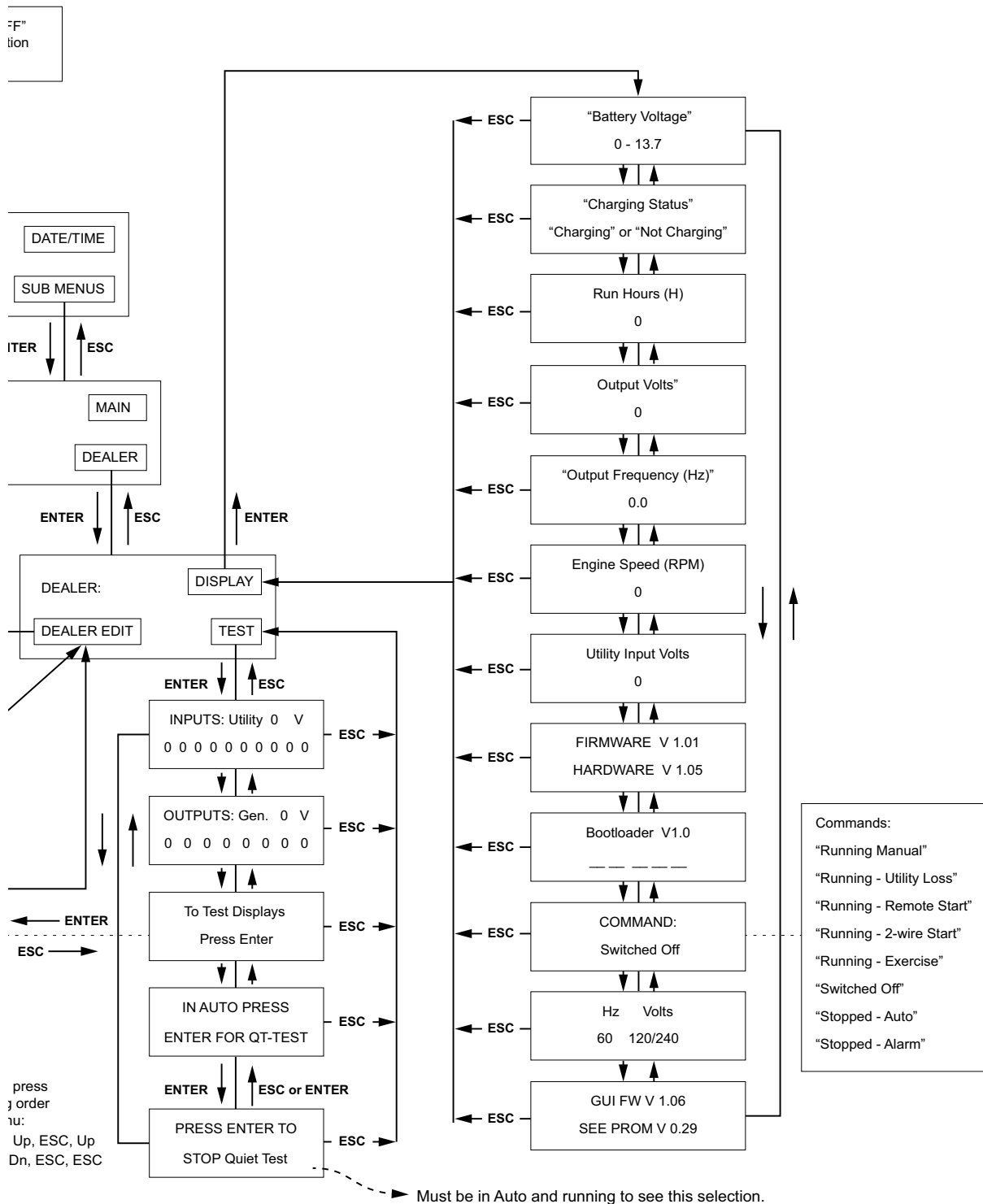


Figure 3-13. Dealer Menu Map

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Change Time and Date

To change the time and date after activation, see the Navigation Menu in [Figure 3-6](#) and [Figure 3-7](#). If power is lost (battery is disconnected/reconnected, control panel fuse is removed/installed, etc.), the display automatically prompts the user for the time and date. All other information is retained in memory.

Programmable Timers

Dealer Programmable

Exercise Duration—A programmable exercise duration time is provided. In AUTO mode, the engine starts and runs once each week at the time and day specified. During the exercise cycle, the unit runs approximately 12–60 minutes (adjustable selection, default time is 12 minutes) during the exercise period.

NOTE: A dealer password is required to change the exercise duration.

User Programmable

Start-Up Delay Timer—A programmable line interrupt delay (or start-up delay) timer is provided. When utility voltage fails (falls below 60% of nominal), the start-up delay timer is started. The timer is reset if the voltage rises above the utility volts low threshold. The unit cranks and starts if the utility voltage remains below the threshold during the duration of the timer.

NOTE: The factory default setting is five seconds, but is adjustable from 2–1500 seconds.

Warm-Up Delay Timer—A programmable warm-up delay timer is provided. The warm-up timer is started as soon as the generator starts. The control transfers load to the generator (through the transfer switch) if the utility voltage is less than 80% of nominal when the warm-up timer expires. The load is not transferred to the generator if utility voltage is greater than the threshold at expiration of the warm-up time, and a cool-down period begins. The generator stops at the end of the cool-down period.

NOTE: The factory default setting is five seconds, but is adjustable from 5–1500 seconds.

Programmable Limits

Gain—The Evolution control panel has an adjustable gain setting. This adjustment allows gain to be adjusted $\pm 10\%$ from the factory set base line. Gain can be adjusted if fuel issues cause instability in the speed regulation. Too much gain the unit will become unstable and have a fast hunt, too little gain and the speed will “drift” around the set point. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

2-Wire Start Selection—The Evolution control panel has a selectable 2-wire start. The unit will work with transfer switches that have the 2-wire start feature if 2-wire start is selected. 2-wire start can be selected with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu. The utility sensing feature, the exercise feature, and all other features used for the RTS type switches will be disabled when this is selected.

NOTE: The 120 volt battery charge circuit must be powered from the load side of the transfer switch when 2-wire start is selected.

Fuel Selection—This allows the selection of natural gas (NG) or liquid petroleum (LP). If the unit is equipped with a diesel engine, diesel will be the only selection. This can be selected with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Set Voltage—This allows the adjustment of the unit's output voltage. The output voltage can adjusted $\pm 10\%$. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Calibrate Voltage—This allows the display voltage (on the generator control panel) to be calibrated to the units actual voltage output. A meter that is in sound operating condition and is within its yearly calibration must be used to verify the unit's output voltage. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Pickup Volts—The voltage level that utility must return to. Once this has been met it will initiate the return to utility timer. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Utility Volts Low Value—The voltage level that utility must drop below to initiate the startup delay timer. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Exercise Duration—This allows the duration of the exercise cycle to be adjusted between 12–60 minutes. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Set Pre-Heat—This will allow the pre-heat time to be adjusted from five seconds to 30 seconds on units equipped with pre-heaters. This can be adjusted with a Level 1 or Level 2 password sequence entered to gain access to the dealer level menu.

Pram Group—Allows engine parameter group to be selected. Must match engine size and kW output. This can be set with a Level 2 password sequence entered to gain access to the dealer level menu.

Voltage Code—Allows voltage code to be selected. Must match voltage output and kW output. This can be set with a Level 2 password sequence entered to gain access to the dealer level menu.

NOTE: For detailed voltage code definitions refer to Service Bulletins SIB10-11-NALL (Nexus) and SIB14-14-ELIQ (Evolution).

Reset Maintenance—This will reset all maintenance timers. This can be set with a Level 2 password sequence entered to gain access to the dealer level menu.

Run Hours (H)—This will allow hours to be added to the panel in the case of panel replacement. This can be set with a Level 2 password sequence entered to gain access to the dealer level menu.

Volts Per Hertz Adjustment—The frequency roll off point at which the generator voltage will start to decrease. This decrease in voltage reduces the load on the engine and allows the engine to recover from heavy and sudden load application. The frequency roll off point is between 59 and 57 Hz (this is unit specific). The voltage per Hz drop adjustment is between 2–20 volts per Hz.

When the unit is hit with a heavy load that causes the frequency to drop below the roll off point, the voltage regulator will drop voltage as per the volts per hertz set

point. When the unit starts to recover from the load hit, the voltage regulator will bring the voltage up to the set voltage level once the frequency starts to recover.

Overload Setting—The controller is equipped with a hall effect sensor that monitors the field excitation power supplied to the rotor by the voltage regulator. When maximum power exceeds the adjustable set point, the controller will momentarily lower the units frequency to approximately 55 Hz (for a 60 Hz unit) before returning to normal frequency. If the overload is still present the controller will shut the unit down and the user interface will display an overload condition. This will require a hard reset.

There are two settings—ON or OFF. If the setting is OFF, overload will have no effect. If the setting is ON the set point can be adjusted. The range of adjustment is from 0 (50% of units rated load) to 10 (100% of units rated load). If load management modules are used this will force the modules into load shed function.

Dealer Tests

"INPUTS: Utility XXX V" "1 2 3 4 5 6 7 8 9 10"		
XXX = Utility Input Voltage		
1 = Low fuel	0 = Fuel below 5 in	1 = Fuel pressure good
2 = Low coolant	0 = Coolant level good	1 = Low coolant
3 = Low oil pressure	0 = Good oil psi (kPa)	1 = Oil pressure below 8 psi (55 kPa)
4 = E-Stop	0 = E-Stop activated	1 = E-Stop good (not activated)
5 = Ruptured basin	0 = No fuel	1 = Fuel in rupture basin
6 = Wiring error	0 = Wired correctly	1 = Wired incorrectly
7 = 2-Wire start	0 = No 2-wire start	1 = 2-Wire start active
8 = Off button	0 = Not in OFF	1 = In OFF
9 = Auto button	0 = Not in AUTO	1 = In AUTO
10 = Manual button	0 = Not in MANUAL	1 = In MANUAL

"OUTPUTS"		
1 = Air/fuel relay	0 = Not energized	1 = Energized
2 = Bosch enable	0 = Actuator not energized	1 = Energized
3 = Alarm relay	0 = No alarm	1 = Alarm active
4 = Battery charge relay	0 = Not charging	1 = Charging
5 = Fuel relay	0 = Not energized	1 = Energized (fuel on)
6 = Starter relay	0 = Not energized	1 = Energized (cranking)
7 = Fuel enrichment relay	0 = FS2 not energized	1 = FS2 on
8 = Transfer relay	0 = 23 Not grounded	1 = Wire 23 grounded

USB Port for Firmware Updates

A USB port is located beneath the rubber flap on the control panel, and is provided for firmware updates. Firmware updates must be performed by an IASD.

NOTE: The USB port is intended for use with a USB thumb drive only. The USB port is not intended for charging devices such as phones or laptops. **Do not connect any consumer electronics to the USB port.**

Battery Charger

NOTE: The battery charger is integrated into the control panel module.

The battery charger ensures:

- Output is continually optimized to promote maximum battery life.
- Charging levels are safe.

NOTE: A warning message is displayed on the LCD screen when the battery requires service.

Transfer Switch Automatic Operation

In AUTO, the generator starts automatically when utility source voltage drops below the preset level. Loads are transferred to the standby power source once the unit starts.

Proceed as follows to select automatic operation:

1. Verify that the transfer switch main contacts are set to the UTILITY position (loads connected to the utility power source).

2. Verify that normal utility power source voltage is available to transfer switch terminal lugs N1, N2, and N3 (if three phase).
3. Set the main circuit breaker switch on the control panel to ON (Closed).
4. Press the AUTO key on the control panel keypad. The green LED above the key illuminates to confirm that the system is in the AUTO mode.

Automatic Sequence of Operation

Utility Failure—If the control panel keypad is set to AUTO when the utility power fails (falls below 60% of nominal, dealer programmable), a ten second start-up delay timer is started (user programmable). If utility power is still absent when the time expires, the engine cranks and starts.

Once started, a five second engine warm-up delay timer starts (user programmable). When the time has elapsed, the load is transferred to the generator. If utility power is restored (above 80% of nominal, dealer programmable) between the time the engine is first started and expiration of the warm-up time, the controller completes the start cycle and then runs through its normal cool-down cycle (while the load remains on the utility source throughout the episode).

Cranking—The cyclic cranking is controlled as follows:

15 seconds crank, seven seconds rest, seven seconds crank, seven seconds rest; this sequence is repeated for a total of six crank cycles.

Load Transfer – With the generator running, the transfer of load is dependent upon the operating mode as shown in the chart below.

AUTO	<ul style="list-style-type: none"> • Starts and runs if utility power fails (falls below 60% of nominal) for five consecutive seconds (adjustable). • Starts a five second (adjustable) engine warm-up timer. • Does not execute transfer if utility power returns before expiration of warm-up timer (but finishes the warm-up and cool-down cycles). • Transfers back to utility once utility power returns (above 80% of nominal) for 15 consecutive seconds. • Only shuts down if the OFF key is pressed or an alarm shutdown occurs. • Once utility power returns, starts a cool-down cycle before it shuts down. <p>NOTE: Cool-down cycle is five minutes if turbocharger equipped, one minute if naturally aspirated.</p>
	<p>EXERCISE</p> <ul style="list-style-type: none"> • Only works in the AUTO mode. • Does not exercise if generator is already running in AUTO. • During exercise cycle, transfers only if utility power fails for 10 consecutive seconds.
	<p>Engine cranks and runs even if utility power is present, but does not transfer to generator.</p> <p>Transfers to standby if utility fails (falls below 60% of nominal) for 10 consecutive seconds.</p> <p>Transfers back to utility when utility returns for 15 consecutive seconds. The engine continues to run until the AUTO or OFF key is pressed.</p>
MANUAL	<p>Engine cranks and runs even if utility power is present, but does not transfer to generator.</p>
	<p>Transfers to standby if utility fails (falls below 60% of nominal) for 10 consecutive seconds.</p>
	<p>Transfers back to utility when utility returns for 15 consecutive seconds. The engine continues to run until the AUTO or OFF key is pressed.</p>

Section 1.5 Nexus Menu System Navigation

Nexus Navigation

Press the ESCAPE button one or more times to get to the main menu from any other display. The main menu is shown in [Figure 1-15](#). There are four sub menus, each with its own set of sub menus. The menu system diagram is shown in [Figure 1-24](#).

There are four selection and navigation buttons below the display. The ESCAPE button moves the display back toward the main menu. The ENTER button is used to activate a menu or accept a value when it is changed. The UP and DOWN arrow buttons perform different functions depending on which screen of a menu is visible.

- They can move the flashing cursor to the next choice (the menu to be selected will flash on and off).
- They can act as left and right arrows to move between the various edit menus.
- Within a menu they can increase or decrease a value or change the choice (i.e. from Yes to No).

See [Figure 1-24](#) for the basic menu system diagram.



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Figure 1-14. Nexus Display and Navigation Buttons

Main Menu

There are 4 selections in the main menu: History, Status, Edit, and Debug.



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Figure 1-15. Nexus Display Main Menu

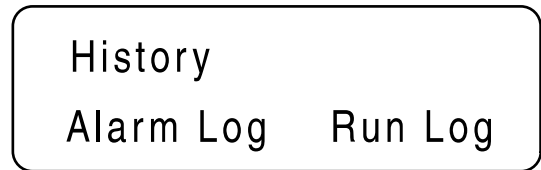
History

The history menu will display two history logs: Alarm Log and Run Log.

- **Alarm Log**—Displays the last 50 alarm conditions. They are in date time order, numbered 1–50; 1 is the most recent. Use the up and down arrow

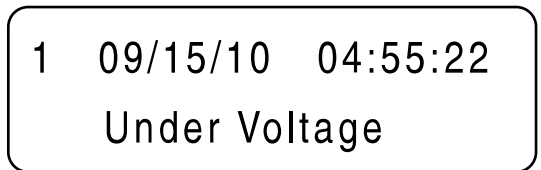
buttons to move from alarm to alarm. Each alarm lists the date, time of trigger, and a description of the alarm.

- **Run Log**—Displays the last 50 run events. It will display the date and time as well as a brief description of the event; for instance Running – Utility Lost; Stopped – Auto.



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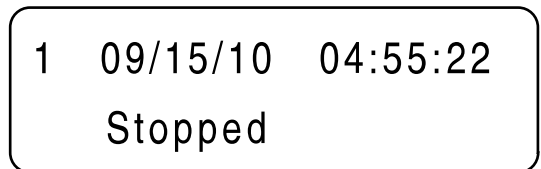
Figure 1-16. History Menu



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Figure 1-17. Alarm Log Display

Use the up and down arrow buttons to move from the most recent alarm (1) to the oldest (50).



003048

Figure 1-18. Run Log Display

Use the up and down arrow buttons to move from the most recent Run event (1) to the oldest (50).

Status

The status menu will display four choices: state, display, command, and versions. Use the up and down arrow buttons to move the flashing cursor to the next choice.

- **State**—Displays the current state of the panel along with the current date, time, and day. See [Figure 1-24](#) for the complete list of possible status messages which will be displayed.
- **Command**—Displays the current command. See [Figure 1-24](#) for the list of possible commands which will be displayed.
- **Versions**—Displays the version of software and hardware of the panel.
- **Display**—Provides up to five generator parameters: run hours, rpm, Hz, battery, and hours under load (if enabled).

- **Run hours**—Displays the total number of hours the generator has run (in 0.0 Hours format)
- **Rpm**—Displays the engine speed (in rpm)
- **Hz**—Displays the generator output frequency (in 0.0 Hz format)
- **Battery**—Displays the battery voltage (i.e. 12.9V)

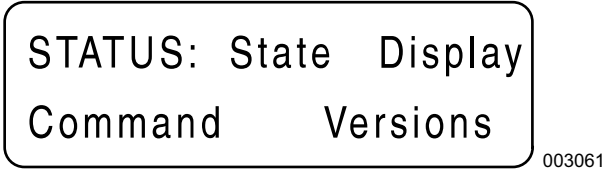


Figure 1-19. Status Menu

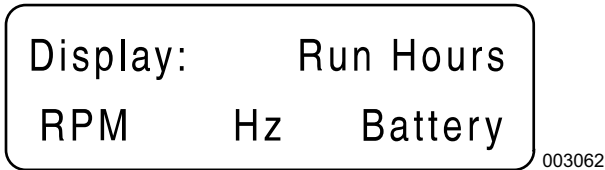


Figure 1-20. Display Menu

Edit

Provides the means to edit five of the operating parameters of the unit: exercise time, current time, frequency, language, startup delay, and reset maintenance. Go to the edit menu and press the ENTER button to access the editing screens—one of the above menus will appear. Use the up and down arrow buttons to move from menu to menu.

Press the ENTER button to select the desired menu. Use the up and down arrow buttons to change the value. Press the ENTER button to select the desired value. Press the ESCAPE button to back out of a choice without changing the value.

- Exercise time will go through four selections: quiet test mode (yes/no), select hour, select minute, and select day. The unit will be programmed to perform a weekly exercise when selections are completed.
- Current time will go through five selections: select hour, select minute, select month, select date, select year. The current time must be set to enable the exercise and maintenance functions of the panel.
- Frequency is not enabled at this time.
- Language provides three choices; English, Francais, and Espanol.
- Startup delay provides a way to change the time delay between when utility fails and when the Generator starts and transfers. It is adjustable from 10 to 30 seconds.
- Reset maintenance will reset the maintenance warning clock.

NOTE: Some parameters are protected and require a password to be entered. See [Security Access](#) .

Debug

Debug provides four test tools integral to the control panel: inputs, outputs, display, and QT-test.

- **Inputs**—Provides a display of the eight input channels that the control panel monitors. See [Table 1-1](#) for the list of inputs the control panel monitors. Each input represents an open or closed set of contacts, and will display either a 0 or 1 character. The 0 character represents an open contact; a 1 character represents a closed contact.
- **Outputs**—Provides a display of the status of the output relays the control panel uses to make things happen (like crank and run and transfer). See [Table 1-1](#) for the list of output channels. Each channel represents a relay with a character of either 0 or 1. The 0 character represents a relay that is de-energized (OFF); a 1 represents a relay that is energized (ON).
- **Display**—Provides two flashing bars that test the display LEDs. As the bars flash on and off bad areas become readily apparent. If an area does not turn on it means those LEDs are not working. The control panel requires replacement to correct a bad display.
- **QT-Test**—Provides a way to test the quiet test mode of the generator. When tested, the generator will run at a lower rpm during the test. Note that for the unit to perform an actual weekly quiet test exercise, it must be enabled in the exercise time editing menu.

NOTE: Output voltage will be lower than normal voltage during QT-Test.

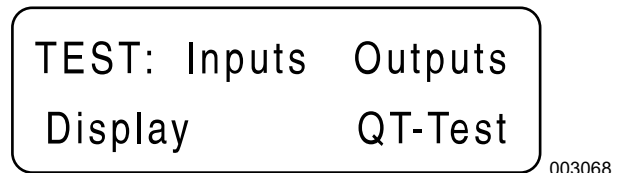


Figure 1-21. Debug Menu

Inputs are numbered from left to right (1-8).

0 indicates an input is OFF.

1 indicates an input is ON.

For instance, in [Figure 1-22](#) inputs 1 and 7 are ON (low oil pressure and the auto switch).

This indicates the unit is shut down and in AUTO mode.

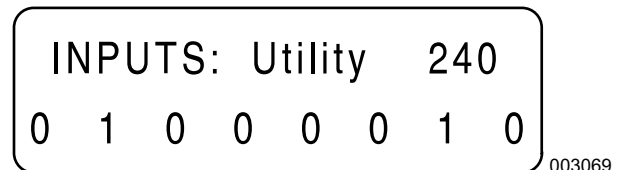


Figure 1-22. Test Inputs Display

Outputs are numbered from left to right (1-8).

0 indicates the Output is OFF.

1 indicates the Output is ON.

For instance, in **Figure 1-23** there are no outputs ON which indicates the unit is shut down.

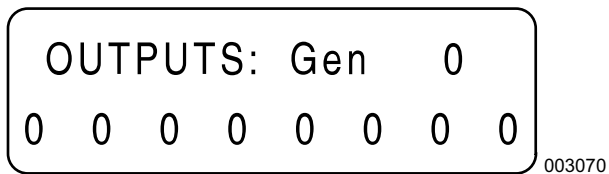


Figure 1-23. Test Outputs Display

Table 1-1. Digital Inputs and Outputs

Position	Digital Inputs	Digital Outputs
1	Low oil pressure	Air/fuel relay
2	Not used	Bosch enable
3	Low coolant level	Alarm relay
4	Low fuel pressure	Battery charge relay
5	Wiring error	Fuel relay
6	2-Wire start	Starter relay
7	AUTO position	Cold start relay
8	MANUAL position	Transfer relay

Security Access

Certain parameters within the EDIT menu on the controller are available only with a security access code. Security access codes are broken into two levels. Level I is used primarily during installation. Level II is for IASD's only, and allows a technician to program and setup a panel.

Entering Security Code

Use the panel keypad and press the buttons in the following order starting from the main menu:

Level I:

▲, ▲, ESC, ▼, ▲, ESC, ▲

Level II:

ESC, ▲, ▲, ▼, ▼, ESC, ESC

Extended EDIT Menu Options:

Items in bold are additional options available with each security access.

NOTE: Level II security code will grant access to all of Level I items.

Level I:

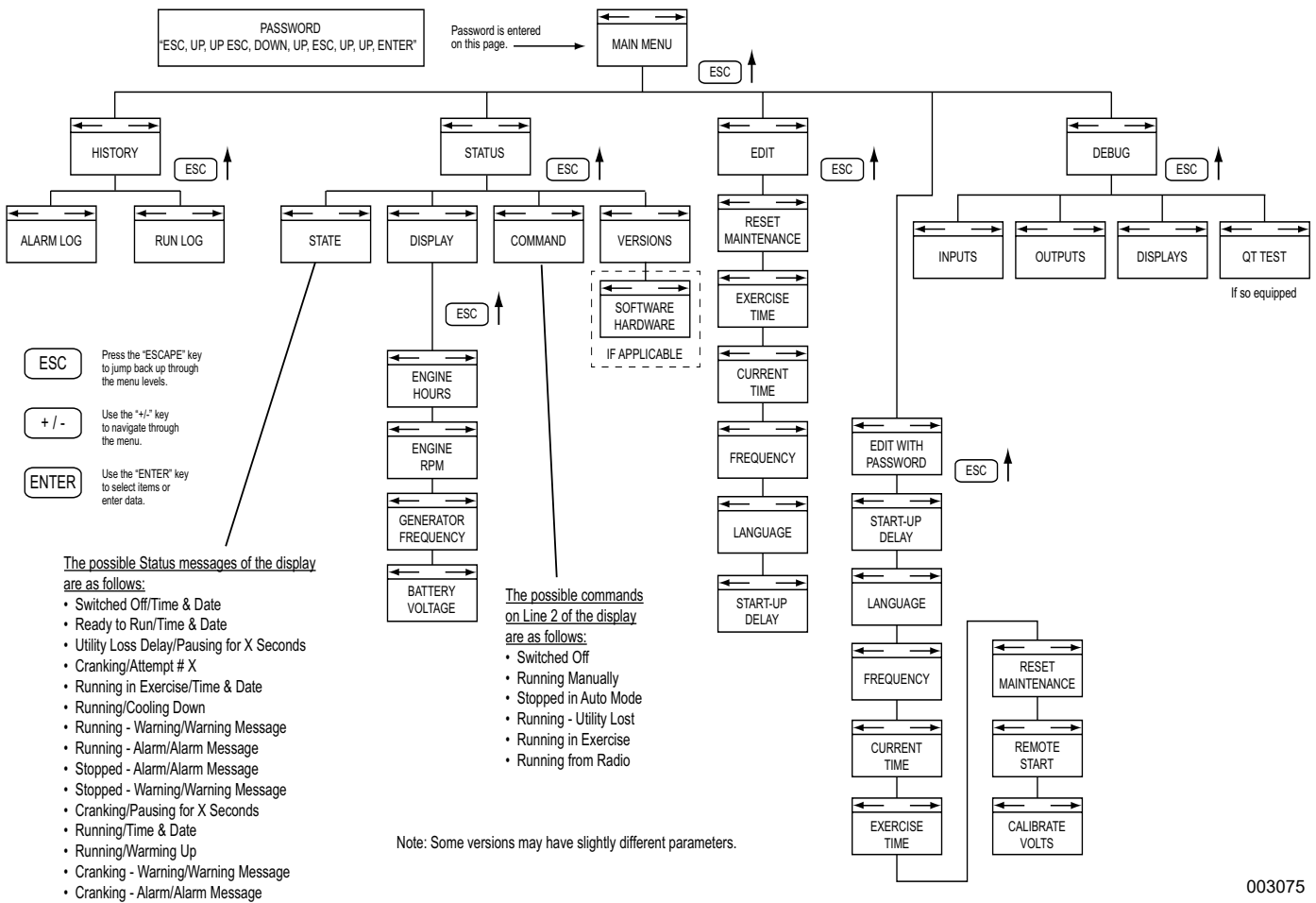
Exercise Time, Current Time, Language, **Calibrate Voltage, Switch Type, Pickup Volts, Startup Delay, Fuel Type**, Reset Maintenance.

Level II:

Exercise Time, Current Time, Language, **V Code, Parameter Group, Calibrate Volts, Switch Type, Pickup Volts, Startup Delay, Fuel Type**, Reset Maintenance.

Programming

Each model of engine and voltage requires a unique set of parameters to ensure proper operation of the unit. These parameters are programmed using the V code and parameter group settings within the EDIT menu after a Level II security code has been entered. Refer to Section 4.1 **Generator Adjustments** for the procedure on programming the panel. Refer to Section 4.1 **Generator Adjustments** for V code and parameter groups. These settings are also available using the latest version of SIB10-11-NALL downloaded from GENservice.



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Figure 1-24. Menu System Diagram

Section 1.6 General Troubleshooting Guidelines

Introduction

This section familiarizes the service technician with recommended procedures for testing and evaluating various problems that can occur on liquid-cooled home standby products. Become familiar with these guidelines before attempting to troubleshoot any of the three main generator components: AC generator, liquid-cooled engine, transfer switch.

Troubleshooting flow charts provide the simplest and quickest means of troubleshooting typical problems that might occur on liquid-cooled home standby products. Performing the appropriate tests as indicated by the flow charts will help identify faulty components and systems. The components or systems can be repaired or replaced as necessary once identified.

The test procedures in each section require a basic knowledge of electricity and electrical safety, hand tool skills, and use of multimeters.

Testing and troubleshooting methods covered in this manual are not exhaustive. No attempt has been made to discuss, evaluate, or advise the home standby service trade of all conceivable ways in which service and trouble diagnosis must be performed. Any test method not recommended herein must be deemed safe for personnel and equipment.

Recommended Tools

In addition to standard hand tools, some test procedures require the use of specialized test equipment as follows:

- A meter that measures AC voltage and frequency, DC voltage and current, and has the ability to record minimum and maximum values. Digital multimeters (DM) are recommended.
- Standard meter test leads, and appropriate testing probes.

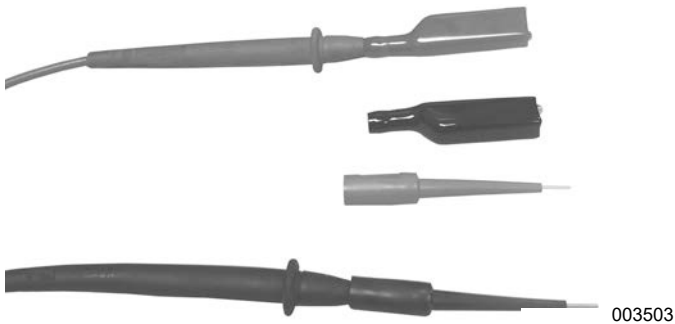


Figure 1-25. Test Probes

NOTE: The manufacturer carries a set of flexible pin leads (P/N 0J09460SRV) for use with AMP connector plugs. These can also be used and are recommended for back probing MOLEX (white) connectors. Optionally, but

least recommended, the manufacturer also carries a set of acceptable piercing probes (P/N 0G7172). Other suppliers piercing probes may be used. Fluke also provides a high quality piercing probes (P/N AC89).

Liquid-Cooled Engine Troubleshooting Requirements

- A manometer which measures low pressure in inches of water column (inch WC or in H₂O).
- An ignition spark tester (P/N 0C5969).
- Mag Pickup Test Kit (P/N 0G41800SRV)

Recommended Tools Check List

- General mechanics tool box
- A meter capable of measuring frequency (Hz), AC and DC volts, DC amps, and Ohms
- A clamp-on ammeter
- A 1/4" and 3/8" metric and SAE socket set
- Allen wrenches (metric and SAE)
- Manometer
- Spark tester
- Compression gauge
- Oil pressure gauge
- Leak down tester

Troubleshooting Reminders and Tips

The most important step in troubleshooting is to correctly identify the problem. Use the history capability of the Evolution panel to help identify what the panel is seeing. Use the alarm log to view the faults that caused the warning or alarm shutdown. The Date/Time stamp provides the date and time (to the second) that the alarm event occurred. If there are several alarms that all have the same date-time stamps, go to the first in the series of alarms for that time. Some failures can cause a cascading series of faults to occur, one right after the other. Compare the alarm log and the run log to each other to see the operational sequence of events.

For example: If the unit shut down on "ALARM - Low Oil Pressure", look to see what time the unit started. If it started at 8/20/10 14:27:30 (2:27 pm), and shut down on low oil pressure on 8/30/10 10:15:22 (10:15 am), then the most likely cause of the loss of oil pressure was low oil level. The unit ran, providing power, for 10 days straight (approximately 234 hours). This could be validated by checking the oil level of the unit. Liquid-cooled engines will use oil while running. If run for extended periods of time (several weeks for instance) they will require periodic shut-down to check oil level and do a general inspection.

Determine the applicable flow chart to use to help diagnose the problem. Use the flow chart index for the part of the generator you are working with.

- Use **Section 2 – AC Generators** for problems involving voltage.
- Use **Section 3 – Engine/DC Control** for engine problems.

The index for each section will help clarify the problem and which flow chart to use. For each flow chart, start at the top and use the indicated test to verify whether or not a component or control item is working properly. At the end of each test follow the GOOD or BAD arrows and perform the next test.

It is a good practice to continue to ask questions during the troubleshooting process. When evaluating a problem, these questions may help identify the problem more quickly.

- What is it doing? (low voltage; not cranking; not transferring; etc)
- What should it do? (run and start; transfer; shutdown; etc)
- Does the same thing happen each time?
- When is it happening?
- What could or would cause this?
- What type of test will either prove or disprove the cause of the fault?

Important Note Concerning Connectors

A number of the tests require the use of a multimeter/volt-meter and a set of wire piercing probes.

It is very easy to damage the female pins in the connectors on the control panel (AMP connectors) and C1 connector (Molex connector) which goes to the alternator stator.

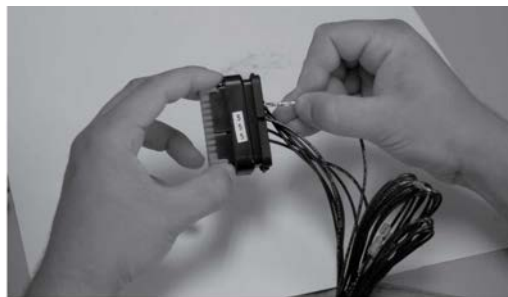
IMPORTANT NOTE: Do not attempt to push probe tips into the connector pins of any AMP or MOLEX connectors. Doing so will damage the female pin. Use the appropriate probes on specific wires to check voltage. Use the flexible pin leads, available from the manufacturer (PN 0J09460SRV) to work with AMP connector plugs. Another alternative is to use approved back probes from the back side of the connector.

Repairing Amp Style Connector Pins

Wires can be removed from the AMP style connector. Lift the tabs at the end of the connector and gently slide the connector face forward, photo shows forward position. Use caution when lifting tabs to prevent breakage.

A stop will keep the face from sliding off the connector body. Do not completely remove the face because it is extremely difficult to put it back on a populated connector.

If the face on a populated connector must be replaced, it is imperative to match the wire lugs with the connector face to prevent damage to the lugs.



003501

Figure 1-26. Removing Pin

The wire to be removed should be pushed, rotated, and pulled. The rotating action releases the wire from the lock. When replacing the wire, insert the wire into the appropriate location and push until it locks, then push the face of the connector back until it locks. Gently tug the inserted wire and inspect. The lug will be just below the face of the connector if inserted fully and can be seen through the face of the connector.

A special tool is required similar to that shown in [Figure 1-27](#) to repair a damaged socket.

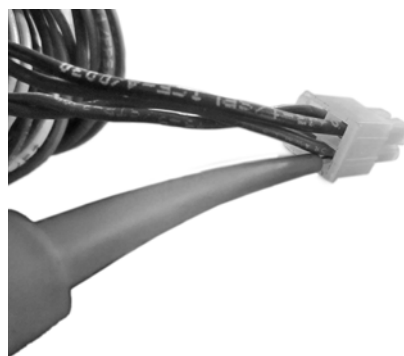


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Figure 1-27. Pin Crimping Tool

Probing and Pin Extraction

If probing and/or back-probing results in a BAD condition, before condemning the controller, remove the pin/plug in question and verify the pin/plug is not distorted, bent, and/or not making electrical contact. Repair as needed.



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Figure 1-28. Back-Probing MOLEX Connector

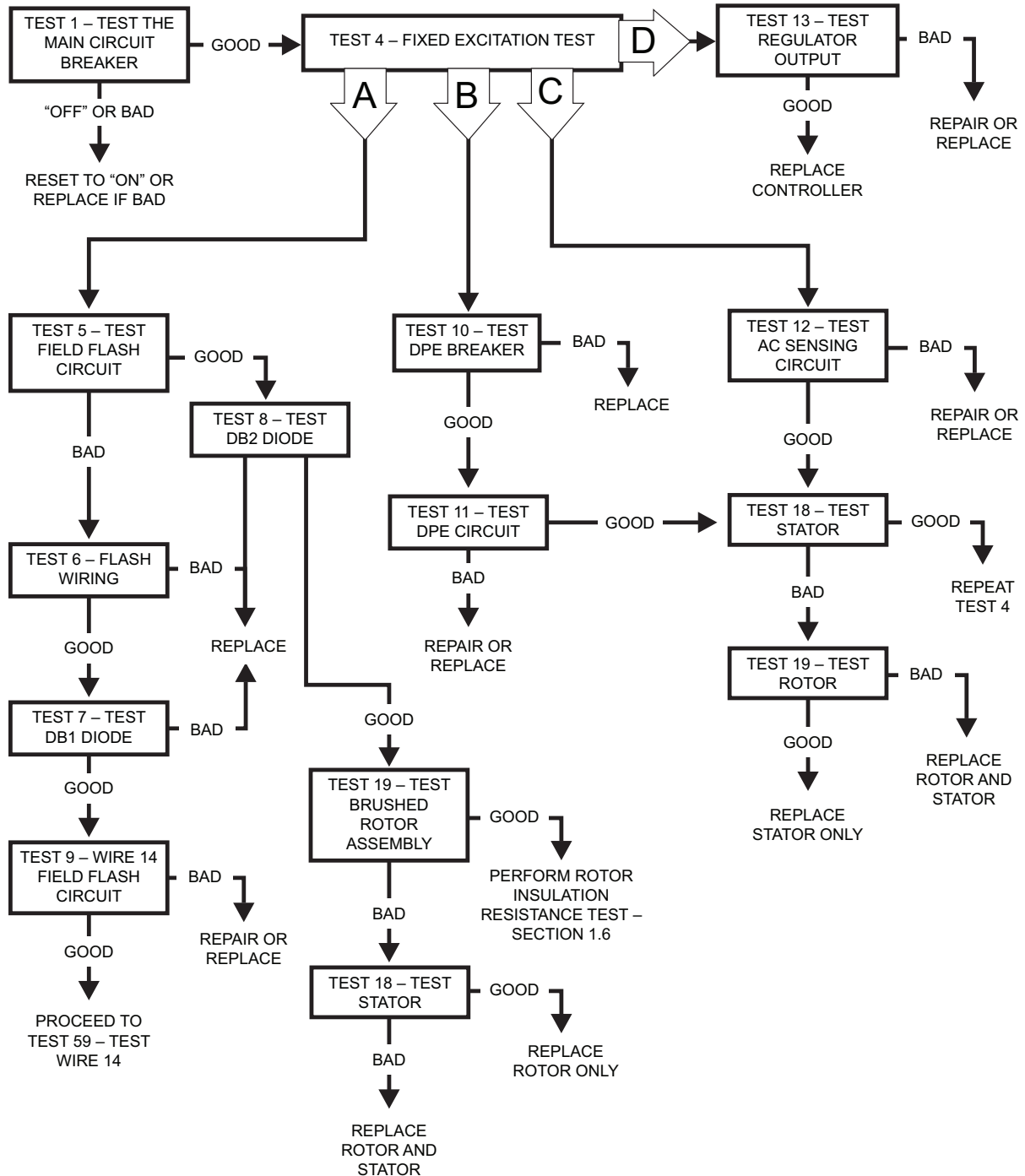
Section 2.1 Brushed Troubleshooting

Use the “Flow Charts” in conjunction with the detailed instructions in Section 4.3. Test numbers used in the flow charts correspond to the numbered tests in Section 4.3.

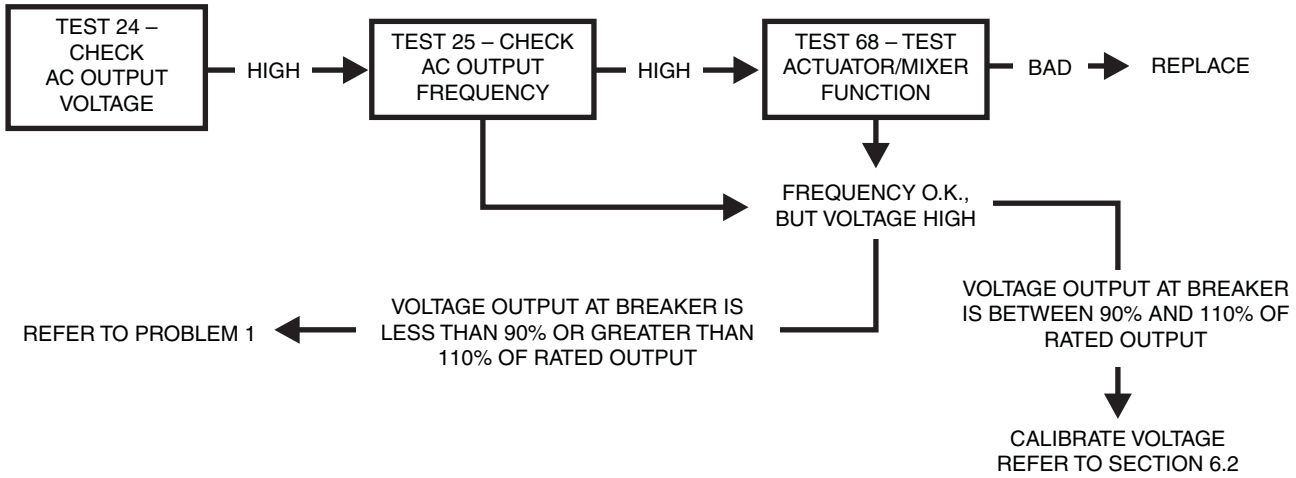
The first step in using the flow charts is to correctly identify the problem. Once that has been done, locate the problem on the following pages. For best results, perform all tests in the exact sequence shown in the flow charts.

Problem 1 – Generator Shuts Down for Under Voltage (Evolution Fault codes 1900 - 1906)

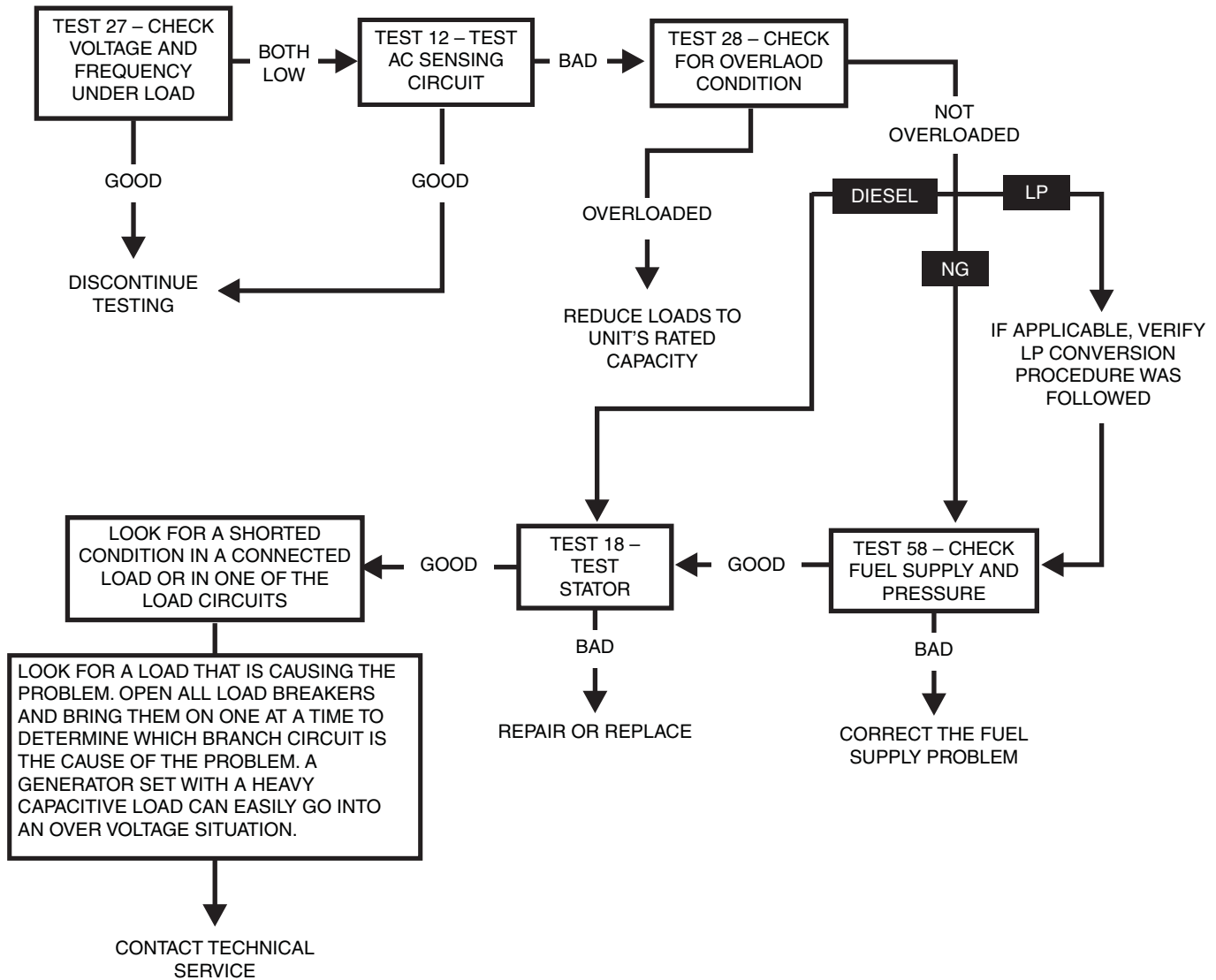
NOTE: Verify proper V-Code and Parameter Group for unit per either SIB10-11-NALL (Nexus) or SIB14-14-ELIQ (Evolution)

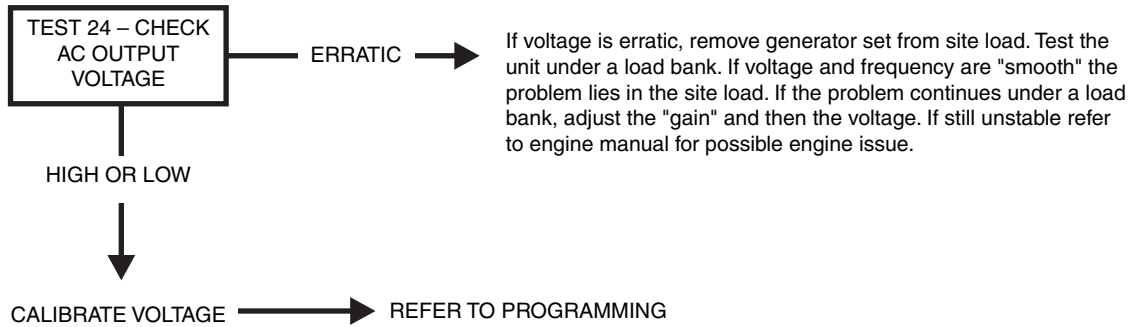


Problem 2 – Generator Produces Low Voltage at No-Load



Problem 3 – Generator Shuts Down for Overload / Over Voltage (Evolution Fault codes 1800 - 1803 and 2101)



Problem 4 – Voltage and Frequency Drop Excessively When Loads Are Applied

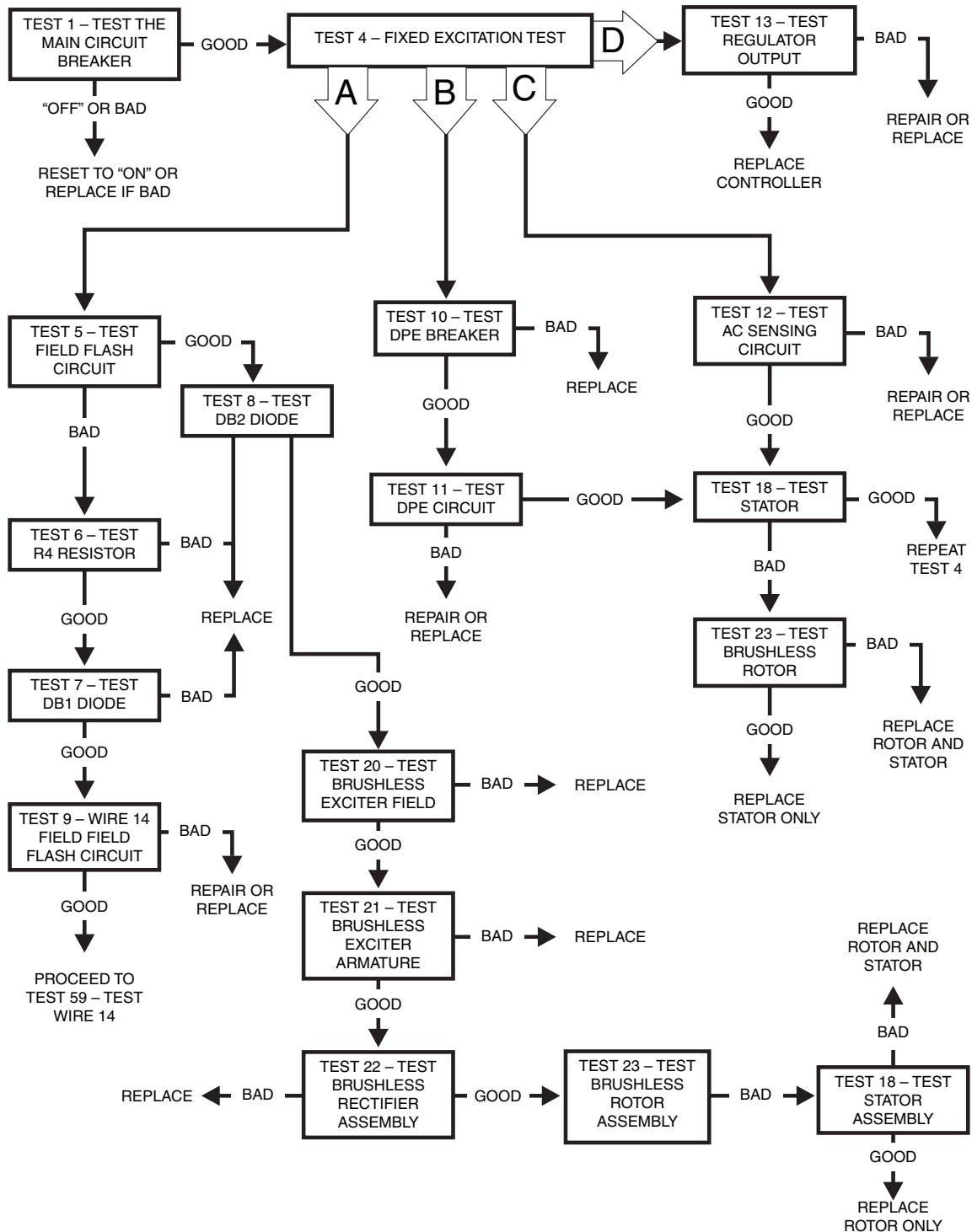
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Section 2.2 Brushless Troubleshooting Flowcharts

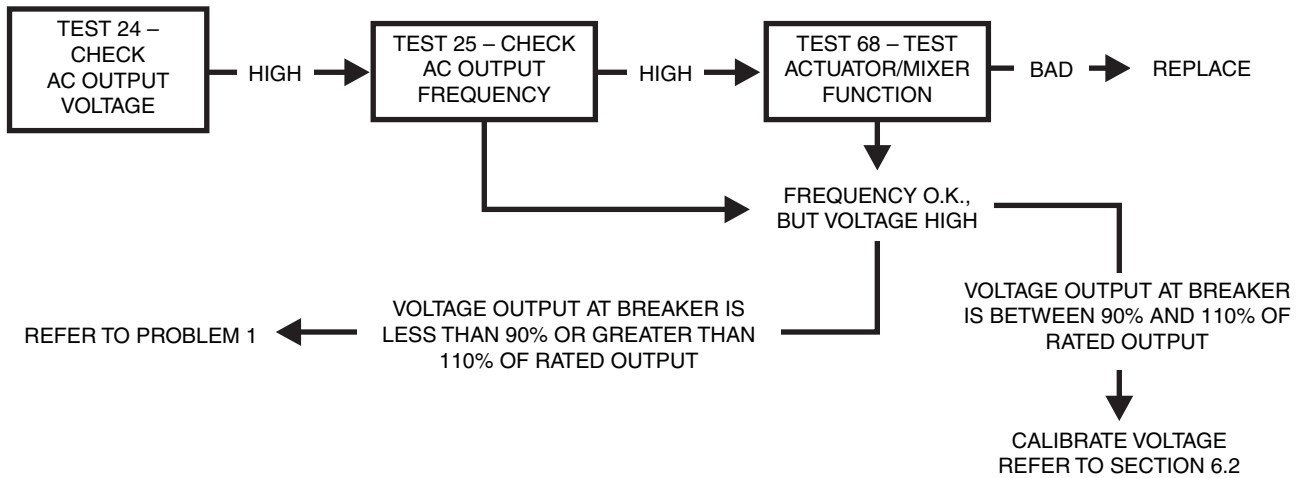
Use the "Flow Charts" in conjunction with the detailed instructions in Section 4.3. Test numbers used in the flow charts correspond to the numbered tests in Section 4.3.

The first step in using the flow charts is to correctly identify the problem. Once that has been done, locate the problem on the following pages. For best results, perform all tests in the exact sequence shown in the flow charts.

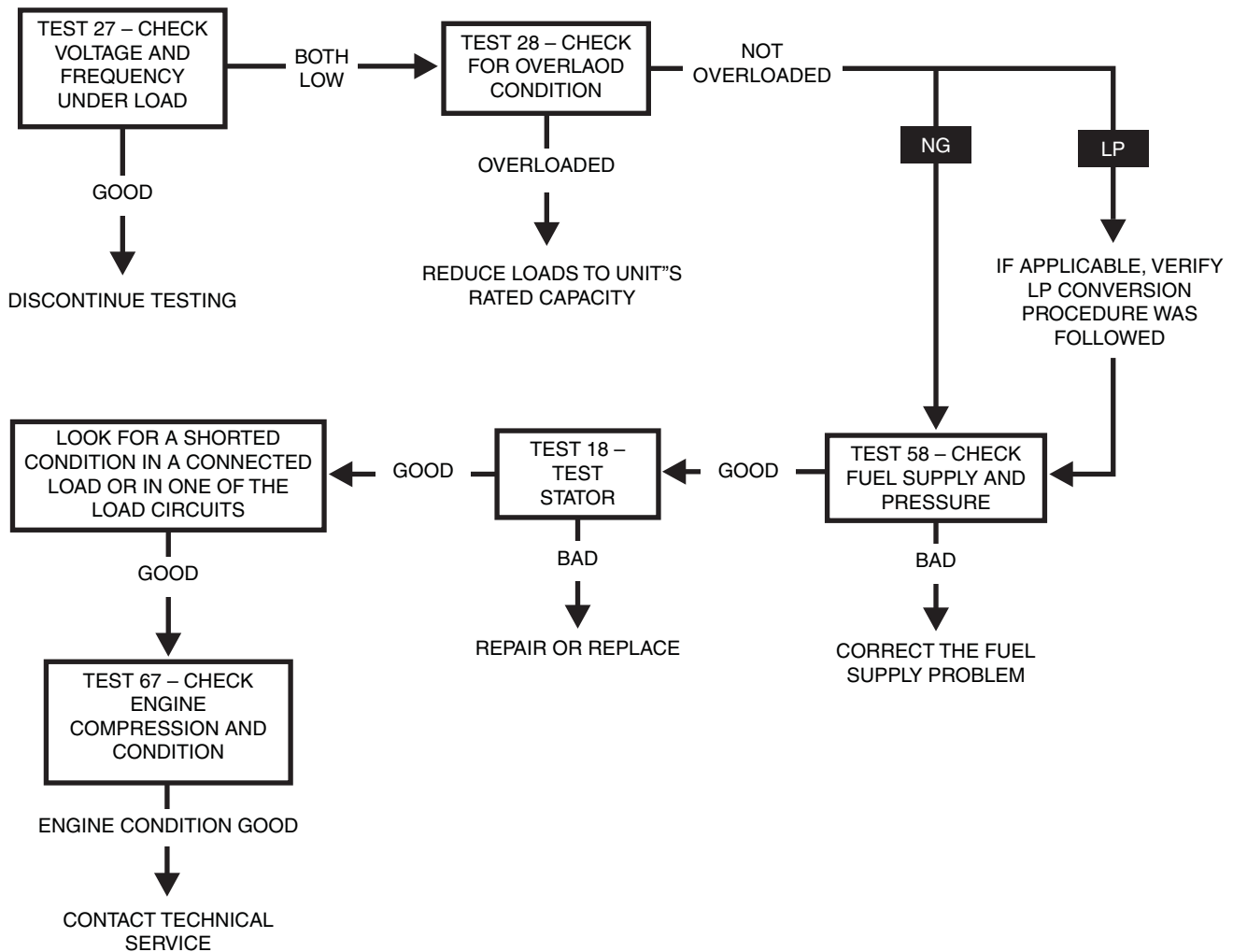
Problem 5 – Generator Shuts Down for Under Voltage



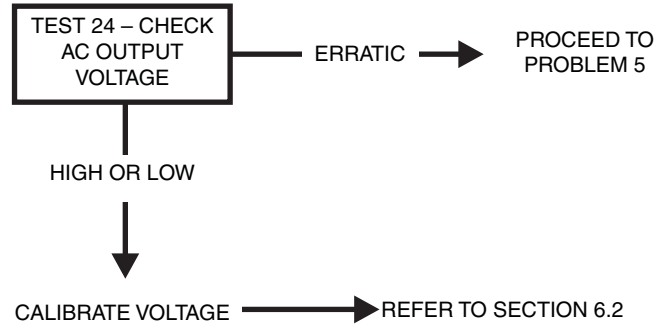
Problem 6 – Generator Produces Low Voltage at No-Load



Problem 7 – Generator Shuts Down for Over Voltage



Problem 8 – Voltage and Frequency Drop Excessively When Loads Are Applied



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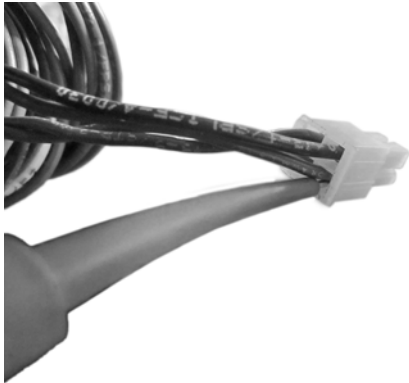
Section 2.3 Diagnostic Tests

Introduction

“True Ground” or “System Ground” is available at the negative battery terminal. When performing a test, if the reading obtained is suspicious, or does not indicate a “Clean frame Ground,” use the negative battery terminal.

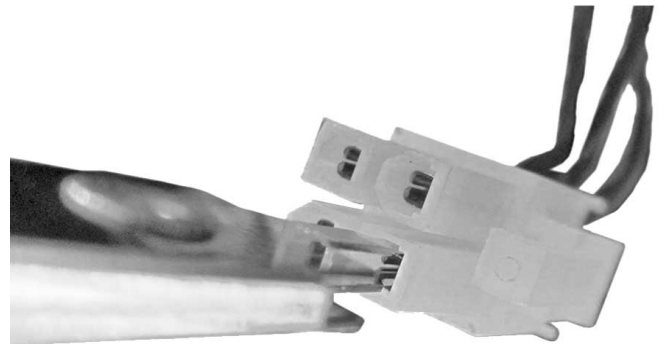
Probing and Pin Extraction

If probing and/or back-probing results in a “BAD” condition, before condemning the controller, remove the pin/plug in question and verify the pin/plug is not distorted, bent and/or not making electrical contact. Repair as needed.



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Figure 2-1. Back-Probing Molex Connector



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Figure 2-3. Using Molex Pin Extractor Tool



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Figure 2-2. Molex Pin Extractor Tool Park 0K4445



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Figure 2-4. Probing AMP Connector

Evolution E-Codes

Alarm	E-Code	Diesel	Gas	Description	Procedure
Controller	180	X	X	Internal Harness Loop Broken —External display board is not able to communicate with main board. This alarm is internal to the display board and is not logged (the main board is not aware of this E-Code).	
Controller	1001	X	X	Internal Harness Loop Broken —Internal harness connecting external display board to main board has become disconnected. Triggered when main board does not see communication from display board.	
Overcrank	1100	X	X	Default—Engine/Starter Problem The default for overcrank alarm, because of the nature of cranking there is almost no insight into the cause of an overcrank alarm with the current sensors.	Problem 18
Overcrank	1101		X	No Fuel Pressure Low to no fuel pressure while cranking. To set, fuel pressure has to be measured as low for at least 1200 ms before the overcrank alarm is set.	Test 58
Overspeed	1200	X	X	Prolonged Over 72 Hz for three seconds.	Test 68
Overspeed	1201	X	X	Prolonged—Throttle stuck open Over 72 Hz for three seconds with the throttle stuck open. Possible causes: Stuck throttle	Test 68
Overspeed	1204		X	External Ignition Overspeed CAN alarm from external ignition, threshold is >30% over nominal.	Test 68
Overspeed	1205	X	X	Instantaneous Over 75 Hz for one second.	Test 68
Overspeed	1206	X	X	Instantaneous—Throttle stuck open Over 75 Hz for one second with the throttle stuck open, total loss of control. Possible causes: Stuck throttle	Test 68
Low Oil Pressure	1300	X	X	Occurred while running—Default The default extended alarm for low oil pressure. Check the oil level.	Problem 28
High Temperature	1400	X	X	Air Flow Impeded / Flow Issue Check the inlet/outlet for debris. Coolant temp greater than 246 °F (119 °C) for 1 second. Check coolant sensor circuit for proper operation.	Problem 27 Test 114
High Temperature	1401		X	Fuel Pressure Low—Running Lean Very low fuel pressure while running will cause an increase in engine temperature. Fuel pressure must be measured as low for 1200 ms preceding high temperature alarm to set this E-Code.	Problem 34
Rpm Sensor	1500	X	X	Missing Mag Pickup Pulses.	Problem 31
Alarm	E-Code	Diesel	Gas	Description	Procedure
Rpm Sensor	1516	X	X	Cranking + Low Fuel Cranking with Low Fuel Pressure faults to rpm sensor loss. Possible causes: Low fuel pressure for at least 1200 ms, ignition fault, air pocket in fuel line, dirty fuel	Problem 34
Rpm Sensor	1517	X	X	Running + Low Fuel Running with low fuel pressure faults to rpm sensor loss. Possible causes: Low fuel pressure for 1200 ms, ignition fault, air pocket in fuel line, dirty fuel	Problem 34

Alarm	E-Code	Diesel	Gas	Description	Procedure
Rpm Sensor	1518		X	No Pulse during Cranking Rpm sensor loss, no tooth pulses sensed for 75 consecutive milliseconds while starter active. Possible causes: starter circuit issue, rpm sensor	Problem 31
Rpm Sensor	1519		X	No Pulse during Running Cranking faults to rpm sensor loss. Possible causes: starter circuit issue, rpm sensor	Problem 31
Rpm Sensor	1520		X	Missing Pulses during Cranking Cranking faults to rpm sensor loss. Starter engaged, no tooth pulses for 75 ms. Possible causes: starter circuit issue, rpm sensor alignment, low battery	Problem 31
Rpm Sensor	1521		X	Missing Pulses during Running While running, no tooth pulses for 75 consecutive milliseconds. Possible causes: rpm sensor alignment, low battery	Problem 31
Underspeed	1600	X	X	Unit Overloaded or Fuel System issue <83.3% speed (60 Hz) or <66.6% speed (50 Hz) for 30 seconds. Unit is overloaded slowing engine speed. Possible cause: highly inductive loads	
Underspeed	1601		X	Low Fuel Pressure Low fuel pressure starves the engine, slowing it. Low fuel pressure detected for 1200 ms before underspeed condition detected. Check fuel supply and settings	Problem 34
Underspeed	1602	X	X	Throttle Stuck Closed/near Closed The throttle is stuck closed or stuck near closed limiting the fuel to the engine, slowing it down. Stuck closed must be detected for one second with underspeed to set E-Code.	Test 68
Overvoltage	1800	X	X	Prolonged three seconds of over 10% above nominal.	Problem 3
Overvoltage	1801	X	X	Instantaneous —Set by an instantaneous measurement 30% over nominal.	Problem 3
Overvoltage	1803	X	X	Overspeed Generator running at higher speed (25% over nominal rpm) causing overvoltage.	Problem 3
Undervoltage	1900	X	X	Prolonged Undervoltage; Generator voltage below 80% of nominal for 10+ seconds.	Problem 1
Undervoltage	1901	X	X	Instantaneous Generator voltage less than 15V. Hold off time of two seconds.	Problem 1
Undervoltage	1902	X	X	Both Zero Crosses missing Undervoltage due to faulty excitation winding, or zero cross circuit, or circuit in general. Both zero crosses must be missing for 1.5 seconds. Possible cause: loose wiring, field boost hardware failure	Problem 1
Undervoltage	1903	X	X	Little / No Voltage (<120V) Controller measuring no voltage resulting in undervoltage. Generator voltage less than 120V when undervoltage set.	Problem 1
Undervoltage	1904	X	X	No Field Current But Have DPE No field current during undervoltage alarm. Possible cause: Wire loose, brush failure	Problem 1

Section 2.3 Diagnostic Tests

Alarm	E-Code	Diesel	Gas	Description	Procedure
Undervoltage	1905	X	X	Low Speed Generator running underspeed for > 30 seconds when undervoltage alarm set. Possible cause: fuel supply/control system, engine intake exhaust or mechanical issues.	Problem 1
Undervoltage	1916	X	X	Single Zero Cross missing Undervoltage due to faulty excitation winding, or zero cross circuit, or circuit in general. One zero cross missing for greater than 1.5 seconds. Possible cause: field boost hardware failure.	Problem 1
Wire Error	2099	X	X	Incorrect DC AC wiring hook up.	
Overload Remove Load	2101	X	X	Overload (DPE Style Field Current Method) Field Current measured value is above threshold. Possible cause: overload	
Fuse Problem	2400	X	X	Missing / Damaged Fuse The controller fuse is missing or damaged in such a way that it does not work. Fuse problem must be detected for 1.5 seconds. Firmware older than V1.30	
Alarm	E-Code	Diesel	Gas	Description	Procedure
Bosch	2500	X	X	Command and position feedback not matching or taking too much time to achieve. Possible causes: governor wire loose, governor module	Test 68
Bosch	2501	X	X	Stuck Open Command and position feedback not matching or taking too much time to achieve. Governor in open position for greater than one second. Possible causes: governor wire loose, governor module	Test 68
Bosch	2502	X	X	Stuck Closed Command and position feedback not matching or taking too much time to achieve. Governor in closed position (commanded otherwise) for greater than one second. Possible cause: governor wire loose, governor module	Test 68
Ignition	2600		X	Ignition Fault	Problem 37, 38, 39
Ignition	2601		X	Missing Cam Pulse —Cam pulses missing for five seconds.	Problem 38
Ignition	2602		X	Crank Circuit (External Module)	Problem 38, 39
Over current cylinder1	2611		X	Coil current too high for one second.	Problem 37
Over current cylinder2	2612		X	Coil current too high for one second.	Problem 37
Over current cylinder3	2613		X	Coil current too high for one second.	Problem 37
Over current cylinder4	2614		X	Coil current too high for one second.	Problem 37
Over current cylinder5	2615		X	Coil current too high for one second.	Problem 37
Over current cylinder6	2616		X	Coil current too high for one second.	Problem 37
Over current cylinder7	2617		X	Coil current too high for one second.	Problem 37
Over current cylinder8	2618		X	Coil current too high for one second.	Problem 37

Alarm	E-Code	Diesel	Gas	Description	Procedure
Over current cylinder9	2619		X	Coil current too high for one second.	Problem 37
Over current cylinder10	2620		X	Coil current too high for one second.	Problem 37
Under current cylinder1	2621		X	Coil current too low for one minute.	Problem 37
Under current cylinder2	2622		X	Coil current too low for one minute.	Problem 37
Under current cylinder3	2623		X	Coil current too low for one minute.	Problem 37
Under current cylinder4	2624		X	Coil current too low for one minute.	Problem 37
Under current cylinder5	2625		X	Coil current too low for one minute.	Problem 37
Under current cylinder6	2626		X	Coil current too low for one minute.	Problem 37
Under current cylinder7	2627		X	Coil current too low for one minute.	Problem 37
Under current cylinder8	2628		X	Coil current too low for one minute.	Problem 37
Under current cylinder9	2629		X	Coil current too low for one minute.	Problem 37
Under current cylinder10	2630		X	Coil current too low for one minute.	Problem 37
Internal Ignition Missing Cam	2650		X	Cranked for four seconds on gaseous unit, no cam pulses detected.	Problem 38
External Ignition Missing Cam	2651		X	No cam pulses detected by external ignition.	Problem 38
Internal Ignition Missing Crank Pulses	2660		X	Missing crank pulses detected by internal ignition.	Problem 39
External Ignition Missing Crank Pulses	2661		X	Missing crank pulses detected by external ignition.	Problem 39
CAN Bus	2671		X	CANbus error reported by external ignition.	Problem 36
CAN Bus	2672	X		CANbus error reported by Diesel ECU.	Problem 36
Fuel Level Low	2700	X		Fuel level below 10% for greater than 60 seconds.	
Low Coolant	2720	X	X	Low coolant digital input detected low coolant for greater than five seconds.	Problem 26
Very Low Battery	2751	X	X	The system detected battery voltage level < 9.0 for 60 seconds and has triggered the alarm.	Problem 29
ESTOP Pressed/AUX Shutdown	2800	X	X	The system detected the E-Stop button was pressed and shutdown. E-Stop can also be set for AUX shutdown.	
Hall Calibration	2810	X	X	The system detected on power up that hall calibration was not performed and has triggered the alarm.	
Diesel ECU Fault	2900	X		ECU reports J1939 CAN diagnostic fault message.	

Warning	E-Code	Diesel	Gas	Description	Procedure
DTC*	134		X	DTC P0134. O ₂ sensor stuck open/closed DTC logged in eeprom. Warning will clear after engine runs with no DTC codes three times.*	
Low Fuel Level	2680	X		Fuel level above 10% but lower than 20% for greater than 60 seconds.	
Low Fuel Pressure	2690		X	Low fuel pressure detected for greater than 60 seconds.	Problem 34
Ruptured Tank	2710	X		The system detected fuel in the outer basin tank and has triggered the warning.	
Exercise Set	2730	X	X	Exercise has never been set.	
Low Battery	2750	X	X	Battery voltage below 12.1V for greater than 60 seconds.	Problem 29
Battery Problem	2760	X	X	Completed 26 hour charge cycle, battery voltage below 12.52V, or current draw from charger still greater than 600 mA.	Problem 30
Charger Warning	2770	X	X	Battery voltage above 16.1V.	Problem 29
Charger Missing AC	2780	X	X	During charging, AC input to battery charger missing for greater than five minutes.	Problem 29
SEEPROM Abuse	2790	X	X	Controller wrote to the EEPROM more than 500 times in less than four minutes.	
Gaseous Emissions	2910		X	Air/fuel mix is too rich for more than 10s or mix is too lean for more than 60s.	Problem 39

*Only appears on models that require DTC reporting.

Introduction

This section is provided to familiarize the service technician with acceptable procedures for testing and evaluating of various problems that could be encountered on standby generators with liquid-cooled engines. Use this section of the manual in conjunction with **Section 4.1 or 4.2, “Troubleshooting Flow Charts”**. The numbered tests in this section correspond with those of **Section 4.1 or 4.2**.

Most tests can be performed with a digital multimeter (DMM). An AC frequency meter is required, where frequency readings must be taken. A clamp-on ammeter may be used to measure AC loads on the generator.

Testing and troubleshooting methods covered in this section are not exhaustive. We have not attempted to discuss, evaluate, and advise the home standby service trade of all conceivable ways in which service and trouble diagnosis might be performed. We have not undertaken any such broad evaluation. Accordingly, anyone who uses a test method not recommended herein must first satisfy themselves that the procedure or method they have selected will not jeopardize their or the product’s safety.

Safety

Service personnel who work on this equipment must be made aware of the dangers of such equipment. Extremely high and dangerous voltages are present that can kill or cause serious injury. Gaseous fuels are highly explosive and can be ignited by the slightest spark. Engine exhaust gases contain deadly carbon monoxide gas that can cause unconsciousness or even death. Contact with moving parts can cause serious injury.

When working on this equipment, use common sense and remain alert at all times. Never work on this equipment while you are physically or mentally fatigued. If you don’t understand a component, device, or system, do not work on it.

NOTE: Before performing any test, do a visual and physical inspection of the connection box and the connections into the Nexus panel. If a faulty connection is detected, reference the specific wiring/schematic diagram before making any connections. All tests are to be performed with the main line circuit breaker in the OPEN position unless otherwise specified.

Test 1 – Check Main Circuit Breaker

General Theory

Often the most obvious cause of a problem is overlooked. If the generator main line circuit breaker is set to OFF (OPEN), no electrical power will be supplied to electrical loads. If loads are not receiving power, perhaps the main circuit breaker is open or has failed.

Procedure

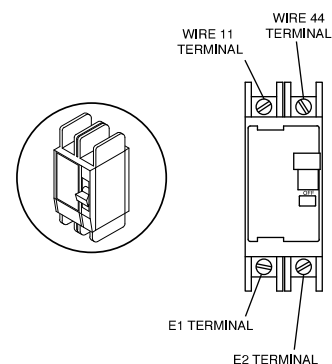
The generator main circuit breaker is located in the customer connection box. If loads are not receiving power, verify the breaker is set to ON (CLOSED).

See **Figure 2-5**. A breaker can be tested for failure as follows:

1. Set a digital multimeter (DMM) to its “R x 1” scale and zero the meter.
2. With the generator shut down, set the AUTO-OFF-MANUAL switch to OFF and disconnect all wires from the main circuit breaker terminals to prevent interaction.
3. Connect one DMM test probe to the Wire 11 terminal of the breaker and the other test probe to the Wire E1 terminal.
4. Set the breaker to ON (CLOSED). The DMM should read CONTINUITY.
5. Set the breaker to OFF (OPEN). The DMM should read INFINITY.
6. Repeat steps 4–5 with the DMM test probes connected across the breaker’s remaining poles.

Results

1. If the circuit breaker tests good, refer to the flow chart.
2. If the breaker tests bad, replace it.



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Figure 2-5. Generator Main Circuit Breaker Test Points

Test 4 – Fixed Excitation Test

General Theory

Measuring the output voltage of the generator will determine the next step in troubleshooting. When measuring voltage, it is important to look at the output voltage that is displayed on the control panel as well as measuring actual output voltage of the generator to determine the root cause of the problem.

NOTE: On Evolution units that do not have the field flash resistor, output voltage under a flash condition will be approximately 50% of a unit's output voltage.

Procedure

1. Set the main line circuit breaker (MLCB) to OFF (OPEN).
2. Using the navigation buttons on the controller, navigate to the voltage display.
3. Set the AUTO-OFF-MANUAL switch to MANUAL.
4. Visually monitor the output volts displayed on the panel. Record the value indicated. You will have 10 seconds to monitor this output before the unit shuts down for "Under Voltage."

Visual voltage indicated: _____

5. After the unit faults for an under voltage shutdown, acknowledge the alarm by setting the AUTO-OFF-MANUAL switch to OFF and pressing ENTER.
6. Set a digital multimeter (DMM) to measure AC voltage.
7. Connect one meter test lead to Wire 11/SA at TB1 and the other meter test lead to Wire 44/SB at the TB1 terminal strip.
8. Set the AUTO-OFF-MANUAL switch to MANUAL.
9. Measure and record the voltage indicated by the DMM. Acknowledge the alarm and reset the fault.

Measured voltage output: _____

Results (for units with flash resistor)

Match the results from step 4 to part A. Match the results from step 9 to part B.

Using the column and row identified in part A and B, match the results to the appropriate troubleshooting procedure.

Part A	
If displayed voltage is between 0–30 volts AC, then use row number 1.	
If displayed voltage is between 30–80 volts AC, then use row number 2.	
If displayed voltage is between 60 volts to $\frac{3}{4}$ of the units rated output voltage then use row number 3.	

Part B	
If measured voltage is between 0–30 volts AC, then use column number 1.	
If measured voltage is between 30–80 volts AC, then use column number 2.	
If measured voltage starts out high (rated voltage or higher) then falls to the 30–60 AC range, then use column number 3.	

		Measured Column		
		1	2	3
Displayed Row	1	A	B	C
	2	Re-test	D	C
	3	Re-test	C	C

Results (for units without flash resistor)

Match the results from step 4 to part A. Match the results from step 9 to part B.

Using the column and row identified in part A and B, match the results to the appropriate troubleshooting procedure.

Part A	
If displayed voltage is between 0–60 volts AC, then use row number 1.	
If displayed voltage is between 60–160 volts AC, then use row number 2.	
If displayed voltage is between 130 volts to $\frac{3}{4}$ of the units rated output voltage, then use row number 3.	

Part B	
If measured voltage is between 0–60 volts AC, then use column number 1.	
If measured voltage is between 60–160 volts AC, then use column number 2.	
If measured voltage starts out high (rated voltage or higher) then falls to the 30–60 AC range, then use column number 3.	

		Measured Column		
		1	2	3
Displayed Row	1	A	B	C
	2	Re-test	D	C
	3	Re-test	C	C

Match the results from step 5 to part A. Match the results from step 10 to part B.

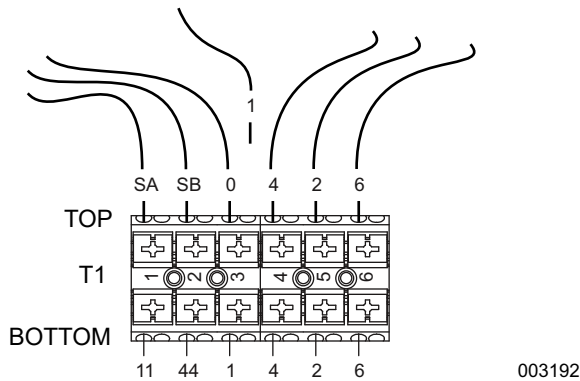


Figure 2-6. Terminal Block

Test 5 – Test Field Flash Circuit

General Theory

The field flash circuit is responsible for flashing the rotor assembly during cranking and while running. Without field flash, the stator output will be minimal with only residual magnetism. Voltage for the field flash circuit originates at the DB1 diode, from the run circuit, normally Wire 14, then continues through the R4 resistor, if equipped. This provides a current limited voltage to the rotor or the exciter field.

Procedure

1. Set digital multimeter (DMM) to measure DC voltage.
2. Locate the TB1 terminal block in the customer connection box and disconnect Wire 4 from the bottom of the terminal block.

NOTE: Remove the larger Wire 4 (red wire). The red wire goes to the + brushes or the + fields for the brushes.

3. Using the access hole available on the terminal block, connect one meter test lead to terminal 4 and the other meter test lead to a clean frame ground.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.
5. Measure and record the voltage indicated by the DMM.

Results

1. If the DMM indicated approximately 10 VDC, refer to the flow chart and proceed to investigate the rotor circuit. [Test 19 – Test Brushed Rotor Assembly](#) or [Test 23 – Test Brushless Rotor Assembly](#).
2. If the DMM indicated 0 VDC, refer to the flow chart.

Test 6 – Flash Wiring

General Theory

The R1 resistor is installed in series to the field flash circuit to limit current to the rotor. If the resistor fails open, field boost voltage will not be delivered to the main rotor and the voltage output at the breaker will be minimal.

NOTE: Some units are not equipped with a R4 resistor.

Procedure

1. Set the digital multimeter (DMM) to measure DC voltage.
2. Locate the R4 resistor in the connection box and remove the yellow Wire 4 from the resistor. If unit is not equipped with R1 resistor, then remove Wire 4 from DB1.
3. Connect one meter test lead to the terminal on the resistor or the bridge where Wire 4 was disconnected and the other meter test lead to the ground terminal in the connection box.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.
5. Measure and record the voltage indicated by the DMM.
 - a. If the DMM indicated 10 VDC or greater, proceed to step 6.
 - b. If the DMM did not indicate a voltage, proceed to step 8.
6. Set the DMM to measure resistance.
7. Connect one meter test lead to Wire 4 on the TB1 terminal block and the other meter test lead to Wire 4 disconnected in step 2. Measure and record the value indicated by the DMM.
 - a. If the DMM indicated CONTINUITY, check for DC voltage at TB1.
 - b. If the DMM indicated INFINITY, repair or replace Wire 4 between the R1 and the TB1 terminal block.
8. Set the DMM to measure DC voltage.
9. Disconnect Wire 29 (white) located on the opposite side of the resistor. See [Figure 2-7](#).

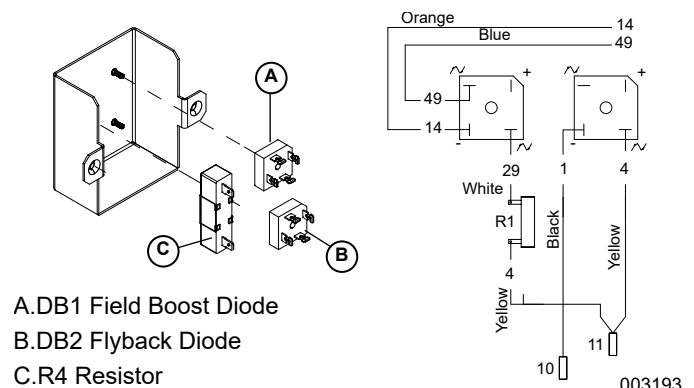


Figure 2-7. DB1 and DB2

10. Connect one meter test lead to the disconnected Wire 29 (white) and the other meter test lead to the ground terminal in the connection box.
11. Set the AUTO-OFF-MANUAL switch to MANUAL.
12. Measure and record the voltage indicated by the DMM.
 - a. If the DMM indicated 10 VDC, proceed to step 13.
 - b. If the DMM indicated 0 VDC, refer to the flow chart. **Test 7 – Test DB1 Field Boost Diode.**
13. Set DMM to measure resistance.
14. Connect the meter test leads across the now disconnected resistor. Measure and record the value indicated by the DMM.
 - a. If the resistance indicated is $\pm 10\%$ of the value indicated in **Table 2-1**, repeat Test 6.
 - b. If the resistance indicated is not within $\pm 10\%$ of the value in **Table 2-1**, replace resistor.

Results

Refer to the flow chart.

Table 2-1. R4 Resistance			
	kW	Phase	Resistance (R4)
Gaseous			
1.6L	ALL	ALL	15 Ω
2.4L	ALL	ALL	15 Ω
4.2L	ALL	ALL	25 Ω
4.6L	80	ALL	50 Ω
6.8L	70	ALL	25 Ω
6.8L	100	ALL	25 Ω
6.8L	130	ALL	25 Ω
6.8L	150	3 \emptyset	50 Ω
6.8L	150	1 \emptyset	25 Ω
Diesel			
2.3L/2.4L/3.4L	ALL	ALL	10 Ω

Test 7 – Test DB1 Field Boost Diode

General Theory

The bridge rectifier is installed on the field flash circuit to benefit two components. It allows for a field flash to occur on the rotor, and a field flash to occur on the engine alternator. It also acts to block voltage so that regulated DC voltage from the voltage regulator does not flow back to the run circuit or engine alternator during normal operation. If any of these diodes failed (shorted) closed, it would allow for a high DC voltage to flow back to the run circuit, potentially damaging critical components.

Procedure

1. Disconnect Wire 29 (white) from DB1 located in connection box.
2. Set DMM to measure DC voltage.
3. Connect one meter test lead (red) to DB1 where Wire 29 (white) was disconnected in step 1 and the other meter test lead (black) to the ground terminal in connection box.

IMPORTANT NOTE: *The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.*

4. Set the AUTO-OFF-MANUAL switch to MANUAL. Measure and record the voltage. Battery voltage should be measured.
5. Set the AUTO-OFF-MANUAL switch to OFF (OPEN).
6. Reconnect Wire 29 (white) to DB1.
7. Disconnect Wire 14 (orange) from DB1.
8. Connect one meter test lead to the disconnected Wire 14 (orange) and the other meter test lead to the ground terminal in the connection box.
9. Set the AUTO-OFF-MANUAL switch to MANUAL.

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

10. Measure and record the voltage. Battery voltage should be measured.

Results

1. If battery voltage was measured in step 4, repair or replace Wire 29 (white) between DB1 and R4.
2. If battery voltage was not measured in step 4, but was measured in step 10, replace DB1.
3. If battery voltage was not measured in step 10, refer to the flow chart. Test 9.

Test 8 – Test DB2 Fly Back Diode

General Theory

A kick back voltage is created when any magnetic field collapses. The fly back diode is connected to Wires 1 and 4 and serves to shunt this kick back voltage to ground when the rotor's magnetic field collapses. The diode is connected to allow current to be blocked during normal operation and shunt to ground when the polarity reverses during the collapse of the magnetic field. If the diode is connected improperly and allows current to flow during normal operation, field boost voltage will be shunted to ground and the output at the breaker will remain minimal.

1. Disconnect yellow Wire 4 (B on DB2) and black Wire 1 (A on DB2) from the diode.
2. Set DMM to the diode test position.
3. Connect the red meter lead to test point A and the black meter test lead to test point B. Measure and record the voltage indicated.
4. Connect the black meter lead to test point A and the red meter test lead to test point B. Measure and record the voltage indicated.

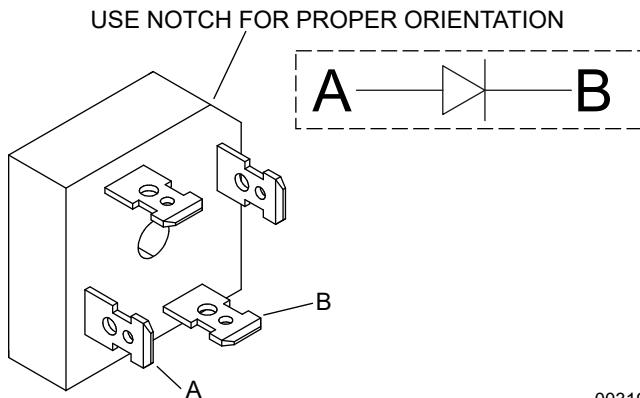


Figure 2-8. DB2 Test Points

Results

1. If the DMM indicated 0.4–0.5 VDC in step 3 and 0 VDC (OPEN) in step 4, refer to the flow chart. See [Test 19 – Test Brushed Rotor Assembly](#).
2. Replace the DB1 diode if any other results are measured.

Test 9 – Test Wire 14 Field Flash Circuit

General Theory

Battery voltage is delivered to DB1 via Wire 14 (orange) from controller. Wire 14 is the run circuit, and is active any time the unit is cranking or running.

Evolution units will have an in-line fuse that supplies the DB1 with voltage. Before running this test, verify that the in-line fuse is not blown. If the fuse is blown or removed, replace fuse and continue testing.

Procedure

1. Disconnect Wire 14 (orange) from DB1.
2. Set DMM to measure DC voltage.
3. Connect one meter test lead to the Wire 14 (orange) that was just removed and the other meter test lead to the ground terminal in the connection box.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

5. Measure and record the voltage indicated by the DMM.

Results

1. If the DMM indicated battery voltage in step 5, replace DB1.
2. On a unit with a Nexus controller, if the DMM did not indicate battery voltage in step 5, repair or replace Wire 14 between the controller and the DB1 diode.
3. On a unit with an Evolution controller, if the DMM did not indicate battery voltage in step 5, repair or replace Wire 14 between the run relay and the DB1 diode.

Test 10 – Test Excitation Circuit Breaker (if equipped)

NOTE: If unit is not equipped with DPE breaker, go to [Test 11 – Test AC Excitation \(DPE\) Circuit](#).

General Theory

Unregulated excitation voltage is delivered to the Nexus panel from the stator excitation (DPE) winding, via Wire 2, an excitation circuit breaker (CB2), Wire 162, and Wire 6. If the excitation circuit breaker has failed open, excitation current will not be available to the panel or to the rotor. Stator AC power winding output will then be reduced to a voltage that is the product of residual magnetism alone, or field flash voltage.

Procedure

CAUTION! The excitation circuit breaker may be hot.

1. With the generator shut down for at least two minutes, locate the excitation circuit breaker on the left side of the control panel inside the DPE housing cage. Disconnect wires from the breaker, to prevent interaction.
2. Set DMM to measure resistance.
3. Connect the DMM test probes across the circuit breaker terminals. The meter will read CONTINUITY.

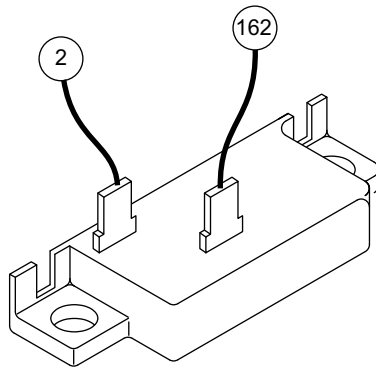
Results

1. After tests conclude, replace the circuit breaker if defective (meter reads "OPEN"), refer to the flow chart.
2. If circuit breaker is good, refer to the flow chart.

Test 11 – Test AC Excitation (DPE) Circuit

General Theory

The AC excitation circuit (DPE) is the power supply to the voltage regulator. The voltage regulator also rectifies the AC voltage to a varying controlled value of DC field excitation. This testing procedure is going to verify the integrity of the DPE winding.

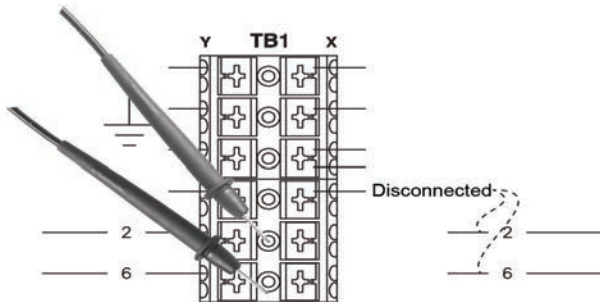


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Figure 2-9. Excitation Circuit Breaker

Procedure

1. Set DMM to measure resistance.
2. Locate the TB1 terminal block (WAGO Block) in the customer connection box.
3. Locate and disconnect Wires 2 and 6 from the TB1 terminal strip that connect to the control panel. Insert test leads into the WAGO block test ports that correspond to Wires 2 and 6. Measure and record the value indicated by the DMM.



005345

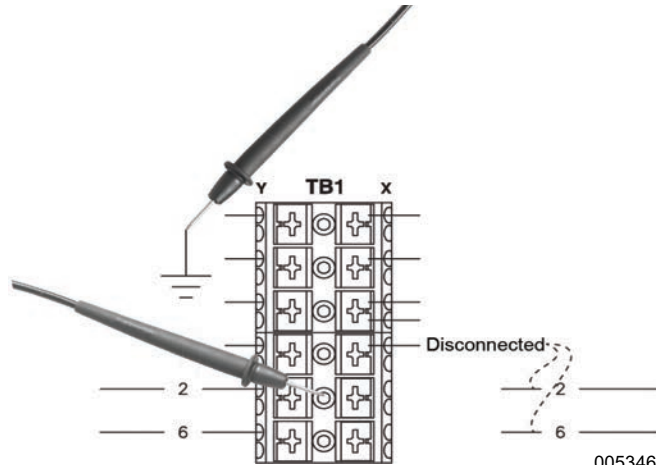
Figure 2-10. Test TB1 Wire 2 and Wire 6 Test Ports

NOTE: Leave the control panel wires disconnected from the WAGO block.

- a. If the DMM indicated the resistance of the DPE winding indicated in Section 1.1 **Rotor And Stator Resistance Tables** within $\pm 10\%$, proceed to step 4.
- b. If the DMM indicated INFINITY, or lower or higher than expected resistance, verify the integrity of the connections at the TB1 terminal

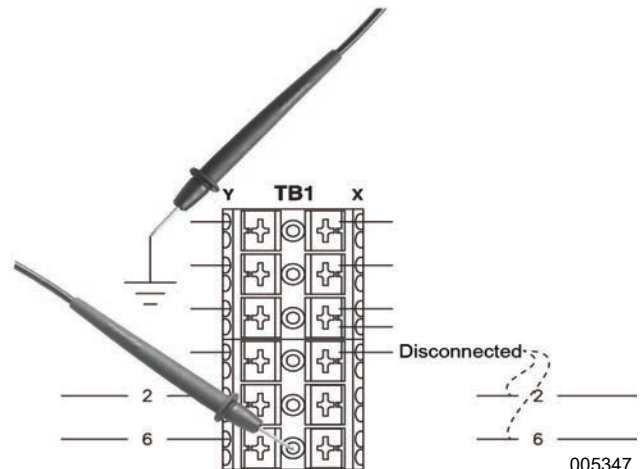
block and the integrity of the wire running to the stator. If the DMM continues to indicate a value out of range of the specifications, replace stator.

4. Locate Wires 2 and 6 on the WAGO block. Set meter to measure resistance. Using the test ports on the WAGO block, measure Wire 2 to ground and Wire 6 to ground. Record the results.



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Figure 2-11. Test TB1 Wire 2 Test Port to Ground



005347

Figure 2-12. Test TB1 Wire 6 Test Port to Ground

- a. If low ohms or low K ohms are measured to ground, the winding is shorted to ground. Replace the stator.
- b. If INFINITY is measured to ground, go to the next step.
5. Reconnect the control panel Wires 2 and 6 to the TB1 terminal block (WAGO block) and disconnect Wires 2 and 6 on the WAGO block that come from the stator.

NOTE: Step 6 is for brushless Nexus units only. The remaining steps of this test are the same for brushed and brushless units.

6. Locate the TB terminal block inside the fan guard surrounding the exciter assembly. Measure resistance between Wire 2 and Wire 6. Compare to

Section 1.1 **Rotor And Stator Resistance Tables.**

If within 10% of published specification, test Wire 2 to clean frame ground and Wire 6 to clean frame ground.

- a. If resistance of Wire 2 to Wire 6 is not within 10% of published specification, replace stator.
 - b. If either Wire 2 or Wire 6 measure any resistance to ground, replace stator.
 - c. If resistance is within 10% of specification and no resistance to ground is measured, proceed to next step.
7. Connect one meter test lead to Wire 2 (for an Evolution controlled generator) or Wire 162 (for a Nexus controlled generator) at the appropriate J-connector at the back of the control panel. Connect the other meter test lead to TB1 Wire 2. Measure and record the resistance indicated.

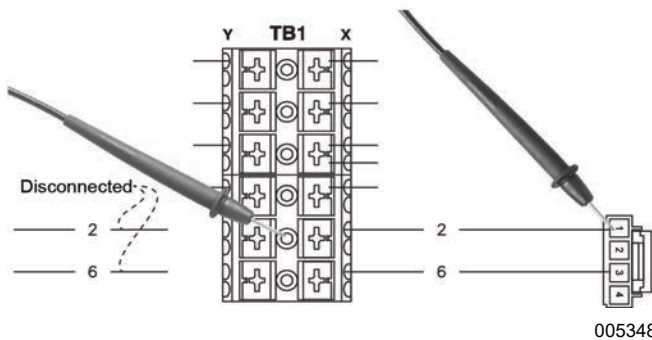


Figure 2-13. Test TB1 Wire 2 Test Port to J-connector

- a. If the DMM indicated CONTINUITY, proceed to step 8.
 - b. If the DMM indicated INFINITY or a high resistance, repair or replace the wire between Wire 2 / 162 on the back of the control panel and the TB1 Wire 2 connections.
8. Connect one meter test lead to Wire 6 (Nexus or Evolution) at the appropriate J-connector at the harness connections to the control panel. Connect the other meter test lead to TB1 Wire 6. Measure and record the resistance indicated.
 - a. If the DMM indicated CONTINUITY, refer to flow chart.
 - b. If the DMM indicated INFINITY or a high resistance, repair or replace the wire between Wire 6 at the harness connections to the control panel and the TB1 Wire 6 connections.
 9. Reconnect control panel Wires 2 and 6 to the TB1 terminal block (WAGO block).

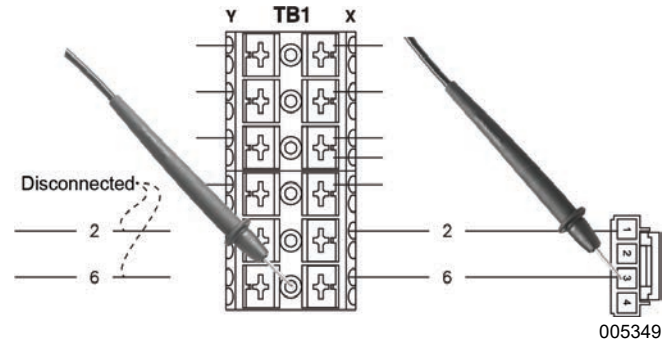


Figure 2-14. Test TB1 Wire 6 Test Port to J-connector

Test 12 – Test AC Sensing Circuit

General Theory

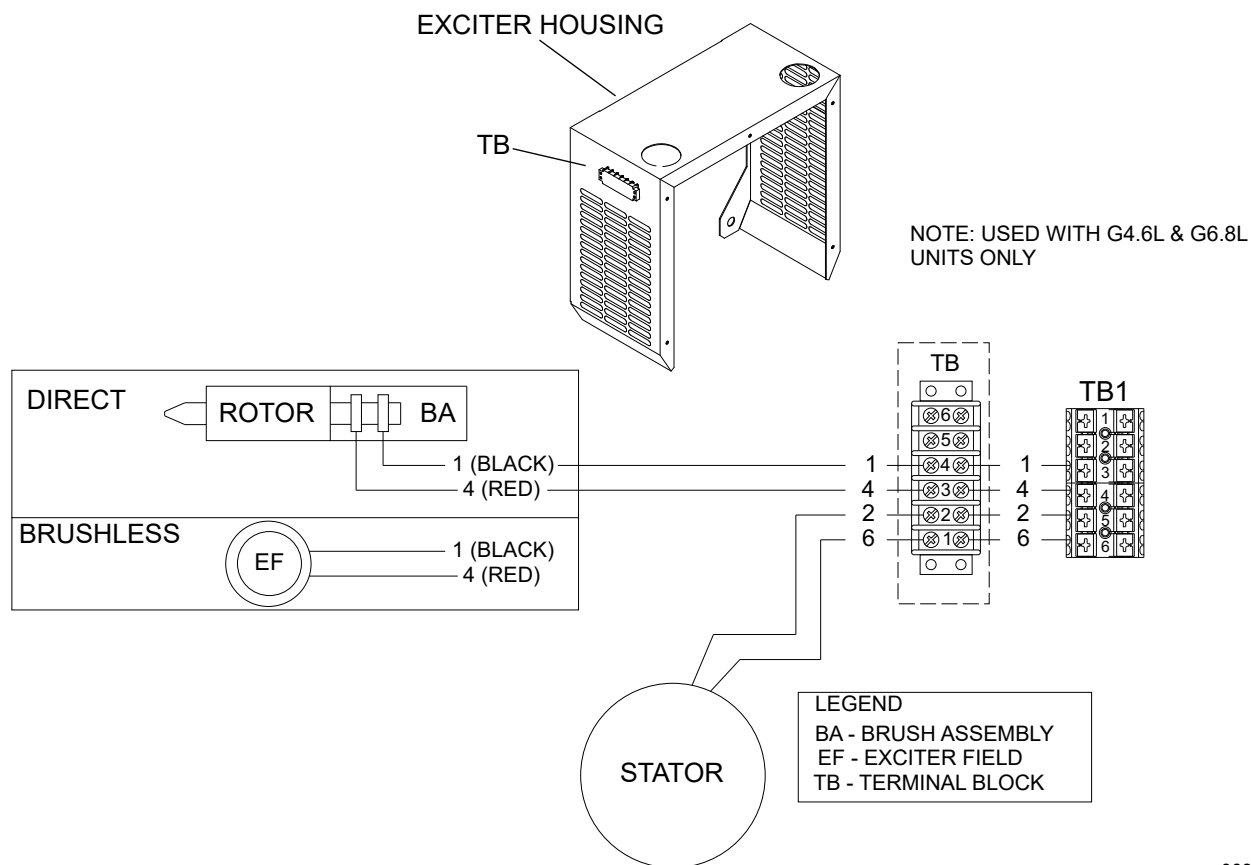
The AC sensing circuit serves to provide a reference of stator output voltage at the main circuit breaker. The regulator reacts to the change in AC sensing voltage by increasing DC field excitation if voltage goes low, and decreasing DC field excitation if output is too high. If the regulator does not receive this voltage, output at the breaker will be minimal. Reference the alternator connection diagrams located in Section 5.23 **OH6342-F Alternator Configurations** to identify what wire numbers are used for the specific voltage rating of the machine.

Procedure

1. Set a digital multimeter (DMM) to measure resistance.
2. Locate the TB1 terminal block located in the customer connection box and the appropriate connector on the back of the controller.
3. Connect one meter test lead to Wire SA/11/S1/S15 at the MLCB and the other meter test lead to the appropriate AC sensing input to the control board. Measure and record the resistance indicated.
 - a. If the DMM indicated CONTINUITY, proceed to step 4.
 - b. If the DMM indicated INFINITY, repair or replace the wire between SA and the control board.
4. Connect one meter test lead to Wire SB/44/S3/S16 and the other meter test lead to the appropriate AC sensing input to the control board. Measure and record the resistance indicated.
 - a. If the DMM indicated CONTINUITY, test is good.
 - b. If the DMM indicated INFINITY, repair or replace the wire between SB and the control board.

Results

Refer to flow chart.



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Figure 2-15. Brushless AC Connections

Test 13 – Test Regulator Output

General Theory

An electrical connection to the rotor is required in order for the regulator circuit to regulate DC field excitation voltage to the rotor. This procedure will test the integrity of the wire between the TB1 terminal block and the controller.

Procedure

1. Locate and disconnect the appropriate connector from the controller that contains Wire 1 and Wire 4.
2. Set a digital multimeter to measure resistance.
3. Connect one meter test lead to Wire 4 and the other meter test lead to Wire 1. Measure and record the resistance indicated.

Results

1. If the DMM indicated the rotor resistance indicated in Section 1.1 *Rotor And Stator Resistance Tables*, replace the controller.
2. If the DMM indicated INFINITY or an unexpected resistance, check Wire 1 and Wire 4 individually between the connector and TB1 and repair as needed.

Test 18 – Test Stator Assembly

General Theory

A digital multimeter (DMM) can be used to test the stator windings for the following faults:

- An open circuit condition
- A “short-to-ground” condition
- A short circuit between windings

NOTE: The resistance of stator windings is very low. Some meters will not read such a low resistance, and will simply indicate CONTINUITY. A high quality, digital type meter capable of reading very low resistances is recommended.

NOTE: Some wire numbers may be different than those illustrated or described in the test. Refer to the appropriate alternator connection diagram of the unit being serviced.

Testing 1-Phase Stators

1. Open the main line circuit breaker.
2. Disconnect stator leads 22 and 33 from the 00 neutral blocks.
3. Disconnect the appropriate connector containing the sensing wires from the panel.

NOTE: Verify wires are isolated and not touching any components.

4. Set DMM to measure resistance between the windings
 - a. Connect one meter test lead to stator lead 11 and connect the other meter test lead to stator lead 22. Measure and record resistance.
 - b. Connect one meter test lead to stator lead 44 and connect the other meter test lead to stator lead 33. Measure and record resistance.
 - c. Connect one meter test lead to stator lead 2 at TB1 of the spring loaded interconnection block and connect the other meter test lead to stator lead 6 at TB1 of the spring loaded interconnection block. Measure and record resistance.
 - d. Refer to chart in the front of this manual for correct resistance readings for your particular stator. If reading is INFINITY or a high ohm reading, then an open is possible across that winding.

NOTE: If the DPE winding is open it can be temporarily bypassed by connecting stator lead Wire 5 in place of Wire 6 on TB1, but the stator will need to be replaced.

5. Set DMM to a high resistance scale to check for a short to ground.

NOTE: Most multimeters will need to be taken out of the auto scaling feature and set to the manual K (1000) ohm scale.

- a. Connect one meter test lead to stator lead 11 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.
 - (1) If CONTINUITY is measured, disconnect sensing Wire 11 from the MLCB that runs to TB1 and see if the short is still in stator lead Wire 11 or is it located in sensing Wire 11.
- b. Connect one meter test lead to stator lead 44 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.
 - (1) If CONTINUITY is measured, disconnect sensing Wire 44 from the MLCB that runs to TB1 and see if the short is still in stator lead Wire 44 or is it located in sensing Wire 44.
- c. Connect one meter test lead to stator lead 2 at TB1 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.
- d. Connect one meter test lead to stator lead 11 and connect other meter test lead to stator lead 44, INFINITY should be measured.

OPTION 1—SINGLE PHASE, 240V

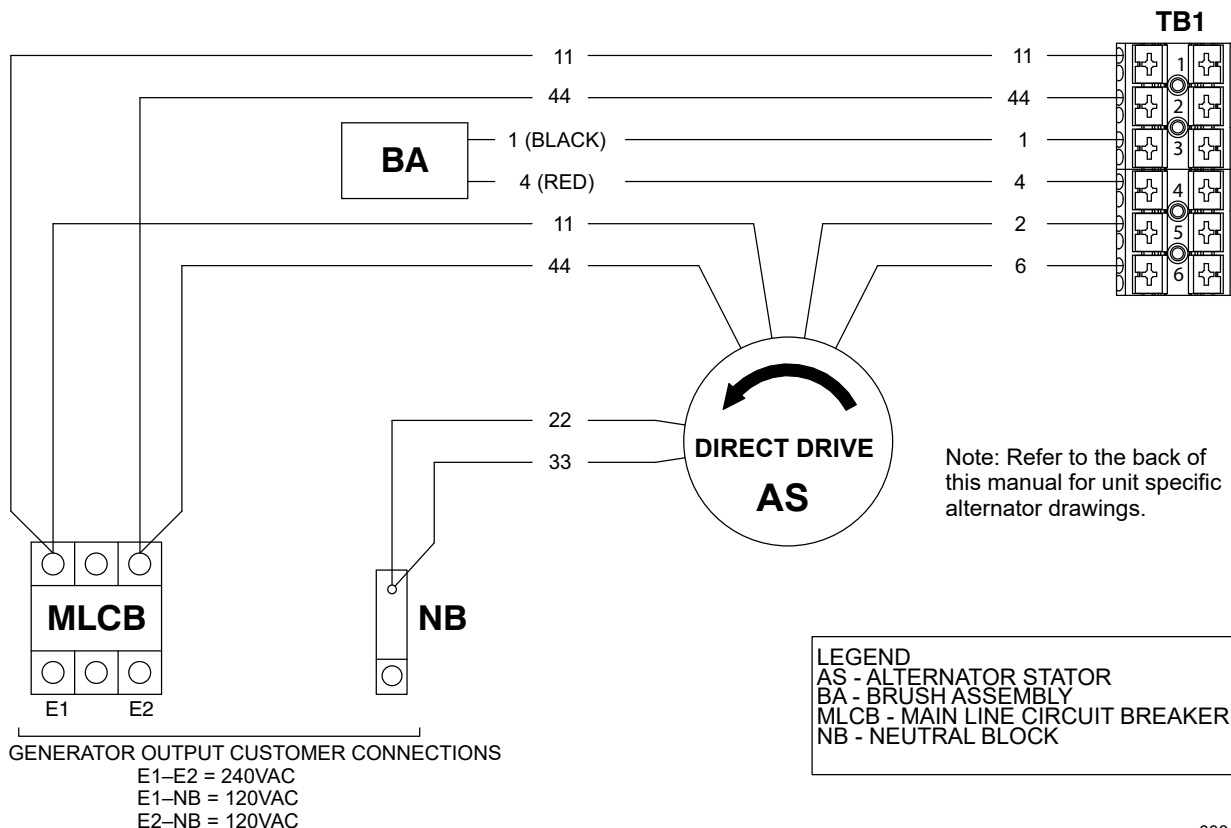


Figure 2-16. 1-Phase Stator and DPE Windings

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- e. Connect one meter test lead to stator lead 11 and connect other meter test lead to Wire 2 of TB1. INFINITY should be measured.
- f. Connect one meter test lead to stator lead 44 and connect other meter test lead to Wire 2 of TB1. INFINITY should be measured.

Stator lead 11 to Wire 2 of TB1
Stator lead 44 to Wire 2 of TB1

- g. If CONTINUITY is measured between any two points, then there is a short between the main AC winding and the DPE winding.

- a. Connect one meter test lead to stator lead S1 and connect the other meter test lead to stator lead to S4. Measure and record the resistance.
- b. Repeat step 4a between the following points.

Stator lead S6 and stator lead S3
Stator lead S5 to stator lead S2
Wire 2 of TB1 and Wire 6 of TB1

- c. Refer to chart in the front of this manual for correct resistance readings for your particular stator. If reading is INFINITY or a high ohm reading, then an open is possible across that winding.

Testing 3-Phase Stators

1. Open the main line circuit breaker.
2. Disconnect all neutral wires from the neutral block.
3. Disconnect the appropriate connector containing the sensing wires from the control panel.

NOTE: Verify wires are isolated and not touching any components.

4. Set DMM to measure resistance between the windings.

5. Set DMM to a high resistance scale to check for a short to ground.

- a. Connect one meter test lead to stator lead S1 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.

- (1) If CONTINUITY is measured, disconnect sensing Wire 11 from the MLCB that runs to TB1 and see if the short is still in stator lead S1 or is it located in sensing Wire 11.

OPTION 2—3-PHASE, 120/208

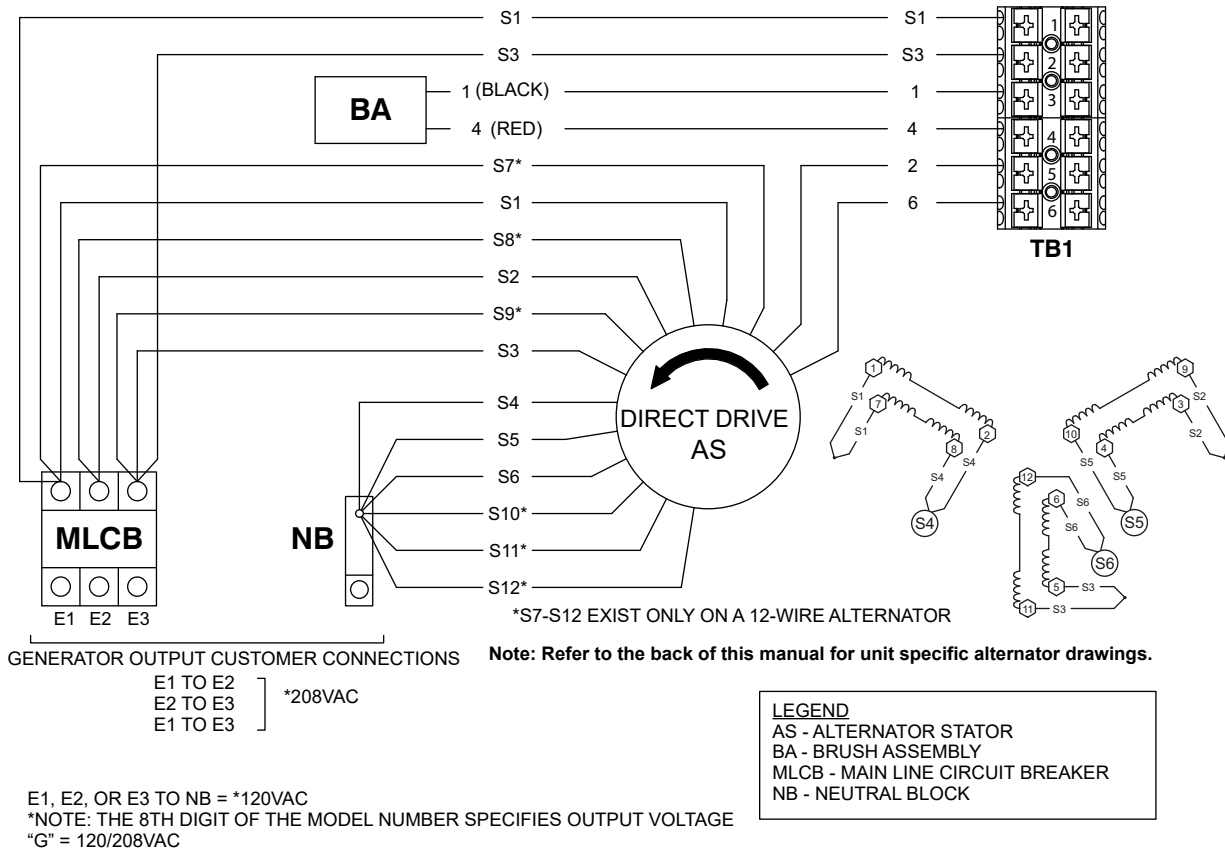


Figure 2-17. 3-Phase 208 VAC Stator and DPE Windings

003197

- b. Connect one meter test lead to stator lead S2 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.
 - c. Connect one meter test lead to stator lead S3 and connect the other meter test lead to a clean frame ground. INFINITY should be measured.
 - (1) If CONTINUITY is measured, disconnect sensing Wire 44 from the MLCB that runs to TB1 and see if the short is still in stator lead Wire S3 or is it located in sensing Wire 44.
 - d. If CONTINUITY is measured then a short exists to ground inside the stator.
6. Set DMM to a high resistance scale to check for a short between the windings.

NOTE: Most multimeters will need to be taken out of the auto scaling feature and set to the manual K ohm scale.

1. Connect one meter test lead to stator lead S1 and connect the other meter test lead to S2. INFINITY should be measured.
2. Repeat step (1) between the following points:

Stator lead S2 and stator lead S3
Stator lead S1 and stator lead S3
Wire 2 of TB1 and stator lead S1
Wire 2 of TB1 and stator lead S6
Wire 2 of TB1 and stator lead S5

NOTE: Refer to *Probing and Pin Extraction* for proper procedures in testing connector plugs and incoming wires.

3. For units with 208, 220, or 240 voltages, proceed to step 8. For units with 400 or 480 voltages, proceed to step 9.
4. Disconnect Wire 11 (S1) and Wire 44 (S2) from the main breaker (sensing wires to TB1).
 - a. Disconnect the appropriate connector containing the sensing wires from the control panel.
 - b. Set DMM to measure resistance.
 - c. Connect one meter test lead to sensing Wire 11 that was disconnected in step 7 and connect the other meter test lead to Wire 11 of TB1. CONTINUITY should be measured, if INFINITY is measured repair or replace wire between main breaker and Wire 11 of TB1.
 - d. Connect one meter test lead to sensing Wire 44 that was disconnected in step 7 and connect the other meter test lead to Wire 44 of TB1. CONTINUITY should be measured. If INFINITY is measured, repair or replace wire between main breaker and Wire 44 of TB1.

5. Disconnect Wire S15 and Wire S16 from the TB1 terminal block.
 - a. Set DMM to measure resistance ().
 - b. Connect one meter test lead to sensing Wire S15 and the other meter lead to disconnect stator lead 00. CONTINUITY should be measured. If INFINITY is measured, repair or replace Wire S15. If no damage is visible on Wire S15, replace stator.
 - c. Connect one meter test lead to sensing Wire S16 and the other meter lead to disconnect stator lead 00. CONTINUITY should be measured. If INFINITY is measured, repair or replace Wire S16. If no damage is visible on Wire S16, replace stator.

Test 19 – Test Brushed Rotor Assembly

General Theory

A rotor assembly having completely open windings will cause the loss of excitation current and as a result the generator AC output voltage will drop to residual voltage. A shorted condition in the rotor winding can result in low voltage.

NOTE: “Residual” voltage may be defined as voltage produced by rotor residual magnetism alone. The amount of voltage induced into the stator AC power windings by residual voltage alone will be approximately 2–16 VAC, depending on the characteristics of the specific generator. If a unit is supplying residual voltage only, either field excitation current is not reaching the rotor, or the rotor windings are open and the excitation current cannot pass. On current units with a liquid-cooled engine, “field boost” current flow is available to the rotor during engine cranking and running.

Procedure

1. Set a DMM to measure resistance.
2. Disconnect the appropriate connector from the control panel that contains Wires 1 and 4.
3. Connect one meter test lead to Wire 1 on TB1 and connect the other meter test lead to Wire 4 on TB1. Measure and record the resistance. Refer to *Rotor And Stator Resistance Tables* for the proper resistance readings.
 - The meter should read within ± 3 ohms of the specification in the tables.
 - If high or low resistance, or a reading of INFINITY was measured, proceed to step 3 and check slip rings and brushes.
 - If the correct resistance reading is present within 3 ohms of the resistance in *Rotor And Stator Resistance Tables*, stop testing and proceed directly to the results.

4. Lift the brushes off of the slip rings and place a non-conductive insulator (such as a paper business card) between the slip rings and both sets of brushes, or remove brushes completely. Connect one meter test lead to the positive (+) slip ring (nearest the rotor bearing) and the other meter test lead to the negative (-) slip ring. Measure and record the reading.
5. With the brushes still isolated from the slip rings, connect one meter test lead to the positive (+) slip ring and the other meter test lead to a clean frame ground. INFINITY should be measured.

NOTE: Do not reassemble the alternator compartment until a valid resistance reading is present at Wire 1 of TB1 and Wire 4 of TB1. If an acceptable resistance reading is not present, there are still issues that need to be resolved.

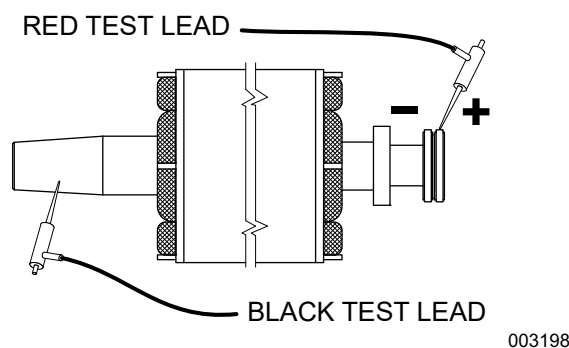


Figure 2-18. Testing Rotor Insulation

6. Check the brushes to
 - a. verify they are making good contact on the slip rings and that they have no visual damage.
 - b. Verify that the brushes are riding on the slip rings and are seated properly with the unit at "REST" and while the unit is "RUNNING".
 - There should be no arcing on the slip rings while running. Arcing is a clear indication that the brushes and the rotor are not properly aligned.
 - c. Verify that the positive and negative wires are connected to the corresponding slip rings and that the polarities are not mismatched, i.e. having a positive and negative wire connected to a brush that is contacting the same slip ring.
 - d. If all tests are good, stop testing and go to results.

NOTE: Verify the proper safety measures are followed while the unit is running with the alternator compartment exposed.

Results

1. If the rotor assembly had either an open or a direct short to ground in steps 3 and 4, replace the rotor.
2. If no resistance reading was present in step 2, but the correct resistance reading was present on the slip rings in step 3 and the brushes are in good shape, replace the brush assembly and wires. The wires leading up to the control panel are damaged and preventing excitation voltage from getting to the rotor.

NOTE: A replacement brush assembly will come with two sets of brushes and two sets of wires (Wires 1 and 4). It is possible to test Wires 1 and 4 to find out which wire is defective or open and replace just that individual wire.

3. If the slip rings appear dull or tarnished, they may be polished with fine sandpaper. **DO NOT USE METALLIC GRIT TO POLISH SLIP RINGS.**
4. If the results of all rotor tests are good, perform **Testing Rotor Insulation** (Section 1.3).

NOTE: Carefully read Section 1.3 **Testing, Cleaning, and Drying**. If rotor tests good, perform an insulation resistance test. If it fails, clean and dry the rotor and then retest. If the rotor fails the second insulation resistance test, it should be replaced.

Test 20 – Test Brushless Exciter Field

General Theory

Brushless alternators use an exciter assembly to create a magnetic field in the main rotor. This test procedure is for testing the connection to the exciter field.

Procedure

1. Set digital multimeter (DMM) to measure resistance.
2. Disconnect the appropriate connector at the back of the controller that contains Wires 1 and 4.
3. Connect one meter test lead to TB1 (Wire 1) and the other meter test lead to TB1 (Wire 4). Measure and record the resistance indicated.
 - a. If the DMM indicated the resistance indicated in Section 1.1 **Rotor And Stator Resistance Tables**, refer to the flow chart.
 - b. If the DMM indicated INFINITY or a high resistance, proceed to TB located in the exciter guarding and recheck Wires 4 and 1. If the resistance continues to be out of specifications, replace exciter field.

Results

Refer to the flow chart.

Test 21 – Test Brushless Exciter Armature

General Theory

The exciter armature is connected directly to the main rotor. The armature has three windings connected in a Y configuration. The armature provides AC voltage to the rotating bridge rectifier where it is rectified into DC voltage and passed on to the main rotor assembly. This test only checks the integrity of the windings.

Procedure

1. Disconnect all three wires from the rotating bridge rectifier.
2. Set a digital multimeter (DMM) to measure resistance.
3. Connect one meter test lead to one wire and the other meter test lead to either of the other wires.

NOTE: Wires will not be marked with any identification and resistance values of a good armature are consistent between each winding.

4. Repeat step 3 until each winding has been tested against the other two windings.

Results

1. If the DMM indicated the resistance values indicated in **table 1 “Rotor and Stator Resistances”**, refer to the flow chart.
2. If the DMM indicated INFINITY or high resistance, replace exciter armature.

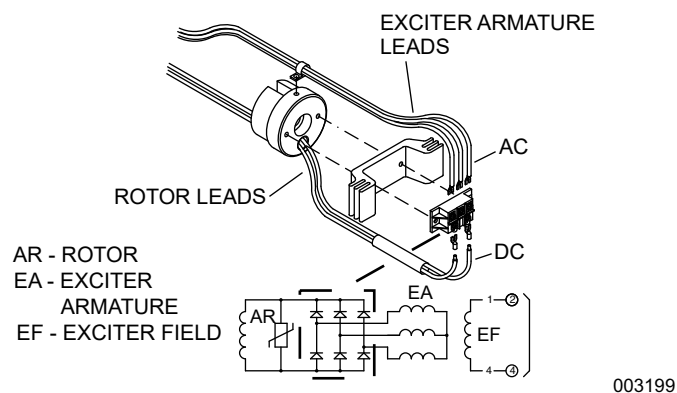


Figure 2-19. Rotating Bridge Rectifier

Test 22 – Test Brushless Rectifier Assembly

General Theory

The rotating bridge rectifier rectifies AC voltage from the exciter armature and provides the required DC field excitation voltage to the main rotor.

Procedure

1. Disconnect all wires from the rotating bridge rectifier and terminal F of the MOV connected across terminal A and B as shown in **Figure 2-20**.
2. Set a digital multimeter (DMM) to diode function.
3. Connect meter test leads according to **Table 2-2** and record the results indicated in step 3 results.
4. Set DMM to measure resistance.
5. Connect one meter test lead to point F and the other meter test lead to point B. Measure and record the results indicated in step 5 results.

Results

1. If the DMM indicated the expected results given in **Table 2-2**, refer to the flow chart.
2. If the DMM indicated INFINITY or an unexpected resistance, replace rotating rectifier assembly.

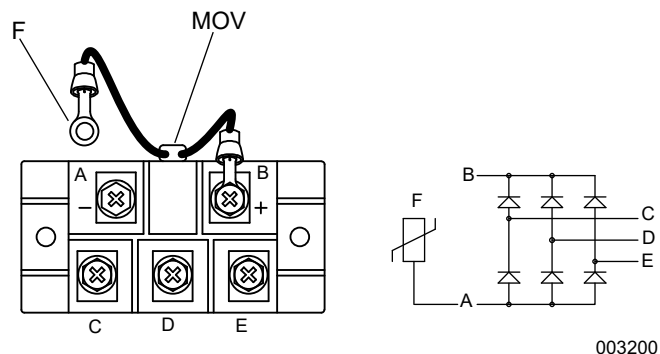


Figure 2-20. Bridge Rectifier Test Points

Table 2-2. Test 22 Results			
RED	BLACK	EXPECTED	RESULTS
STEP 3—ROTATING BRIDGE RECTIFIER TEST			
A	C	0.4–0.5 VDC	
A	D	0.4–0.5 VDC	
A	E	0.4–0.5 VDC	
B	C	OPEN	
B	D	OPEN	
B	E	OPEN	
C	A	OPEN	
D	A	OPEN	
E	A	OPEN	
C	B	0.4–0.5 VDC	
D	B	0.4–0.5 VDC	
E	B	0.4–0.5 VDC	
STEP 5—MOV TEST			
F	B	INFINITY	

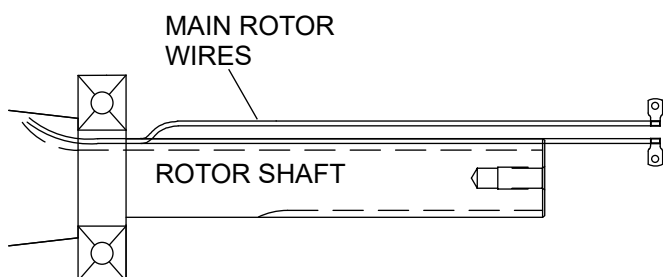
Test 23 – Test Brushless Rotor Assembly

General Theory

The main rotor assembly is connected to the rotating bridge rectifier assembly where it receives DC field excitation voltage to create the magnetic field required to create the desired output from the stator.

Procedure

1. Disconnect the rotor wires from the rotating bridge rectifier.
2. Set digital multimeter (DMM) to measure resistance.
3. Connect one meter test lead to one wire and the other meter test lead to the other. Measure and record the resistance.
4. Continue to have one meter test lead connected to the rotor and the other meter test lead to a clean frame ground. Measure and record the resistance.
5. Visually inspect the rotor wires along the channel of the main rotor for any cracks or breaks in the wire. Record findings as needed.



003201

Figure 2-21. Brushless Rotor Wires

Results

1. If the DMM indicated the resistance shown in the [Rotor And Stator Resistance Tables](#), refer to the flow chart.
2. If the DMM indicated INFINITY, low, or high resistance, replace main rotor assembly.
3. If the main rotor wires have any cracks or breaks in the wire, attempt repair or replace main rotor assembly.

Test 24 – Check AC Output Voltage

General Theory

A digital multimeter (DMM) may be used to check the generator output voltage. Output voltage may be checked at the unit's main circuit breaker terminals. Refer to the unit's data plate for rated line to-line and line-to-neutral voltages.

Procedure

1. With the engine shut down, connect the AC voltmeter test leads across any two poles on the main breaker of the generator main circuit breaker (see [Figure 2-5](#)). These connections will permit line-to-line voltages to be read.
2. Set the generator main circuit breaker to OFF (OPEN). This test will be conducted with the generator running at no-load.
3. Start the generator and let it stabilize and warm up for a minute or two.
4. Take the meter reading. On units with a rated line-to-line voltage of 240 volts, the no-load voltage should be about 242–252 VAC.
5. Shut the engine down and remove the meter test leads.

NOTE: Refer to the units DATA plate for the units rated line-to-line voltage.

Results

1. If zero volts or residual voltage is indicated, go to [Test 4 – Fixed Excitation Test](#).
2. If the voltage reading is higher than residual, but is lower than the stated limits, go to [Test 11 – Test AC Excitation \(DPE\) Circuit](#).
3. If a high voltage is indicated, go to [Test 26 – Calibrate Voltage Regulator](#).

Test 25 – Check AC Output Frequency

General Theory

Generator AC frequency is proportional to the operating speed of the rotor. A 4-pole rotor (having two north and two south magnetic poles) will supply a 60 Hz AC frequency at 1800 RPM. A 2-pole rotor will supply a 60 Hz AC frequency at 3600 RPM. Thus, if the AC frequency is high, or low, fuel or the engine speed governor circuit could be the problem.

NOTE: A 4-pole rotor at 50 Hz rotates at 1500 RPM. A 2 pole rotor rotates at 3000 RPM

Procedure

1. Connect an accurate AC frequency meter across the main line circuit breaker (line-to-line).
2. Set the AUTO-OFF-MANUAL mode to MANUAL.

IMPORTANT NOTE: The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.

3. Let the engine warm up and stabilize at no-load. When the engine has stabilized, the frequency reading should be 60 Hz.

Results

1. If the AC frequency is high or low, go to Section 3.4 **Problem 21 – Unit Starts Hard and Runs Rough / Lacks Power**.
2. If frequency is good, but voltage is high or low, go to Section 4.1 **Generator Adjustments** for voltage regulator adjustments.
3. If frequency and voltage are both good, tests may be discontinued.

Test 26 – Calibrate Voltage Regulator

Refer to specific programming section for adjustment of the panel regulator.

Test 27 – Test Voltage and Frequency Under Load

General Theory

It is possible for the generator AC output frequency and voltage to be good at no-load, but they may drop excessively when electrical loads are applied. This condition can be caused by (a) overloading the generator, (b) loss of engine power, or (c) a shorted condition in the stator windings or in one or more connected loads.

Procedure

1. Connect an accurate AC frequency meter and an AC voltmeter across the stator AC power winding leads.

IMPORTANT NOTE: *The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.*

2. Set AUTO-OFF-MANUAL switch to MANUAL. Let the generator stabilize and warm-up.
3. Apply electrical loads to the generator equal to the rated capacity of the unit.
4. Check the AC frequency and voltage. Frequency should not drop below approximately 59 Hz for 60 Hz product (49 Hz for 50 Hz product). Voltage should not drop below 20% of the rated voltage.

Results

1. If frequency and voltage drop excessively under load, refer to Section 3.4 **Problem 21 – Unit Starts Hard and Runs Rough / Lacks Power**.
2. If frequency and voltage under load are good, discontinue tests.

Test 28 – Test for an Overload Condition

General Theory

An “overload” condition is one in which the generator rated wattage/amperage capacity has been exceeded. To test for an overload condition on an installed unit, the best method is to use an ammeter.

Procedure

Use a clamp-on ammeter to measure load current draw, with the generator running and all normal electrical loads turned on.

NOTE: For Overload Setting adjustment see **Programmable Limits**.

Results

1. If the unit is overloaded, reduce loads to the unit’s rated capacity.
2. If unit is not overloaded, but rpm and frequency drop excessively when loads are applied, refer to Section 3.4 **Problem 21 – Unit Starts Hard and Runs Rough / Lacks Power**.

Test 29 – Test Engine Condition

General Theory

If engine speed and frequency drop excessively under load, the engine may be under-powered. An under-powered engine can be caused by a dirty air cleaner, loss of engine compression, incorrect ignition timing, lack of fuel, etc.

Procedure

For engine testing, troubleshooting, and repair procedures refer to the appropriate engine service manual.

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Section 3.1 Controller Identification

Introduction

Information in this section is provided to familiarize the reader with the various components that make up the DC control system on units having a liquid-cooled engine. These components may be divided into three broad categories:

- Generator customer connection box components
- Engine mounted components
- Engine protective devices

Customer Connection Box

Location and Description

The customer connection box includes:

- Quick disconnect blocks TB1, TB2, and TB3
- Mounting location for control panel
- High and low voltage plugs and receptacles
- Flash circuit and fly back diode assemblies

Quick Disconnect Blocks

These quick disconnect blocks (*Figure 3-1*) provide a convenient connection point for AC and DC control system wiring. Terminals, associated wires, and their functions are listed in the following chart.

Pin #	Wire #	Function
TB1-1	SA/11/S1/S15	Voltage sensing A
TB1-2	SB/44/S3/S16	Voltage sensing B
TB1-3	1	(-) Side of DC to rotor from Nexus AVR
TB1-4	4	(+) Side of DC to rotor from Nexus AVG
TB1-5	2	AC excitation to DPE breaker for Nexus AVR
TB1-6	6	AC excitation to Nexus AVR
TB2-1	N1	Utility voltage sensing 1
TB2-2	N2	Utility voltage sensing 2
TB2-3	T1	120 VAC source for battery charger
TB2-4	NEU	120 VAC neutral for battery charger
TB3-1	194	Transfer relay +
TB3-2	23	Transfer relay coil control
TB3-3	183	Remote start
TB3-4	178	Remote start

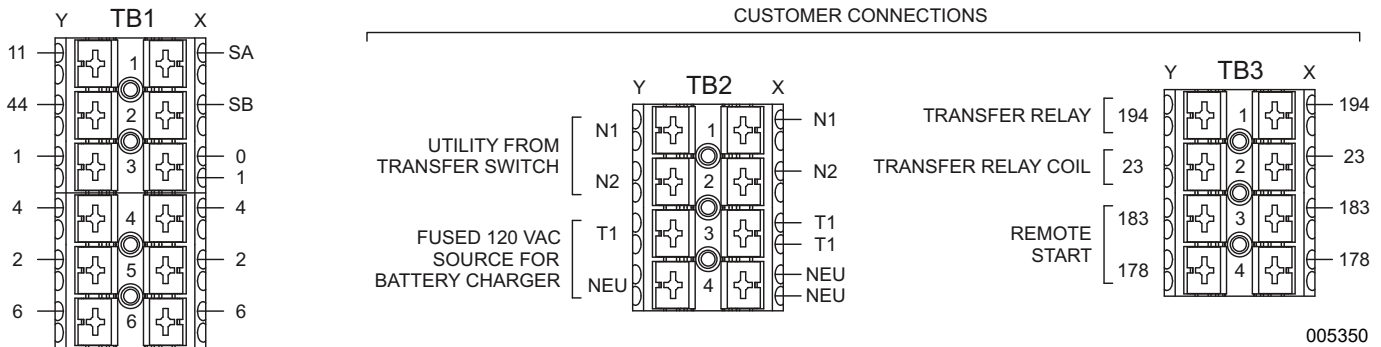


Figure 3-1. Quick Disconnect Blocks

Controller

This solid state circuit board controls all standby electric system operations, including voltage regulation, speed governing, engine cranking, startup, running, automatic transfer, and shutdown.

The circuit board also provides automatic engine shutdown in the event of (a) low engine oil pressure, (b) high engine coolant temperature, (c) low coolant level, (d) overspeed, (e) overcrank, (f) under voltage, and (g)

rpm sensor loss. See *Engine Protective Devices/Shutdowns*. On occurrence of any one or more of these engine faults, the controller will display the fault via a 2-line digital display.

The various functions handled by the controller are listed in the following charts, along with appropriate connector pin numbers and wire numbers.

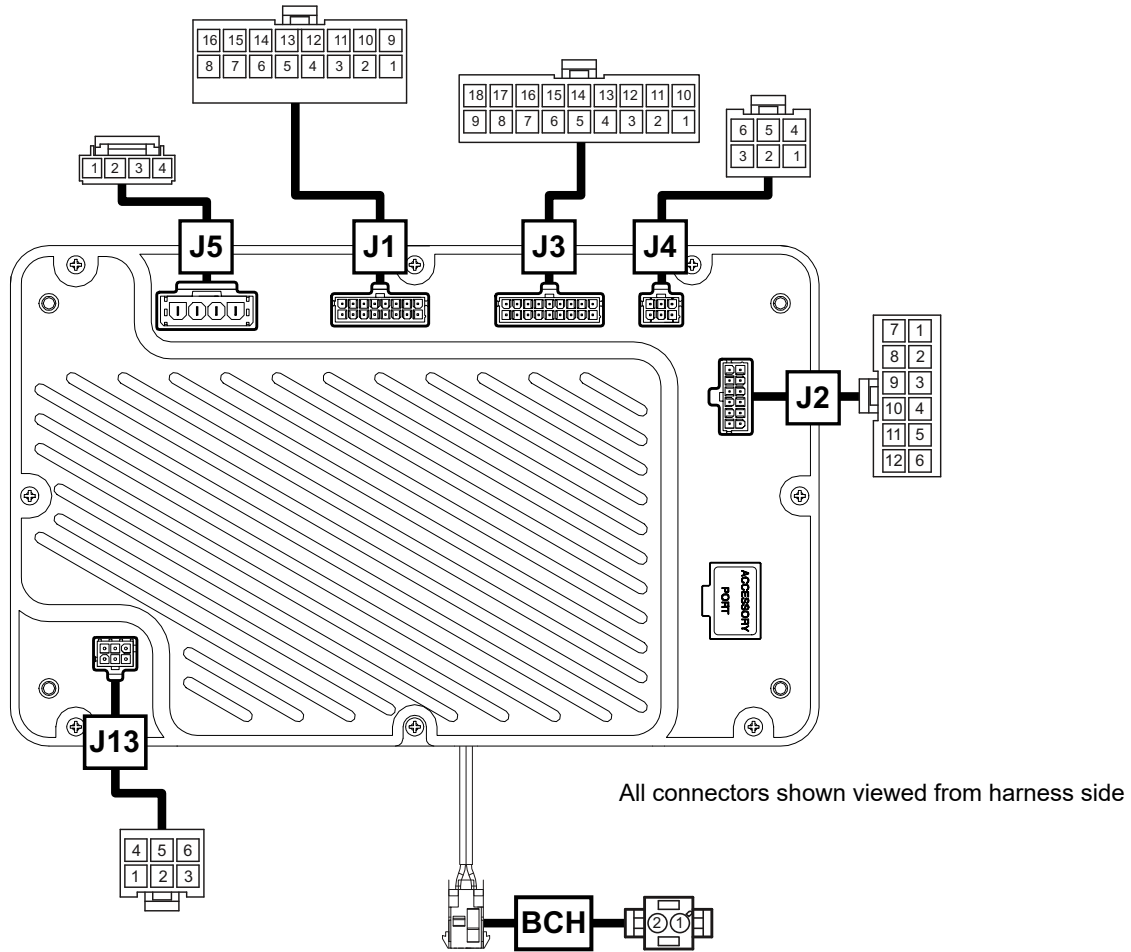


Figure 3-2. Evolution™ Controller Pinouts

Pin #	Wire #	Function
J1		GEN I/O
J1-1	13	Battery + input
J1-2	13	Battery + input
J1-3	56	Starter output
J1-4	0	Battery - input
J1-5	183	2-Wire start return
J1-6	194	XFER + 12V
J1-7	23	XFER return
J1-8	211	Common alarm
J1-9	14	Fuel output
J1-10	771	Bosch output 2
J1-11		Thermistor (battery charger)
J1-12		Thermistor (battery charger)
J1-13		Hall input signal
J1-14	178	2-Wire start out
J1-15	210	Common alarm
J1-16		Enrichment or preheat

Pin #	Wire #	Function
J2		GEN I/O
J2-1	808	Air/fuel actuator
J2-2		Hall output power (+12V)
J2-3		Spare
J2-4	396	E-stop return
J2-5		Spare
J2-6		CAN ground
J2-7		Spare
J2-8	395	E-stop source
J2-9	573	Coolant level +
J2-10	573A	Coolant level -
J2-11	743	CAN-H
J2-12	744	CAN-L

Table 3-4. Evolution™ Controller J3 Pinout Chart

Pin #	Wire #	Function
J3		GEN I/O
J3-1	SHLD	Flywheel shield
J3-2	79A	CAM in
J3-3	0A	CAM return
J3-4	591	Fuel pressure ground
J3-5	575	Fuel pressure level
J3-6	68	Coolant temperature
J3-7	765	Bosch position feedback source (+3.3V)
J3-8	766	Bosch position feedback signal
J3-9	770	Bosch output 1
J3-10	79	Flywheel in
J3-11	0	Flywheel return
J3-12	SHLDA	CAM shield
J3-13	731	Rupture tank
J3-14	590	Fuel pressure power
J3-15	86	Oil pressure
J3-16	804	O ₂ positive
J3-17	806	O ₂ negative
J3-18	767	Bosch position feedback return (ground)

Table 3-5. Evolution™ Controller J4 Pinout Chart

Pin #	Wire #	Function
J4		V SENSE
J4-1	11S	Generator VSENSE
J4-2	----	Spacer pin
J4-3	N1	Utility VSENSE
J4-4	44S	Generator VSENSE
J4-5	----	Spacer pin
J4-6	N2	Utility VSENSE

Table 3-6. Evolution™ Controller J5 Pinout Chart

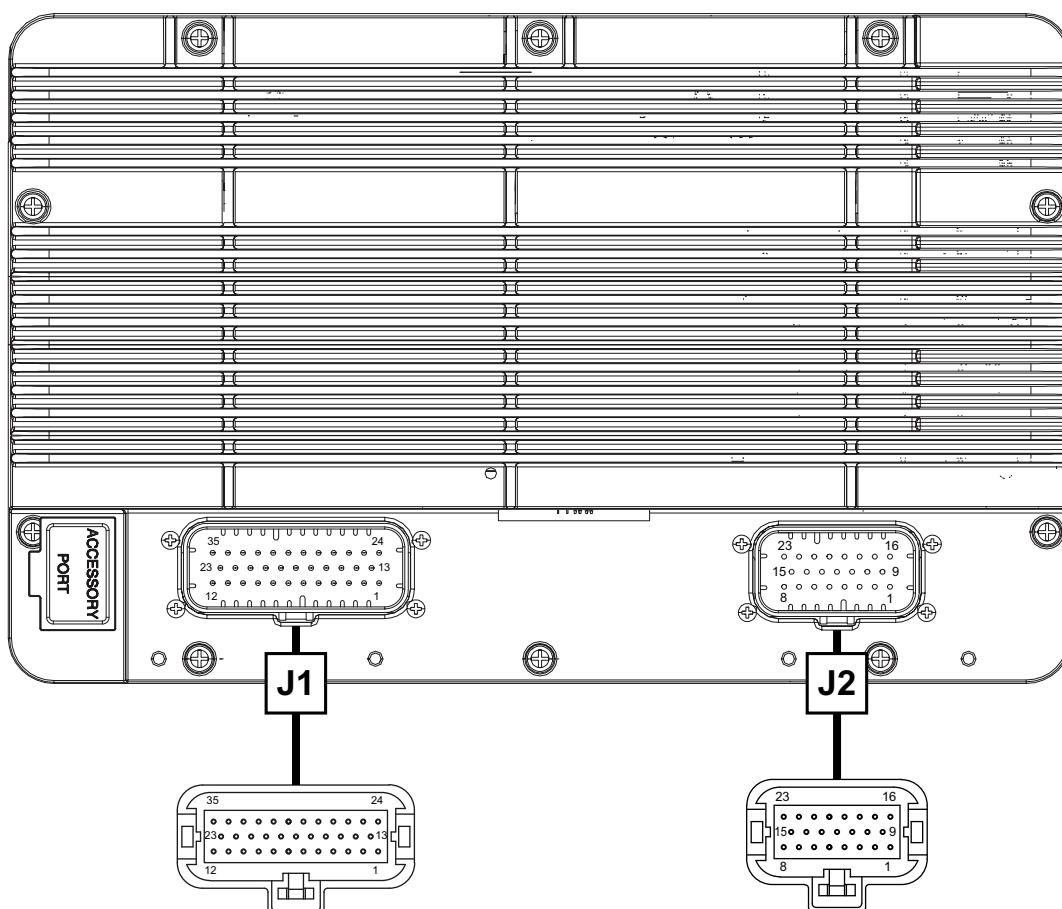
Pin #	Wire #	Function
J5		AVR
J5-1	2	DPE
J5-2	1	Field -
J5-3	6	DPE
J5-4	4	Field +

Table 3-7. Evolution™ Controller BCH Pinout Chart

Pin #	Wire #	Function
J10		Programming
J11/J12	B/C INPUT	Same as 2013 air-cooled

Table 3-8. Evolution™ Controller J13 Pinout Chart

Pin #	Wire #	Function
J13		IGNITION
J13-1	15A	Coil power
J13-2	----	Spare
J13-3	451	Cylinder 1
J13-4	452	Cylinder 2
J13-5	453	Cylinder 3
J13-6	454	Cylinder 4



All connectors shown viewed from harness side

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Figure 3-3. Nexus™ Controller Pinouts

Pin #	Wire #	To	Function
1	178	CUST CON	Remote start return
4	817	BWR-2	Remote display system ready
5	818	BWR-3	Remote display alarm
6	15	F1	Note 4
7	15	F1	Note 4
8	0	GNO	Note 1
9	0	GNO	Note 1
10	0	MP1-2	Flywheel sensor
11	OA	MP2-2	Cam sensor (internal ignition only)
12	820	BWR-1	+5V power for basic remote
13	SA/11/ S1/ S15	MLCB	Output voltage sensing A
14	183	CUST CON	Remote start
15	SHLD A	MP2-1	Cam sensor drain (internal ignition only)
16	SHLD	MP1-1	Flywheel sensor drain

17	819	BWR 4	Remote display maintenance
18	767	GOV-2	Throttle position feedback return
19	765	GOV-3	Throttle position feedback source
20	766	GOV-6	Throttle position feedback signal
21	68	WTS-2	Coolant temp signal
22	79A	MP2-3	Cam sensor + (internal ignition only)
23	79	MP1-3	Flywheel sensor +
24	SB	MLCB	Output voltage sensing B
25	N1	CUST CON	Utility voltage sensing 1
26	N2	CUST CON	Utility voltage sensing 2
31	573A	WLS-A	Coolant level signal return
32	573	WLS-B	Coolant level signal
33	86	LOS-NC	Low oil pressure signal
34	804	EC-6	Oxygen sensor +
35	805	EC-5	Oxygen sensor return

Table 3-10. Nexus™ Controller J2 Pin Out Chart

Pin #	Wire #	To	Function
1	770	GOB-4	Throttle drive HI
2	808	EC-4	Air/fuel ratio solenoid driver
3	56B	FS2	Starting fuel solenoid control
4	451	CYL1	Ignition coil drive 1 (internal ignition)
5	452	CYL2	Ignition coil drive 2 (internal ignition)
6	453	CYL3	Ignition coil drive 3 (internal ignition)
7	454	CYL4	Ignition coil drive 4 (internal ignition)
8	14	DB1/FS/EC-2	Run circuit output
9	771	GOV-1	Throttle drive LO
12	23	CUST CON	Transfer relay coil control
13	194	CUST CON	Transfer relay coil +
14	601	LFP	Low fuel pressure
15	210	CAR	Common alarm relay
16	6	DPE	AC excitation voltage
17	162	CB	AC excitation voltage (breaker protected)
18	4	FIELD	Field (brush) +
19	1	FIELD	Field (brush) -
20	T1	CUST CON	120 VAC source for battery charger
21	NEU	CUST CON	120 VAC return for battery charger
22	56	SC	Starter contactor driver
23	15A	EC-2/CYL1-CYL4	Fuse 12 VDC for general use

Internal Ignition Module (IM)

The controller uses a distributor-less ignition system. It can control up to four cylinders with individual ignition coils. The ignition system is used to control spark for each cylinder and fire the spark plug at the proper time. The ignition module utilizes both inputs from the crank sensor and the cam sensor to determine the specific point to ignite a particular cylinder.

External Ignition Module

On engines that have six cylinders or more, it is required that the unit be equipped with an external ignition module. The external ignition module is controlled by a CAN BUS connection to the control panel. The CAN BUS connection allows the control panel to set the specific timing based upon engine size and fuel type being used. The CAN BUS

also allows ignition faults to be annunciated on the control panel display. The ignition module utilizes both inputs from the crank sensor and the cam sensor to determine the specific point to ignite a particular cylinder. Battery voltage is delivered to the ignition module via a fuse protected circuit through Wire 15B and is present at all times.

Table 3-11. External Ignition Pinouts

Pin #	Wire #	Function
1	460	Ignition coil cylinder 10 (if equipped)
2	454	Ignition coil cylinder 4
3	456	Ignition coil cylinder 6
4	451	Ignition coil cylinder 1
5	452	Ignition coil cylinder 2
6	455	Ignition coil cylinder 5
7	457	Ignition coil cylinder 7 (if equipped)
8	459	Ignition coil cylinder 9 (if equipped)
9	453	Ignition coil cylinder 3
10	SHLD	Camshaft sensor shield
11	-	-
12	-	-
13	-	-
14	79A	Crankshaft sensor positive
15	458	Ignition coil cylinder 8 (if equipped)
16	15B	12 VDC power supply
17	0	Ground connection
18	15D	12 VDC used for ignition coils
19	-	-
20	SHLDA	Crankshaft sensor shield
21	0A	Crankshaft sensor negative
22	0A	Camshaft sensor negative
23	450	Camshaft sensor positive

Fuse (F1)

A 7.5 amp fuse is located on the front of the control panel. It protects the panel components from damaging overload. Always remove this fuse before commencing work on the generator. The unit will not start or crank if the fuse is blown.

NOTE: With the battery charger active and the fuse removed, the display will remain active but the panel will be locked out. Evolution equipped units may display "Fuse Problem".

NOTE: On Evolution units with firmware version 1.12 and newer, the unit can start and run with the fuse removed. Disconnect the negative battery cable from the battery to prevent unit operation.

Battery Charger (BCH)

The charger operates at one of three battery charging voltage levels depending on ambient temperature.

- 13.5 VDC at high temperature
- 14.1 VDC at normal temperature
- 14.6 VDC at low temperature

The battery charger is powered from a 120 VAC load connection through a fuse (F3) in the transfer switch. This 120 VAC source must be connected to the generator in order to operate the charger.

During a utility failure, the charger will momentarily be turned off until the generator is connected to the load. During normal operation, the battery charger supplies all the power to the controller.

The battery charger begins the charge cycle when battery voltage drops below approximately 12.6V. The charger provides current directly to the battery dependent on temperature, and the battery is charged at the appropriate voltage level. At the end of the appropriate charging period, battery charge current is measured when the generator is off. If battery charge current at the end of the charge time is greater than a pre-set level, or the battery open-circuit voltage is less than approximately 12.5V, an “inspect battery” warning is raised. If the engine cranks during the charge period, then the charge timer is restarted.

Charge Period	
Nexus	18 hours
Evolution	26 hours

At the end of the charge period, the charger does one of two things. If the temperature is less than approximately 40 °F (4 °C), the battery is continuously charged at a voltage of 14.1V (i.e. the charge voltage is changed from 14.6V to 14.1V after the appropriate charge cycle has elapsed). If the temperature is above approximately 40 °F (4 °C), then the charger will stop charging the battery.

The battery has a similar role as that found in an automobile application. It does nothing until it either self-discharges below 12.6V, or an engine crank cycle occurs (i.e. such as occurs during the weekly exercise cycle). If either condition occurs the battery charge will begin its charge cycle.

Common Alarm Relay

The common alarm relay provides a set of contacts to drive a customer provided external alarm indication. When the control is powered up, if there are no alarms, the relay contacts will be open. Any alarm (not warning) will trigger the common alarm relay to operate, closing the contacts. The connections are made to the generator either as:

- a loop near the TB2/TB3 connections in the customer connection area on the harness itself on an Evolution controlled unit.
- or as two wires separated from the harness near the J connectors at the controller on a Nexus Controlled unit.

Specifications		
Contact Rating	10A at 250 VAC	5A at 30 VDC

Engine Mounted Components

Engine mounted DC control system components include the following:

- DC alternator
- Starter motor and control contactor
- Fuel solenoid - injection pump
- 5 amp diesel injection pump fuse (diesel units)
- Fuel primer solenoid
- 25 amp fuse (F2) (nexus only)
- 15 amp fuse (F3) (external ignition only)
- Cam sensor
- Crank sensor
- Oxygen sensor if equipped (OS)
- Air/fuel solenoid if equipped (AFS)

Battery and Battery Charge System

A belt driven alternator delivers a charging voltage to the battery during engine operation. The charging voltage is regulated and rectified by the DC regulator. Alternator maintenance is limited to replacement of defective parts.

Battery and Battery Charge System (1.5L and 1.6L Engines)

See [Figure 3-4](#). An alternator delivers a charging voltage to the battery during engine operation. The charging voltage is regulated and rectified by the DC regulator.

The belt driven alternator is a permanent magnet type. Alternator maintenance is limited to replacement of defective parts.

The DC voltage regulator is housed in an aluminum heat sink. All components are covered with epoxy resin. The regulator is NOT repairable. Regulator connector pins are numbered from left to right, as follows:

Pin #	Function
1	Charging output to battery (12.5–14.5 VDC)
2	Charging input from alternator (AC)
3	Charging input from alternator (AC)
4	Charge indication lamp connection (not used)
5	Sensing voltage from battery (Wire 15)

NOTE: The alternator supplies alternating current (AC) which is changed to direct current (DC) by the regulator.

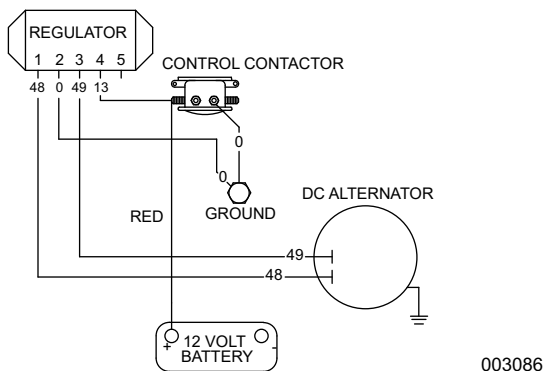


Figure 3-4. Battery Charging System

Battery and Battery Charge System (2.3L Diesel, 2.4L Gas and Larger)

See **Figure 3-5**, the externally excited belt driven alternator delivers a charging voltage to the battery during engine operation. The charging voltage is regulated and rectified by the regulator that is internal to the belt driven alternator. This belt driven alternator is externally excited. Wire 49 from the flash circuit does the initial excitation of the alternators field circuit. Without this initial “flash” there will be no output from the alternator. Alternator trouble shooting is limited to verifying proper inputs and outputs of the alternator.

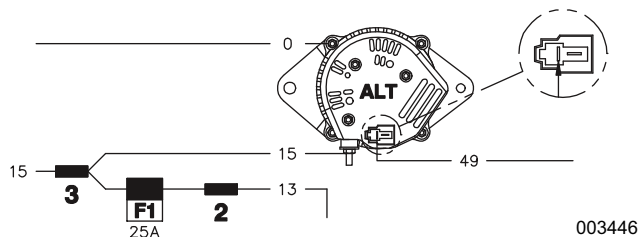


Figure 3-5. Battery Charging System

Run Relay

The run relay is energized by Wire 14A and controls Wire 13A. The relay will close its contacts when the control board energizes Wire 14/14A. When these contacts close, it allows voltage to go from Wire 13 to Wire 13A. Wire 13A is the run circuit.

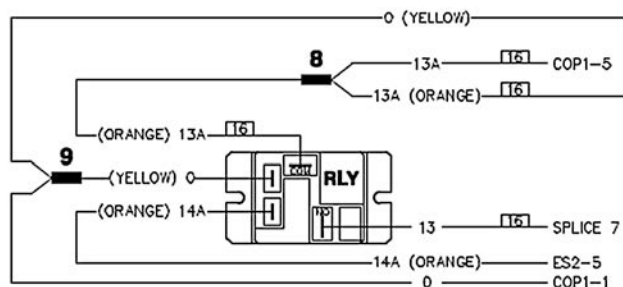


Figure 3-6. Run Relay Circuit

Starter Motor (SM) and Starter Contactor (SC)

During manual or automatic startup, control board action delivers 12 VDC to a starter contactor (SC) coil. The coil energizes, its contacts close, and battery power is delivered to the starter motor (SM). The starter motor energizes and the engine cranks.

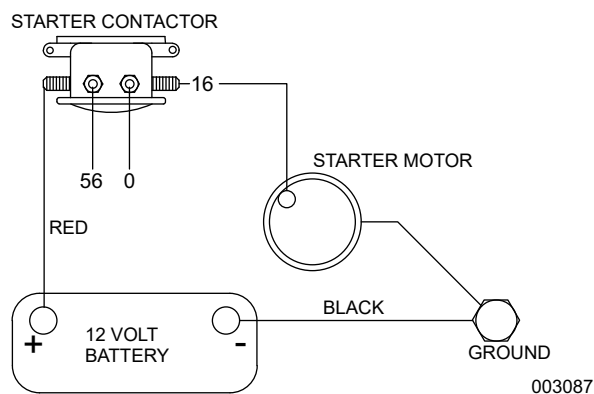


Figure 3-7. Engine Cranking Circuit

Fuel Solenoid—Injection Pump

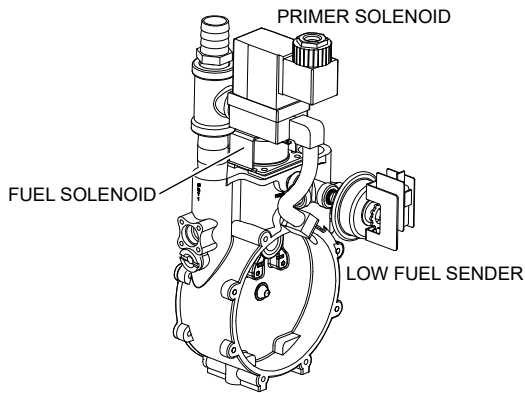
The fuel solenoid (FS or IP) provides a means to shutoff fuel when the engine is not running. The solenoid is energized OPEN by 12 volts DC (Wire 14); CLOSED when de-energized.

NOTE: Minimum voltage to the injection pump solenoid is 10 VDC.

Fuel Primer Solenoid (if equipped)

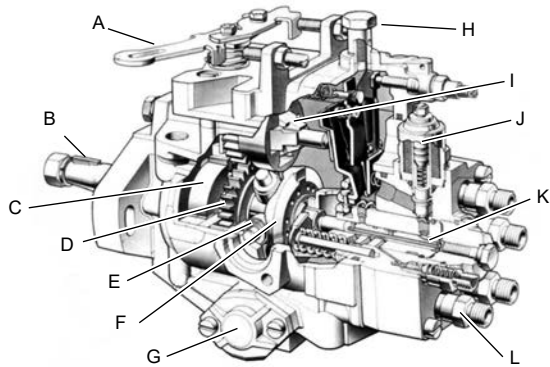
The fuel solenoid (FS1 or FS2) provides fuel to the mixer during cranking only. The solenoid is energized OPEN to provide fuel to the engine by either the control board energizing or grounding a control wire to the solenoid coil. This is to allow fuel into the engine before the diaphragm in the fuel regulator has a chance to open and will improve generator starting on the first crank attempt. Fuel will not be delivered to the engine if an ignition fault is present.

NOTE: The fuel primer solenoid is controlled by the control panel and will only go active if the ignition system is operational.



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Figure 3-8. Fuel Solenoid (FS)



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- | | |
|-----------------------|---------------------------|
| A.Flow Control Lever | G.Hydraulic Timing Device |
| B.Drive Shaft | H.Overflow Restriction |
| C.Feed Pump | I.Governor |
| D.Governor Drive Gear | J.Fuel Cut Solenoid |
| E.Roller | K.Distributor Plunger |
| F.Cam Plate | L.Delivery Valve |

Figure 3-9. Fuel Injection Pump

25 Amp Fuse (F1) (If equipped)

The 25 amp fuse provides fused 12 VDC to the battery charge alternator, fuel primer solenoid, and control panel.

10/15 Amp Fuse (F2) (If equipped)

For external ignition module systems the 10 amp fuse protects the Wire 15B and provides 12 VDC to the ignition control module. On internal ignition units, F2 is a 15 amp fuse for the field boost circuit.

15 Amp Fuse (F3) (If equipped)

Units with external ignition (ICM) may have this 15 amp fuse (F3) which protects the field boost circuit.

Cam Sensor (MP2) (If equipped)

The cam sensor is installed below the timing belt cover. As the engine is running, a magnet installed on the timing gear passes by the tip of the magnetic pickup. The pulse generated is read by the ignition module as top dead center (TDC).

Camshaft Sensor (CAM)

The camshaft sensor (CAM) is installed on the engine to monitor camshaft position and revolution and report it to the ignition module. It is located in front of or over the top of (one of) the camshaft(s) on the engine.

Crank Sensor (MP1)

The crank sensor is installed on the flywheel housing. As the engine is running, the crank sensor receives a signal every time a flywheel tooth passes the tip of the pickup. It utilizes this signal for a speed signal to regulate the engine at the desired speed, and as a crank shaft position reference for ignition timing.

Crankshaft Sensor (CSS) (for External Ignition Module Units)

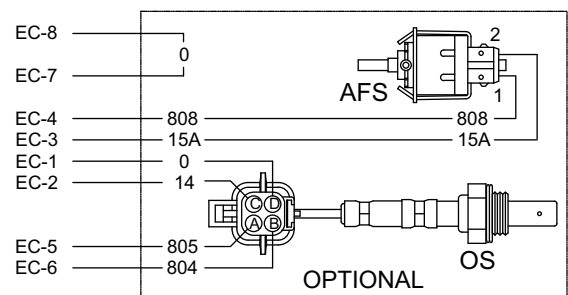
The crankshaft sensor (CSS) is installed on the engine to monitor the crankshaft revolutions to report engine speed to the ignition module.

Oxygen Sensor (OS) (If equipped)

On emissions enabled units, this sensor sends a feed back signal to the control board that will interpret the air/fuel ratio of the exhaust content.

Air/Fuel Solenoid (AFS) (If equipped)

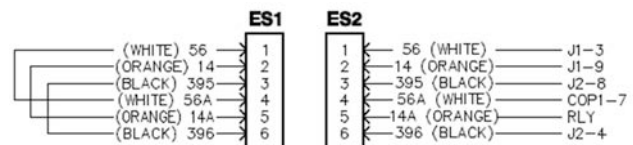
On emissions enabled units, a variable 12 VDC signal is applied to the solenoid that will either enrich the mixture or lean the mixture out depending on the input from the oxygen sensor.



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Figure 3-10. Oxygen Sensor and Air/Fuel Solenoid

Emergency Stop Connection



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Figure 3-11. Emergency Stop Connection Circuit

Auxiliary Engine Shutdown Switches

Units can be equipped with auxiliary engine shutdown switches. If installed there will be two switches, wired in series. When the circuit is actuated, it will go from a closed state to an open state. This will shut the unit down and the control panel will annunciate the shutdown message and error code.

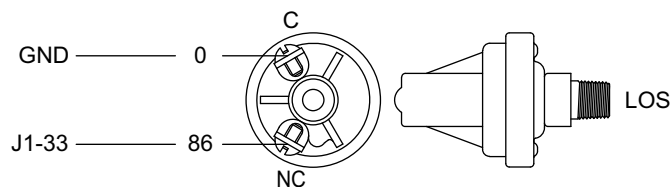
Engine Protective Devices/Shutdowns

Standby electric power generators will often run unattended for long periods of time. Because engine operation will not be monitored, the use of engine protective safety devices is required to prevent engine damage in the event of a problem. Operating parameters include (a) engine oil pressure, (b) engine temperature, (c) engine operating speed, (d) engine cranking and startup, and (e) under and over voltage.

Generator engines mount several engine protective devices. These devices work in conjunction with a control circuit board, to protect the engine against such operating faults as (a) low engine oil pressure, (b) high temperature, (c) overspeed, (d) overcrank, and (e) under and over voltage. On occurrence of any one or more of those operating faults, control board action will effect an engine shutdown.

Low Oil Pressure Switch

The low oil pressure (LOP) switch has normally closed contacts which are held open by engine oil pressure during cranking and running conditions. Should engine oil pressure drop below approximately 8–12 psi, the switch contacts will close. The controller will then initiate a 10 second hold-off timer. At the end of 10 seconds, an automatic engine shutdown will occur, and the low oil pressure shutdown message will be displayed.



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Figure 3-12. Low Oil Pressure Switch

Low Fuel Pressure (If equipped)

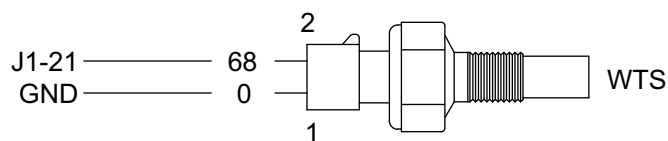
The low fuel pressure warning message will turn ON if the fuel supply pressure drops below approximately 5 in. water column (i.e. occurs when the low fuel pressure sensing switch on the fuel regulator opens). This is a non-latched fault (visual warning only) and does not trigger the controller alarm output. Low fuel pressure sensing is active in all generator operating modes (i.e. MANUAL, OFF, and AUTO).

Low Battery Alarm

While running, if the average battery voltage falls below 11.9 volts for one minute, the low battery alarm will be displayed.

High Coolant Temperature Sensor

The engine temperature sensor is a variable resistance sensor. At 70 °F (21 °C) the sensor will have a resistance of approximately 2.6 K ohm. As the temperature increases, the resistance decreases. The control board will send a DC voltage signal to the sender. When the voltage drops to near 0 the unit will shut down.



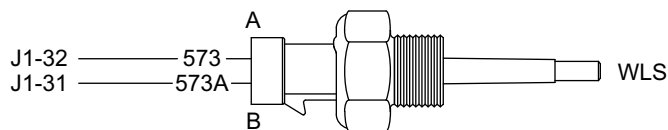
003093

Figure 3-13. High Coolant Temperature Switch Sensor

Low Coolant Level Sensor

It is possible the engine coolant level may drop low enough so that the high temperature sensor is no longer immersed in the liquid coolant. If this happens, engine temperatures could increase rapidly but the temperature switch would not sense the high temperature condition and the engine would continue to run. To prevent this occurrence, a low coolant level sensor is provided. The sensor is immersed in cooling system liquid. If coolant level drops below the level of the low coolant level sensor, the engine will shutdown and the low coolant level message will be displayed.

This is a shutdown alarm. The sensor will be continuously monitored. If an error condition is seen for five consecutive seconds, the alarm will be displayed.



003094

Figure 3-14. Low Coolant Level Switch

Overspeed

Warning indicator is measured and calculated by the microprocessor.

Overspeed is defined as +20% of nominal engine speed for three seconds, or +25% immediate.

Nominal engine speed = 60.0 Hz

Rpm Sensor Failure Shutdown Alarm

During cranking: If the board does not see a valid rpm signal within four seconds of cranking, it will shut down and lock out on rpm sensor loss.

Rpm Signal Failure During Running

During running: If the rpm signal is lost for one full second while the unit is in AUTO, the board will shut the engine down, wait 15 seconds, then crank the engine. It will not crank in MANUAL.

If no rpm signal is detected within the first four seconds of cranking, the control board will shut the engine down and latch out on rpm sensor loss.

If the rpm signal is detected the engine will start and run normally.

If the rpm signal is subsequently lost, the control board will try two more cranks before latching out and flashing the rpm sensor failure message (if it is in AUTO).

Overcrank

If the unit fails to start during a cranking period, it will display the overcrank shutdown alarm. The system will control the cranking cycles as follows:

The first crank cycle is a 16 second crank time followed by a 7 second rest. The next 5 cycles will be 7 seconds of cranking time each followed by a 7 second rest time.

If the unit fails to start by the end of the 6 crank/rest cycles the overcrank shutdown alarm will display and the unit will not attempt to crank until the alarm is reset.

CANBUS Alarm (If equipped)

Where applicable, if the CANBUS communications link fails to communicate, a "CANBUS Alarm" will be generated. This only applies to systems with external ignition modules. The alarm may be generated if:

1. The physical link is broken.
2. The ignition module fails or resets.
3. The controller fails or resets.
4. Having the battery charger's 120 VAC connected without a battery installed.
5. A blown 10 amp ignition module fuse (approximately 12 in away from the starter).
6. A blown 25 amp system fuse (located approximately 12 in away from the DC alternator).

NOTE: The CANBUS Alarm will not clear on its own. To clear the alarm, press the ENTER button to acknowledge the alarm. The alarm will clear and if the fault is still present, the alarm will reoccur.

Check Engine (If equipped)

Liquid-cooled units that are equipped with the Generac emission system have a fault annunciation named "Check Engine." In the event that the emissions system is not operating within set parameters the Check Engine message will appear on the display. This message is annunciation only and will not shut the unit down. The Check Engine annunciation has two distinct modes of operation, one for natural gas and the other for vaporous propane.

For natural gas emissions units—If the panel does not see a signal from the O₂ sensor for one minute after the four minute warm up period, the check engine warning will turn on. The warning will not shut the unit down.

For propane emissions units—If the panel does not see a signal from the O₂ sensor for one minute after the four minute warm up period, the check engine warning will turn on. The warning will not shut the unit down. The check engine will also turn on if the panel does not see the output of the O₂ sensor modulating. The warning will not shut the unit down.

Check engine is a self resetting warning and will clear automatically if the condition which caused the warning is cleared.

To manually clear the alarm, start and run the unit in MANUAL four (4) times for six (6) minutes each time. If the unit is clear of fault, the warning will not re-populate. If the warning is still present, the fault condition still exists.

Ignition Module Fault (If equipped)

When an ignition alarm occurs, “Ignition Fault” along with a number (shown in *Ignition Fault Codes (Nexus Units)* below) will be displayed as the fault code. The fault codes are the same for both internal and external ignition systems.

Refer to Section 5.6 *Evolution E-Codes* for Evolution ignition faults.

Code 0	The ignition fails to spark or quits sparking. This indicates the signal relationship between the CAM and crank is out of sync.
Code 10	Current is detected on the coil high side when none is expected.
Code 11	Coil open cylinder 1
Code 12	Coil open cylinder 2
Code 13	Coil open cylinder 3
Code 14	Coil open cylinder 4
Code 15	Coil open cylinder 5
Code 16	Coil open cylinder 6
Code 17	Coil open cylinder 7
Code 18	Coil open cylinder 8
Code 19	Coil open cylinder 9
Code 20	Coil open cylinder 10
Code 21	Coil short cylinder 1
Code 22	Coil short cylinder 2
Code 23	Coil short cylinder 3
Code 24	Coil short cylinder 4
Code 25	Coil short cylinder 5
Code 26	Coil short cylinder 6
Code 27	Coil short cylinder 7
Code 28	Coil short cylinder 8
Code 29	Coil short cylinder 9
Code 30	Coil short cylinder 10
Code 50	Not enough outputs on the ignition. If the Nexus is setup to run a 10 cylinder with a 6 output ignition module.

Clearing an Alarm

When the generator is shut down due to a latching alarm, the AUTO-OFF-MANUAL switch must be set to OFF and the ENTER key pressed to unlatch any active fault and clear the corresponding fault alarm message.

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Section 3.2 Operational Analysis—Evolution Diesel

Introduction

The schematic diagrams and verbiage on this and the following pages show the DC control system in four modes of operation:

- Utility Source Voltage Available, Evolution Controller in AUTO
- Utility Failure—Engine Cranking, Evolution Controller in AUTO
- Utility Failure, Engine Running and Transfer to Emergency, Evolution Controller in AUTO
- Return Of Utility, Engine Cool Down and Engine Shutdown, Evolution Controller in AUTO

Utility Source Voltage Available—Evolution Controller in AUTO

Positive (+) battery voltage is supplied from the battery through Wire 13 to the starter motor (SM). It is then connected by splice 1 to the starter contactor (SC), splice 7, the relay and the Evolution control board J1 pins 1 and 2. The starter contactor is not active at this point. Wire 13 also goes to the B+ on the DC – ALT.

NOTE: Fused 120 VAC is supplied from a customer based source and connected to TB2 - T1 (Hot) and NEU (Neutral). It is then directed to the BCH 1 and 2 connector then to the Evolution control board J11 and J12.

Positive (+) from the battery charger built into the Evolution controller feeds both Wire's 13 at J1-1 and J1-2. This is back-fed to Wire 13 to the starter contactor (SC), starter motor (SM) and then the battery (BAT). This circuit keeps the battery properly charged.

For RTS transfer switches utility voltage from the transfer switch N1 and N2 is connected to the controller on J4-3 and J4-6. The Evolution controller monitors this voltage to fall below the adjustable voltage dropout. The 2-wire start is ignored in this mode.

For configured GTS transfer switches, the Evolution controller looks for a 2-wire start signal and ignores the input of N1 and N2. The controller supplies a 5 VDC signal input from J1-5 Wire 183 and waits for a dry contact closure to the remote start return Wire 178 on J1-14. The dry contact closure is provided by the GTS transfer switch circuitry.

The Evolution controller display and menu allow for programming parameters.

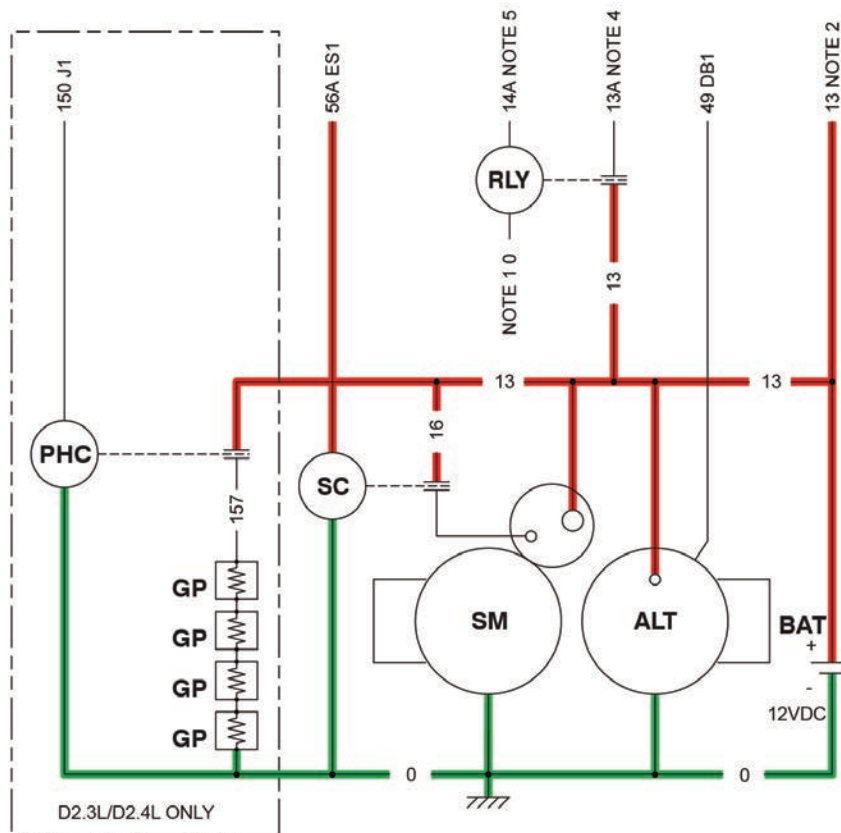
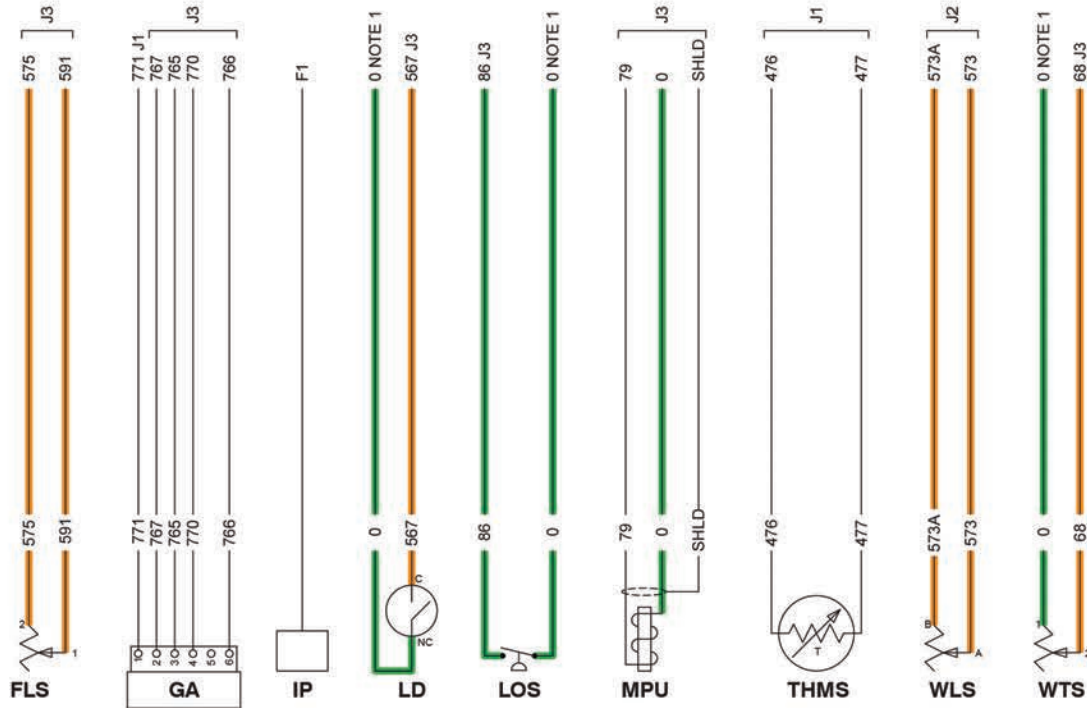
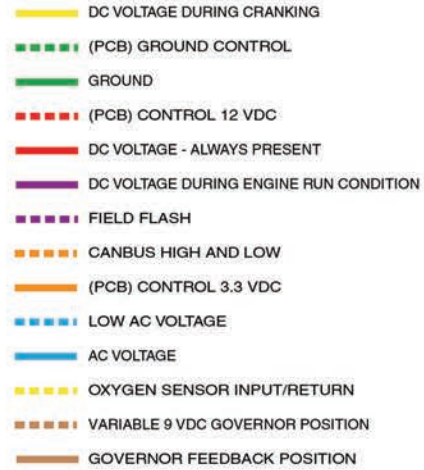
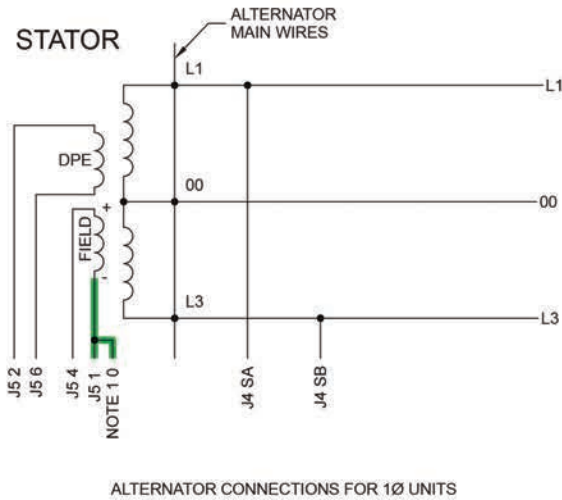


Figure 3-15. Utility Source Voltage Available—Evolution Controller in AUTO

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Utility Source Voltage Available—Evolution Controller in AUTO

LEGEND			
00 - NEUTRAL	F - FUSE	LOS - LOW OIL PRESSURE SWITCH	SM - STARTER MOTOR
ALT - DC CHARGE ALTERNATOR	FLS - FUEL LEVEL SENDER	MLCB - MAIN LINE CIRCUIT BREAKER	THMS - THERMISTOR
BAT - BATTERY	GA - GOVERNOR ACTUATOR	MPU - MAGNETIC PICKUP	WLS - COOLANT LEVEL SENSOR
BCH - BATTERY CHARGER	GP - GLOW PLUG	PHC - PREHEAT CONTACTOR	WTS - COOLANT TEMPERATURE SENSOR
DB - DIODE BRIDGE	IP - INJECTION PUMP	R - RESISTOR	
DPE - EXCITER	J - MAIN CONTROLLER CONN.	RLY - CONTROL RELAY	
ES1 - EMERGENCY STOP SWITCH	LD - LEAK DETECTOR	SC - STARTER CONTACTOR	



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Figure 3-16. Utility Source Voltage Available—Evolution Controller in AUTO

Utility Source Voltage Available—Evolution Controller in AUTO

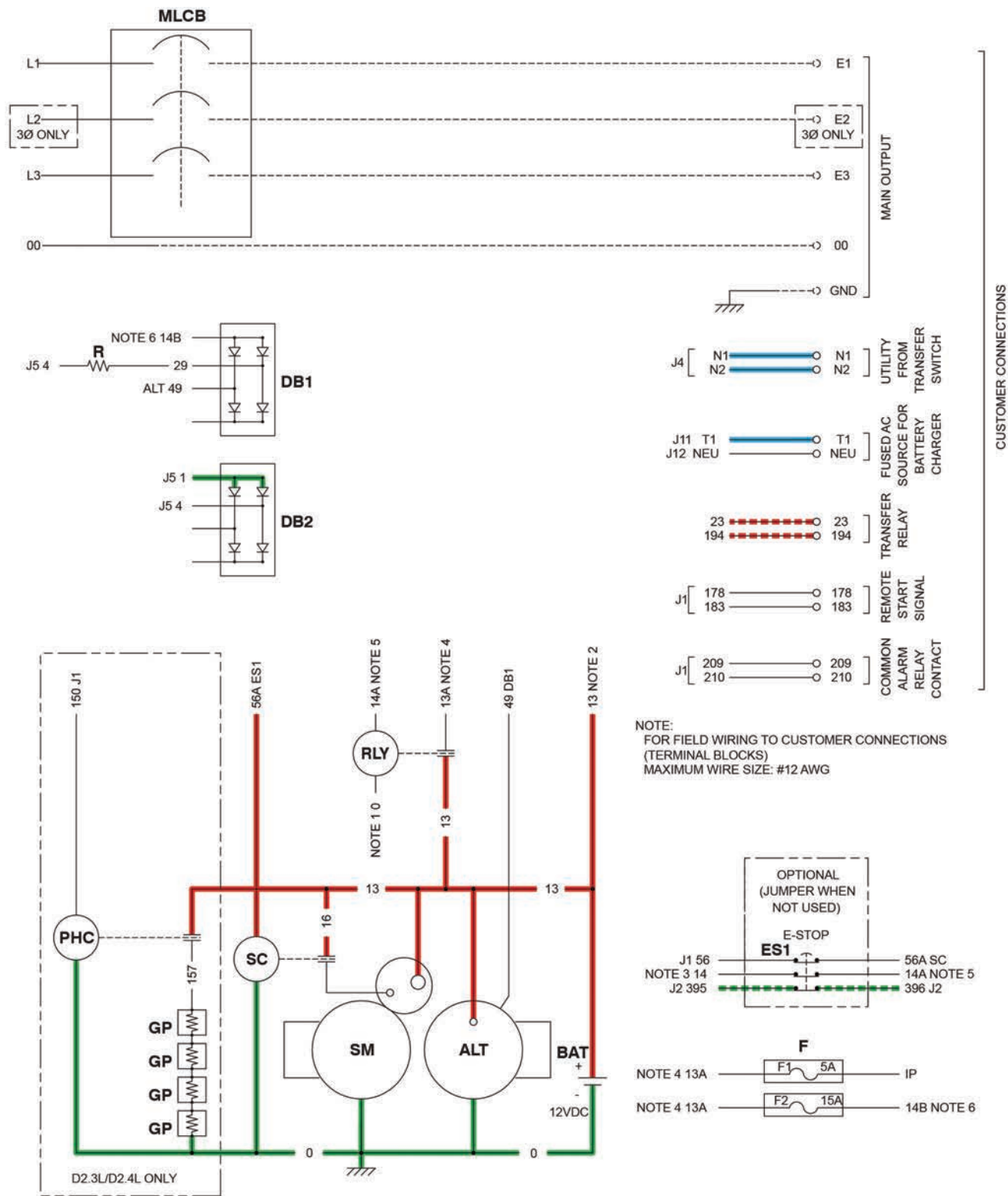


Figure 3-17. Utility Source Voltage Available—Evolution Controller in AUTO

005352

Utility Failure—Engine Cranking, Evolution Controller in AUTO

Initial Utility Failure

For RTS transfer switches, line-to-line voltage on wires N1 and N2 fall below the voltage and the controller starts a 2–1500 second (programmable) line interrupt timer. If the utility voltage is above the set point of nominal utility voltage, the engine will not crank at the end of the line interrupt timer. The engine will crank and start if the utility voltage is below the set point of nominal utility voltage at the end of the timer.

The unit will abort further crank cycles if it cranks for more than 10 seconds and utility rises above the set point of nominal (programmable) and the unit has not started.

For GTS configured transfer switches, the utility voltage sensing is performed by the circuitry in the GTS. Nothing happens at the generator until the GTS signals the generator to start by closing the dry contact(s) on Wires 183 and 178 (the 5–1500 second programmable line interrupt timer will still apply before unit cranks and starts). All other timers are controlled by the GTS transfer switch.

Cranking and Initial Start Up

For RTS Transfer Switches – After utility voltage is below the adjustable voltage dropout setpoint and the startup delay timer has been met the engine will crank.

NOTE: If the unit is equipped with glow plugs, they will activate for a 5–30 seconds (programmable) activation cycle.

For GTS Transfer Switches – After utility voltage is below a programmed percentage and programmed time period, the utility voltage sensing circuit will signal the generator to crank by closing the dry contact on Wires 183 and 178 (5 VDC circuit from controller).

NOTE: If the unit is equipped with glow plugs, they will activate for a 5–30 seconds (programmable) activation cycle.

The start circuit is now activated and the following steps occur:

1. The controller energizes positive (+) 12 VDC to Wire 56 from J1 pin 3. Wire 56 is directed to the starter contactor, which energizes the internal electromagnetic coil causing its dry contact to close and connect Wire 13 to Wire 16.
2. Wire 16 is directed to the starter motor (SM) which causes the starter motor to energize, spin, engage the flywheel, and crank the engine.
 - The initial crank cycle is 16 seconds followed by a seven second rest.
 - The next five cycles will be seven seconds of crank time followed by seven seconds rest time.

- If the unit fails to start after the six crank cycles it will stop and annunciate an overcrank shutdown alarm.

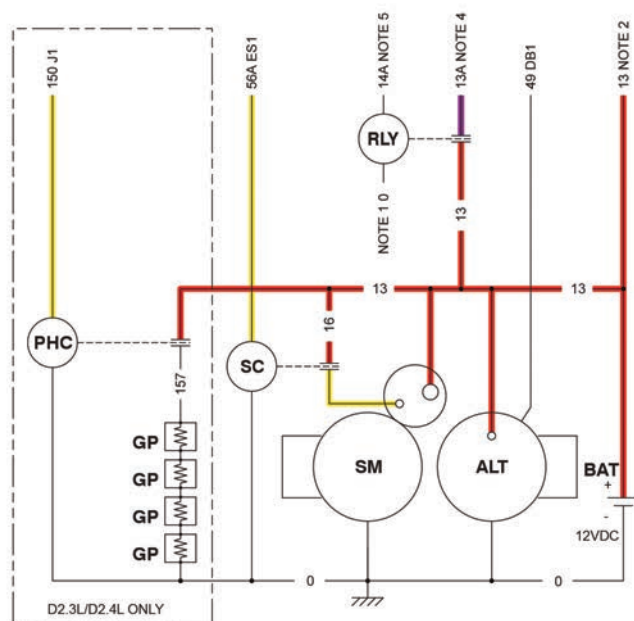
- The unit will not attempt to crank until the alarm is reset (AUTO-OFF-MANUAL switch set to OFF and the ENTER key pressed).

3. The controller energizes positive (+) 12 VDC to Wire 14 from J1 pin 9. Wire 14 is connected to ES2 and loops through ES1 to Wire 14A, then connects to the RLY (Relay). The RLY main coil will energize and close Wire 13 to Wire 13A. Wire 13A then goes to splice 8 which will go to 2 locations:

- COP1-5 and COR1-5 then to the splice 2 then F1 fuse and then the IP (injection pump run solenoid).
- F2 fuse which connects to the diode bridge (DB1) for field boost.

NOTE: Wire 14 circuit activates the fuel and field boost.

4. The electronic governor actuator (GOV) is controlled by the Evolution controller. When the unit is cranking, the throttle position is approximately 1/8 – 1/4 open and as it starts, the throttle plate will open and readjust quickly to maintain a no load running speed (50 or 60 Hz). Wire 770 is the positive (+) or throttle high signal to the actuator. Wire 771 is the negative (-) or throttle low to the actuator. The feedback circuit allows the controller to monitor the throttle plate position. Wire 765 is the 3 VDC source to the actuator feedback circuit. Wire 766 from the actuator provides a 0–3 VDC feedback circuit back to the controller. Wire 767 is the 0 VDC return wire.

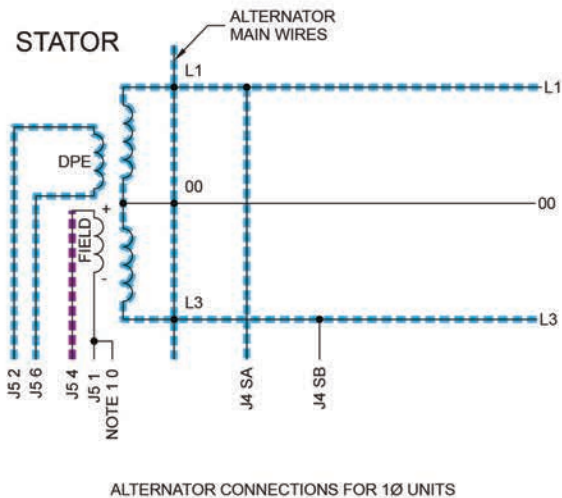


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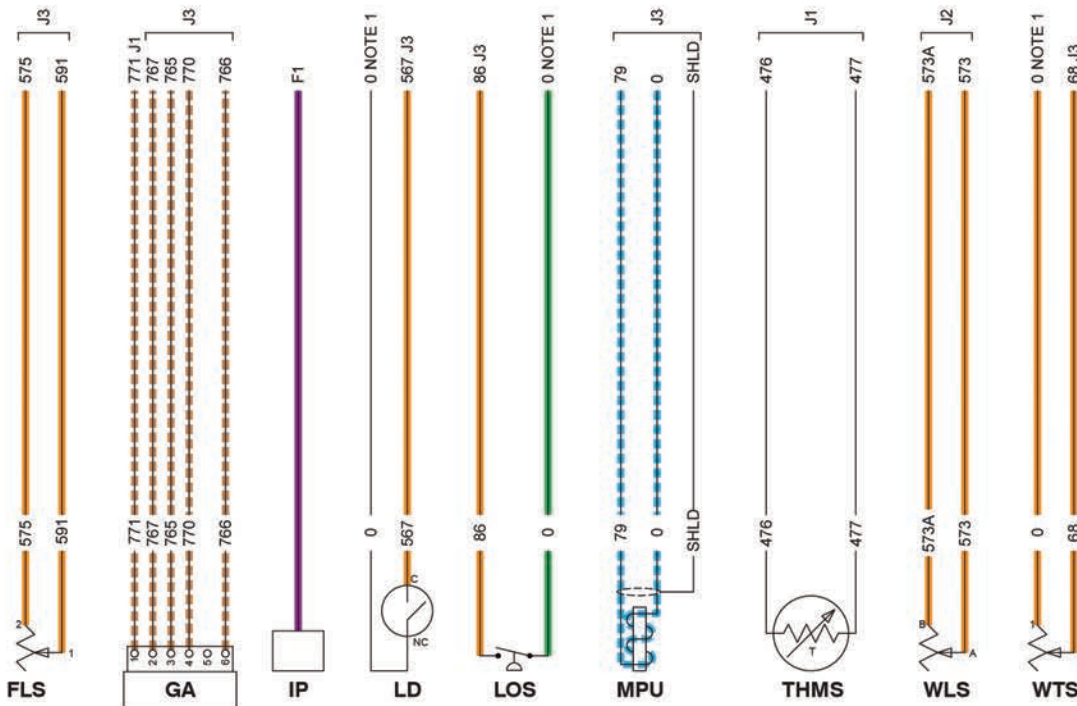
Figure 3-18. Cranking and Running Circuits

Utility Failure—Engine Cranking, Evolution Controller in AUTO

LEGEND			
00 - NEUTRAL	F - FUSE	LOS - LOW OIL PRESSURE SWITCH	SM - STARTER MOTOR
ALT - DC CHARGE ALTERNATOR	FLS - FUEL LEVEL SENDER	MLCB - MAIN LINE CIRCUIT BREAKER	THMS - THERMISTOR
BAT - BATTERY	GA - GOVERNOR ACTUATOR	MPU - MAGNETIC PICKUP	WLS - COOLANT LEVEL SENSOR
BCH - BATTERY CHARGER	GP - GLOW PLUG	PHC - PREHEAT CONTACTOR	WTS - COOLANT TEMPERATURE SENSOR
DB - DIODE BRIDGE	IP - INJECTION PUMP	R - RESISTOR	
DPE - EXCITER	J - MAIN CONTROLLER CONN.	RLY - CONTROL RELAY	
ES1 - EMERGENCY STOP SWITCH	LD - LEAK DETECTOR	SC - STARTER CONTACTOR	



- DC VOLTAGE DURING CRANKING
- (PCB) GROUND CONTROL
- GROUND
- (PCB) CONTROL 12 VDC
- DC VOLTAGE - ALWAYS PRESENT
- DC VOLTAGE DURING ENGINE RUN CONDITION
- FIELD FLASH
- CANBUS HIGH AND LOW
- (PCB) CONTROL 3.3 VDC
- LOW AC VOLTAGE
- AC VOLTAGE
- OXYGEN SENSOR INPUT/RETURN
- VARIABLE 9 VDC GOVERNOR POSITION
- GOVERNOR FEEDBACK POSITION



005354

Figure 3-19. Utility Failure—Engine Cranking, Evolution Controller in AUTO

Utility Failure—Engine Cranking, Evolution Controller in AUTO

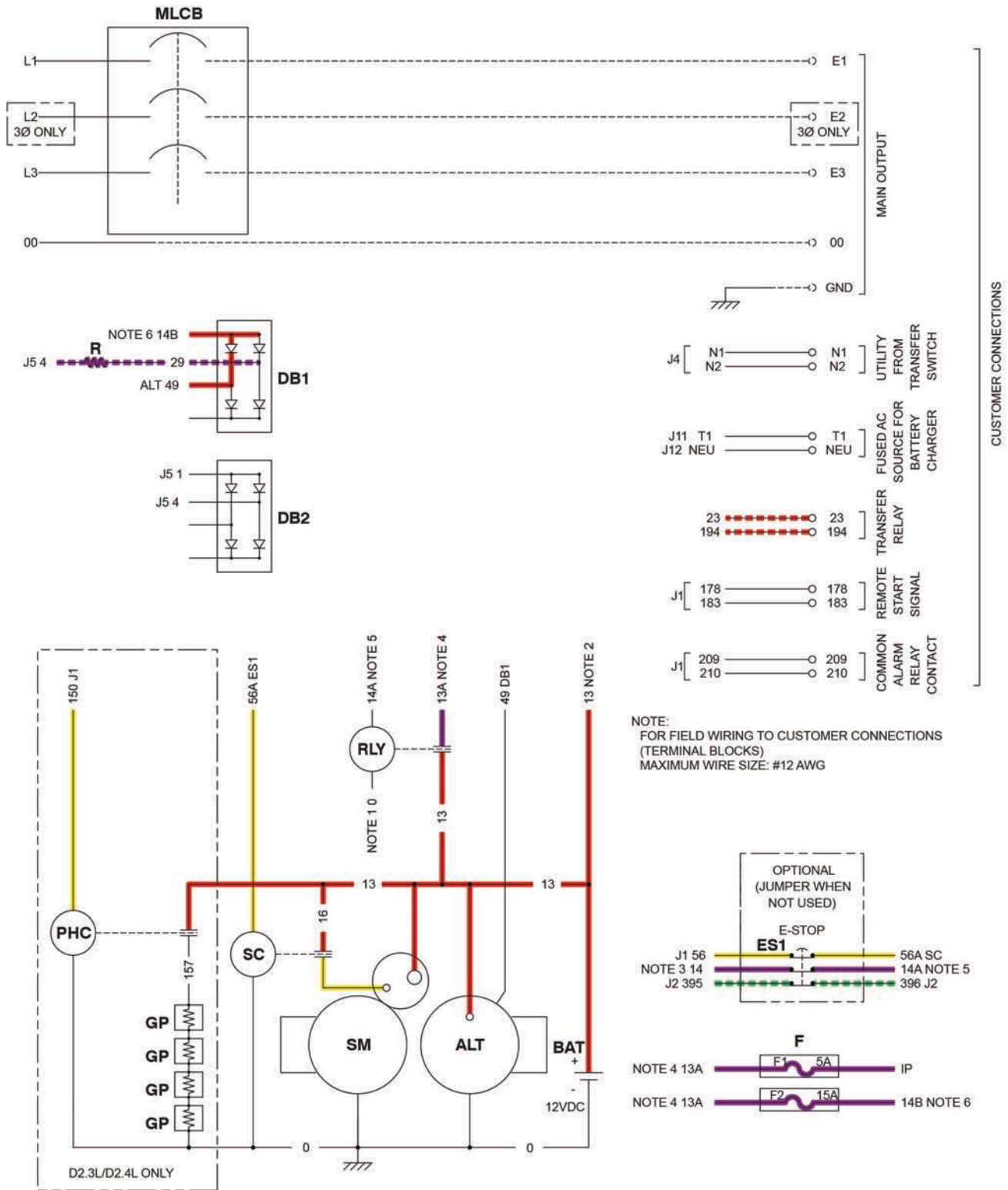


Figure 3-20. Utility Failure—Engine Cranking, Evolution Controller in AUTO

005354

Utility Failure Engine Running, Transfer To Emergency, Evolution Controller In AUTO

When the engine reaches approximately 600–800 rpm, the controller will deactivate the crank circuit Wire 56 (positive 12 VDC) and will start the adjustable warm-up timer. The engine speed is sensed by the MP1 magnetic pickup (flywheel) Wire 79 and Wire 0. Crank termination, overspeed, and governed speed are all functions of the MP1 and the controller speed referencing circuit.

There is a 10 second hold-off timer for the oil pressure to buildup and the contacts of the LOS (low oil pressure switch) to open.

While the engine begins its crank/run operation, Wire 14B provides a positive (+) 12 VDC supply to DB1 which is connected to Wire 29 (white) and the R1 resistor (if so equipped). This resistor steps the DC voltage down so the automatic voltage regulator (AVR) in the Nexus controller can take over operation. Wire 4 and Wire 1 are also connected to the Evolution controller J5-4 and J5-2 and continue to the BA brush assembly or field assembly. This is the field boost/field excitation circuit and provides DC voltage to the rotor.

The field boost circuit magnetizes the rotor which will create AC voltage on the DPE displaced phase excitation winding—this winding is the power supply for the AVR in the controller and is connected to J5-1 and J5-3.

The AC sensing circuit is Wire 11 and Wire 44 which turns into Wire SA sensing “A” and SB sensing “B” and are connected to J4-1 and J4-4. The AVR uses this circuit to monitor the generators AC output and adjusts the DC field excitation to maintain the correct output.

For RTS operation, Wire 194 is positive (+)12 VDC, and is connected from the controller J1-6 to one side of the TR transfer relay coil. Wire 23 comes from the other side of the TR transfer relay coil and is connected to the controller J1-7. After the programmable warm up timer is expired, the controller will take Wire 23 to ground and activate the TR relay causing the transfer switch mechanism (contactor) to transfer the load from the utility position to the emergency standby position.

When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry (the 2–1500 second programmable line interrupt timer will still apply before unit cranks and starts).

Return Of Utility, Engine Cool Down And Engine Shutdown, Evolution Controller In AUTO

Return of Utility

For RTS transfer switches, when utility returns the controller will monitor N1 and N2 (on pins J4-3 and J4-6) to rise above the limits (programmable) of nominal voltage. This will initiate a 15 second return to utility timer. At the end of the return to utility timer, if the utility voltage is still greater than the programmable limits of nominal voltage (programmable) the controller will lift the ground on Wire 23 which will cause the TR relay to de-energize and the transfer switch mechanism (contactor) to transfer the load from the emergency standby position back to the utility position.

When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry.

Engine Cool Down

The controller will then initiate an engine cool down timer.

- Naturally aspirated = one minute
- Turbo charged units = five minutes

NOTE: During this cool down period, the Evolution LC controller turns the AVR OFF but leaves field flash ON, resulting in reduced output voltage during cooldown.

NOTE: If utility voltage drops below the voltage drop out set point, the controller will turn the AVR back on, initiate the warm-up timer and then will connect Wire 23 to ground causing the transfer switch mechanism (contactor) to transfer the load from the utility position back to the emergency standby position.

When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry.

Shutdown

For RTS transfer switch applications, the unit will shut down after the cool down timer expires.

For GTS configured switches, all transfer control and timers are controlled by the GTS circuitry and when the timers expire it will open the dry contacts on Wire 183 and Wire 178.

Return Of Utility, Engine Cool Down And Engine Shutdown, Evolution Controller In AUTO

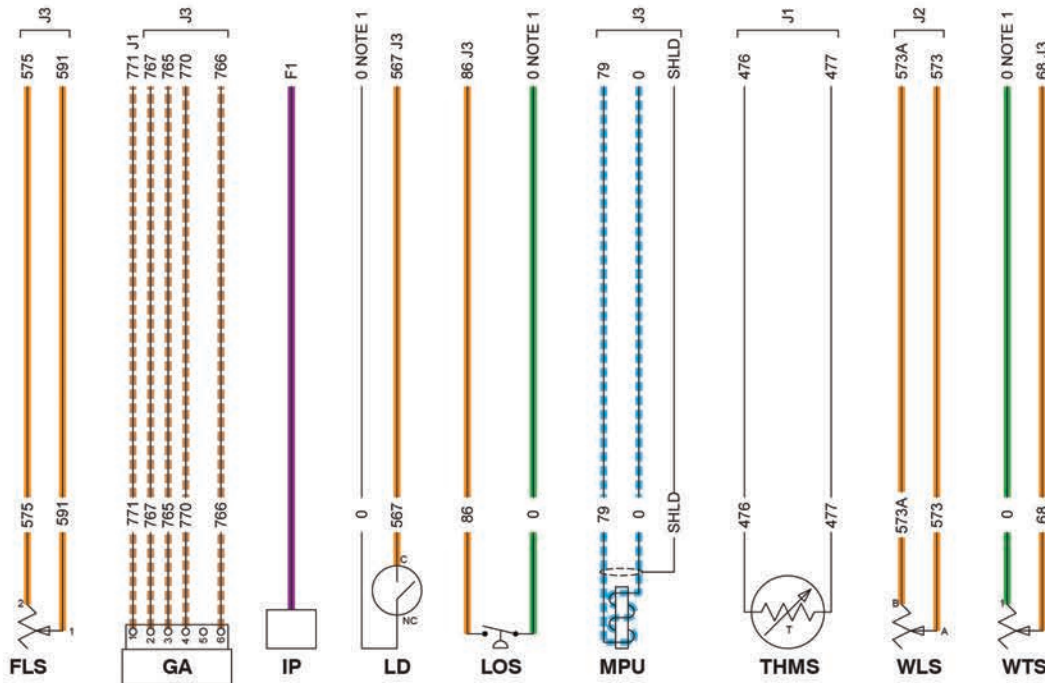
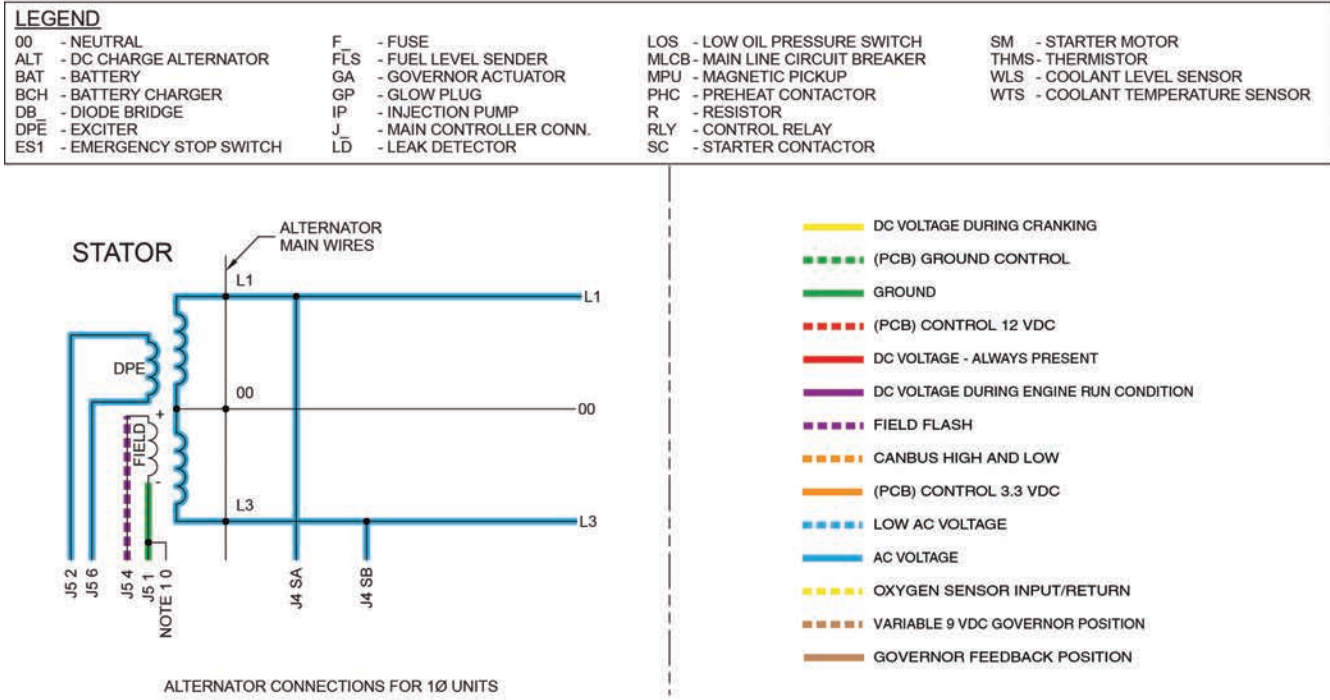


Figure 3-21.

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Return Of Utility, Engine Cool Down And Engine Shutdown, Evolution Controller In AUTO

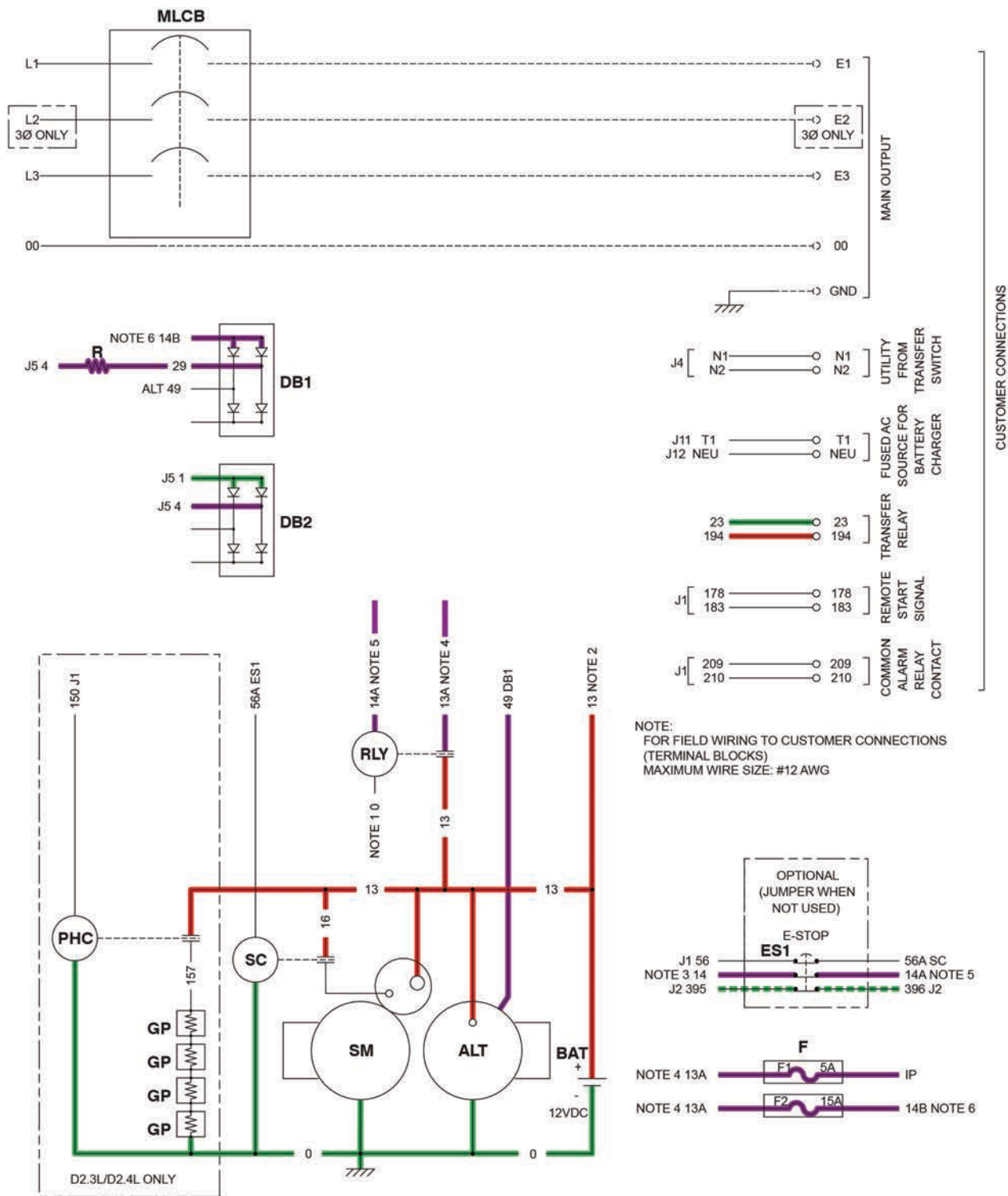


Figure 3-22.

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Section 3.3 Operational Analysis—Nexus

Introduction

The schematic diagrams and verbiage on this and the following pages show the DC control system in four modes of operation:

- Utility Available, Nexus Controller in AUTO
- Utility Failure, Engine Cranking, Nexus Controller in AUTO
- Utility Failure, Engine Running and Transfer to Emergency, Nexus Controller in AUTO
- Return Of Utility, Engine Cool Down and Engine Shutdown, Nexus Controller in AUTO

Utility Source Voltage Available—Nexus Controller In AUTO

Positive (+) battery voltage is supplied from the battery through Wire 13 to the starter motor (SM). It is then connected by splice 4 to the starter contactor (SC), fuse (F1), and fuse (F2) if equipped with an external ignition module. The starter contactor is not active at this point. If equipped, after fuse (F2), it becomes Wire 15B and is connected to the ICM J1-Pin 16 (ignition control module). After fuse (F1), it becomes Wire 15 and is connected by splice 2 to the following four component/circuit points:

- ALT – DC charge alternator
- FSP-2 Fuel supply plug, Pin 2 which goes to FSR-2 fuel supply receptacle, Pin 2 which is connected to Fuel Solenoid 2 (FS2)
- J1-6 – Engine control module (Nexus)
- J1-7 – Engine control module (Nexus)

NOTE: Fused 120 VAC is supplied from a customer based source and connected to TB2 - T1 (hot) and NEU (neutral). It is then directed to the HVP (high voltage plug 12-pin bulkhead) through pins 3 and 4.

Controller feeds both Wires 15 at J1-6 and J1-7. This is back-fed to the fuse (F1) and turns into Wire 13 to the starter contactor (SC), starter motor (SM) and then the battery (BAT). This circuit keeps the battery properly charged.

For RTS transfer switches utility voltage from the transfer switch N1 and N2 is connected to the controller on J1-25 and J1-26. The nexus controller monitors this voltage to fall below 60% of nominal. The 2-wire start is ignored in this mode.

For configured GTS transfer switches, the Nexus controller looks for a 2-wire start signal and ignores the input of N1 and N2. The controller supplies a 5 VDC signal input from J1-14 Wire 183 and waits for a dry contact closure to the remote start return Wire 178 on J1-1. The dry contact closure is provided by the GTS transfer switch circuitry.

The Nexus controller display and menu allow for programming parameters.

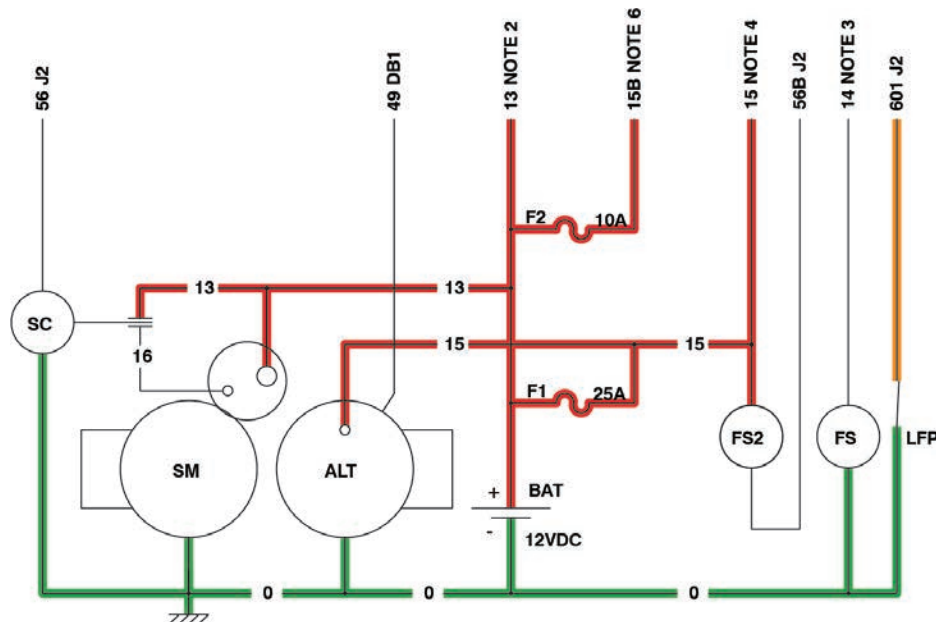
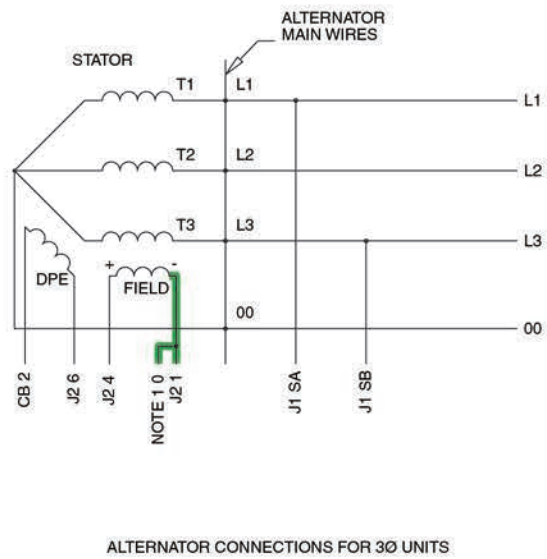
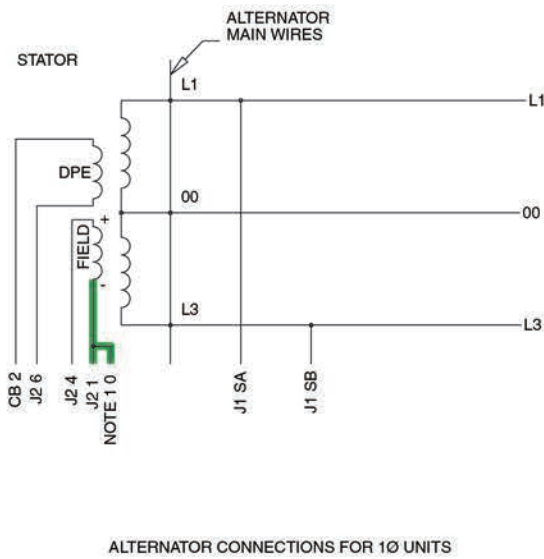


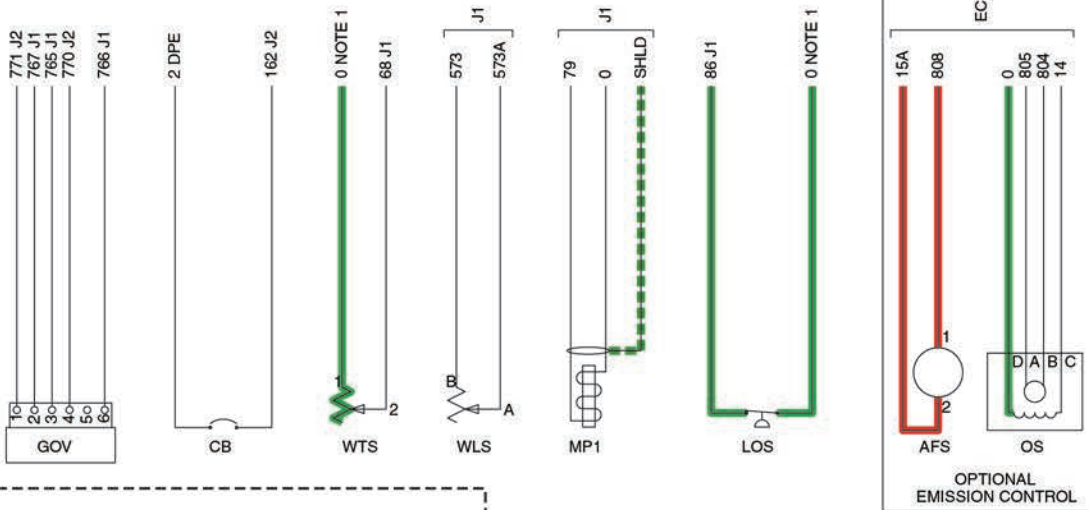
Figure 3-23. Utility Source Voltage Available—Nexus Controller in AUTO

Utility Source Voltage Available—Nexus Controller in AUTO



ALTERNATOR CONNECTION BOX

GENERATOR SET



REV C

UTILITY VOLTAGE AVAILABLE
SWITCH IN AUTO

SCHEMATIC DIAGRAM
G4.2L G4 NEXUS
0H6682

005394

Figure 3-24. Utility Source Voltage Available—Nexus Controller in AUTO

Utility Source Voltage Available—Nexus Controller in AUTO

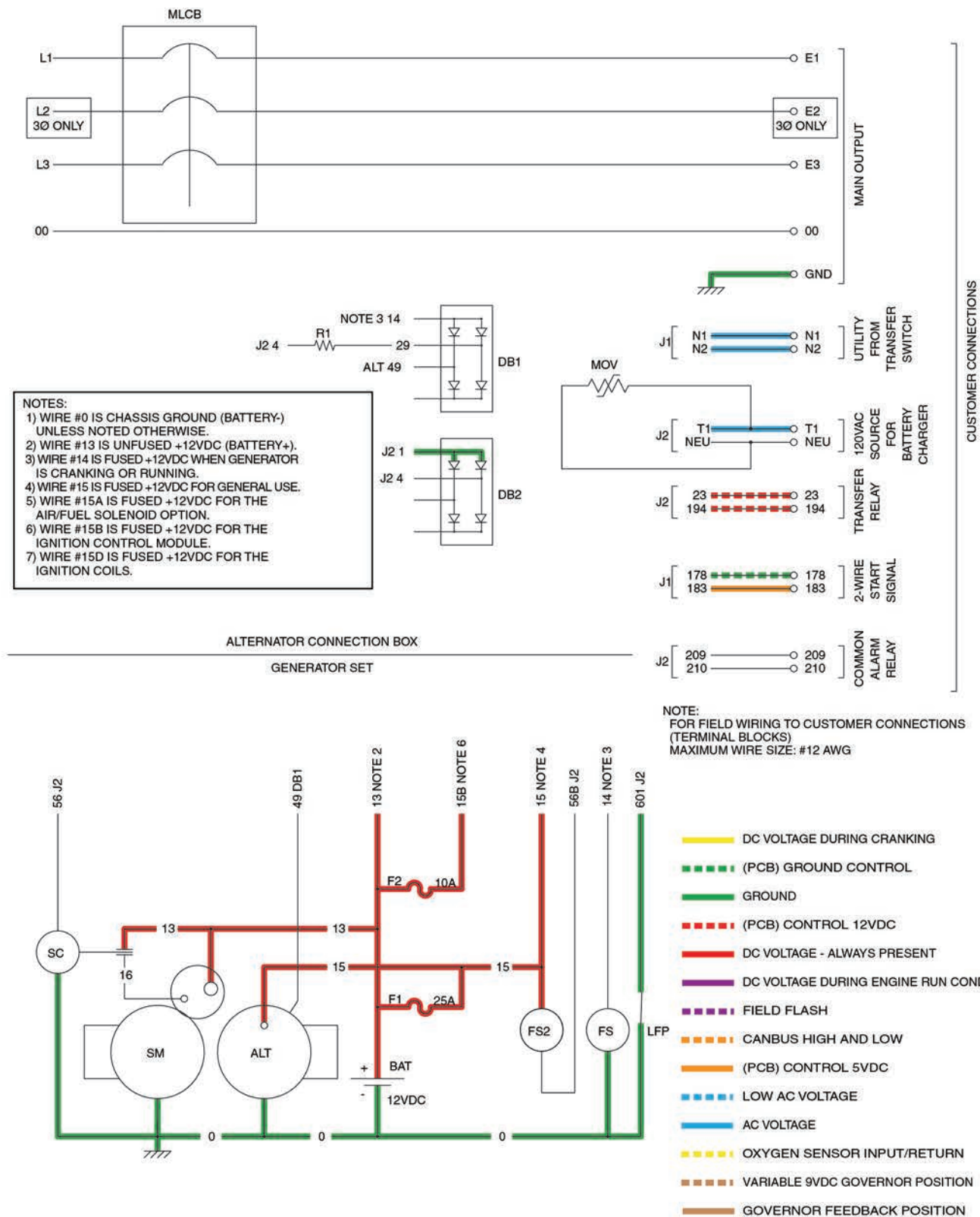
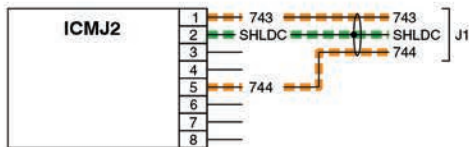
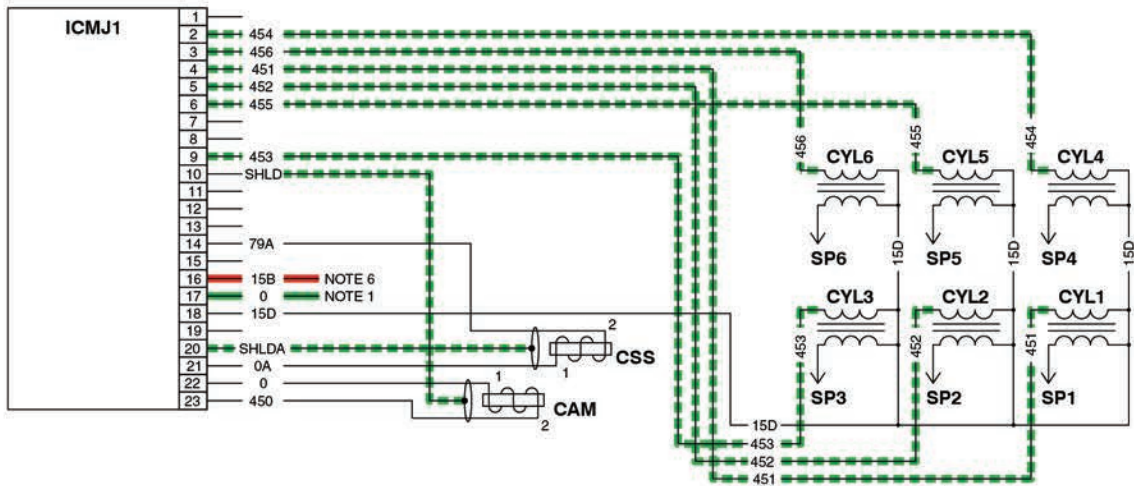


Figure 3-25. Utility Source Voltage Available—Nexus Controller in AUTO

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Utility Source Voltage Available—Nexus Controller in AUTO



- DC VOLTAGE DURING CRANKING
- - - (PCB) GROUND CONTROL
- GROUND
- - - (PCB) CONTROL 12VDC
- DC VOLTAGE - ALWAYS PRESENT
- DC VOLTAGE DURING ENGINE RUN CONDITION
- - - FIELD FLASH
- - - CANBUS HIGH AND LOW
- (PCB) CONTROL 5VDC
- - - LOW AC VOLTAGE
- AC VOLTAGE
- - - OXYGEN SENSOR INPUT/RETURN
- - - VARIABLE 9VDC GOVERNOR POSITION
- GOVERNOR FEEDBACK POSITION

REV C

**UTILITY VOLTAGE AVAILABLE
SWITCH IN AUTO**

SCHEMATIC DIAGRAM
G4.2L G4 NEXUS
OH6682

005395

Figure 3-26. Utility Source Voltage Available—Nexus Controller in AUTO

Utility Source Voltage Available—Nexus Controller in AUTO

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F_ - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SP_ - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL_ - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB_ - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

- NOTES:
- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 - 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
 - 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 - 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
 - 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
 - 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
 - 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

005395

Figure 3-27. Utility Source Voltage Available—Nexus Controller in AUTO

Utility Failure—Engine Cranking, Nexus Controller In AUTO

Initial Utility Failure

For RTS transfer switches, when line-to-line voltage on Wires N1 and N2 falls below 60% of nominal the controller starts a 10–30 second (programmable) line interrupt timer. If at the end of the line interrupt timer the utility voltage is above 60% of nominal, the engine will not crank. If the utility voltage is below 60% of nominal at the end of the timer, the engine will crank and start. If the unit cranks for more than 10 seconds, and utility rises above 80–95% of nominal (programmable) and the unit has not started, it will abort further crank cycles.

For GTS configured transfer switches, the utility voltage sensing is performed by the circuitry in the GTS. Nothing will happen at the generator until the GTS signals the generator to start by closing the dry contact(s) on Wires 183 and 178 (the 10–30 second programmable line interrupt timer will still apply before unit cranks and starts). All other timers are controlled by the GTS transfer switch.

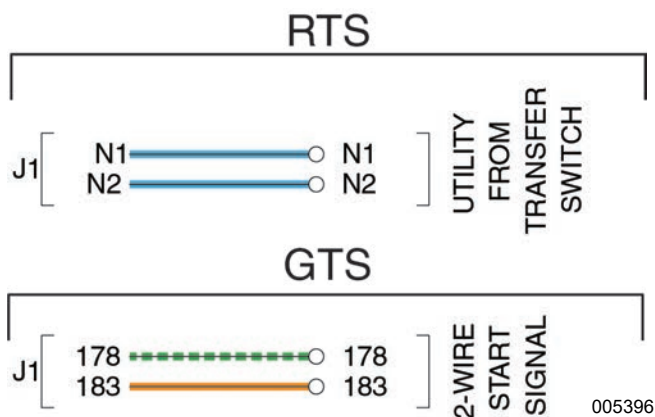


Figure 3-28. Switch Operation

Cranking and Initial Start Up

For RTS transfer switches, after utility voltage is below 60% for 10–30 seconds (programmable) the engine will begin to crank.

For GTS transfer switches, after utility voltage is below a programmed percentage and programmed time period, the circuitry in the GTS (utility voltage sensing circuit) will signal the generator to crank by closing the dry contact on Wires 183 and 178 (5 VDC circuit from controller).

The start circuit is now activated and the following steps occur:

1. The controller energizes positive (+) 12 VDC to Wire 56 from J2 pin 22. Wire 56 is directed to the starter contactor which energizes the internal electromagnetic coil causing its dry contact to close and connect Wire 13 to Wire 16. Wire 16 is directed to the starter motor (SM) which causes the starter motor to energize, spin, engage the flywheel, and crank the engine over. The initial crank cycle is 16 seconds followed by a 7 second rest. The next five cycles will be 7 seconds of crank time followed by 7 seconds rest time. If the unit fails to start after the six crank cycles it will stop and announce an overcrank shutdown alarm. The unit will not attempt to crank until the alarm is reset (AUTO-OFF-MANUAL switch set to OFF and the ENTER key pressed).
2. While cranking, on units equipped with an external Ignition Control Module (ICM) the ICM syncs itself to the engine by using the CSS crankshaft sensor and CAM camshaft sensor. The ICM controls the ignition to each cylinder individually. Wire 15D from the ICM provides power to the coils. Wires 451, 452, 453, 454, 455, 456 (in addition to 457, 458 for an 8-cylinder engine plus 459 and 460 for a 10-cylinder engine) individually go to ground on the primary side of the coil, and are opened by the ICM causing that coil to collapse and the secondary side to create spark. The precise timing of this is controlled by the ICM. Once the ICM is synced, it sends a comms signal to the Nexus controller through CANBUS Wires 743 and 744 that it is synced and ready for the start/run circuit to be activated (Wires 14 and 56B).
3. If no external ignition module is present, the MPU1 and MPU2 or CAM sensors feed their information into the Nexus controller and the controller outputs positive voltage on Wire 15A from pin J2-23, which is distributed to the coil pack (CP pin 3 for a G1.6L or to Splice 4 on a G1.5L; Splice 6 for a G2.4L and subsequently to each of the individual cylinder's coils). On the G1.5L and G2.4L Wires 451, 452, 453 and 454 from the controller to the coils are functionally similar to the external ignition coil description above, with the exception being that they are controlled by the Nexus controller rather than the external ignition module. On the G1.6L the secondary of the coil pack is controlled by either Wires 25A or 25B, firing two cylinders at the same time, one in the compression stroke and one in the exhaust stroke simultaneously by collapsing the circuit of the primary on both cylinders' coils.
4. The controller energizes positive (+) 12 VDC to Wire 14 from J2 pin 8. Wire 14 is connected to splice 5 and is then connected to the following three component/circuit points:
 - EC-2 emissions connector which is connected to the OS oxygen sender.
 - FSP-4 fuel supply plug which is connected to the FS fuel solenoid.
 - LVR low voltage receptacle which connected to the DB1 diode bridge 1 for field boost.

NOTE: Wire 14 circuit activates the fuel and field boost and powers the heater element in the oxygen sender if so equipped.

5. The controller takes Wire 56B to ground. Wire 15 at FS2 is the positive (+) 12 VDC supply and 56B is the grounded control circuit which energizes the FS2 fuel solenoid. This circuit is a fuel boost circuit and it terminates when the crank circuit terminates in the controller.
6. The GOV electronic governor actuator is controlled by the controller. When the unit is cranking, the throttle position is approximately 1/8–1/4 open and

as it starts, the throttle plate will open and readjust quickly to maintain a no load running speed (50 or 60 Hz).

Wire 770 is the positive (+) or throttle high signal to the actuator. Wire 771 is the negative or throttle low to the actuator.

The feedback circuit allows the controller to monitor the throttle plate position. Wire 765 is the 5 VDC source to the actuator feedback circuit. Wire 766 from the actuator provides a 0–5 VDC feedback circuit back to the controller. Wire 767 is the 0 VDC return wire.

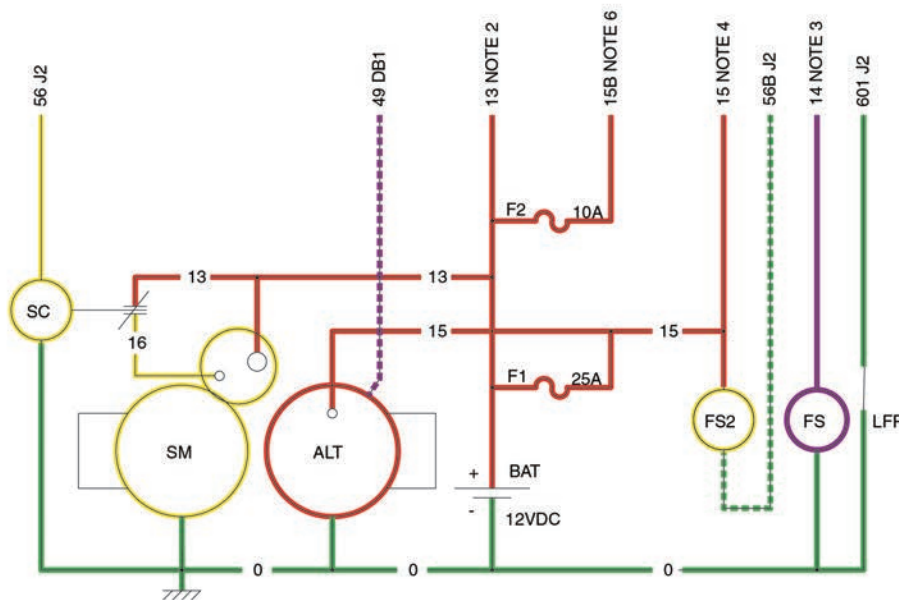
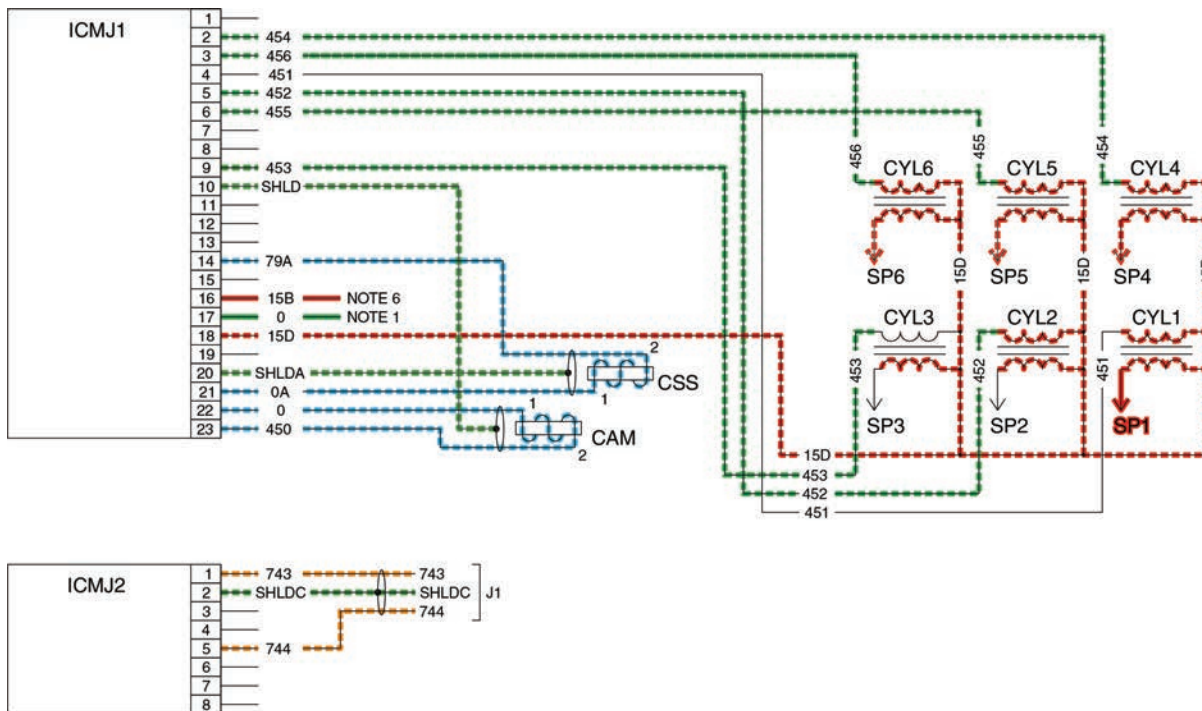
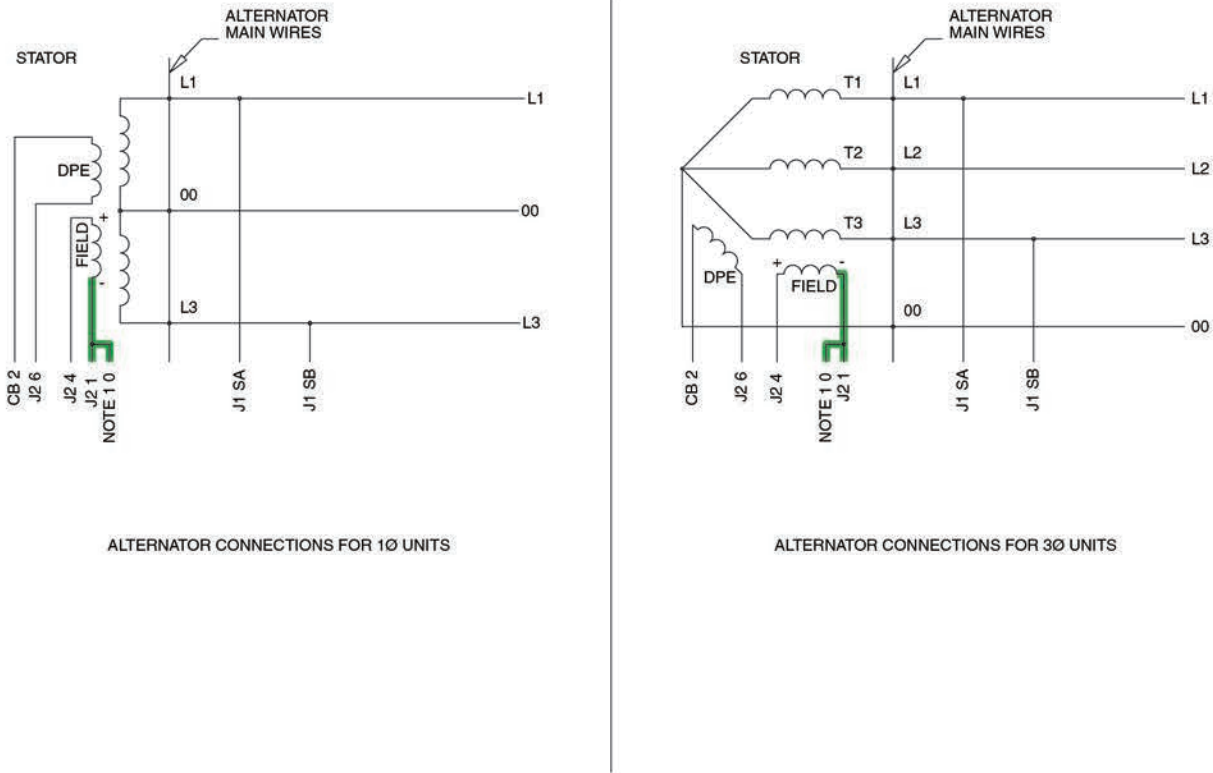


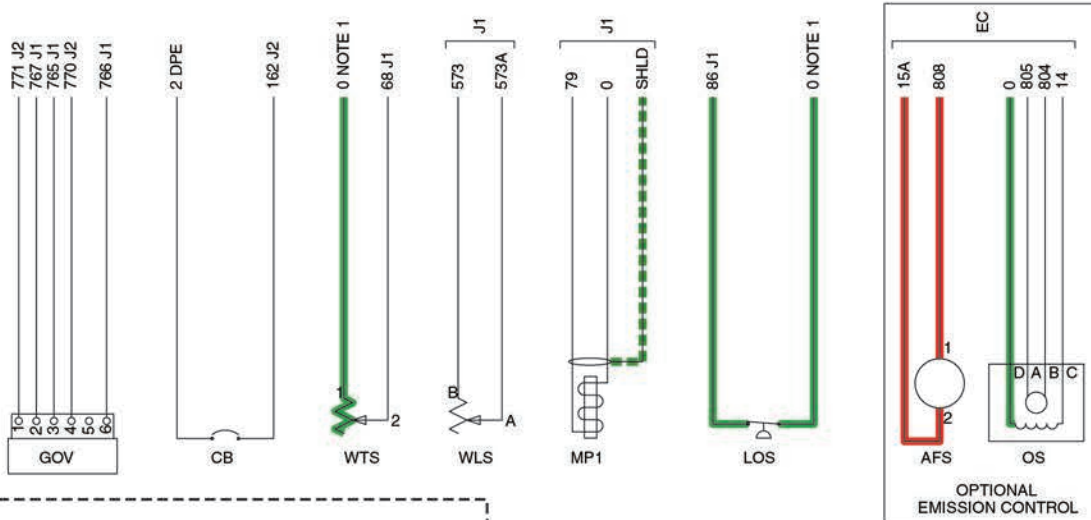
Figure 3-29. Cranking and Running Circuits

Utility Failure—Engine Cranking, Nexus Controller In AUTO



ALTERNATOR CONNECTION BOX

GENERATOR SET



REV C

UTILITY VOLTAGE AVAILABLE
SWITCH IN AUTO

SCHEMATIC DIAGRAM
G4.2L G4 NEXUS
OH6682

005394

Figure 3-30. Utility Failure—Engine Cranking, Nexus Controller In AUTO

Utility Failure—Engine Cranking, Nexus Controller In AUTO

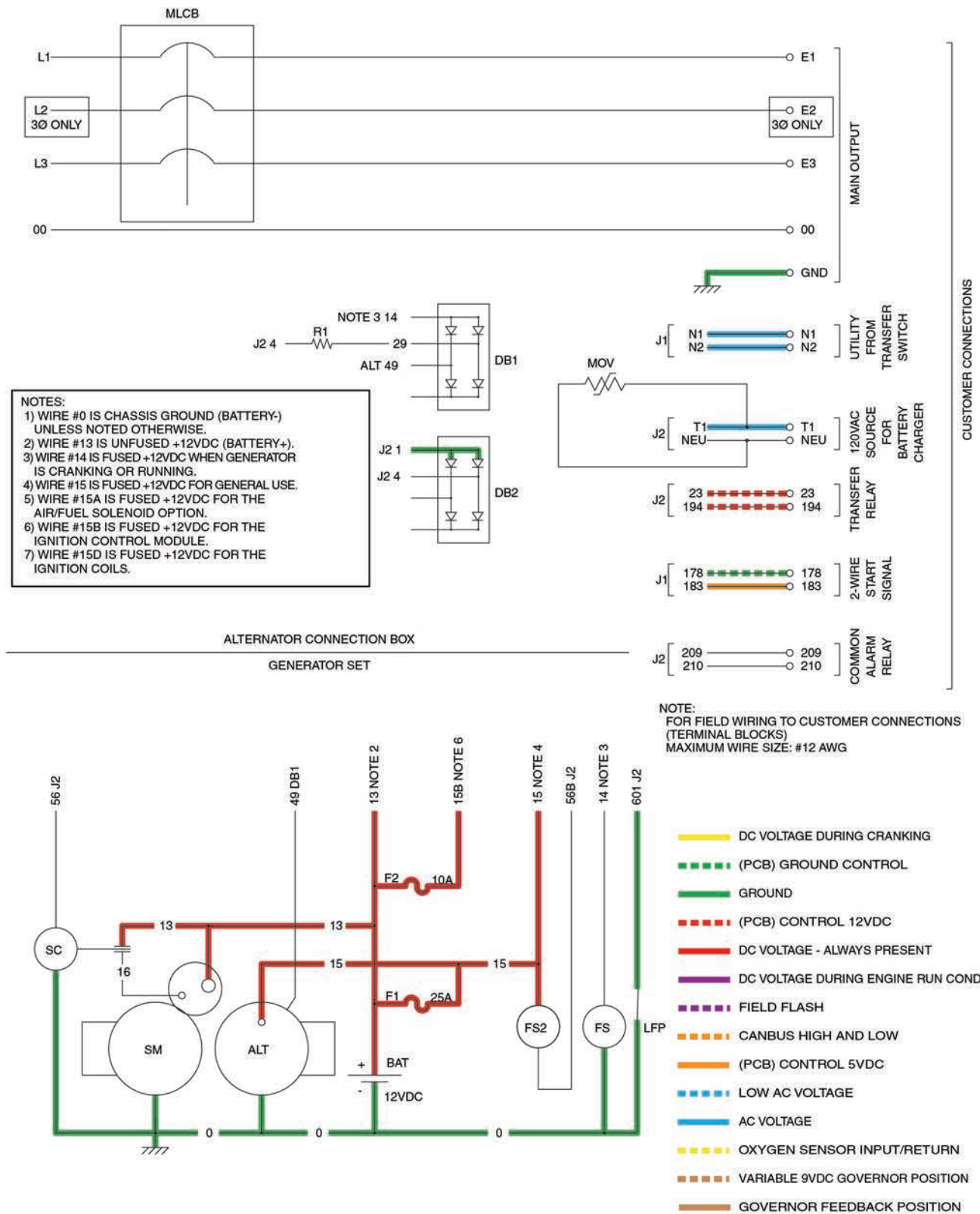
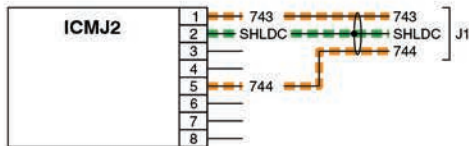
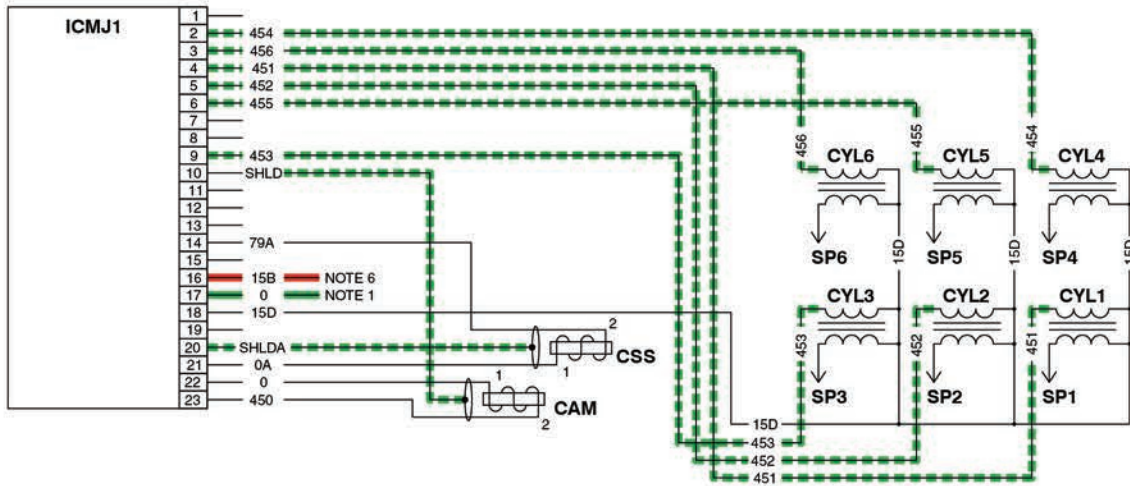


Figure 3-31. Utility Failure—Engine Cranking, Nexus Controller In AUTO

005394

Utility Failure—Engine Cranking, Nexus Controller In AUTO



- DC VOLTAGE DURING CRANKING
- - - - (PCB) GROUND CONTROL
- GROUND
- - - - (PCB) CONTROL 12VDC
- DC VOLTAGE - ALWAYS PRESENT
- DC VOLTAGE DURING ENGINE RUN CONDITION
- - - - FIELD FLASH
- - - - CANBUS HIGH AND LOW
- (PCB) CONTROL 5VDC
- - - - LOW AC VOLTAGE
- AC VOLTAGE
- - - - OXYGEN SENSOR INPUT/RETURN
- - - - VARIABLE 9VDC GOVERNOR POSITION
- GOVERNOR FEEDBACK POSITION

REV C

UTILITY VOLTAGE AVAILABLE
SWITCH IN AUTO

SCHEMATIC DIAGRAM
G4.2L G4 NEXUS
0H6682

005395

Figure 3-32. Utility Failure—Engine Cranking, Nexus Controller In AUTO

Utility Failure—Engine Cranking, Nexus Controller In AUTO

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
- 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
- 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J - ENGINE CONTROL MODULE CONNECTOR	SP - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

005395

Figure 3-33. Utility Failure—Engine Cranking, Nexus Controller In AUTO

Utility Failure Engine Running, Transfer To Emergency, Nexus Controller In AUTO

When the engine reaches approximately 600–800 rpm, the controller will deactivate the crank and fuel boost circuit Wires 56 (positive 12 VDC) and 56B (lifts signal to ground) and will start a five second warm-up timer. The engine speed is sensed by the MP1 magnetic pickup (fly-wheel) Wire 79 and Wire 0. Crank termination, over-speed, and governed speed are all functions of the MP1 and the controller speed referencing circuit.

There is a 10 second hold-off timer for the oil pressure to build-up and the contacts of the LOS (low oil pressure switch) to open.

While the engine begins its crank/run operation, Wire 14 provides a positive (+) 12 VDC supply to DB1 which is connected to Wire 29 (white) and the R1 resistor. This resistor steps the DC voltage down so the AVR automatic voltage regulator in the Nexus controller can take over operation. Wire 4 and Wire 1 are also connected to the Nexus controller J2-18 and J2-19 and continue to the BA brush assembly. This is the field boost/field excitation circuit and provides DC voltage to the rotor.

The field boost circuit magnetizes the rotor, which will create AC voltage on the DPE displaced phase excitation winding—this winding is the power supply for the AVR in the controller and is connected to J2-16 and J2-17.

The AC sensing circuit is Wire 11 and Wire 44, which turns into Wire SA sensing “A” and SB sensing “B” and are connected to J1-13 and J1-24. The AVR uses this circuit to monitor the generators AC output and adjusts the DC field excitation to maintain the correct output.

For RTS operation Wire 194 is positive (+) 12 VDC and is connected from the controller J2-13 to one side of the TR transfer relay coil. Wire 23 comes from the other side of the TR transfer relay coil and is connected to the controller J2-12. After the five second warm-up timer is expired, the controller will take Wire 23 to ground and activate the TR relay causing the transfer switch mechanism (contactor) to transfer the load from the utility position to the emergency standby position.

When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry (the 10–30 second programmable line interrupt timer will still apply before unit cranks and starts).

Return Of Utility, Engine Cool Down And Engine Shutdown, Nexus Controller In AUTO

Return of Utility

For RTS transfer switches, the controller will monitor N1 (J1-25) and N2 (J1-26) for voltage rise above 80%-95% (programmable) of nominal. This will initiate a 15 second return to utility timer. At the end of the return to utility timer, if the utility voltage is still greater than 80–95% of nominal (programmable) the controller will lift the ground on Wire 23 which will cause the TR relay to de-energize and the transfer switch mechanism (contactor) to transfer the load from the emergency standby position back to the utility position.

When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry.

Engine Cool Down

The controller will then initiate a one minute engine cool down timer.

NOTE: If utility voltage drops below 60% of nominal, the controller will initiate the five second warm-up timer and then will connect Wire 23 to ground causing the transfer switch mechanism (contactor) to transfer the load from the utility position back to the emergency standby position.

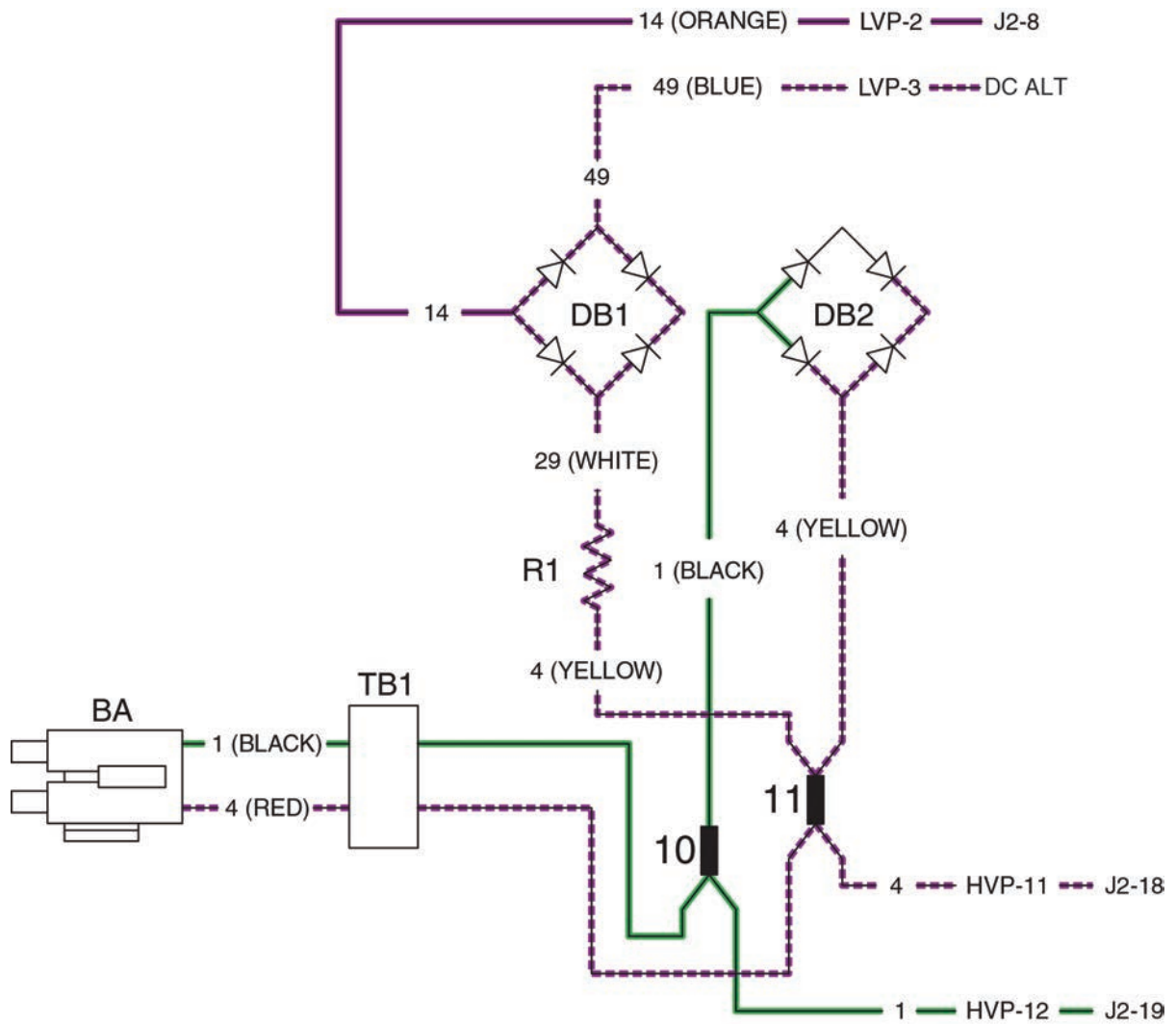
When equipped with a GTS configured switch, all transfer control and timers are controlled by the GTS circuitry.

Shutdown

For RTS transfer switch applications, the unit will shut down after the one minute cool down timer expires.

For GTS configured switches, all transfer control and timers are controlled by the GTS circuitry and when the timers expire it will open the dry contacts on Wire 183 and Wire 178.

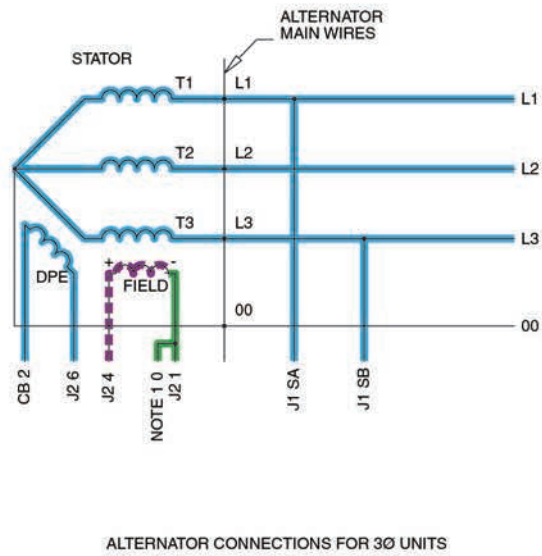
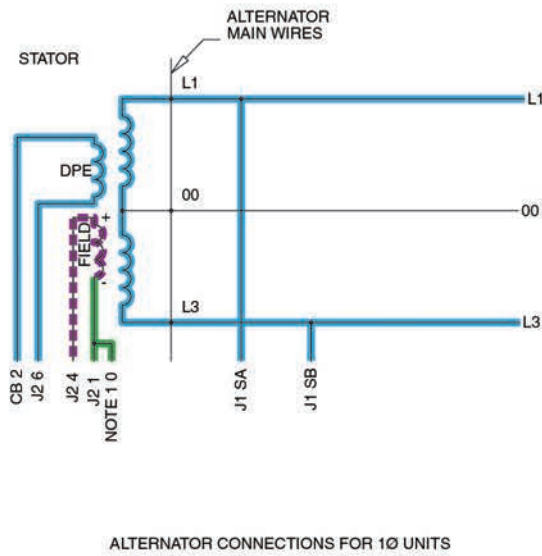
Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO



005400

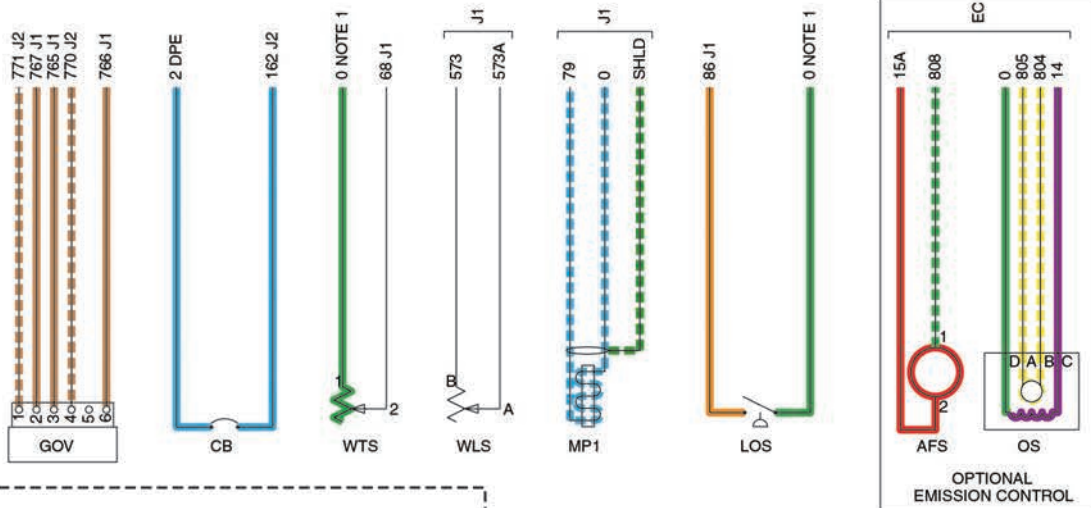
Figure 3-34. Field Excitation Circuit

Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO



ALTERNATOR CONNECTION BOX

GENERATOR SET



REV C

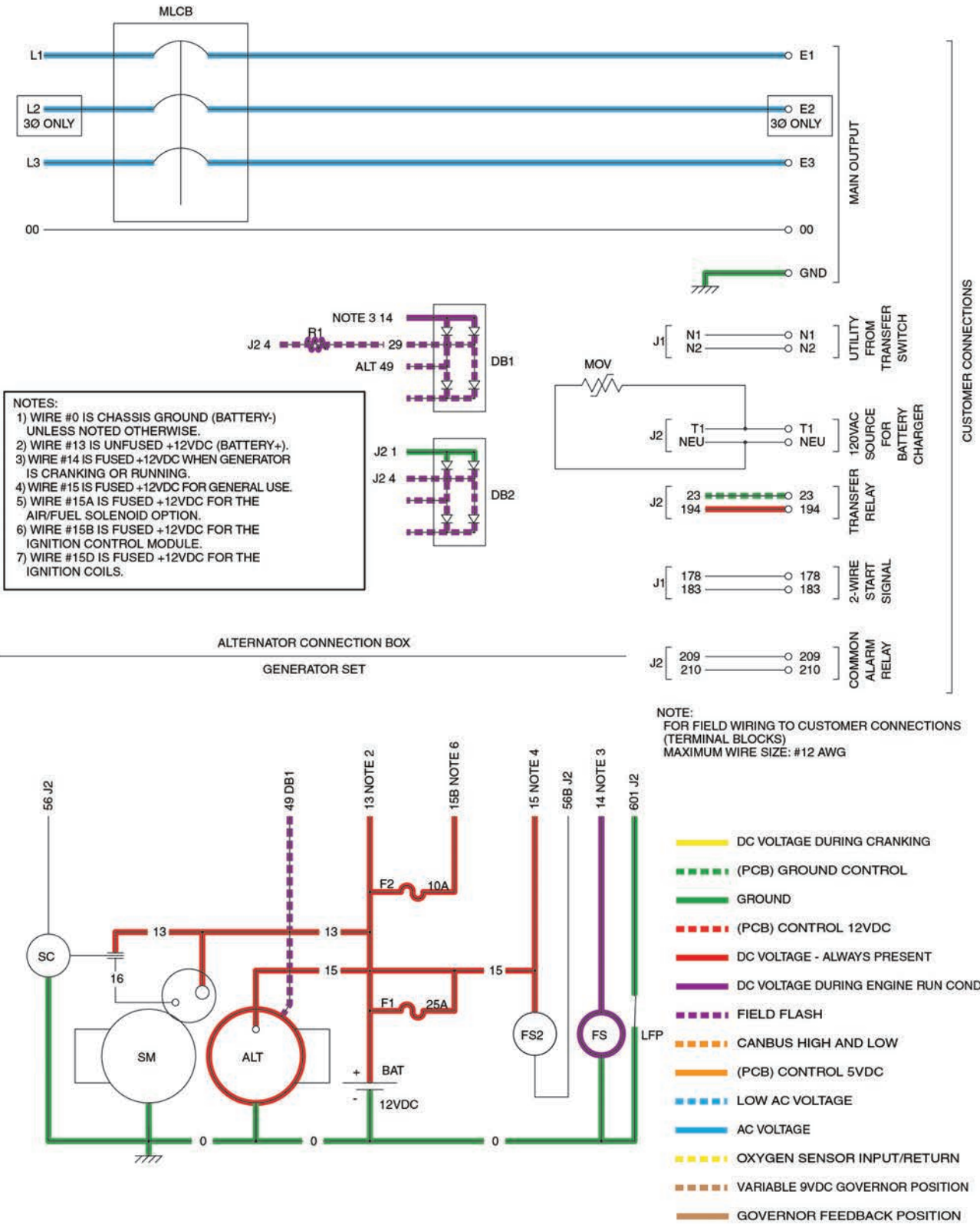
**UTILITY FAILURE – ENGINE RUNNING,
TRANSFER TO EMERGENCY,
NEXUS CONTROLLER IN AUTO**

SCHMATIC DIAGRAM
G4.2L G4 NEXUS
0H6682

005401

Figure 3-35. Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO

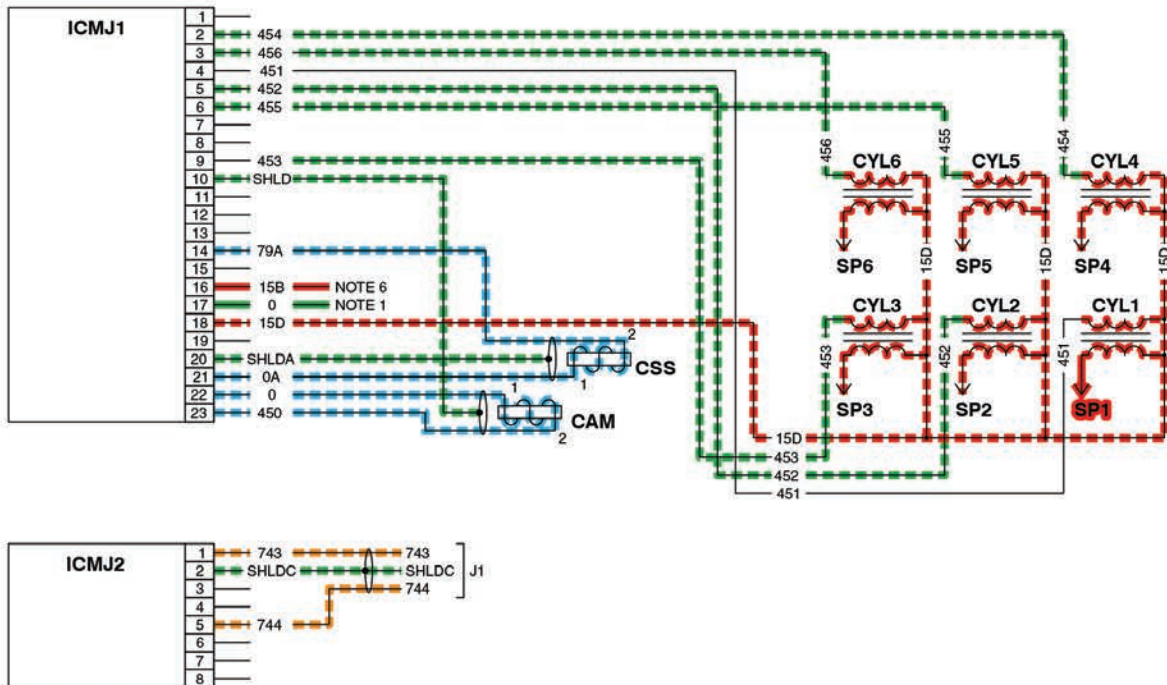
Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO



005401

Figure 3-36. Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO

Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO



- DC VOLTAGE DURING CRANKING
- (PCB) GROUND CONTROL
- GROUND
- (PCB) CONTROL 12VDC
- DC VOLTAGE - ALWAYS PRESENT
- DC VOLTAGE DURING ENGINE RUN CONDITION
- FIELD FLASH
- CANBUS HIGH AND LOW
- (PCB) CONTROL 5VDC
- LOW AC VOLTAGE
- AC VOLTAGE
- OXYGEN SENSOR INPUT/RETURN
- VARIABLE 9VDC GOVERNOR POSITION
- GOVERNOR FEEDBACK POSITION

REV C

**UTILITY FAILURE – ENGINE RUNNING,
TRANSFER TO EMERGENCY,
NEXUS CONTROLLER IN AUTO**

SCHEMATIC DIAGRAM
G4.2L G4 NEXUS
OH6682

005402

Figure 3-37. Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO

Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
- 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
- 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS**J1**

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F_ - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SP_ - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL_ - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB_ - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

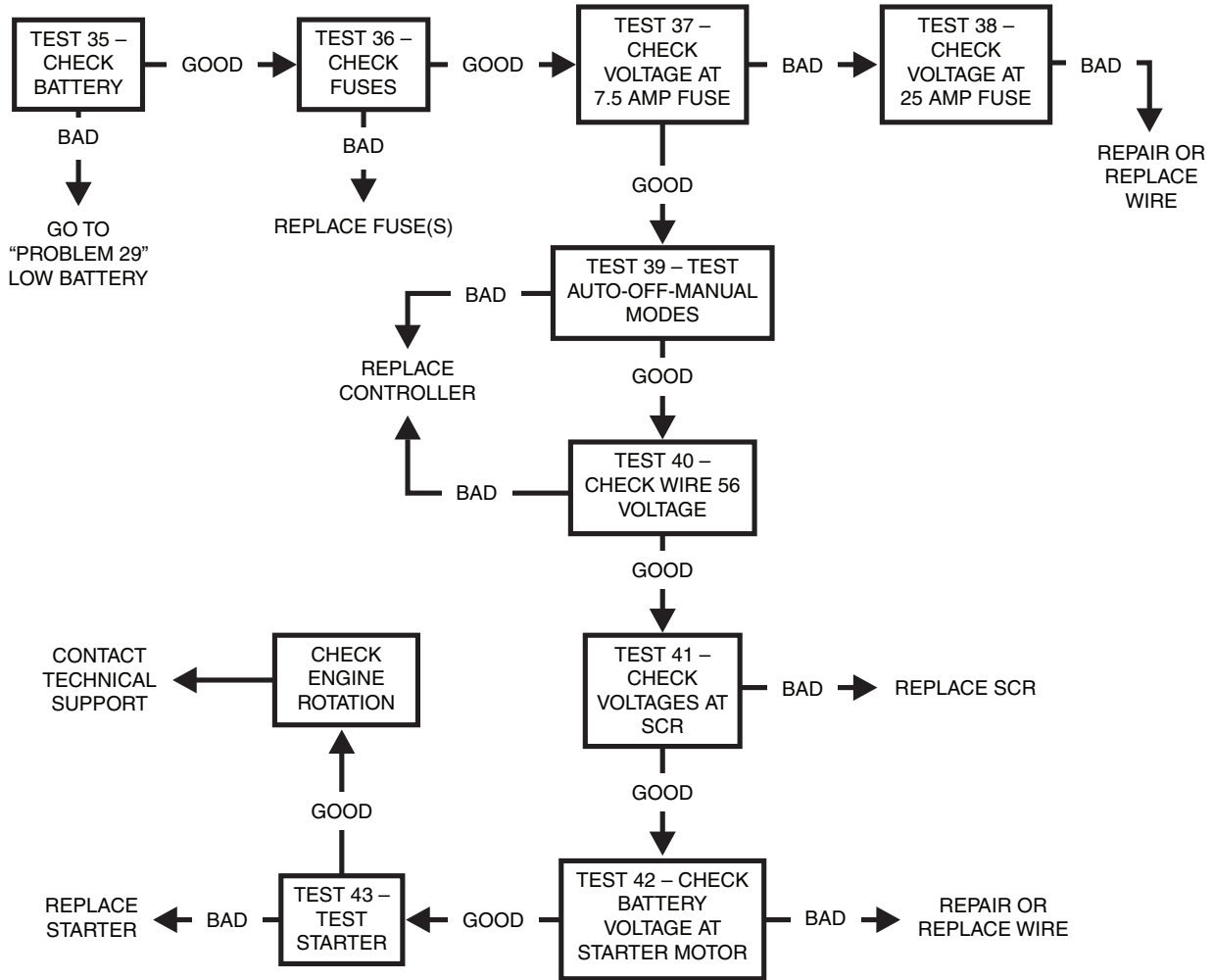
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Figure 3-38. Utility Failure—Engine Running, Transfer To Emergency, Nexus Controller In AUTO

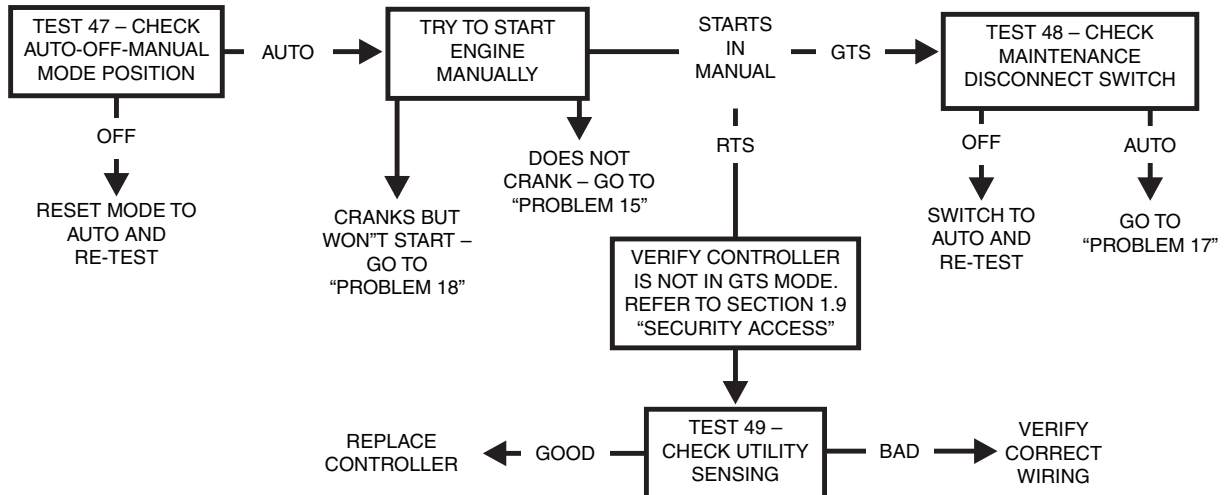
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Section 3.4 Troubleshooting Flowcharts

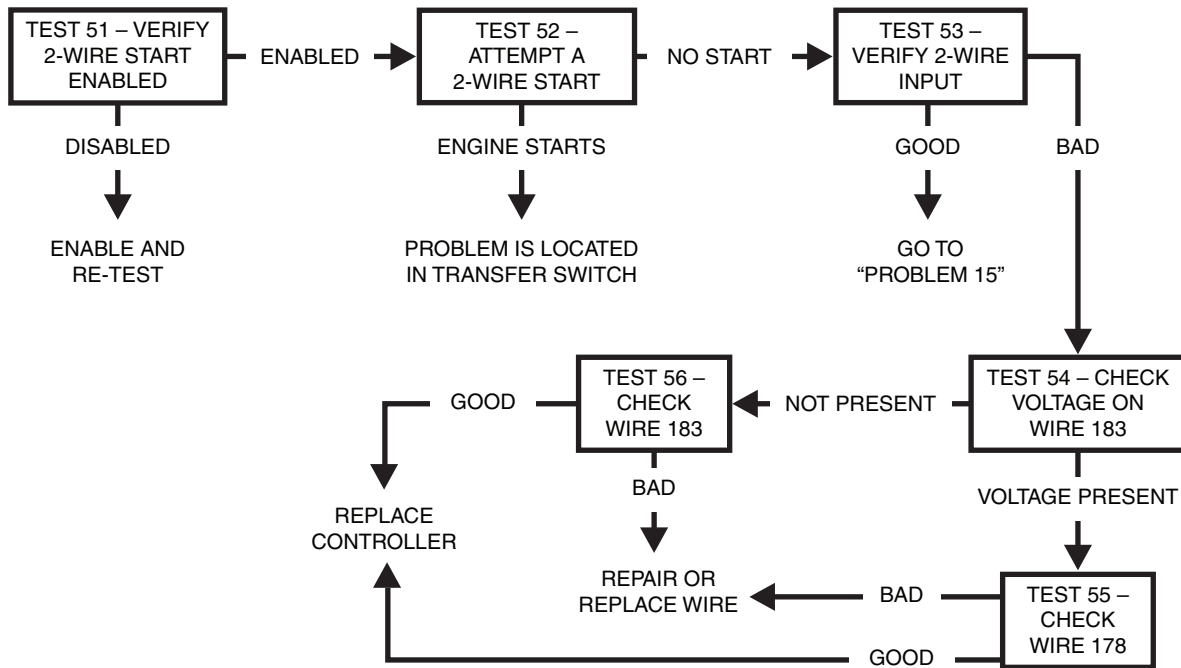
Problem 15 – Unit Will Not Crank When AUTO-OFF-MANUAL Mode is Set to MANUAL



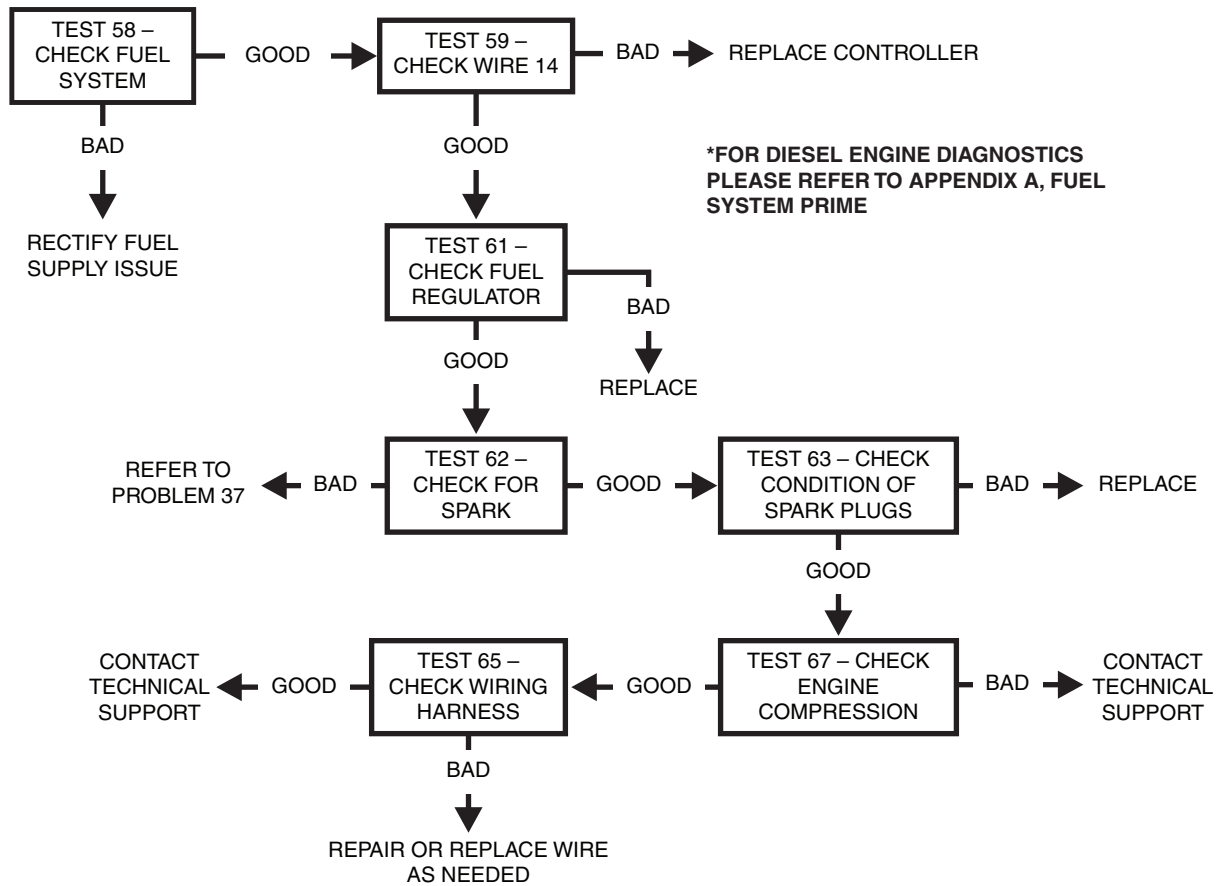
Problem 16 – Engine Will Not Crank When Utility Power Fails

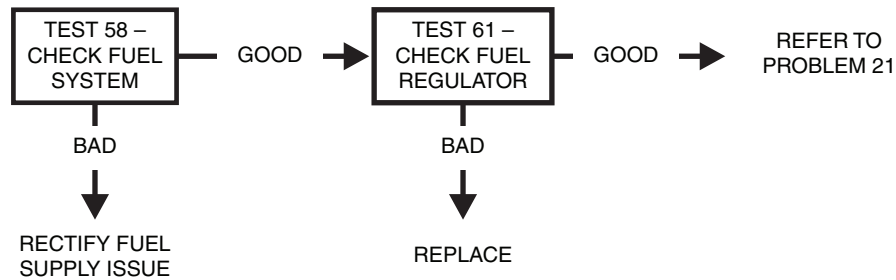
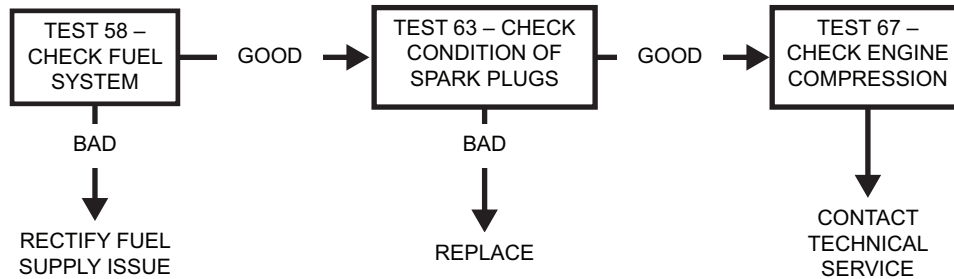


Problem 17 – Engine Will Not Crank With a 2-Wire Start

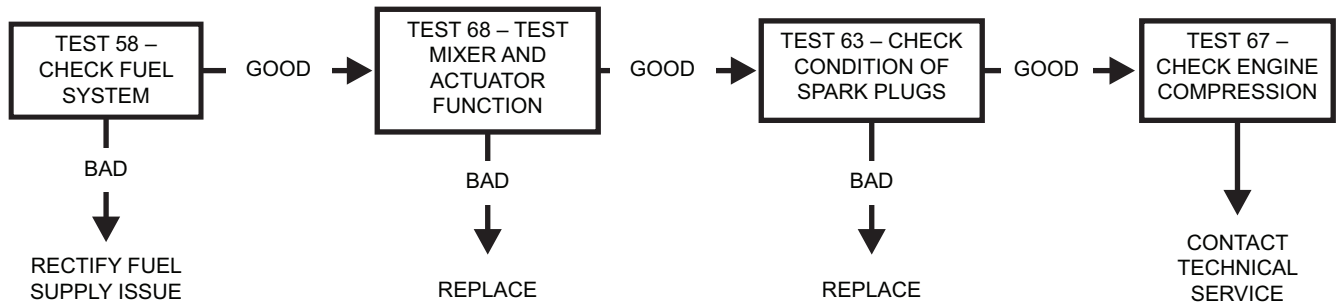


Problem 18 – Unit Cranks But Will Not Start (Overcrank Alarm)

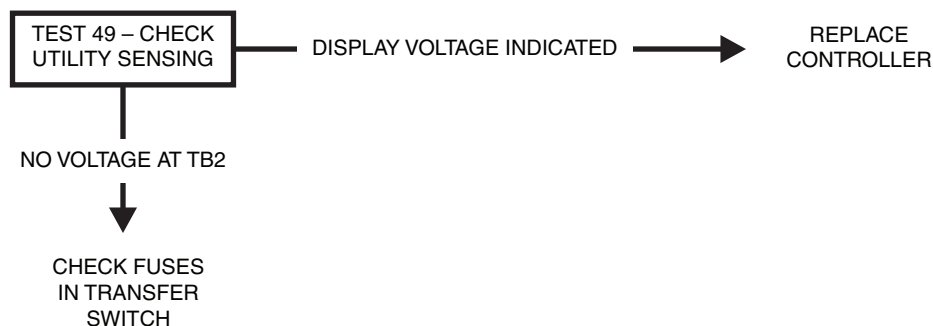


Problem 19 – Unit Starts And Runs, Then Shuts Down With No Fault Indicated**Problem 20 – Unit Cranks and Starts, but Backfires With No Fault Indicated**

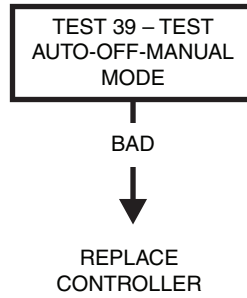
NOTE: *For diesel engine diagnostics please refer to [Diesel Checks and Tests](#).

Problem 21 – Unit Starts Hard and Runs Rough / Lacks Power

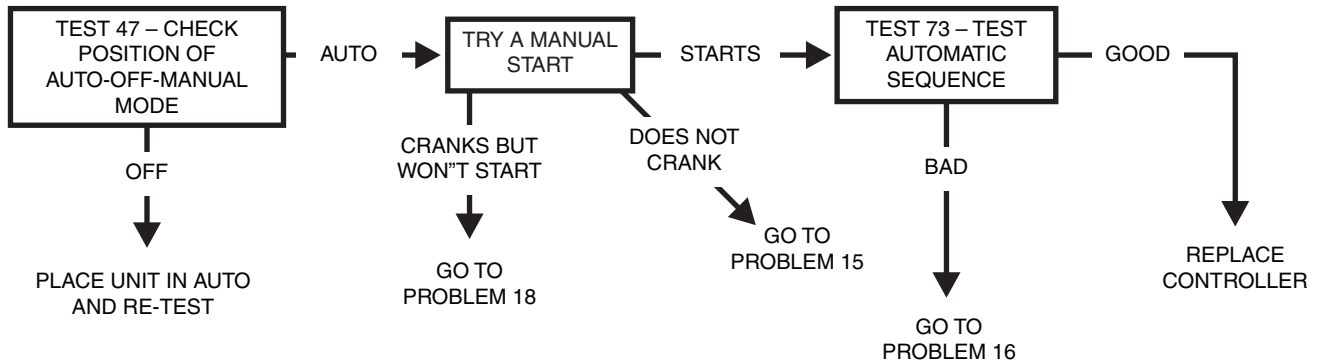
NOTE: *For diesel engine diagnostics please refer to [Diesel Checks and Tests](#).

Problem 22 – Unit Starts and Transfer Occurs When Utility Power is Available

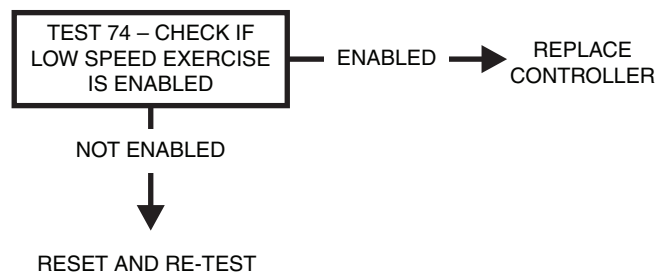
Problem 23 – Unit Starts Immediately in Auto, but No Transfer to Standby and Utility



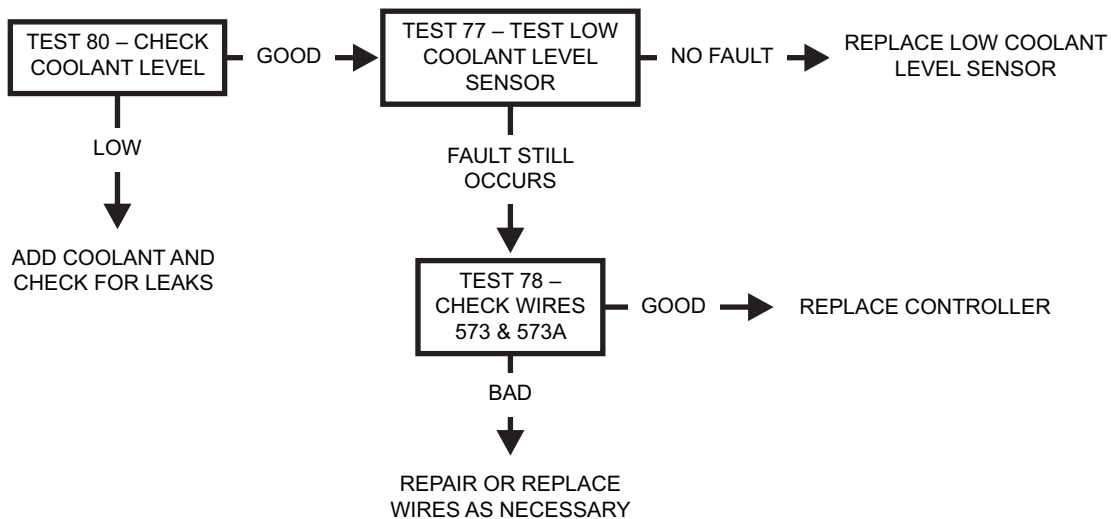
Problem 24 – Generator Will Not Exercise or Exercises at the Wrong Time



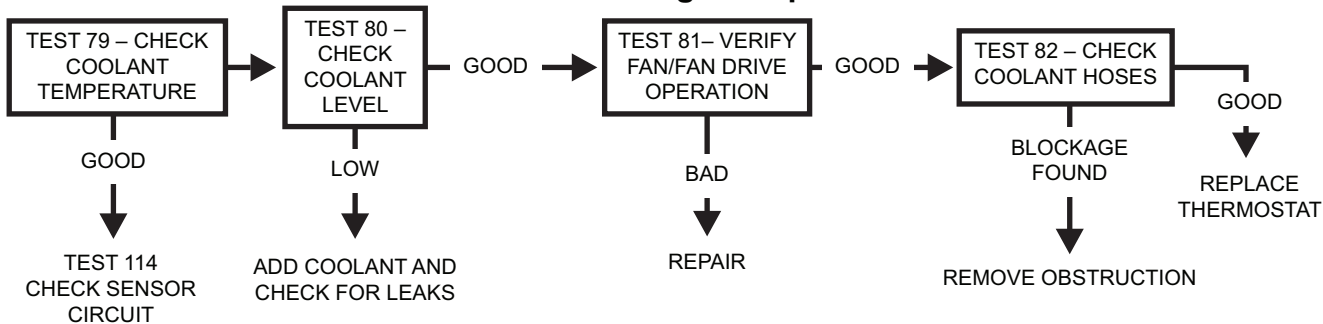
Problem 25 – Generator Will Not Low Speed Exercise



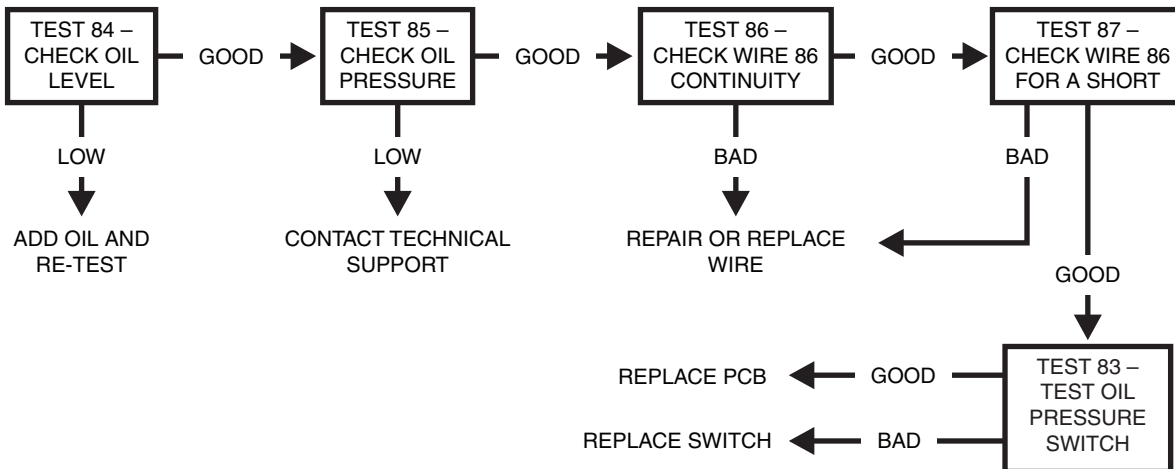
Problem 26 – Low Coolant Level



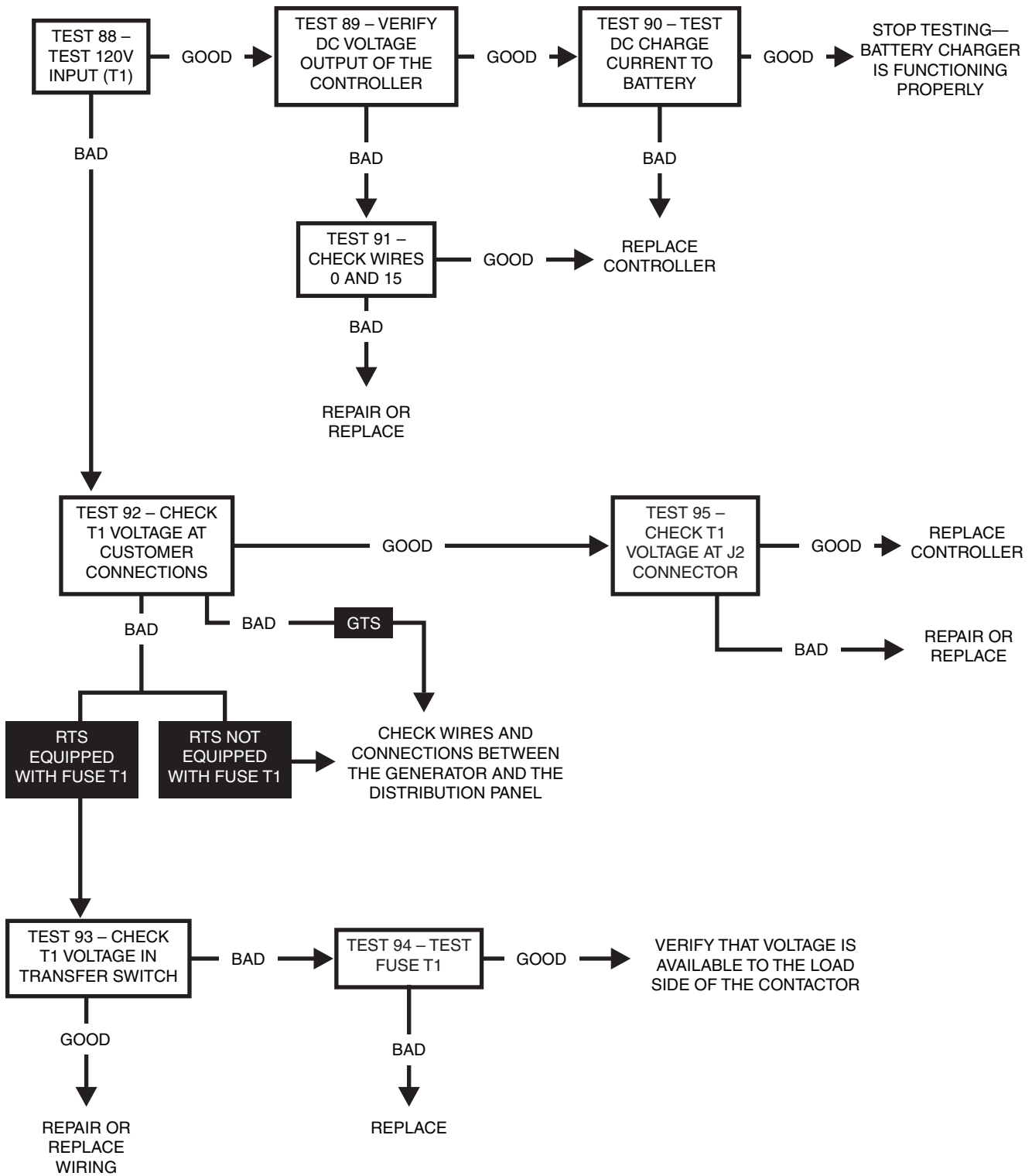
Problem 27 – High Temperature



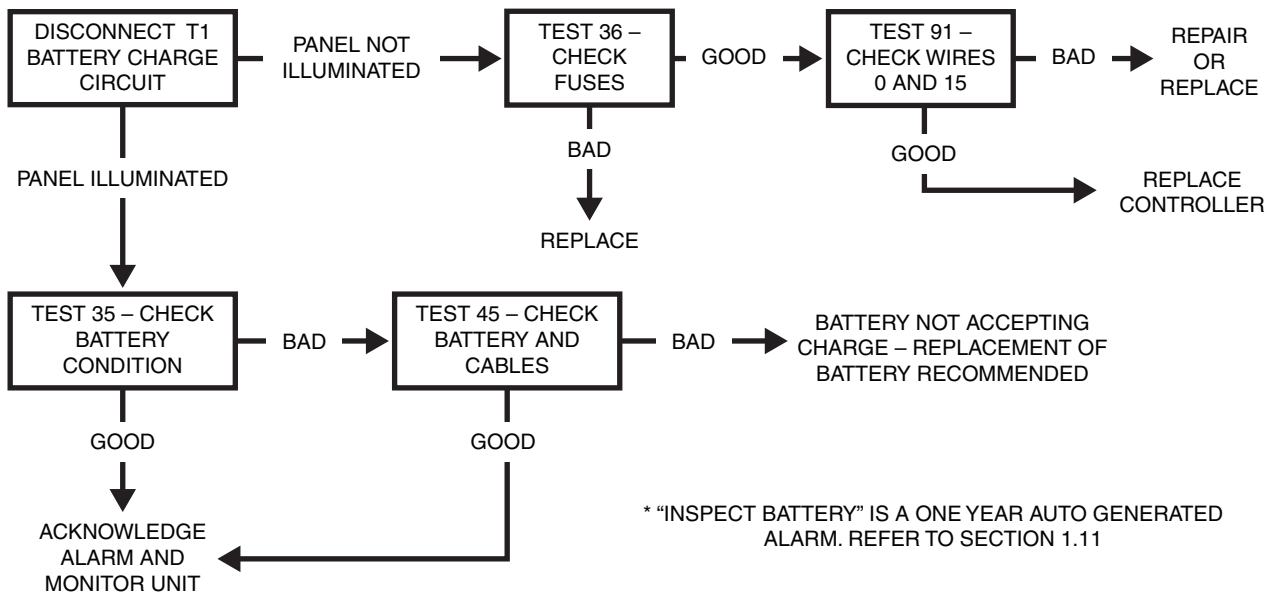
Problem 28 – Low Oil Pressure



Problem 29 – Low Battery Alarm/Dead Battery

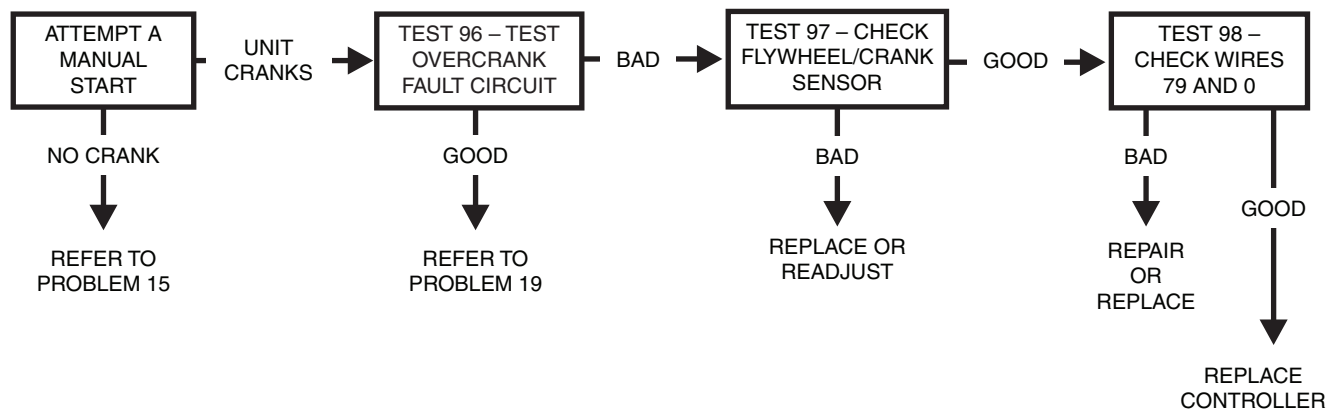


Problem 30 – Inspect Battery*

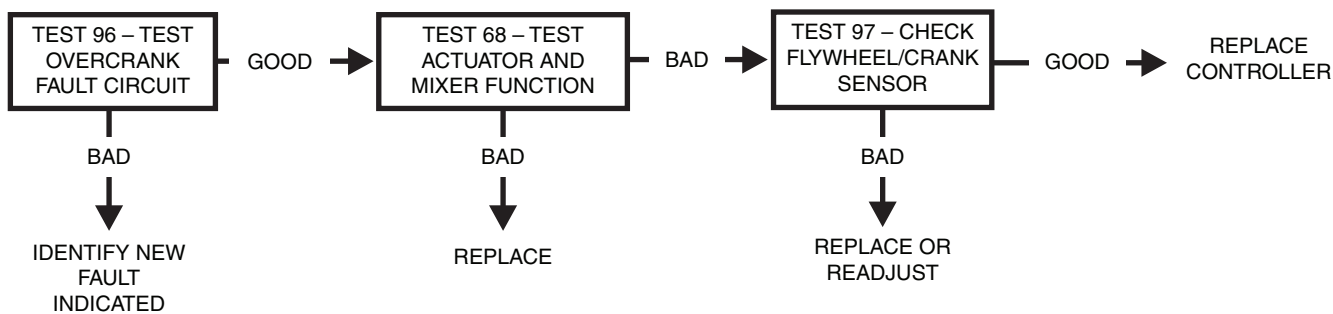


Problem 31 – RPM Sensor Loss

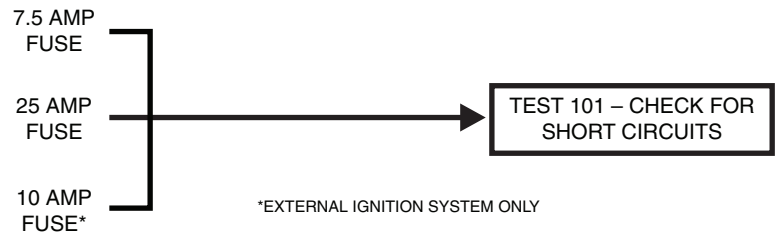
NOTE: VERIFY PANEL IS PROGRAMMED CORRECTLY BEFORE TROUBLESHOOTING.



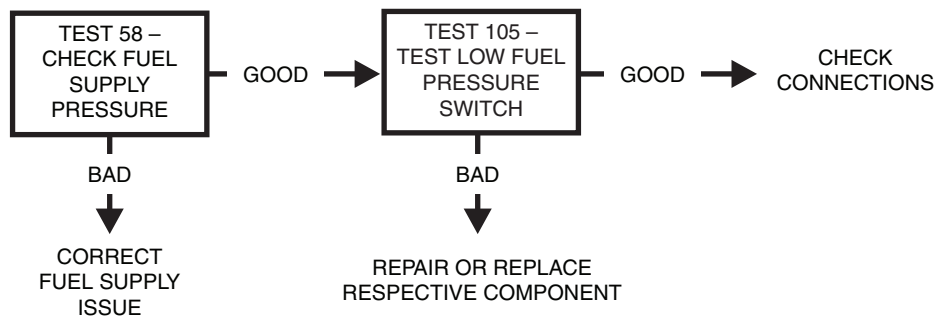
Problem 32 – Overspeed



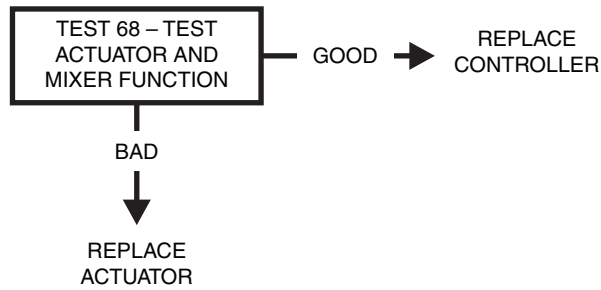
Problem 33 – Blown Fuse(s)



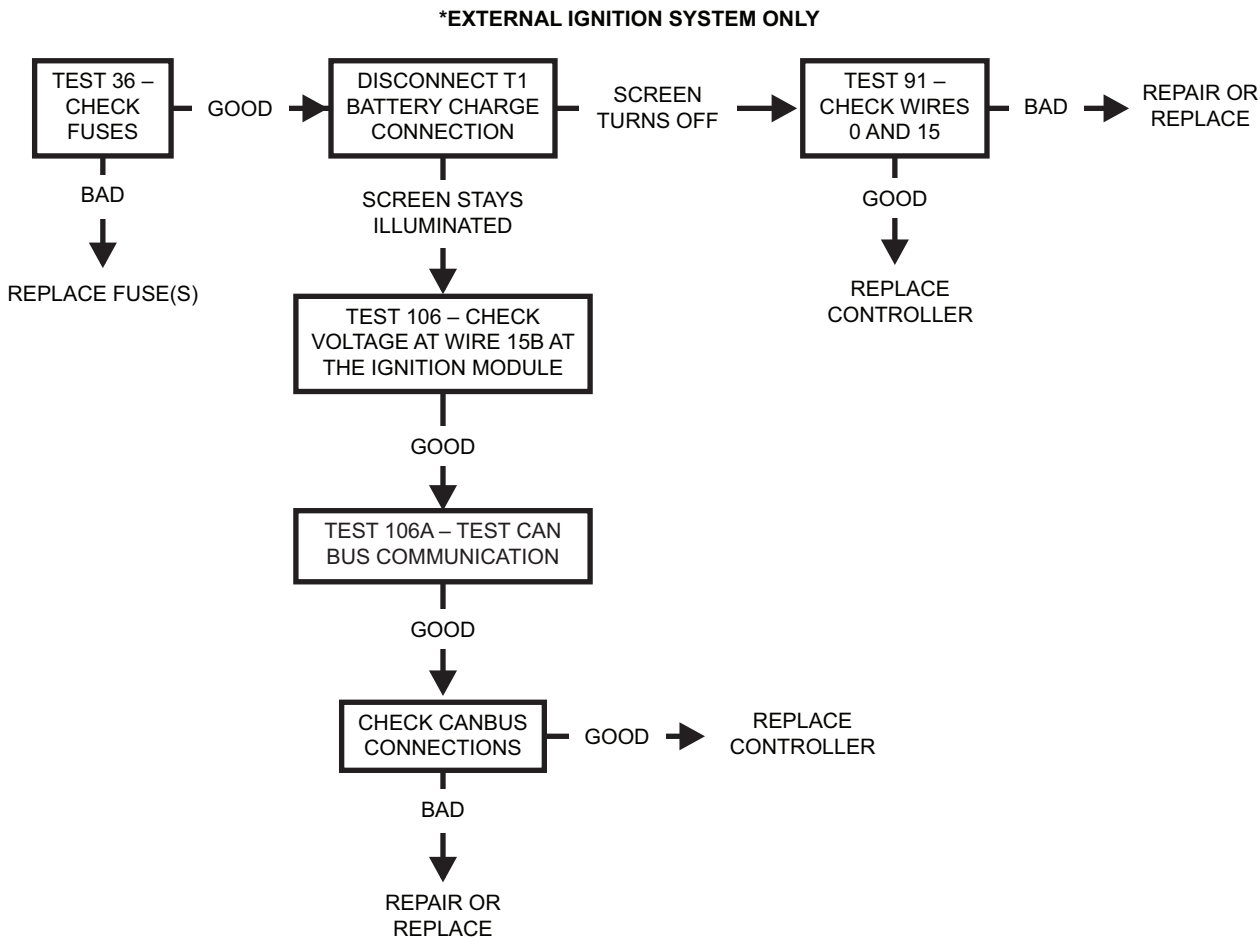
Problem 34 – Low Fuel Pressure



Problem 35 – Governor Fault

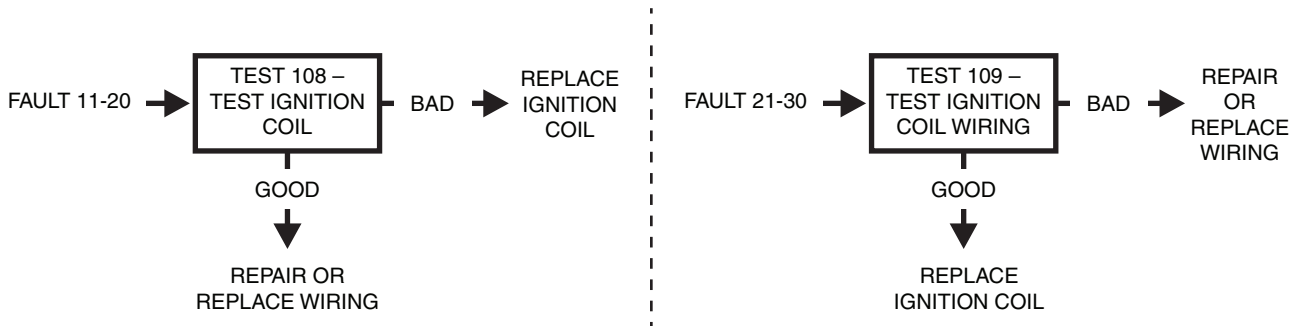


Problem 36 – Canbus Alarm



Problem 37 – Ignition Fault

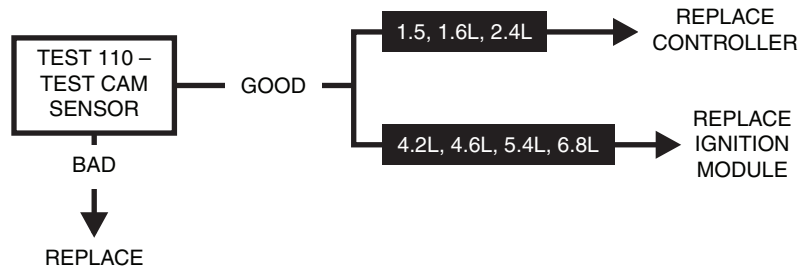
NOTE: See *Ignition Module Fault (If equipped)* in section 3.1 for a list of the Nexus Ignition Faults



Problem 38 – Missing Cam Pulse

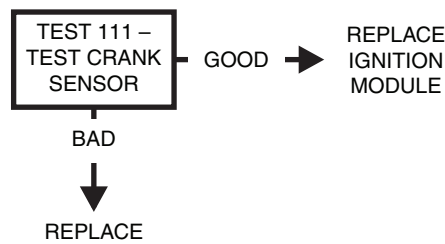
NOTE: REFER TO SECTION 6.2 TO VERIFY PANEL IS PROGRAMMED CORRECTLY BEFORE TROUBLESHOOTING.

NOTE: WHEN REPLACING THE CONTROLLER ON A UNIT WITH 1.5L/1.6L ENGINE, LEAVE T1 DISCONNECTED UNTIL UNIT HAS BEEN RUN ONCE IN "MANUAL"

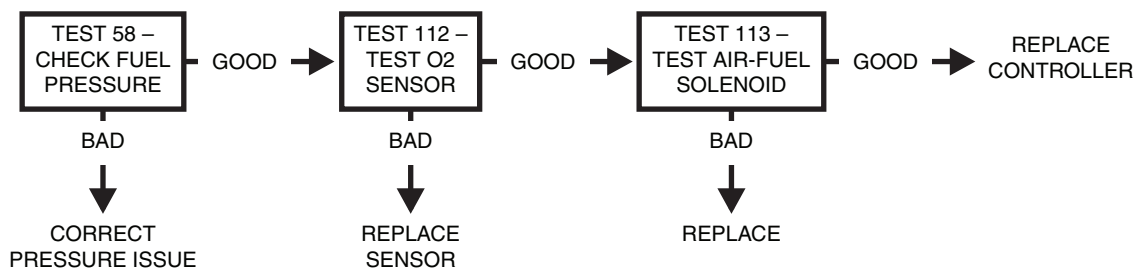


Problem 39 – Missing Crank Pulse

NOTE: REFER TO SECTION 6.2 TO VERIFY PANEL IS PROGRAMMED CORRECTLY BEFORE TROUBLESHOOTING.



Problem 40 – Check Engine



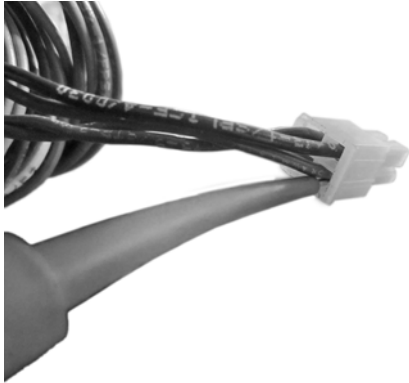
Section 3.5 Diagnostic Tests

Introduction

“True Ground” or “System Ground” is available at the negative battery terminal. When performing a test, if the reading obtained is suspicious, or does not indicate a “Clean frame Ground,” use the negative battery terminal.

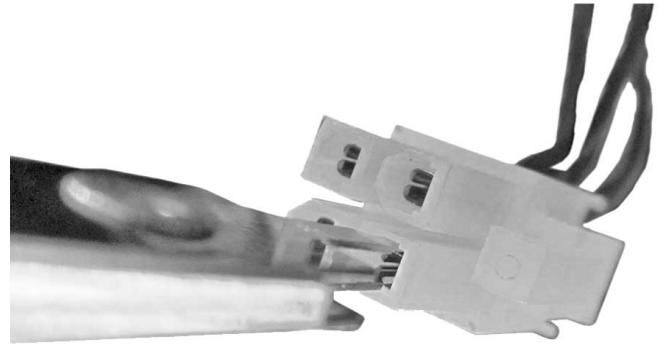
Probing and Pin Extraction

If probing and/or back-probing results in a “BAD” condition, before condemning the controller, remove the pin/plug in question and verify the pin/plug is not distorted, bent and/or not making electrical contact. Repair as needed.



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Figure 3-39. Back-Probing Molex Connector



002453

Figure 3-41. Using Molex Pin Extractor Tool



002452

Figure 3-40. Molex Pin Extractor Tool Park 0K4445



002451

Figure 3-42. Probing AMP Connector

Evolution E-Codes

Alarm	E-Code	Diesel	Gas	Description	Procedure
Controller	180	X	X	Internal Harness Loop Broken —External display board is not able to communicate with main board. This alarm is internal to the display board and is not logged (the main board is not aware of this E-Code).	
Controller	1001	X	X	Internal Harness Loop Broken —Internal harness connecting external display board to main board has become disconnected. Triggered when main board does not see communication from display board.	
Overcrank	1100	X	X	Default—Engine/Starter Problem The default for overcrank alarm, because of the nature of cranking there is almost no insight into the cause of an overcrank alarm with the current sensors.	Problem 18
Overcrank	1101		X	No Fuel Pressure Low to no fuel pressure while cranking. To set, fuel pressure has to be measured as low for at least 1200 ms before the overcrank alarm is set.	Test 58
Overspeed	1200	X	X	Prolonged Over 72 Hz for three seconds.	Test 68
Overspeed	1201	X	X	Prolonged—Throttle stuck open Over 72 Hz for three seconds with the throttle stuck open. Possible causes: Stuck throttle	Test 68
Overspeed	1204		X	External Ignition Overspeed CAN alarm from external ignition, threshold is >30% over nominal.	Test 68
Overspeed	1205	X	X	Instantaneous Over 75 Hz for one second.	Test 68
Overspeed	1206	X	X	Instantaneous—Throttle stuck open Over 75 Hz for one second with the throttle stuck open, total loss of control. Possible causes: Stuck throttle	Test 68
Low Oil Pressure	1300	X	X	Occurred while running—Default The default extended alarm for low oil pressure. Check the oil level.	Problem 28
High Temperature	1400	X	X	Air Flow Impeded / Flow Issue Check the inlet/outlet for debris. Coolant temp greater than 246 °F (119 °C) for 1 second. Check coolant sensor circuit for proper operation.	Problem 27 Test 114
High Temperature	1401		X	Fuel Pressure Low—Running Lean Very low fuel pressure while running will cause an increase in engine temperature. Fuel pressure must be measured as low for 1200 ms preceding high temperature alarm to set this E-Code.	Problem 34
Rpm Sensor	1500	X	X	Missing Mag Pickup Pulses.	Problem 31
Alarm	E-Code	Diesel	Gas	Description	Procedure
Rpm Sensor	1516	X	X	Cranking + Low Fuel Cranking with Low Fuel Pressure faults to rpm sensor loss. Possible causes: Low fuel pressure for at least 1200 ms, ignition fault, air pocket in fuel line, dirty fuel	Problem 34
Rpm Sensor	1517	X	X	Running + Low Fuel Running with low fuel pressure faults to rpm sensor loss. Possible causes: Low fuel pressure for 1200 ms, ignition fault, air pocket in fuel line, dirty fuel	Problem 34

Alarm	E-Code	Diesel	Gas	Description	Procedure
Rpm Sensor	1518		X	No Pulse during Cranking Rpm sensor loss, no tooth pulses sensed for 75 consecutive milliseconds while starter active. Possible causes: starter circuit issue, rpm sensor	Problem 31
Rpm Sensor	1519		X	No Pulse during Running Cranking faults to rpm sensor loss. Possible causes: starter circuit issue, rpm sensor	Problem 31
Rpm Sensor	1520		X	Missing Pulses during Cranking Cranking faults to rpm sensor loss. Starter engaged, no tooth pulses for 75 ms. Possible causes: starter circuit issue, rpm sensor alignment, low battery	Problem 31
Rpm Sensor	1521		X	Missing Pulses during Running While running, no tooth pulses for 75 consecutive milliseconds. Possible causes: rpm sensor alignment, low battery	Problem 31
Underspeed	1600	X	X	Unit Overloaded or Fuel System issue <83.3% speed (60 Hz) or <66.6% speed (50 Hz) for 30 seconds. Unit is overloaded slowing engine speed. Possible cause: highly inductive loads	
Underspeed	1601		X	Low Fuel Pressure Low fuel pressure starves the engine, slowing it. Low fuel pressure detected for 1200 ms before underspeed condition detected. Check fuel supply and settings	Problem 34
Underspeed	1602	X	X	Throttle Stuck Closed/near Closed The throttle is stuck closed or stuck near closed limiting the fuel to the engine, slowing it down. Stuck closed must be detected for one second with underspeed to set E-Code.	Test 68
Overvoltage	1800	X	X	Prolonged three seconds of over 10% above nominal.	Problem 3
Overvoltage	1801	X	X	Instantaneous —Set by an instantaneous measurement 30% over nominal.	Problem 3
Overvoltage	1803	X	X	Overspeed Generator running at higher speed (25% over nominal rpm) causing overvoltage.	Problem 3
Undervoltage	1900	X	X	Prolonged Undervoltage; Generator voltage below 80% of nominal for 10+ seconds.	Problem 1
Undervoltage	1901	X	X	Instantaneous Generator voltage less than 15V. Hold off time of two seconds.	Problem 1
Undervoltage	1902	X	X	Both Zero Crosses missing Undervoltage due to faulty excitation winding, or zero cross circuit, or circuit in general. Both zero crosses must be missing for 1.5 seconds. Possible cause: loose wiring, field boost hardware failure	Problem 1
Undervoltage	1903	X	X	Little / No Voltage (<120V) Controller measuring no voltage resulting in undervoltage. Generator voltage less than 120V when undervoltage set.	Problem 1
Undervoltage	1904	X	X	No Field Current But Have DPE No field current during undervoltage alarm. Possible cause: Wire loose, brush failure	Problem 1

Section 3.5 Diagnostic Tests

Alarm	E-Code	Diesel	Gas	Description	Procedure
Undervoltage	1905	X	X	Low Speed Generator running underspeed for > 30 seconds when undervoltage alarm set. Possible cause: fuel supply/control system, engine intake exhaust or mechanical issues.	Problem 1
Undervoltage	1916	X	X	Single Zero Cross missing Undervoltage due to faulty excitation winding, or zero cross circuit, or circuit in general. One zero cross missing for greater than 1.5 seconds. Possible cause: field boost hardware failure.	Problem 1
Wire Error	2099	X	X	Incorrect DC AC wiring hook up.	
Overload Remove Load	2101	X	X	Overload (DPE Style Field Current Method) Field Current measured value is above threshold. Possible cause: overload	
Fuse Problem	2400	X	X	Missing / Damaged Fuse The controller fuse is missing or damaged in such a way that it does not work. Fuse problem must be detected for 1.5 seconds. Firmware older than V1.30	
Alarm	E-Code	Diesel	Gas	Description	Procedure
Bosch	2500	X	X	Command and position feedback not matching or taking too much time to achieve. Possible causes: governor wire loose, governor module	Test 68
Bosch	2501	X	X	Stuck Open Command and position feedback not matching or taking too much time to achieve. Governor in open position for greater than one second. Possible causes: governor wire loose, governor module	Test 68
Bosch	2502	X	X	Stuck Closed Command and position feedback not matching or taking too much time to achieve. Governor in closed position (commanded otherwise) for greater than one second. Possible cause: governor wire loose, governor module	Test 68
Ignition	2600		X	Ignition Fault	Problem 37, 38, 39
Ignition	2601		X	Missing Cam Pulse —Cam pulses missing for five seconds.	Problem 38
Ignition	2602		X	Crank Circuit (External Module)	Problem 38, 39
Over current cylinder1	2611		X	Coil current too high for one second.	Problem 37
Over current cylinder2	2612		X	Coil current too high for one second.	Problem 37
Over current cylinder3	2613		X	Coil current too high for one second.	Problem 37
Over current cylinder4	2614		X	Coil current too high for one second.	Problem 37
Over current cylinder5	2615		X	Coil current too high for one second.	Problem 37
Over current cylinder6	2616		X	Coil current too high for one second.	Problem 37
Over current cylinder7	2617		X	Coil current too high for one second.	Problem 37
Over current cylinder8	2618		X	Coil current too high for one second.	Problem 37

Alarm	E-Code	Diesel	Gas	Description	Procedure
Over current cylinder9	2619		X	Coil current too high for one second.	Problem 37
Over current cylinder10	2620		X	Coil current too high for one second.	Problem 37
Under current cylinder1	2621		X	Coil current too low for one minute.	Problem 37
Under current cylinder2	2622		X	Coil current too low for one minute.	Problem 37
Under current cylinder3	2623		X	Coil current too low for one minute.	Problem 37
Under current cylinder4	2624		X	Coil current too low for one minute.	Problem 37
Under current cylinder5	2625		X	Coil current too low for one minute.	Problem 37
Under current cylinder6	2626		X	Coil current too low for one minute.	Problem 37
Under current cylinder7	2627		X	Coil current too low for one minute.	Problem 37
Under current cylinder8	2628		X	Coil current too low for one minute.	Problem 37
Under current cylinder9	2629		X	Coil current too low for one minute.	Problem 37
Under current cylinder10	2630		X	Coil current too low for one minute.	Problem 37
Internal Ignition Missing Cam	2650		X	Cranked for four seconds on gaseous unit, no cam pulses detected.	Problem 38
External Ignition Missing Cam	2651		X	No cam pulses detected by external ignition.	Problem 38
Internal Ignition Missing Crank Pulses	2660		X	Missing crank pulses detected by internal ignition.	Problem 39
External Ignition Missing Crank Pulses	2661		X	Missing crank pulses detected by external ignition.	Problem 39
CAN Bus	2671		X	CANbus error reported by external ignition.	Problem 36
CAN Bus	2672	X		CANbus error reported by Diesel ECU.	Problem 36
Fuel Level Low	2700	X		Fuel level below 10% for greater than 60 seconds.	
Low Coolant	2720	X	X	Low coolant digital input detected low coolant for greater than five seconds.	Problem 26
Very Low Battery	2751	X	X	The system detected battery voltage level < 9.0 for 60 seconds and has triggered the alarm.	Problem 29
ESTOP Pressed/AUX Shutdown	2800	X	X	The system detected the E-Stop button was pressed and shutdown. E-Stop can also be set for AUX shutdown.	
Hall Calibration	2810	X	X	The system detected on power up that hall calibration was not performed and has triggered the alarm.	
Diesel ECU Fault	2900	X		ECU reports J1939 CAN diagnostic fault message.	

Warning	E-Code	Diesel	Gas	Description	Procedure
DTC*	134		X	DTC P0134. O ₂ sensor stuck open/closed DTC logged in eeprom. Warning will clear after engine runs with no DTC codes three times.*	
Low Fuel Level	2680	X		Fuel level above 10% but lower than 20% for greater than 60 seconds.	
Low Fuel Pressure	2690		X	Low fuel pressure detected for greater than 60 seconds.	Problem 34
Ruptured Tank	2710	X		The system detected fuel in the outer basin tank and has triggered the warning.	
Exercise Set	2730	X	X	Exercise has never been set.	
Low Battery	2750	X	X	Battery voltage below 12.1V for greater than 60 seconds.	Problem 29
Battery Problem	2760	X	X	Completed 26 hour charge cycle, battery voltage below 12.52V, or current draw from charger still greater than 600 mA.	Problem 30
Charger Warning	2770	X	X	Battery voltage above 16.1V.	Problem 29
Charger Missing AC	2780	X	X	During charging, AC input to battery charger missing for greater than five minutes.	Problem 29
SEEPROM Abuse	2790	X	X	Controller wrote to the EEPROM more than 500 times in less than four minutes.	
Gaseous Emissions	2910		X	Air/fuel mix is too rich for more than 10s or mix is too lean for more than 60s.	Problem 39

*Only appears on models that require DTC reporting.

Introduction

This section is provided to familiarize the service technician with acceptable procedures for the testing and evaluation of various problems that could be encountered on standby generators with liquid-cooled engines. Use this section of the manual in conjunction with Section 3.4 **Troubleshooting Flowcharts**. The numbered tests in this section correspond with those flowcharts.

Most tests can be performed with a digital multimeter (DMM). An AC frequency meter is required, where frequency readings must be taken. A clamp-on ammeter may be used to measure AC loads on the generator.

Testing and troubleshooting methods covered in this section are not exhaustive. No attempt has been made to discuss, evaluate and advise the standby service trade of all conceivable ways in which service and trouble diagnosis must be performed. Accordingly, anyone who uses a test method not recommended herein must first satisfy himself that the procedure or method he has selected will jeopardize neither his nor the products safety.

Safety

Service personnel who work on this equipment must be made aware of the dangers of such equipment. Extremely high and dangerous voltages are present that can kill or cause serious injury. Gaseous fuels are highly explosive and can be ignited by the slightest spark. Engine exhaust gases contain deadly carbon monoxide gas that can cause unconsciousness or even death. Contact with moving parts can cause serious injury.

When working on this equipment, use common sense and remain alert at all times. Never work on this equipment while physically or mentally fatigued. If a component, device, or system is not understood, do not work on it.

Test 35 – Check Battery Voltage

Procedure

1. Set a DMM to measure DC voltage.
2. Connect the red test lead to the positive terminal of the battery, and connect the black test lead to the negative terminal on the battery. Measure and record the voltage
3. Set the AUTO-OFF-MANUAL switch to MANUAL. Measure and record the voltage.

IMPORTANT NOTE: *The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.*

Results

1. If voltage was above 12 VDC in step 2, but dropped below 10 VDC, the battery may have a dead cell or a direct short between the cells and **needs** to be replaced. The battery can be load tested using a hand held device or taken to a facility with the capability of testing the state of a battery.

2. If voltage was above 12 VDC in step 2 and above 10 VDC in step 3, refer to the flow chart.

Test 36–Check Fuses

Procedure

1. Locate the 25 amp fuse (in line with DC alternator wires 13 and 15, if equipped) and inspect to see if it is blown.
2. Locate the 25 amp fuse (if equipped) and inspect to see if it is blown. See **Figure 3-43**.

4.2L, 4.6L, 6.8L Only:

3. Locate the 15/25 amp fuse and inspect to see if it is blown.

NOTE: The location of the fuses will vary from unit to unit.

Results

1. Replace fuses as needed and retest.
2. If all fuses are good, refer to the flow chart.

Test 37 – Check Voltage at 7.5 Amp Fuse

Procedure

1. Set DMM to measure DC voltage.
2. Remove the 7.5 amp fuse from the controller.
3. Disconnect the battery charge circuit by either removing the T1 fuse from the transfer switch, or opening the branch circuit feeding the battery charger.
4. Connect one meter test lead to the left terminal (Nexus) or the right terminal (Evolution) of the fuse holder where the fuse was removed from in step 2. Connect the other meter test lead to a clean frame ground. Measure and record the DC voltage.

Results

1. If the DMM indicated battery voltage in step 4, refer to the flow chart.
2. If the DMM did not indicate battery voltage in step 4, refer to the flowchart.

Test 38 – Check Voltage at 25 Amp Fuse (if so equipped)

Procedure

1. Locate the 25 amp fuse and remove it from the socket.
2. Set a DMM to measure DC voltage.
3. Connect one meter test lead to the terminal furthest away from the DC alternator and the other meter test lead to a clean frame ground. Measure and record the DC voltage indicated by the DMM.

Results

1. If the DMM indicated battery voltage, repair or replace the wiring or connections between the controller and the 25 amp fuse socket.
2. If the DMM did not indicate battery voltage, repair or replace wiring between the 25 amp fuse socket and the battery.

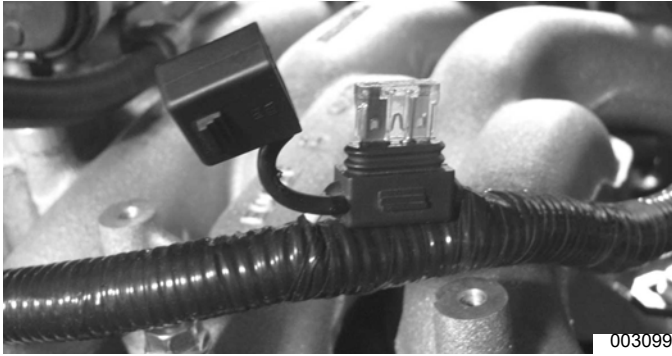


Figure 3-43. 25 Amp Fuse

Test 39 – Test AUTO-OFF-MANUAL Switch

Evolution Procedure

1. Enter Level 1 or 2 password.
2. Navigate to SUB MENUS and press ENTER. Navigate to DEALER and press ENTER. Navigate to TEST and press ENTER. The first screen shown will be “INPUTS”.
3. With the inputs screen displayed, press the AUTO button. If the controller reads the auto input from the switch, input 9 will change from “0” to “1” momentarily. (If utility is not available, unit will crank.)
4. With the inputs screen displayed, press the MANUAL button. If the controller reads the manual input from the switch, input 10 will change from “0” to “1” momentarily. (Unit will crank and run.)
5. With the inputs screen displayed, press the OFF button. If the controller reads the OFF input from the switch, input 8 will change from “0” to “1” momentarily.

Nexus Procedure

1. Remove T1 fuse or disconnect T1 (if applicable) to isolate battery.
2. See **Figure 3-44**, Screen 1. Press the ESC button on the controller until the home page is reached.
3. **Figure 3-44**, Screen 2. Press the right arrow button until DEBUG flashes. Press ENTER and the “TEST” screen will appear.
4. Press the right arrow key until INPUTS flashes, press ENTER.

5. With the “INPUTS” screen displayed, place the AUTO-OFF-MANUAL switch to AUTO. If the controller reads the auto input from the switch, Input 7 will change from “0” to “1”.

Position	Digital Inputs	Digital Outputs
1	Low oil pressure	Air/fuel relay
2	Not used	Bosch enable
3	Low coolant level	Alarm relay
4	Low fuel pressure	Battery charge relay
5	Wiring error	Fuel relay
6	2-Wire start	Starter relay
7	AUTO position	Cold start relay
8	MANUAL position	Transfer relay

6. With the “INPUTS” screen displayed, place the AUTO-OFF-MANUAL switch to MANUAL. If the controller reads an input from the switch, Input 8 will change from “0” to “1”.
7. With the AUTO-OFF-MANUAL switch placed in OFF, both inputs will read zero.

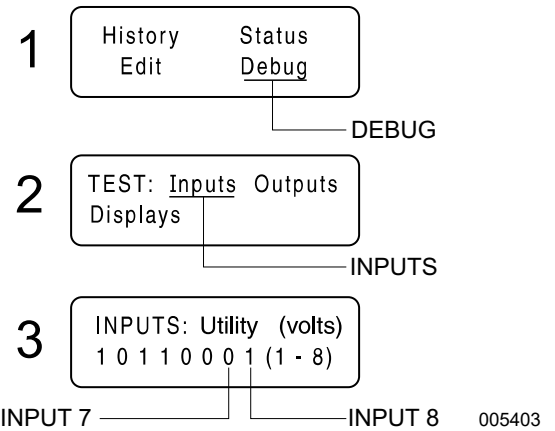


Figure 3-44. The Home Page, Debug, and Input Screens

Results

1. If controller failed either step 4 or step 5, replace the controller assembly.
2. If the controller passed step 4 and step 5, refer to the flow chart.

Test 40 – Check Wire 56

General Theory

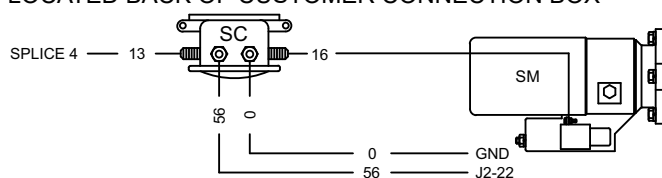
During an automatic start or when starting manually, an internal crank relay energizes. Each time the crank relay energizes, the controller delivers 12 VDC to a start

contactor (SC) and the engine cranks. This test will verify (a) that the crank relay in the controller is energizing, and (b) that the controller is delivering 12 VDC to the SC.

Evolution/Nexus Procedure

1. Navigate to the appropriate OUTPUTS screen.
2. Set the AUTO-OFF-MANUAL switch to MANUAL and observe digital output number 6. If the controller is working correctly, output number 6 will change from 0 to 1. Observe and record the change in state.
 - a. If the display changed from 0 to 1 proceed to step 3.
 - b. If the display did not change, replace controller.
3. Locate the starter contactor (SC) on the back of the control panel.

LOCATED BACK OF CUSTOMER CONNECTION BOX



003100

Figure 3-45. Starter Contactor

4. Disconnect Wire 56 from the SC.
5. Set a DMM to measure DC voltage.
6. Connect one meter test lead to Wire 56 and the other meter test lead to a clean frame ground.
7. Set the AUTO-OFF-MANUAL switch to MANUAL. Measure and record the DC voltage indicated.
 - a. If the DMM indicated battery voltage, discontinue testing and refer to the flow chart.
 - b. If the DMM did not indicate battery voltage, proceed to step 8.
8. Connect one meter test lead to the appropriate pin connector (back probe) and the other meter test lead to a clean frame ground.
9. Set the AUTO-OFF-MANUAL switch to MANUAL. Measure and record the DC voltage indicated.
 - a. If the DMM indicated battery voltage, discontinue testing and proceed to step 10.
 - b. If the DMM did not indicate battery voltage, retest. If the DMM did not indicate battery voltage, replace controller.
10. Disconnect the appropriate connector from the back of the controller.
11. Set the DMM to measure resistance.
12. Connect one meter test lead to the Wire 56 pin location (J1-3 Evolution and J2-22 Nexus) and the other meter test lead to the disconnected Wire 56 at the SC. Measure and record the resistance indicated.

- a. If the DMM indicated CONTINUITY, inspect connections at the controller connector.
- b. If the DMM indicated INFINITY, repair or replace wire between the controller connector and the SC.

Results

If repairs and/or tests are good, refer to the flow chart.

Test 41 – Check Voltages at Starter Contactor

General Theory

The starter contactor relay (SCR) is used to apply battery voltage to the starter solenoid allowing the starter motor to turn the engine over during cranking operations. The controller applies battery voltage to Wire 56 on the starter contactor relay (SC). When Wire 56 has battery voltage applied to the SC, the battery voltage from Wire 13 is permitted through the SCR and to Wire 16 that goes to the starter solenoid.

Procedure

1. Connect one meter test lead to Wire 13 at the starter contactor and the other meter test lead to a clean frame ground. Battery voltage should always be present.
 - a. If battery voltage is present, proceed to step 2.
 - b. If little or no battery voltage is present, verify that Wire 13 is not pinched, cut, or is in any other way prevented from having proper battery voltage.
2. Connect one meter test lead to Wire 16 at the starter contactor and the other meter test lead to a clean frame ground.
3. Set the AUTO-OFF-MANUAL switch to MANUAL. Measure and record the voltage indicated by the meter.

Results

1. If battery voltage is present at Wires 13 and 16, refer to the flow chart.
2. If little or no battery voltage is present on Wire 16 and Wires 56 and 13 have battery voltage present, replace the starter contactor relay (SCR).

Test 42 – Check Battery Voltage at Starter Motor (SM)

Procedure

1. Set the DMM to measure DC voltage.
2. Place the negative (-) test lead to a clean frame ground and the positive (+) test lead to Wire 16 on the starter solenoid.
3. Set the AUTO-OFF-MANUAL switch to MANUAL.

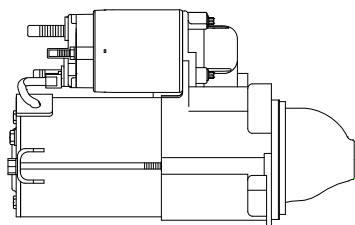
Results

1. If battery voltage is present when setting the AUTO-OFF-MANUAL switch to MANUAL, and the engine still didn't turn over, replace the starter motor.
2. If battery voltage is present when setting the AUTO-OFF-MANUAL switch to MANUAL, and the starter motor tried to engage (pinion engaged), but engine did NOT crank, check for mechanical binding of the engine or rotor.
3. If there is little or no battery voltage present, verify Wire 16 is not pinched or cut and inspect for any other conditions that would not allow battery voltage to Wire 56.

Test 43 – Testing Starter Motor

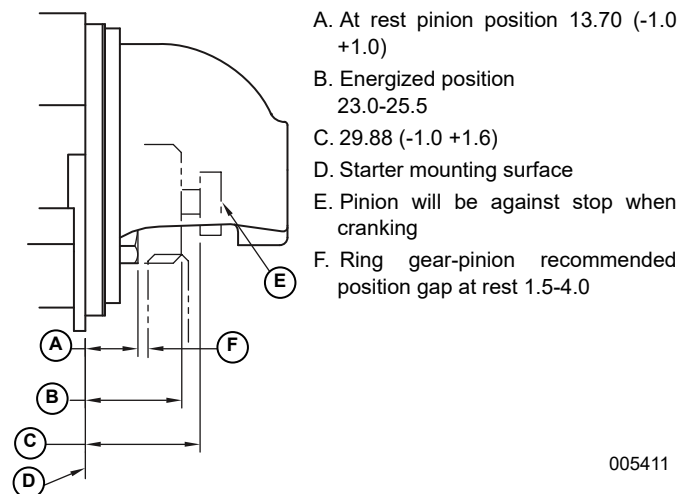
Checking The Pinion

See [Figure 3-47](#). When the starter motor is activated, the pinion gear will move and engage the flywheel ring gear. If the pinion does not move normally, inspect the pinion for binding or sticking.



005410

Figure 3-46. Starter Motor



005411

Figure 3-47. Check Pinion Gear Operation

Test 45 – Check Battery and Cables

General Theory

Battery power is used to crank the engine and to power the circuit board. Low or no battery voltage can result in failure of the engine to crank, either manually or during automatic operation. The battery charger in the control

panel is not designed to recharge a dead battery. If there is a loose connection or corrosion associated with a wire (positive or negative), battery voltage may be present, but because of the high resistance, will not allow current to flow. Electrical voltage drop varies according to current flow. Unless the circuit is operated so current flows through it, voltage drop cannot be measured. To properly measure voltage drop, a crank attempt will need to be performed. This test will determine whether the battery, battery cables, or both are at fault.

Procedure

A. Perform Starter Circuit Voltage Drop Test:

1. De-energize the T1 circuit by whatever means necessary.
2. Set a DMM to measure DC voltage.
3. Connect the red meter test lead to the positive battery post and connect the black meter test lead to the negative battery post.
 - a. If battery voltage is 12.1 VDC or below, proceed to step C or step D.
 - b. If battery voltage is 12.2 VDC or above, proceed to next step. (For this test, battery voltage should be at least 12.2 VDC)
4. Turn off the fuel source and remove Wire 14 from the fuel solenoid to inhibit any possible startup.
5. See [Figure 3-48](#) battery post and starter connections and perform a voltage drop test as indicated.
6. Set the controller to MANUAL; measure and record the voltage.
7. Record readings from test points A, B, and C as depicted in [Figure 3-48](#). Although resistance-free connections, wires, and cables would be ideal, most of them will contain at least some voltage drop. The maximum voltage readings you should see are as follows:
 - a. 0.00–0.10 VDC across a connection
 - b. 0.10–0.20 VDC on a ground connection
 - c. 0.20–0.30 VDC across a wire or cable (A, B)
 - d. 0.20–0.30 VDC across a switch or starter contactor (C).
 - e. 0.40–0.50 VDC across the entire circuit
8. If voltage drop is greater than the above, based on the circuit or component, proceed to step B. If voltage drop is within the above, based on the circuit or component, proceed to step C or D.

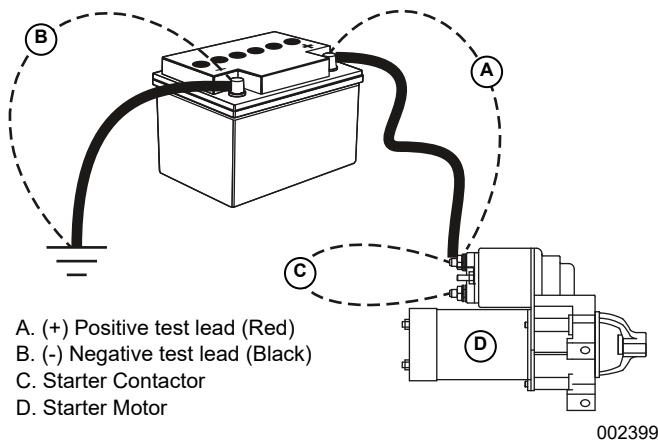


Figure 3-48. Starter Circuit Voltage Drop Test

B. Inspect Battery Cables, Terminals, and Connections:

1. Inspect battery cables and battery posts.
2. If cable clamps or terminals are corroded, clean away all corrosion.
 - a. If corrosion cannot be cleaned or eliminated, replace the component in question.
3. Make sure all cable clamps are tight. The red battery cable from the starter contactor (SC) must be securely attached to the positive (+) battery post; the black cable from the frame ground stud must be tightly attached to the negative (-) battery post.

**C. Perform a Load Test on the Battery:
 (All Lead-Acid Type Batteries)**



WARNING

Explosion. Batteries emit explosive gases. Always disconnect negative battery cable first to avoid spark. Failure to do so could result in death or serious injury.

(000238)

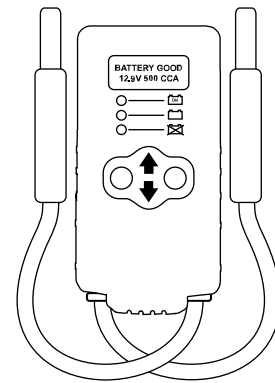
1. Remove 7.5 amp fuse from the controller.
2. Remove the T1 fuse from the transfer switch.
3. Disconnect both negative and positive cables.

NOTE: Disconnect negative cable first.

NOTE: Use of a quality conductance battery tester is highly recommended. A conductance battery tester places less stress on a battery during testing, and takes less time than other methods

4. Using a suitable load tester, test the load capability of the battery.
5. Follow the load tester manufacturer's instructions carefully.
6. Reconnect both positive and negative cables.

NOTE: Reconnect positive cable first.



003391

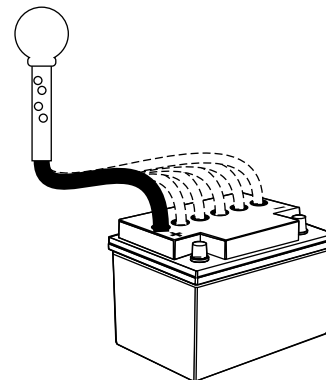
Figure 3-49. Typical Battery Load Tester

**D. Test Battery State of Charge:
 (Non-Maintenance Free Battery Only)**

1. Use an automotive type battery hydrometer to test battery state of charge.

NOTE: Use a temperature compensated hydrometer. Check each cell after charging.

2. Follow the hydrometer manufacturer's instructions carefully. Read the specific gravity of the electrolyte fluid in all battery cells.
3. If cells are low, distilled water can be added to refill cell compartment.



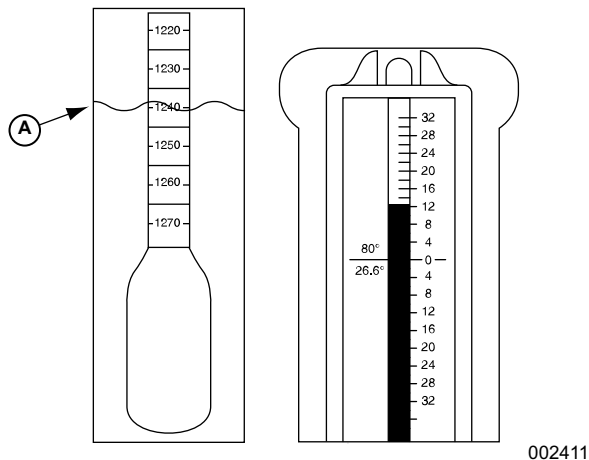
002410

Figure 3-50. Using a Battery Hydrometer

4. If the hydrometer does not have a percentage of charge scale, compare the reading obtained to the following:
 - a. An average reading of 1.260 indicates the battery is 100% charged.
 - b. An average reading of 1.230 means the battery is 75% charged.
 - c. An average reading of 1.200 means the battery is 50% charged.
 - d. An average reading of 1.170 indicates the battery is 25% charged.
5. Test Battery Condition:
 - a. If the difference between the highest and lowest reading cells is greater than 0.050 (50

points), battery condition has deteriorated and the battery should be replaced.

- b. However, if the highest reading cell has a specific gravity of less than 1.230, the test for condition is questionable. Recharge the battery to a 100% state of charge, and then repeat the test for condition.



A. Liquid Level

Cell #	Specific Gravity
1	1.255
2	1.260
3	1.235
4	1.250
5	1.240
6	1.225

HIGH READING
 ↑
 35 POINTS DIFFERENCE
 ↓
 LOW READING

Figure 3-51. Reading a Battery Hydrometer

Results from Step C or Step D

1. If the DMM indicated less than 10.5 VDC in step C, remove the battery and recharge with an automotive battery charger.
2. If battery fails tests in step C or D, replace with a new battery.
3. If battery condition is good, refer to the flow chart.

Test 47 – Check Position of AUTO-OFF-MANUAL Mode

General Theory

If the standby system is to operate automatically, the generator AUTO-OFF-MANUAL mode must be set to AUTO. The generator will not crank and start on occurrence of a utility power outage unless in AUTO mode. In addition, the generator will not exercise as programmed unless in AUTO mode.

Procedure

Test automatic operation with the AUTO-OFF-MANUAL switch set to AUTO and by turning off the utility power supply to the transfer switch. When the utility power is turned off, the standby generator will crank and start. Transfer to the standby source will occur after startup. Turn ON the utility power supply to the transfer switch after the generator starts up and transfers to the standby source. Transfer to the utility source will occur. Generator shutdown will occur after an engine cool down timer has timed out.

Results

1. If normal automatic operation is obtained, discontinue tests.
2. If the engine does not crank when utility power is turned off, proceed to **Problem 15 – Unit Will Not Crank When AUTO-OFF-MANUAL Mode is Set to MANUAL**.
3. If engine cranks but won't start, proceed to **Problem 18 – Unit Cranks But Will Not Start (Overcrank Alarm)**.
4. If the engine cranks and starts, but transfer to standby does NOT occur, refer to the appropriate transfer switch diagnostic manual.
5. If transfer to standby occurs, but transfer to utility does NOT occur when utility source voltage is restored, proceed to **Test 49 – Check Utility Sensing**.

Test 48 – Check Maintenance Disconnect Switch

General Theory

In a GTS type transfer switch, a maintenance disconnect switch is installed in the switch to disable its automatic features to prevent a generator from starting and a transfer occurring while a technician is working on a piece of equipment.

Procedure

1. Locate the maintenance disconnect switch inside the transfer switch.
2. Verify that it is in the AUTO position.

Results

1. If the switch was in the AUTO position, refer to the flow chart.
2. If the switch was OFF, place in AUTO position and try a simulated power outage.

Test 49 – Check Utility Sensing

Evolution/Nexus Procedure

1. Navigate to the digital input display screen.

2. Observe the voltage indicated on the display.
 - a. If the display indicates the approximate utility voltage, replace controller.
 - b. If the display does not indicate the approximate utility voltage, proceed to step 3.
3. Set the DMM to measure AC voltage.
4. Locate the TB2 terminal strip in the customer connection box.
5. Connect one meter test lead to terminal 1 and the other meter test lead terminal 2. Measure and record the voltage indicated.

Results

1. If the voltage observed in step 2 was good, replace controller.
2. If the voltage observed in step 2 was not good, and utility voltage was measured in step 5, repair or replace the wiring between the TB2 terminal block and the J1 connector.
3. If the DMM did not indicate proper voltage in step 5, check fuses in transfer switch.

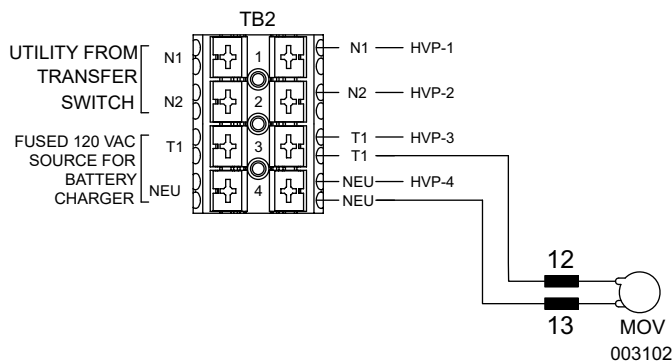


Figure 3-52. AC Customer Connections

Test 51 – Verify 2-Wire Start Enabled

Procedure

1. Using the procedure provided in [Security Access](#), (Section 1.5) verify that switch type has been set to GTS (for Nexus) or that “Two Wire Start Selection” is set to “YES”.

Results

Refer to flow chart.

Test 52 – Attempt a 2-Wire Start

General Theory

The generator will utilize Wire 183 and 178 to look for a 2-wire start signal from the transfer switch. The controller will put 5 VDC on Wire 183 and wait to see the same 5 VDC on 178, when the wires are connected either

through a relay or a circuit board. The generator will start up and stay running as long as those wires are kept closed.

Procedure

1. Set AUTO-OFF-MANUAL switch to AUTO.
2. Place a jumper wire across terminal to TB3 terminal 3 (Wire 183) and TB3 terminal 4 (Wire 178) of terminal block 3 (Located in the customer connection area).

IMPORTANT NOTE: When performing step 2, the generator will crank and start after a 10 second delay.

Results

1. Refer back to flow chart.

Test 53—Verify 2-Wire Start Input

Required Tools

- Jumper Wire

Evolution Procedure

1. Navigate to the digital input display screen.
 - a. Enter level 1 or 2 password.
 - b. Navigate to SUB MENUS and press ENTER.
2. Navigate to DEALER and press ENTER.
3. Navigate to TEST and press ENTER.
 - a. The first screen is INPUTS.
 - b. The 2-wire start input is digital input 7.

Nexus Procedure

NOTE: Controller does not need to be in GTS mode for this testing procedure.

1. Navigate to the digital input display screen.
 - a. Press ESC until the main menu is reached.
 - b. Press the right arrow button until DEBUG is flashing.
 - c. Press ENTER.
 - d. Press the right arrow button until INPUTS is flashing.
 - e. Press ENTER.
2. Locate the TB3 terminal block in the customer connection box.
3. Install jumper wire between wires 183 and 178.
4. Verify that input 6 for Nexus or digital input 7 for Evolution changed from 0 to 1.

IMPORTANT NOTE: Engine may crank and run if test is successful.

Results

Refer to the flow chart.

Test 54—Check Voltage on Wire 183

Procedure

1. Locate the TB2 terminal block in the customer connection box.
2. Disconnect the customer supplied 2-wire start wire.
3. Set a DMM to measure DC voltage.
4. Connect one meter test lead wire 183 and connect the other meter to wire 178. Measure and record the voltage.

Results

1. If the DMM indicated 5 VDC, replace controller.
2. If the DMM indicated 0 VDC, refer to the flow chart.

Test 55—Check Wire 178

Procedure

1. Disconnect the appropriate connector from the back of the control panel.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to wire 178 and the other meter test lead to TB2 wire 178. Measure and record the resistance indicated.

Results

1. If the DMM indicated CONTINUITY, replace controller.
2. If the DMM indicated INFINITY or a high resistance, repair or replace Wire 178 between TB2 and the appropriate connector.

Test 56—Check Wire 183

Procedure

1. Locate and disconnect the appropriate connector from the back of the controller.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to Wire 183 (J1-14 for Nexus or J1-5 for Evolution) and the other meter test lead to TB2 Wire 183. Measure and record the resistance.

Results

1. If the DMM indicated CONTINUITY, refer to the flow chart.
2. If the DMM indicated INFINITY or high resistance, repair or replace Wire 183 between TB2 and the appropriate connector.

Test 58—Check Fuel System

General Theory

The engine-generator set was factory tested and adjusted using the primary fuel source (natural gas or LP) as the fuel supply.

- An adequate gas supply and sufficient fuel pressure must be available or the engine will not start or run properly.
- Minimum gaseous fuel pressure at the generator fuel inlet connection is 5 in water column.
- Maximum gaseous fuel pressure at the generator fuel inlet connection is 14 in water column.
- The gaseous fuel system must be properly tested for leaks following installation and periodically thereafter. No leakage is permitted. Leakage testing methods must strictly comply with gas codes. Maximum allowed deviation of fuel pressure at no-load or full load is 1 in of water column.



▲ DANGER

Explosion and fire. Fuel and vapors are extremely flammable and explosive. No leakage of fuel is permitted. Keep fire and spark away. Failure to do so will result in death or serious injury.

(000192)

Procedure

A water manometer or a gauge that is calibrated in inches of water column may be used to measure the fuel pressure. Fuel pressure at the inlet side (top port—where the low fuel pressure switch is located) on the fuel regulator should be between 5–14 in water column when measured with a manometer. Refer to appropriate unit specification sheet for proper fuel pressures.

The fuel pressure can be checked using the recommended fuel pressure tester kit or any fuel pressure tester that measures inches of water column.

1. Turn off fuel to primary regulator by whatever means are provided.
2. **See Figure 3-53.** Connect a manometer to test port B.
3. Turn fuel supply on.
4. Measure and record the NOT RUNNING (static) pressure.
5. Set AUTO-OFF-MANUAL switch to MANUAL.

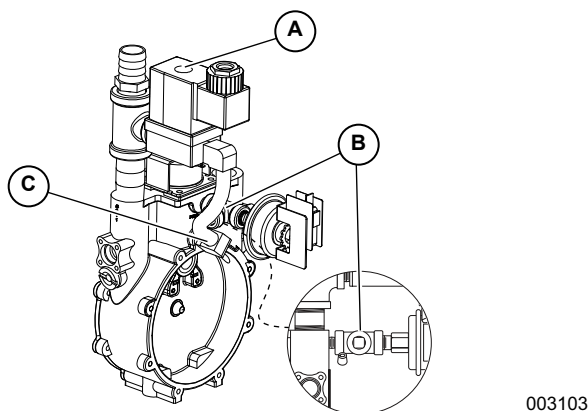


Figure 3-53. Fuel Regulator Test Points

IMPORTANT NOTE: The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.

6. Measure and record the RUNNING pressure.

NOTE: The difference in pressure between Not Running and Running should not be greater than 1 in of water column and must remain within specifications.

NOTE: Where a primary regulator is used to establish fuel inlet pressure, adjustment of that regulator is usually the responsibility of the fuel supplier or the fuel supply system installer.

Results

1. If fuel supply and pressure are adequate, but engine will not start, refer to flow chart.
2. If generator starts, but runs rough or lacks power, repeat the above procedure with the generator running and UNDER LOAD. The fuel system must be able to maintain the proper fuel pressure at all load requirements. If proper fuel supply and pressure is maintained, refer to flow chart.

Test 59—Check Wire 14 Output

General Theory

An internal run relay energizes during starting and when running. Each time the run relay energizes, the controller should deliver 12 VDC to the run circuit (Nexus) or a run circuit and external run relay (Evolution). Any device that is connected to the circuit should run. This test will verify that the run circuit relay in the controller is energizing, and that the controller is delivering 12 VDC to the needed components.

Three different circuits are used for the wire 14 run circuit. The Nexus wire 14 circuit comes from the board and is delivered to the FS, IP, and flash circuit. The Evolution uses a run relay. The run relay may power the FS, IP, and Flash circuit or just the Flash circuit. Refer to the unit specific wiring diagram for more information.

Evolution Procedure

1. Locate the injection pump (IP, Diesel) or fuel solenoid (FS, Gaseous) and disconnect wire 13A (Diesel), or 14A (Gaseous).
2. Set a DMM to measure DC voltage.
3. Connect one meter test lead to Wire 13A or 14A disconnected in step 1, and the other meter test lead to a clean frame ground.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.
5. Measure and record the voltage indicated.
 - a. If the DMM indicates battery voltage, discontinue testing and refer to the flow chart.
 - b. If the DMM did not indicate battery voltage, proceed to step 6.
6. Locate and remove fuse F1. Use a DMM to check the fuse for continuity.
 - a. If the fuse is open, replace the fuse and retest for voltage at the disconnected Wire 13A or 14A at the FS or IP.
 - b. If voltage is not measured, proceed to step 7.
7. With the fuse removed, place one test lead to wire 13A feeding fuse F1.
8. Set the AUTO-OFF-MANUAL switch to MANUAL.
9. Measure and record the voltage.
 - a. If the DMM indicated battery voltage, repair or replace Wire 13A between the fuse and the IP or FS.
 - b. If the DMM did not indicate battery voltage, proceed to step 10.
10. Locate the relay (RLV). Identify Wire 13A on the relay's output, removed Wire 13A.
11. Place the test lead of the DMM on Wire 13A and the other on a clean frame ground.
12. Place the unit in MANUAL and measure voltage. Record results. If voltage is measured, proceed to step 13. If voltage is not measured, go to step 14, TEST RLV.
13. With the meter set to measure resistance, measure between the removed Wire 13A and the Wire 13A at the fuse. Repair or replace Wire 13A between the relay and the fuse at the IP.
14. On the relay, identify Wires 14A, 0, 13, and 13A.
 - a. With the DMM set for DC volts, test wire 13 to ground. Record results. If voltage is measured, proceed to "14b". If voltage is not measured, repair or replace Wire 13.
 - b. With your DMM set to read resistance, test wire 0 to ground and record results. If 0 ohm is measured, proceed to "c". If open or megohms are measured, repair or replace wire 0.
 - c. With your DMM set for DC volts, test Wire 14A to ground and record results. If voltage is

measured, replace relay (RLY). If no voltage is measured, proceed to step 15.

15. Go to the back of the Evolution control panel and identify the connector that Wire 14 is connected to. Using appropriate back probe, set the DMM to measure DC voltage, and insert the back probe into the back of Wire 14 connection. Place the other test lead to ground. Place the unit in MANUAL and record the results. If voltage is measured, repair or replace Wire 14 from back of control panel Wire 14A on the relay. If voltage is not measured, then replace the control board.

Nexus Procedure

1. Locate the fuel solenoid (FS) and disconnect wire 14.
2. Set a DMM to measure DC voltage.
3. Connect one meter test lead to wire 14 disconnected in step 1 and the other meter test lead to a clean frame ground.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.
5. Measure and record the voltage indicated.
 - a. If the DMM indicates battery voltage, discontinue testing and refer to the flow chart.
 - b. If the DMM did not indicate battery voltage, proceed to step 6.
6. Locate field flash diode (DB1) and disconnect Wire 14.
7. Connect one meter test lead to disconnected Wire 14 and the other meter test lead to a clean frame ground.
8. Set the AUTO-OFF-MANUAL switch to MANUAL.
9. Measure and record the voltage.
 - a. If the DMM indicated battery voltage, repair or replace Wire 14 between the controller J2-8 (Wire 14) and the fuel solenoid.
 - b. If the DMM did not indicate battery voltage, proceed to step 10.
10. Press ESC until the main menu is reached.
11. Press the down arrow button until DEBUG is flashing.
12. Press ENTER.
13. Press the down arrow button until OUTPUTS is flashing.
14. Press ENTER.
15. Set the AUTO-OFF-MANUAL switch to MANUAL.
16. Observe the state of output 5.

NOTE: The output will take 1–2 seconds after cranking to change.

- a. If the output changed from a 0 (OFF) to 1 (ON), proceed to step 17.
- b. If the output did not change, replace controller.

17. Disconnect the J2 connector (23 pin) from the back of the controller.
18. Set DMM to measure resistance.

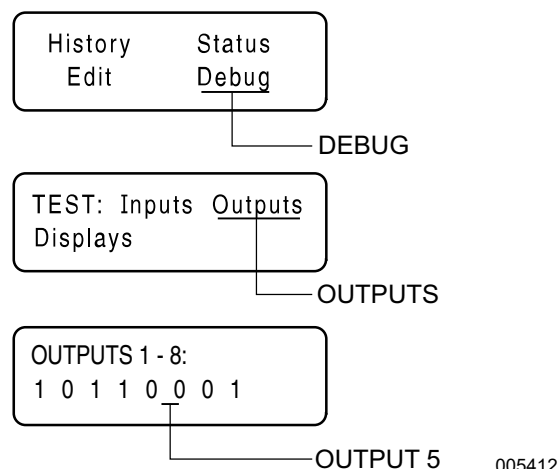


Figure 3-54. The Home Page, Debug, and Output Screens

19. Connect one meter test lead to J2-8 (Wire 14) and the other meter test lead disconnected Wire 14 at the fuel solenoid. Measure and record the resistance indicated.
20. Connect one meter test lead to J2-8 (Wire 14) and the other meter test lead to disconnected Wire 14 at DB1. Measure and record the resistance indicated.
 - a. If the DMM indicated CONTINUITY in step 19 and 20, replace controller.
 - b. If the DMM indicated INFINITY or a high resistance in either step 19 or 20, repair or replace wire as needed.

NOTE: If CONTINUITY was not measured between J2 and the fuel solenoid, an additional place to check is the fuel regulator adapter harness for any breaks or opens.

Results

Refer to the flow chart.

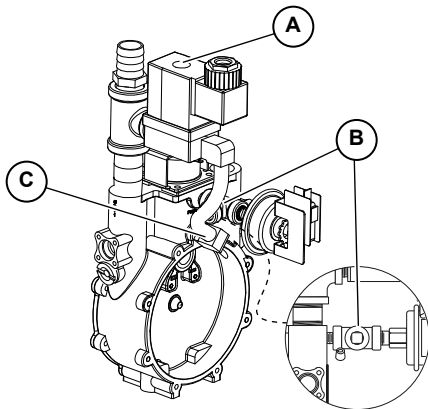
Test 61—Check Fuel Regulator (If Equipped)

General Theory

If Wire 14 had voltage, but fuel is still not getting to the Bosch governor, the fuel solenoid may not be opening properly or not at all. There are two fuel solenoids on the unit which provide fuel during two conditions: cranking and running. The (FS) fuel solenoid is used during normal cranking and running operations. The (FS2) fuel solenoid is only used during cranking operations and is controlled by (+) voltage on Wire 56B. This is the cold start fuel solenoid.

Procedure

1. Disconnect the hose from test port C shown in [Figure 3-55](#).
2. Connect a manometer to port C.



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Figure 3-55. Fuel Regulator Test Points

3. Set AUTO-OFF-MANUAL switch to MANUAL. A nominal fuel pressure reading of between 5–14 inches of water column should be measured.
 - a. If there proper fuel pressure was indicated in step 3, proceed to step 4.
 - b. If there was no fuel pressure indicated in step 3, remove both wires from the FS coil.
 - c. Set the DMM to measure resistance and record the resistance value. The DMM should indicate approximately 15 ohms.
 - d. If the DMM did not indicate the proper resistance value, replace the FS fuel solenoid.
 - e. If the DMM indicates the proper resistance value, disassemble and clean and inspect plunger and spring for proper installation.
 - f. Check fuel pressure per steps 1–3.

IMPORTANT NOTE: *The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.*

4. Remove the wire harness from the cold start solenoid (FS2 coil). Set the DMM to measure resistance. Measure the resistance of the FS2 solenoid coil. Record the resistance value. The DMM should indicate approximately 6 ohms. If the DMM did not indicate proper resistance, replace the FS2 fuel solenoid. If the DMM did indicate proper resistance value, proceed to step 5.
5. With the wire harness removed from the FS2 solenoid coil, set the DMM to measure DC voltage.
6. **Nexus:** Connect one meter test lead to the disconnected Wire 56B and connect the other meter test lead to the positive post of the battery.
Evolution: Connect one meter test lead to the disconnected Wire 56 and the other test meter lead to the NEGATIVE post of the battery.

7. Set AUTO-OFF-MANUAL switch to MANUAL. For both Nexus and Evolution, battery voltage should be measured. If battery voltage is measured, proceed to step 8. If battery voltage is not measured, verify connections at the FSP/FSR connection point, then for
 - a. Nexus, repair or replace Wire 56B between the cold start solenoid and J2-3 (Wire 56B).
 - b. Evolution, repair or replace Wire 56 and Wire 56B between the Cold Start Solenoid and J1-16.

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

8. Hold the blade of a screw driver over test point A (see [Figure 3-55](#)).
9. Set AUTO-OFF-MANUAL switch to MANUAL. The solenoid should magnetize and pull the screw driver securely to the solenoid.

Results

1. If proper pressure was measured in step 3 and DC voltage was measured in step 6 and the screw driver was pulled in step 9, then refer to the flow chart.
2. If fuel pressure was not measured then the fuel solenoid (FS) is not opening. Replace the solenoid.
3. If the screw driver was not pulled in, then the cold start solenoid (FS2) is not opening. Replace the solenoid.

NOTE: Air leaks may be present in the fuel lines causing the engine fuel mixture to run either too lean or too rich. Spraying carb cleaner or brake cleaner around the fuel lines while running will show if an air leak is present, because the engine will suck the liquid in and speed up for a moment.

Test 62—Check for Spark

IMPORTANT NOTE: *When checking for spark on the unit, make sure to have the fuel supply to the unit turned off.*

Procedure

1. Locate the spark plug wires on top of the valve cover and mark them so they can be placed in the proper location.
2. Remove spark plug wires from the valve cover.
3. Working one cylinder at a time, connect a commercially available spark plug tester that is capable of measuring spark on the specific engine and test each cylinder for good spark.

NOTE: Verify the spark plug tester is secure to get the most accurate spark reading.

- Turn the AUTO-OFF-MANUAL switch to MANUAL.

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

- Observe the spark plug tester window while the engine is cranking over.
- Repeat steps 3–5 on the remaining cylinders.

Results

- If spark is bright and strong for each plug, then it is good. Refer to the flow chart.
- If any of the spark plugs have no spark or a weak spark, replace the respective plug and refer to the flow chart.

Test 63—Check the Condition of the Spark Plugs

Procedure

- Locate the spark plug wires on top of the valve cover and mark them so they can be replaced in the proper location.
- Remove spark plug wires from the valve cover.
- Remove the spark plugs one at a time and inspect for the conditions shown in [Figure 3-56](#).
- Check the gap of each plug. Refer to [Table 3-14](#) for the correct plug gap.

Spark Plug Gap	*Secondary I.D. Part Number	Engine Liter
0.76 mm (0.030 in)	SQR480 (BLK)	1.6L
0.71 mm (0.028 in) (Turbo)	4G64S4M (BLK)	2.4L
1.07–1.17 mm (0.042–0.046 in) (Non-Turbo)	4G64S4M (BLK)	2.4L
1.30–1.40 mm (0.052–0.056 in)	6G 724 AB90 (VC)	4.2L
1.30–1.40 mm (0.052–0.056 in)	6G 726 AB (VC)	4.2L
1.30–1.42mm (0.051–0.056 in)	9S 844 BA (VC)	4.6L
1.30–1.42mm (0.051–0.056 in)	0A 844 AA (VC)	4.6L
1.30–1.42mm (0.051–0.056 in)	BS 816 AA (VC)	4.6L
1.14 mm (0.045 in)	6P 680 AA (VC)	6.8L

VC = Located on Valve Cover

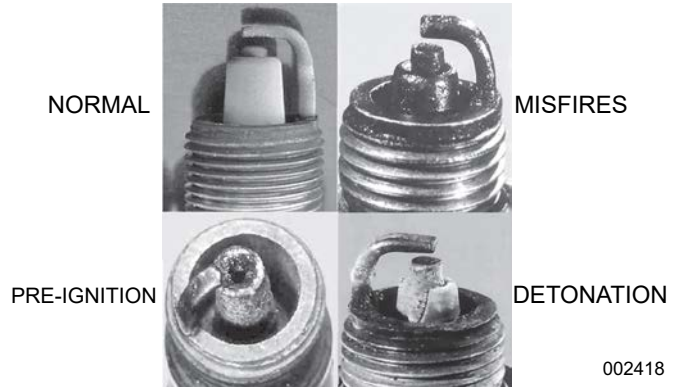
NOTE: Refer to the unit specific owner’s manual for the proper spark plug gap.

Results

- If the spark plugs exhibit any possible signs of any of the symptoms shown in [Figure 3-56](#), replace the spark plugs and investigate the possible cause of the problem.
- Refer to the flowchart.

Assembly

- Install the spark plugs into the cylinder head.
- Torque each spark plug to 18 ft-lbs (24.4 Nm).
- Reconnect the spark plug wires to the spark plugs.



002418

Figure 3-56. Spark Plug Conditions

Test 65—Checking Wiring Harness

General Theory

Starting or running issues are sometimes caused by something as simple as a bad or intermittent electrical connection. Electrical connections can be very difficult to properly diagnose, especially when there is an intermittent connection.

NOTE: Reference [Section 1.10](#) for proper procedures in testing connector plugs and incoming wires.

Procedure

Obtain and refer to the proper electrical print (wiring, schematic, or harness) for the unit being serviced.

Measure the resistance between the starting point and all ends of the individual circuits, and check for shorts to ground as well. Move the connectors and wires while measuring the resistance to look for bad connections. Verify all ground connections. With circuits involving voltage (i.e. Wire 14), measure voltage on the circuit at all points looking for voltage drops. Be sure to use the same ground reference point for all voltage measurements. Again, while taking the readings, move the wires and connectors and note any changes in the readings observed.

Results

Resistance readings should be within 0.2 ohms of the resistance of the meter leads.

Voltage readings should be within $\pm 5\%$ of the source voltage reading. If any readings are outside these tolerances, verify that all connections are clean and tight, and then retest. If the readings continue to remain outside the tolerances, repair or replace the bad connection(s) and/or wire(s).

Test 67—Check Engine Compression and Condition

Discussion

If the engine cranks but will not start, or if it starts hard and runs rough, one possible cause of the problem is a mechanical failure or excessive wear in the engine.

Procedure

1. Warm up the engine, if it will start and run.
2. Shut engine down and remove all spark plugs.
3. Use an automotive type compression tester to check engine compression.
4. Compression pressure should be as follows:

Standard	160 psi (12.1 kg/cm ²) at 350 rpm
Minimum	120 psi (8.4 kg/cm ²) at 350 rpm

Difference between cylinders should not exceed 15 psi (1.1 kg/cm²)

If compression is low in any cylinder, pour a small amount of clean engine oil into the spark plug opening. Then, retest compression and evaluate as follows:

- If compression pressure increases after adding the oil, check for worn or damaged piston rings.
- If compression pressure did NOT increase after adding the oil, check for sticking or improperly seated valves.
- If compression in any two adjacent cylinders is low and adding oil did NOT increase the compression pressure, check for a leaking head gasket (possibly indicated by oil in the coolant).

Test 68—Check Actuator and Mixer Function

General Theory

The Bosch throttle actuator is an electronically controlled throttle-valve. It will control the amount of fuel and air mixture allowed into the engine so the engine can maintain proper speed through the entire load range of the unit. It is comprised of a throttle valve with electric drive, and a feedback circuit for throttle position back to the controller. The governor actuator that is in the Nexus / Evolution control panel will control the throttle.

Terms

- **Throat**—The path where air flows through the governor.
- **Throttle Plate**—The butterfly valve in the throat of the governor.
- **Rest Position**—Position of the throttle plate with no power to unit. (Throttle plate almost perpendicular to the direction of air flow)
- **Open Position**—Throttle plate parallel to the direction of air flow.
- **Upper Mechanical Stop (UMS)**—Internal mechanical stop to prevent over rotation of throttle plate in the opening direction. (Past the open position)
- **Lower Mechanical Stop (LMS)**—Internal mechanical stop to prevent over rotation of throttle plate in the closing direction. (Past the rest position)
- **Feedback circuit**—The circuit between pins 2, 3, and 6 on the governor.

Tools Required

- 0J09460SRV test lead kit or equivalent narrow test leads 2 EA
- Miscellaneous test leads
- Volt-ohm-meter

Table 3-15. Bosch Actuator Pinout

Pin #	Wire #	Function
Pin 1	Wire 771	Negative (-) DC voltage actuator power.
Pin 2	Wire 767	Throttle position feedback return.
Pin 3	Wire 765	Throttle position feedback source.
Pin 4	Wire 770	Positive (+) DC voltage actuator power.
Pin 6	Wire 766	Throttle position feedback signal.

Procedure

1. Shut down the generator.
2. Set the generator to OFF. (Verify the generator is not in AUTO or MANUAL.)
3. Shut off the fuel line(s) to the generator.
4. Remove the air intake assembly or remove governor throttle arm to expose the throat of the governor.
5. Carefully verify the movement of the throttle.
6. Disconnect the harness from the governor.
7. Carefully move the internal throttle plate by hand. Watch for the throttle plate snapping back due to the internal spring. The throttle plate should rotate open and return to the rest position.

8. If the throttle plate does not move smoothly through the total range (from LMS to UMS), replace the governor.
9. Reconnect the harness to the governor.



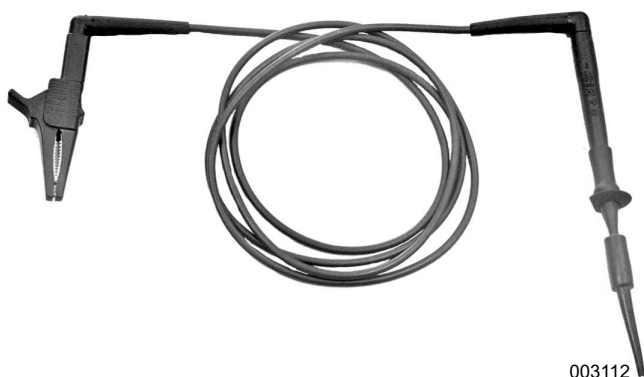
003104

Figure 3-57. Test Lead Adapters



003105

Figure 3-58. Bosch Throttle Plate



003112

Figure 3-59. Bosch Testing Harness for Wires 770 and 771

Procedure B (Part 1)—Verify Governor Actuator Voltage Supply

This test will verify that the actuator has 3 VDC (Nexus/ Evolution) supplied to the actuator feedback circuit from the governor located inside the control panel. Voltage should be present between Wires 765 and 767.

NOTE: Use appropriate back probes so as not to damage the mini amp connector.

1. Using the appropriate wiring schematic / drawing, identify the pin out locations for Wires 765 and 767.
2. Set a multimeter to read DC voltage (If applicable in a 0–5V range).
3. Using appropriate back probe test leads, use the black test lead (-) to back probe the negative / ground Wire 767.
4. Using appropriate back probe test leads, use the red test lead (+) to back probe the positive Wire 765.
5. The measured voltage should be 3 VDC + or – 15%.
6. If the appropriate voltage is present, go to Procedure B (Part 2).
7. If the appropriate voltage is not present, verify the female pins are making tight contact with their corresponding male pins on the control board. If connection is good replace controller.



003113

Figure 3-60. Back Probes in Use

Procedure B (Part 2)—Verify Governor Actuator Voltage Supply

This test will verify that feedback voltage from the governor actuator is being sent from the actuator and that the control panel is receiving this voltage. A varying voltage should be measured between Wires 766 and 767.

NOTE: Use appropriate back probes so as not to damage the mini amp connector.

1. Using the appropriate wiring schematic / drawing, identify the pin out locations for wires 766 and 767.
2. Set a multimeter to read DC voltage (If applicable in a 0–5V range).
3. Using appropriate back probe test leads, use the black test lead (-) to back probe the negative / ground Wire 767.
4. Using appropriate back probe test leads, use the red test lead (+) to back probe the positive Wire 766.
5. Moving the throttle plate from LMS to UMS, verify that there are no spikes or sharp drops in voltage through the entire range of motion.
6. Measure and record values for LMS, rest, and UMS. Verify the results with the table below.

Results

1. If feedback voltage is out of tolerance, replace the governor actuator.
2. If feedback voltage is not present, perform a point to point resistance check of the harness from the connector on the actuator to the corresponding pins connected to the control panel.
3. If there is an open in the circuit, repair or replace the harness as needed.

NOTE: Female connectors can easily get flared out or damaged, preventing contact with the male pins on the actuator or control panel. Thoroughly inspect the connections before condemning any components.

Voltage Value vs. Evolution/Throttle Plate/Arm Position Voltage on Pin 6 Tolerance	
LMS	0.467V ± 10%
Rest	0.482V ± 10%
UMS	3.000V ± 10%
Voltage Value vs. Nexus/Throttle Plate Position on Pin 6 Tolerance	
LMS	0.355V ± 10%
Rest	0.482V ± 10%
UMS	2.965V ± 10%

Procedure C—Test Throttle Motor Operation

1. Identify Wire 770 and 771 in the harness and remove the associated connector plugs from the back of the control panel. This may cause a warning or alarm condition to appear on the control panel display.
2. Using a harness with an in-line 7.5 amp fuse, momentarily apply 12 VDC to wires 770 and 771. Wire 771 is negative (-) and Wire 770 is positive (+).
3. The throttle should move to its full open position.

NOTE: If the actuator goes to the fully closed position when performing this test, reverse the wiring.

Results

1. If the governor actuator does not move, perform a point to point resistance check of the harness from the connector on the actuator to the corresponding pins that are connected to the control panel. This test will be done with the harness isolated.
2. If there is an open in the circuit, repair or replace the harness as needed.
3. If no open is detected, check the resistance of the drive motor.
4. Disconnect the appropriate harnesses containing Wires 770 and 771 from the control board. The

corresponding harness pin locations for Wires 770 and 771 should have a resistance measurement of 2.8 ohms ± 15%.

5. If the harness and drive motor checks are within tolerance, then replace the control panel.

NOTE: Female connectors can easily get flared out or damaged, preventing contact with the male pins on the actuator / control panel. Thoroughly inspect the connections before condemning any components.

Test 73—Test Automatic Sequence

Discussion

Procedure

1. Set AUTO-OFF-MANUAL switch to AUTO.
2. Disconnect utility power by whatever means provided.



Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

3. The controller should indicate a utility dropout timer of 10 seconds and then start. Evolution models have an adjustable timer.
4. After the appropriate timers have expired, the generator should start and transfer.

Results

Refer to the flow chart.

Test 74—Check to See if Low Speed Function is Enabled

Discussion

When it is enabled, the low speed exercise function allows the generator to exercise the following speeds:

- 1800 rpm Nexus units will exercise at 1400 rpm
- 1800 rpm Evolution units will exercise at 1500 rpm
- 3600 rpm units will exercise at 1800 rpm

If the low speed exercise function is disabled, the generator will run at its rated speed during exercise.

Procedure

1. Press the ESC button until the main menu is reached.
2. Press the right arrow button until EDIT is flashing.
3. Press ENTER.
4. Press the right arrow button until EXERCISE TIME appears on the controller.

5. Press ENTER.
6. Press the right arrow button until the low speed exercise option is displayed.
7. Verify that it is enabled.

Results

Refer to the flow chart.

Test 77—Test Low Coolant Level Sensor

Tools Required

- 1 – 1000 Ohm, ¼ Watt Resistor

Procedure

1. Locate and disconnect the low coolant level switch from the radiator.
2. Install the 1000 ohm resistor between wires 573 and 573A on the engine harness side.

Results

1. If the coolant level fault went away, replace sensor.
2. If the coolant level fault remained, refer to the flow chart.

Test 78—Check Wires 573 and 573A

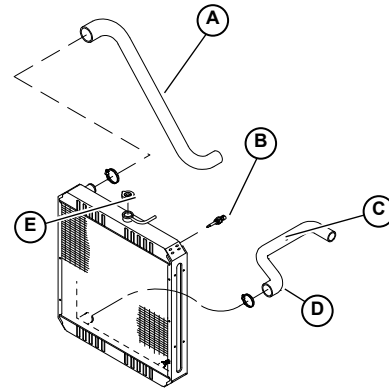
Procedure

1. Set a DMM to measure resistance.
2. Locate and disconnect the appropriate connector from the back of the controller.
3. Locate and disconnect the low coolant level sensor.
4. Connect one meter test lead to Wire 573A in the harness at the controller and the other meter test lead to Wire 573A located at the coolant sensor connector plug (engine harness side). Measure and record the resistance indicated by the DMM.
5. Connect one meter test lead to Wire 573 in the harness at the controller and the other meter test lead to Wire 573 located at the coolant sensor connector plug (engine harness side). Measure and record the resistance indicated by the DMM.
6. Connect one meter lead to connector on Wire 573 and the other lead to the connector on Wire 573A. Check for a short between the wires.

Results

1. If the DMM indicated CONTINUITY in steps 4 and 5, replace controller.
2. If the DMM indicated INFINITY or a high resistance in either step 4 or 5, repair or replace wire as needed.

Test 79—Check Coolant Temperature at Thermal Adapter



003114

- A. Upper Radiator Hose (To Thermostat Housing)
- B. Low Coolant Level Sensor
- C. Check Temperature Test Point
- D. Lower Radiator Hose (To Water Pump)
- E. Radiator Cap

Figure 3-61. Coolant System Identification

Tools Required

- Device capable of measuring heat

Procedure

1. Measure the temperature of the lower coolant hose.
2. Record the reading.

Results

Refer to the flow chart.

Test 80—Check Coolant Level

General Theory

The coolant is used to cool the engine by dissipating heat away from the engine. The coolant is then cooled by passing through the radiator. If the coolant is not filled to the proper level for cooling, the engine may become damaged from excess heat build up over a period of time.

Procedure

1. Remove the black rain cap on top of the generator housing.



WARNING

Risk of burns. Contents under pressure. Do not remove the radiator pressure cap while engine is hot. Doing so could result in death or serious injury. (000322a)

2. Remove the radiator cap from the top of the radiator.
3. Verify the coolant filled to the bottom of the filler neck.

Results

1. If coolant level is low, fill the radiator with coolant prescribed by owners manual. Check for leaks. Check oil for a milky color (this may be a sign of a leak internal to the engine).
2. If coolant level is normal, refer to the flow chart.

NOTE: The age of the coolant may also effect how well it operates with the coolant level sensor. If the coolant becomes dirty, this can cause intermittent faults to occur.

Test 81—Verify Fan/Fan Drive Operation (If Equipped)

Procedure

1. Locate the fan mounted either directly to the engine or on the opposite of the radiator.
2. Set AUTO-OFF-MANUAL switch to MANUAL.
3. Verify fan and proper belt operation.

Results

1. Repair or replace failed components as identified.
2. If operation is good, refer to the flow chart.

Test 82—Check Coolant Hoses

General Theory

If maintenance is not performed regularly, the radiator hoses can become cracked or dry rotted, and may even break down due to weather exposure. The hose clamps can also become loose, causing coolant leaks. Check the radiator hoses when troubleshooting coolant issues.

Procedure

1. Locate and inspect the upper and lower radiator hoses.

Results

1. If no problem is found with either the upper or lower hoses on the generator and the problem continues, replace the thermostat.
2. If the hose displays blockage, remove the blockage from the area that is being affected.

Test 83—Test Oil Pressure Switch

Procedure

1. Locate the low oil pressure sender.
2. Set a DMM to measure DC voltage.
3. Connect one meter test lead to Wire 86 at the low oil pressure sender and the other meter test lead to a clean frame ground. 0 VDC should be measured.
4. Set the AUTO-OFF-MANUAL switch to MANUAL.

⚠ DANGER

Automatic start-up. Disconnect normal power source and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000236)

5. The VOM should read 0 VDC while cranking and should read approximately 5 VDC once the unit is at its rated speed and oil pressure is above 10 psi (69 kPa).

Results

1. The voltage that should be measured should start at 0 VDC, indicating the switch is closed. The voltage should climb to 5 VDC, indicating proper function of the switch.
2. If the voltage at the switch remained at 0 VDC, replace the switch.
3. If the voltage at the switch rose to 5 VDC, replace the controller.

Test 84—Check Oil Level

Procedure

Remove the oil dipstick and observe the oil level.

Results

1. If oil level is low, reference the front of this manual for crankcase capacity and Owner's Manual for proper weight and type. Fill oil to proper level.
2. If oil level is too high, remove the excess oil from the engine.
3. If oil level is correct, refer to the flow chart.

Test 85—Check Engine Oil Pressure

General Theory

If the engine can't maintain a certain oil pressure range, engine damage may result due to improper lubrication. If the engine has too much oil pressure the engine may suffer severe internal and/or external damage during running operations.

Tools Required

- Oil pressure gauge

Procedure

1. Remove the oil pressure switch from the engine block.
2. Insert oil pressure gauge.
3. Turn the AUTO-OFF-MANUAL switch to MANUAL.

IMPORTANT NOTE: The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.

NOTE: With the oil pressure switch removed, the engine will shut down for low oil pressure after 10 seconds.

- Record the results.

Results

- If the unit doesn't have oil pressure after 10 seconds, shut the unit down and reference the engine service manual.
- If the oil pressure is within operating range between 58–90 psi (399-620 kPa), refer to the flow chart.

Test 86—Check Wire 86 for Continuity

General Theory

The control board uses Wire 86 to monitor the low oil pressure switch for a possible problem with the engine internal oil pressure. If wire 86 is shorted or pinched, the unit will shutdown after 10 seconds of running.

Procedure

- Turn the AUTO-OFF-MANUAL switch to OFF.
- Locate the low oil pressure switch and the appropriate connector located on the back of the controller.
- Disconnect Wire 86 from the low oil pressure switch. Disconnect the appropriate connector from the control board in the control panel.
- Set DMM to measure resistance.
- Connect the positive lead to Wire 86 on the harness oil pressure switch end and the negative lead to the appropriate Wire 86 at the controller end. Measure and record the resistance.

Results

- If the DMM indicated CONTINUITY, refer back to flow chart.
- If the DMM indicated open or high resistance, repair or replace Wire 86 between low oil pressure switch and controller connections.

Test 87—Check Wire 86 for a Short to Ground

Procedure

- Disconnect the appropriate connector from the controller.
- Isolate Wire 86 from the low oil pressure switch.
- Set a DMM to measure resistance.
- Connect one meter test lead to disconnected wire 86 and the other meter test lead to a clean frame ground.

Results

- If resistance is measured to ground, repair or replace Wire 86.
- If the DMM indicated INFINITY, refer to the flow chart.

Test 88—Test 120 Volt Input (T1)

General Theory

The controller requires 120 VAC supplied from the load side of the contactor in the transfer switch to function properly. When the circuit is supplied to the controller, it will allow the controller to remain ON, but in a disabled mode where it will not crank or function properly.

Procedure

NOTE: An inspect battery alarm may appear while performing this test procedure. Ignore this alarm, it is a symptom of the test procedure.

- Locate the 7.5 amp fuse on the controller.
- Remove the fuse and observe the LCD screen.

Results

- If the controller remained illuminated or continued to show its status after the fuse was removed, the 120 VAC input is good. Refer to the flow chart.
- If the controller powered down when the fuse was removed, the controller is not getting the 120 VAC input. Refer to the flow chart.

Test 89—Verify DC Voltage Output of the Controller

General Theory

The battery voltage of the unit can be viewed within the status menu of the Nexus controller or on the "Display" menu of the Evolution controller. This test procedure will verify battery voltage connections to the controller.

Procedure (Nexus)

- Disable the 120 VAC battery charge circuit by whatever means available.
- Navigate to the BATTERY VOLTAGE menu in the controller.
 - Press ESC until the main menu screen is present.
 - Press the right arrow button until STATUS is flashing. Press ENTER.
 - Press the right arrow button until DISPLAY is flashing. Press ENTER.
 - Press the right arrow button until BATTERY flashes. Press ENTER.
- Record the displayed voltage.

Procedure (Evolution)

1. Disable the 120 VAC battery charge circuit by whatever means available.
2. Navigate to the BATTERY VOLTAGE menu in the controller.
 - a. Enter dealer password (ESC, UP, UP, DOWN, DOWN, ESC, ESC)
 - b. Navigate to and select “Sub menu”.
 - c. Navigate to and select “Dealer”.
 - d. Navigate to and select “Display”.
 - e. Navigate to “Battery Voltage”.
3. Record the displayed voltage.

Results

1. If the battery voltage indicated on the display is greater than 12 VDC, the connections to the controller from the battery are good. Refer to the flow chart (Good).
2. If the battery voltage indicated on the display is 0 VDC, the connections to the controller are bad. Refer to the flow chart.
3. If the battery voltage indicated on the display is between 10–12 VDC, refer to the flow chart (Bad).

Test 90—Test DC Charge Current to the Battery

General Theory

Previous testing has verified the 120 VAC input connection and the battery connection. This test procedure will determine if there is a negative draw on the battery or a positive one, which will indicate successful operation of the charger.

Procedure

NOTE: An inspect battery alarm may be generated during this test procedure. It will not effect the results of the test and can be acknowledged when testing is complete.

1. Set the AUTO-OFF-MANUAL switch to MANUAL and crank the engine for 2–3 seconds.
2. Disconnect the negative cable battery.
3. Set the DMM to measure DC amperage.

NOTE: Consult the meters owner’s manual to verify proper setup of meter and that the internal fuse is good before proceeding.

4. Connect the positive (red) meter test lead to the negative battery post and connect the negative (black) meter test lead to disconnected negative battery cable. Measure and record the amperage.

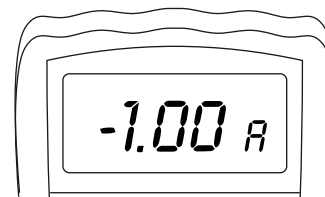
Results

1. If the DMM indicated positive DC amperage between 50 milliamps to 2.5 amps, stop testing. The charger is functioning properly.
2. If the DMM indicated negative DC amperage, replace the controller.



002435

Figure 3-62. Positive DC Amps



002436

Figure 3-63. Negative DC Amps

Test 91—Check Wires 0 and 15

General Theory

If the controller did not register voltage at the controller on the display or it was less than required, a possible cause could be a bad connection at the controller.

Procedure

1. Disconnect the J1 connector from the controller.
2. Set a volt-ohm-meter to measure DC voltage.
3. Connect one meter test lead to J1-6 (Wire 15) for a Nexus unit, J1-1 (Wire 15) for an Evolution and the other meter test lead to a clean frame ground. Measure and record the voltage.
4. Connect one meter test lead to J1-7 (Wire 15) for a Nexus unit, J1-2 (Wire 15) for an Evolution unit and the other meter test lead to a clean frame ground. Measure and record the voltage.
5. Connect one meter test lead to J1-8 (Wire 0) for a Nexus unit and J1-4 for an Evolution and the other meter test lead to the positive post of the battery. Measure and record the voltage.
6. Connect one meter test lead to J1-9 (Wire 0) and the other meter test lead to the positive post of the battery. Measure and record the voltage.

Results

1. If the DMM indicated battery voltage in steps 3–6, replace controller.
2. If the DMM did not indicate battery voltage in any one of Steps 3–6, repair or replace respective wire as needed.

Test 92—Check T1 Voltage at Customer Connections

Procedure

1. Set a DMM to measure AC Voltage.
2. Connect one meter test lead to TB2 terminal 3 (Wire T1) at the customer connections in the generator. Connect the other meter test lead to TB2 terminal 4 (Wire NEU). Measure and record the voltage.

Results

1. If the DMM indicated 120 VAC, proceed to check voltage at the J2 connector. Refer to the flow chart (Good).
2. If the DMM indicated less than 120 VAC or 0, refer to the flow chart (Bad).

Test 93—Check T1 Voltage in Transfer Switch (If Equipped)

General Theory

If 120 VAC was not present in the generator; the most likely cause is a blown T1 fuse or an open wire.

Procedure

1. Set the DMM to measure AC voltage.
2. Connect one meter test lead to the bottom side of the T1 fuse holder and the other meter test lead to the NEUTRAL connection. Measure and record the voltage.

Results

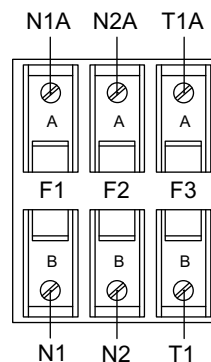
1. If the DMM indicated 120 VAC, repair or replace wire T1 between the generator and the transfer switch (Good).
2. If the DMM indicated less than 120 VAC or 0, refer to the flow chart (Bad).

Test 94—Test T1 Fuse Circuit

Procedure

1. Set a DMM to measure AC voltage.
2. Connect one meter test lead to the top side of the T1 fuse holder and connect the other test lead to the NEUTRAL connection. Measure and record the voltage.
 - a. If the DMM indicated 120 VAC, proceed to step 3.
 - b. If the DMM indicated less than 120 VAC or 0, verify that load voltage is available to the load side of the contactor.
3. On the generator panel, set the AUTO-OFF-MANUAL switch to OFF.

4. Disconnect utility from the transfer switch.
5. Remove fuse F3 from the fuse holder (see [Figure 3-64](#).)



002633

Figure 3-64. Transfer Switch Fuse Block

6. Inspect and test fuses for an OPEN condition with a DMM set to measure resistance. CONTINUITY should be measured across the fuse.

Results

Replace blown fuse as needed and proceed to Problem 10 "Blown T1 Fuse".

Test 95—Check T1 Voltage at Control Panel Connector

Procedure

1. Set a DMM to measure AC voltage.
2. Locate and disconnect the appropriate connector from the back of the controller.
3. Connect one meter test lead to the appropriate wire (Wire T1) and the other meter test lead to the appropriate wire (Wire NEU). Measure and record the voltage.

Results

1. If the DMM indicated approximately 120 VAC, replace controller.
2. If the DMM did not indicate a voltage, repair or replace wire between the customer connection block and the appropriate connector.

Test 96—Test Overcrank Fault Circuit

Procedure

1. Turn off the fuel supply to the generator.
2. Set the AUTO-OFF-MANUAL switch to MANUAL and let generator crank through an entire cycle.

Results

Refer to the flow chart.

Test 97—Check Flywheel Sensor

General Theory

The flywheel sensor (MPU1) is a dual purpose sensor. For engines that utilize internal ignition only, it is a crank sensor for ignition and an rpm sensor for governing. For units that use an external ignition system, it is only an rpm sensor.



Figure 3-65. Flywheel Sensor (MPU1)

NOTE: Reference 1.10 for proper procedures on testing connector plugs and incoming wires.

NOTE: On units equipped with G1.5L, G1.6L and G2.4L as well as D2.3L, D2.4L and D3.4L engines, the flywheel sensor serves as the rpm sensor and the crank sensor for ignition.

Tools Required

- 0G41800SRV Breakout Harness

Procedure

1. Disconnect the flywheel sensor (MPU1) from the engine harness.
2. Set the DMM to measure resistance (Ω).
3. Connect one meter test lead to wire 79 and the other meter test lead to wire 0 on MPU1. Measure and record the resistance.
 - If the flywheel sensor resistance is approximately 700–1000 ohms, proceed to step 4.
 - If the flywheel sensor resistance is not within limits, replace the flywheel sensor and refer to ***Crank and Flywheel Sensor Installation and Adjustments (All Engines)*** in Section 6.1.
4. Set a DMM to measure AC voltage.
5. Connect one meter test lead to Wire 79 and the other meter test lead to wire 0. **Refer to Table 3-16 for the proper voltage values.**
6. Set the AUTO-OFF-MANUAL switch to MANUAL.

Table 3-16. Magnetic Pickup Voltage Settings

Liter	RPM	Voltage
1.5L	3600	7 VAC \pm 0.3 VAC
1.6L	3600	7 VAC \pm 0.3 VAC
2.4L	1800	3 VAC \pm 0.3 VAC
2.4L	3600	7 VAC \pm 0.3 VAC
4.2L	1800	6 VAC \pm 0.3 VAC
4.6L	All	5 VAC \pm 0.3 VAC
6.8L	All	5 VAC \pm 0.3 VAC
Diesel		
2.3L	All	5 VAC \pm 0.3 VAC
2.4L	All	5 VAC \pm 0.3 VAC
3.4L	All	5 VAC \pm 0.3 VAC

NOTE: If acceptable flywheel sensor resistance was measured in step 3 and proper voltage was measured in step 5, an issue may still exist whereby the tip of the flywheel sensor is dirty and may need to be cleaned. See Section 4.1 ***Generator Adjustments*** for cleaning and reinstallation of the Flywheel Sensor.

Results

1. If the DMM did not indicate proper resistance in step 3, replace the flywheel sensor.
2. If the DMM indicated proper resistance in step 3, but little or no voltage was measured in step 5, refer to **Section 6.2** for readjusting the flywheel sensor.
3. If proper resistance was measured in step 3 and proper voltage was measured in step 5, refer to the flow chart.

Test 98—Check Wires 79 and 0

Procedure

1. Locate and disconnect the J1 connector (35 Pin) from the back of the controller for Nexus and J3 connector (18 pin) for Evolution.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to J1-10 (Wire 0) and the other meter test lead to J1-23 (Wire 79) for Nexus or J3-10 (Wire 79) and J3-11 (Wire 0) for Evolution. Measure and record the resistance.

Results

1. If DMM indicated a resistance value between 700–1100 ohms, replace controller.
2. If the DMM did not indicate a resistance value between 700–1100 ohms, repair or replace Wire 79 and Wire 0 between the appropriate connector at the controller and the flywheel sensor.

Test 101—Check for Short Circuits

General Theory

If any fuse has opened, the most likely cause is a short to ground in the circuit that the fuse is protecting. Troubleshooting an open requires an understanding of the resistance differences between INFINITY and CONTINUITY. **Figure 3-66** shows the DMM in two different states.

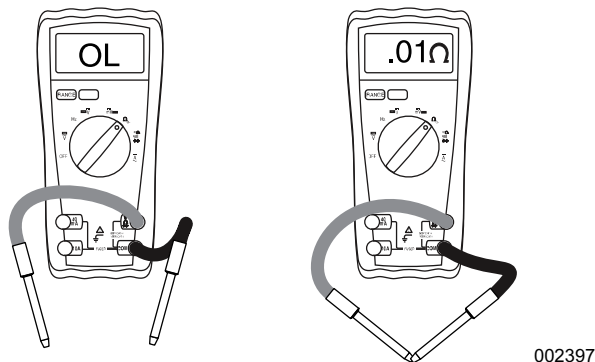


Figure 3-66. Infinity vs. Continuity

The left DMM indicates an OPEN circuit or INFINITY. The right DMM indicates CONTINUITY. Since the resistance is very low it can be considered that 0.03 ohms equals a direct short, or a short to ground. A short to ground will usually cause a fuse to open.

In order to troubleshoot a circuit that has a short to ground the various legs and components of the circuit will need to be isolated. For example, if a circuit that includes a fuel solenoid has an open fuse in it, the cause could be the fuel solenoid itself or the positive power source wire. Begin troubleshooting by checking the resistance across the coil and the resistance from the coil to a clean frame ground. The resistance on the coil can be found in **Table 3-17**.

NOTE: When measuring resistance the component must be completely isolated.

Component	Resistance
Starter contactor	4.6 Ω
Main fuel solenoid	15 Ω
Cold start fuel solenoid	6.7 Ω
Oxygen sensor heater	5.4 Ω
Air/fuel solenoid	27 Ω
Transfer relay	110 Ω

The coil should read INFINITY to ground. If it reads CONTINUITY to ground the problem has been located. If the coil tests good, test the positive power source wire for continuity to ground. Remove one end of the wire and place a meter lead on it, and place the other meter lead

on a clean frame ground. The meter should read open if the wire is isolated, or if the coil resistance if the component is still connected. If very low resistance is present the wire is shorted to ground. Locate the short and repair it or replace the wire.

Test 105—Test Low Fuel Pressure Switch

General Theory

The low fuel pressure switch is a normally OPEN switch that will CLOSE when pressure is above 5 inches of water column. Wires 601 and 0 are connected to the switch. The controller will monitor Wire 601 for a ground, indicating the unit has 5 inches of water column or greater. When the switch is OPEN, 5 VDC will be present on Wire 601 indicating a low fuel pressure condition has occurred. This fault will not shutdown the engine. It will only indicate that there is an issue with fuel.

Procedure

1. Remove Wire 601 and Wire 0 from the switch.
2. Turn off the fuel supply to the generator.
3. Set a DMM to measure resistance (Ω).
4. Connect one meter test lead to one terminal of the switch and the other meter test lead to the other terminal on the switch where Wires 601 and 0 were removed. INFINITY should be measured.
5. Turn on the fuel supply to the generator.
6. Repeat step 4, however this time CONTINUITY should be measured.
7. Set the AUTO-OFF-MANUAL switch to AUTO.
8. Set a DMM to measure DC voltage.

NOTE: Wires 601 and 0 should still be removed.

9. Connect one meter test lead to wire 601 and connect the other meter test to a clean frame ground. 5 VDC should be measured.
10. Set a DMM to measure resistance (Ω).
11. Connect one meter test lead to wire 0 and the other meter test lead to a clean frame ground. CONTINUITY should be measured.
12. If 5 VDC was measured in step 9, proceed to the results. If 5 VDC was not measured, proceed to step 13.
13. Disconnect the appropriate connector from the controller.
14. Set a DMM to measure resistance (Ω).

NOTE: Reference 1.10 for proper procedures on testing connector plugs and incoming wires.

15. Connect one meter test lead to wire 601 that was removed from the switch and connect the other meter test lead to Wire 601. CONTINUITY should be measured.

Results

1. If steps 4, 5, 9, and 11 tested good, check for bad crimps on connectors or possibly a switch that has gone out of calibration in which case the switch would need to be replaced.
2. If either steps 4 or 5 failed, replace the switch.
3. If steps 4 and 5 tested good, but no voltage was measured in step 12, and step 15 was good, replace printed circuit board.
4. If steps 4 and 5 tested good, but no voltage was measured in step 12, and step 15 tested bad, repair or replace wire 601 between the controller and the low fuel pressure switch.

Test 106—Check Voltage on Wire 15B at the Ignition Module

Procedure

1. Locate the ignition module mounted on the left hand side of the connection box.
2. Disconnect the J1 connector from the ignition module.
3. Set a DMM to measure DC voltage.
4. Connect one meter test lead to wire 15B and the other meter test lead to a clean frame ground. Measure and record the voltage indicated.
5. Connect one meter test lead to wire 0 and the other meter test lead to the positive post on the battery. Measure and record the voltage indicated.

Results

1. If the DMM indicated battery voltage in step 4 and 5, refer to the flow chart.
2. If the DMM indicated battery voltage in step 4 and did not in step 5, repair or replace wire 0 between the ignition module and the battery.
3. If the DMM indicated battery voltage in step 5 and did not in step 4, repair or replace wire 15B between the ignition module and the battery.

Test 106A – Test the Can Bus

Procedure

1. Identify Wire 744 (Can Bus low) and Wire 743 (Can Bus High) on the Evolution / Nexus controller connector. With the connector still connected to the control panel and the system active, measure for DC voltage at Wire 744 and Wire 743 to ground. Record the measured voltages.
2. If Wire 744 measures approximately 1.67 VDC to ground and Wire 743 measures approximately 2.57 VDC to ground then verify DC voltage is present at Wire 15B (Battery +). Verify Wire 0 has continuity to ground. If battery voltage and ground are present then replace the ICM.

3. If Wire 744 measures approximately 1.88 VDC to ground and wire 743 measures approximately 3.315 VDC to ground then verify continuity in Wire 744 and Wire 743 from the controller to the ICM (verify male and female pins are making connection).
4. If approximately 0 volts are measured then disconnect the harness from the control panel and measure pins 744 to 743. If 120 ohms is not measured then replace controller.
5. Before replacing the ICM, disconnect all harnesses and measure at the ICM pins 744 to 743. A resistance of approximately 138 Ohms should be present.

Test 107—Test Canbus Wiring

Procedure

NOTE: The references to J2 used in this test are not the J2 connector going into the controller.

1. Locate the ignition module located on the left hand side of the connection box and disconnect the (smaller) J2 connector.
2. Locate and disconnect the J1 connector (35 Pin) on the back of the controller.
3. Set a volt-ohm-meter to measure resistance.
4. Connect one meter test lead to J1-29 (wire 743) and the other meter test lead to J2-1 (wire 743). Measure and record the resistance indicated by the panel.
5. Connect one meter test lead to J1-28 (Wire 744) and the other meter test lead to J2-5 (Wire 744). Measure and record the resistance indicated by the panel.

Results

1. If the DMM indicated CONTINUITY in step 4 and 5, refer to the flow chart.
2. If the DMM indicated CONTINUITY in step 4, but did not in step 5, repair or replace Wire 744 between the controller and the ignition module.
3. If the DMM indicated CONTINUITY in the step 5, but did not in step 4, repair or replace Wire 744 between the controller and the ignition module.

Test 108—Test Ignition Coil

General Theory

Different engines will use different ignition coils. It is required to identify the correct procedure with the engine being worked on. These engine systems use an individual coil for each cylinder. For these types of systems, it is required to identify which coil needs to be tested using the ignition fault code. Refer to Section 5.1 **Table 3-12 “Ignition Fault Codes”** to identify which cylinder has failed.

1.5L and 2.4L (Individual Coil) Procedure

NOTE: Ignition fault codes will identify which cylinder is faulty.

1. Locate the appropriate cylinder that is faulty.
2. Disconnect the coil connector.
3. Set a DMM to measure resistance.
4. Connect the meter test leads across the terminals exposed by disconnecting the coil. Measure and record the resistance.

Results

1. If the DMM indicated approximately 1.6 ohms of resistance, refer to the flow chart.
2. If the DMM indicated INFINITY, high, or low resistance, replace ignition coil and retest.

1.6L (Coil Pack) Procedure

1. Set a DMM to measure resistance.
2. Connect one meter test lead to CP-2 (Wire 25B) and the other meter test lead to CP-3 (Wire 15A). Measure and record the resistance.
3. Connect one meter test lead to CP-1 (Wire 25A) and the other meter test lead to CP-3 (Wire 15A). Measure and record the resistance.

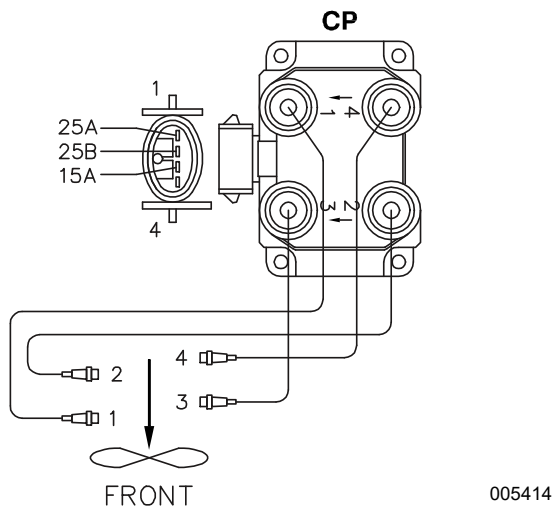


Figure 3-67. 1.6L Coil Pack

Results

1. If the DMM indicated approximately 0.9 ohms of resistance in steps 2 and 3, refer back to the flow chart.
2. If the DMM indicated INFINITY, high or low resistance in either step 2 or 3, replace the coil pack.

4.2L (Individual Coil) Procedure

1. Locate the appropriate cylinder that is faulty.
2. Disconnect the coil connector.

3. Set a DMM to measure resistance.
4. Connect the meter test leads across the terminals exposed by disconnecting the coil. Measure and record the resistance.

Results

1. If the DMM indicated approximately 1 ohm of resistance, refer to the flow chart.
2. If the DMM indicated INFINITY, high, or low resistance, replace ignition coil and retest.

4.6L, 6.8L (Individual Coil) Procedure

1. Locate the appropriate cylinder that is faulty.
2. Disconnect the coil connector.
3. Set a DMM to measure resistance.
4. Connect the meter test leads across the terminals exposed by disconnecting the coil. Measure and record the resistance.

Results

1. If the DMM indicated approximately 0.3–0.8 ohms of resistance, refer to the flow chart.
2. If the DMM indicated INFINITY, high, or low resistance, replace ignition coil and retest.

Test 109—Test Ignition Coil Wiring

General Theory

Different engines will use different ignition coils. It is necessary to identify the correct procedure for the engine being worked on. An individual coil is used for each cylinder. An ignition fault code is required to identify which coil wiring to test. Refer to Section 5.1 [Table 3-12](#) to identify which cylinder has failed. See [Figure 3-68](#) to identify test points for given coil number.

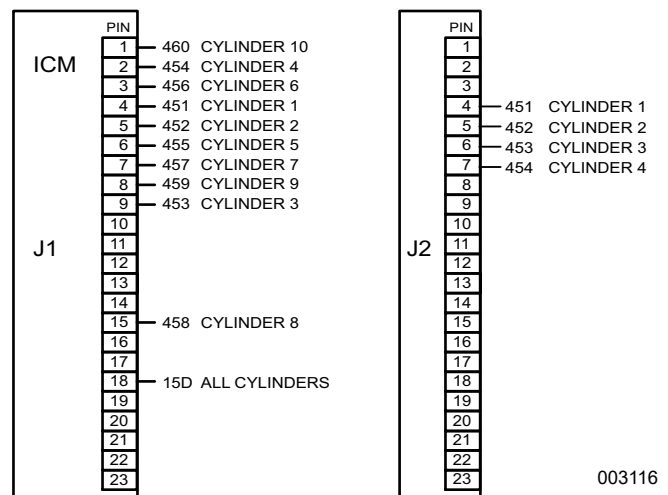


Figure 3-68. Ignition Module Test Points

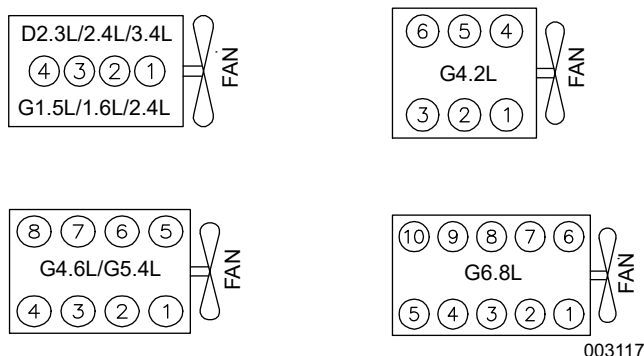


Figure 3-69. Engine Cylinders (Top View)

1.5L and 2.4L (Individual Coil) Procedure

1. Locate the J1 connector on the ignition control module and disconnect.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to J1-18 (wire 15D). Measure and record the resistance.
4. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to a clean frame ground. Measure and record the resistance.

Results

1. If the DMM indicated approximately 1.6 ohms of resistance and the DMM indicated INFINITY to ground, replace ignition module.
2. If the DMM indicated INFINITY in step 3 or high resistance, repair or replace as needed.
3. If the DMM indicated a short to ground in step 3, repair or replace as needed.
4. If the DMM indicated a lower than normal resistance, replace coil.

1.6L (Coil Pack) Procedure

1. Locate and disconnect the J2 connector from the back of the controller.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to J2-4 (Wire 25A) and the other meter test lead to a J2-23 (Wire 15A). Measure and record the resistance.
4. Connect one meter test lead to J2-5 (Wire 25B) and the other meter test lead to a J2-23 (Wire 15A). Measure and record the resistance.
 - a. If the DMM indicated approximately 0.9 ohms of resistance in Steps 3 and 4, replace controller.
 - b. If the DMM indicated INFINITY, high, or low resistance in either Step 3 or 4, proceed to Step 5.
5. Disconnect the connector at the coil pack.

6. Connect one meter test lead to Pin 3 and the other meter test lead to Pin 2. Measure and record the resistance.
7. Connect one meter test lead to Pin 3 and the other meter test lead to Pin 1. Measure and record the resistance.
 - a. If the DMM indicated approximately 0.9 ohms of resistance in Steps 6 and 7, repair or replace respective wire between the controller.
 - b. If the DMM indicated INFINITY, high, or low resistance in either Step 3 or 4, replace coil pack.

Results

1. If the DMM indicated approximately 0.9 ohms of resistance in Steps 3 and 4, replace controller.
2. If the DMM indicated INFINITY, high, or low resistance in either Step 3 or 4, repair or replace wire.

4.2L (Individual Coil) Procedure

1. Locate the J1 connector on the ignition control module and disconnect.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to J1-18 (wire 15D). Measure and record the resistance.
4. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to a clean frame ground. Measure and record the resistance.

Results

1. If the DMM indicated approximately 1.6 ohms of resistance and the DMM indicated INFINITY to ground, replace ignition module.
2. If the DMM indicated INFINITY in step 3 or high resistance, repair or replace as needed.
3. If the DMM indicated a short to ground in step 3, repair or replace as needed.
4. If the DMM indicated a lower than normal resistance, replace coil.

4.6L, 5.4L, and 6.8L (Individual Coil) Procedure

1. Locate the J1 connector on the ignition control module and disconnect.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to J1-18 (Wire 15D). Measure and record the resistance.
4. Connect one meter test lead to the cylinder wire that is identified in [Figure 3-69](#) and the other meter test lead to a clean frame ground. Measure and record the resistance.

Results

1. If the DMM indicated approximately 0.3–0.8 ohms of resistance and the DMM indicated INFINITY to ground, replace ignition module.
2. If the DMM indicated INFINITY in step 3 or high resistance, repair or replace as needed.
3. If the DMM indicated a short to ground in step 3, repair or replace as needed.
4. If the DMM indicated a lower than normal resistance, replace coil.

Test 110—Test Cam Sensor

General Theory

The camshaft position sensor (MPU2) identifies when piston #1 is at top dead center (TDC) of the compression stroke. The generator controller uses this information to synchronize the firing of cylinders. Different engines use different styles of cam sensors. This test procedure is broken into the different sizes of engines.

1.5L Procedure

1. Locate the CAM sensor located in the rear of the valve cover immediately in front of the coils.
2. Remove the CAM sensor from the cylinder head.
3. Set AUTO-OFF-MANUAL mode to MANUAL.
4. Observe the rotation of the camshaft (an inspection mirror may be required).
 - a. If the camshaft failed to rotate, an internal problem exists inside the engine.
 - b. If the camshaft rotated, proceed to Step 5.

5. Locate Wire 15H at the harness connector on the back of the control board (12 VDC supply to the hall effect cam sensor).
6. Set a DMM to measure DC voltage.
7. Connect one meter test lead to Wire 15H and the other meter test lead to a clean frame ground. Measure voltage with unit off and with unit cranking.
 - a. If 12 VDC + or – 15% is measured then proceed to next step.
 - b. If 0 VDC is measured, replace control board.
8. Locate Wire 402 at the harness connector on the back of the control board (return signal from the hall effect cam sensor).
9. Set a DMM to measure DC voltage.
10. Connect one meter test lead to Wire 402 and the other meter test lead to a clean frame ground. Measure voltage with unit off and with unit cranking.
 - a. If 4.8 VDC + or – 15% is measured when not cranking and 0 to 4.8 VDC is measured while cranking, proceed to next step.
 - b. If 0 VDC is measured, perform diode check on hall effect cam sensor.

Diode Check: Remove the connector from the control board. Verify the cam sensor connector is plugged in. Perform a diode test on the wires indicated in [Table 3-18](#).

If the Hall Effect cam sensor / harness fails the diode test, then test individual components to determine if the fault lies in the harness or the sensor.

11. Reconnect all harnesses and check to see if fault still exists. If fault still exists, perform [Test 97—Check Flywheel Sensor](#).

Table 3-18. Diode Check Test Points

Wire Number	Negative Test Lead		To	Wire Number	Positive Test Lead		Results
	Evolution Pin Number	Nexus Pin Number			Evolution Pin Number	Nexus Pin Number	
0A	J3-3	J1-11	To	15H	J2-2	J1-30	1.130 Volts
15H	J2-2	J1-30		0A	J3-3	J1-11	O/L
0A	J3-3	J1-11		402	J1-13	J2-10	O/L
402	J1-13	J2-10		0A	J3-3	J1-11	0.42 Volts
15H	J2-2	J1-30		402	J1-13	J2-10	1.459 Volts
402	J1-13	J2-10		15H	J2-2	J1-30	O/L

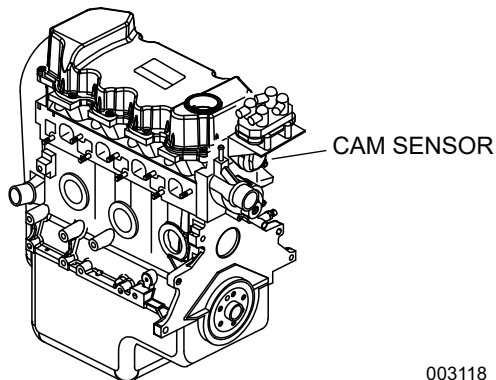
NOTE: All readings are + or – 20%.

NOTE: The cam sensor is a hall effect sensor (solid state) and performing a resistance check will be invalid. Be sure your meter has the diode function setting.

1.6L Procedure

1. Locate the cam sensor located underneath the coil pack on the back of the engine.
2. Remove the cam sensor from the support bracket.
3. Set AUTO-OFF-MANUAL switch to MANUAL.
4. Observe the rotation of the cam shaft.
 - a. If the cam shaft failed to rotate, an internal problem exists inside the engine.
 - b. If the cam shaft rotated, proceed to step 5.
5. Locate and disconnect both the J1 and J2 connector from the controller on either Nexus or Evolution controlled units.

6. Disconnect the connector on the cam sensor.
7. Set a DMM to measure resistance.
8. Connect one meter test lead to Wire 15H at the appropriate pin of the connector previously removed from the control panel and the other meter test lead to the cam sensor connector Wire 15H. Measure and record the resistance
 - a. If the DMM indicated CONTINUITY, proceed to step 9.
 - b. If the DMM indicated INFINITY, repair or replace Wire 15H.



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Figure 3-70. 1.6L Cam Sensor

9. Connect one meter test lead to Wire 402 at the previously disconnected harness connectors at the control panel and the other meter test lead to the cam sensor connector Wire 402. Measure and record the resistance.
 - a. If the DMM indicated CONTINUITY, proceed to step 10.
 - b. If the DMM indicated INFINITY, repair or replace Wire 402.
10. Connect one meter test lead to Wire 0A at the previously disconnected harness connectors at the control panel and the other meter test lead to the cam sensor connector Wire 0A. Measure and record the resistance.
 - a. If the DMM indicated CONTINUITY, replace controller.
 - b. If the DMM indicated INFINITY, repair or replace Wire 0A.

Results

Refer to the flow chart.

2.4L Procedure

1. Locate and disconnect the appropriate connector (35 Pin) from the back of the controller.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to wire 79A and the other meter test lead to wire 0A. Measure and record the resistance.

- a. If the DMM indicated between 700–1100 ohms of resistance proceed to Section 6.2 **Cam Sensor Installation and Adjustments (2.4L Only)** to verify gap.
- b. If the DMM indicated INFINITY or a high resistance proceed to step 4.
4. Locate the cam sensor near the timing belt cover (see **Figure 3-71**).
5. Disconnect the cam sensor from the engine harness.
6. Connect one meter test lead to wire 79A and the other meter test lead to 0A of MPU2.
 - a. If the DMM indicated between 700–1100 ohms of resistance, repair or replace wiring between the J1 connector and the cam sensor.
 - b. If the DMM indicated INFINITY or a high resistance, replace came sensor and see Section 4.1 **Cam Sensor Installation and Adjustments (2.4L Only)**.



003119

Figure 3-71. 2.4L Cam Sensor

4.2L Procedure

1. Locate the ignition module mounted on the left hand side of the connection box and disconnect the J1 connector.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to wire 0 and the other meter test lead to wire 450. Measure and record the resistance indicated.
 - a. If the DMM indicated approximately 560–575 ohms of resistance, replace ignition module.
 - b. If the DMM indicated INFINITY or a high resistance, proceed to step 4.
4. Locate the cam sensor on the front of the engine in the valley, then disconnect the connector.
5. Connect one meter test lead to wire 450 and the other meter test lead to wire 0 on the cam sensor. Measure and record the resistance indicated.
 - a. If the DMM indicated approximately 560–575 ohms of resistance, repair or replace wiring between the ignition module and the cam sensor.
 - b. If the DMM indicated INFINITY, high, or low resistance, replace cam sensor.

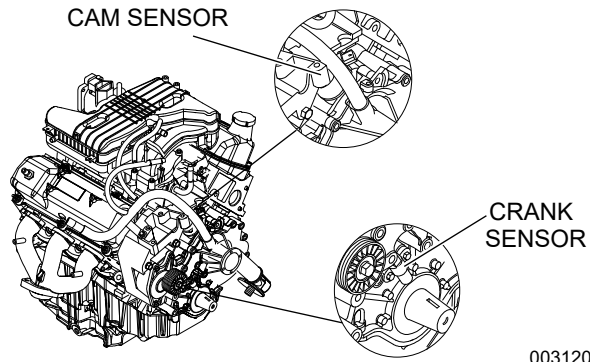


Figure 3-72. 4.2L Cam Sensor

4.6L, 5.4L, and 6.8L Procedure

1. Locate the ignition module mounted on the left hand side of the connection box and disconnect the J1 connector.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to wire 0 and the other meter test lead to wire 450. Measure and record the resistance indicated.
 - a. If the DMM indicated approximately 290–390 ohms of resistance, replace ignition module.
 - b. If the DMM indicated INFINITY or a high resistance, proceed to step 4.
4. Locate the cam sensor on the right bank of cylinders on the front of the engine.
5. Connect one meter test lead to Wire 450 and the other meter test lead to Wire 0 on the cam sensor. Measure and record the resistance indicated.
 - a. If the DMM indicated approximately 290–390 ohms of resistance, repair or replace wiring between the ignition module and the cam sensor.
 - b. If the DMM indicated INFINITY, high, or low resistance, replace cam sensor.

Test 111—Test Crank Sensor (4.2L, 4.6L, 5.4L, and 6.8L Engines)

General Theory

The crank sensor input is used by the ICM to determine engine speed and angular position of the crankshaft. The location of the crankshaft position sensor is shown in *Figure 3-73*.

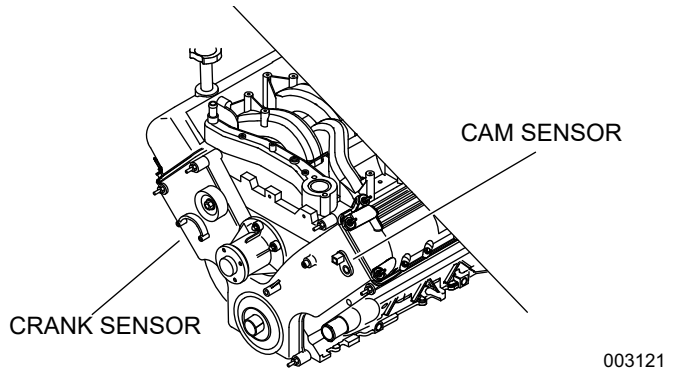


Figure 3-73. G4.6L, G5.4L and G6.8L Cam Sensor/ Crank Sensor

Procedure

1. Locate the ignition module located on the left hand side of the connection box.
2. Disconnect the J1 connector.
3. Set a DMM to measure resistance.
4. Connect one meter test lead to Wire 79A and the other meter test lead to Wire 0A. Measure and record the resistance indicated.
 - a. If the DMM indicated approximately the resistance identified in *Table 3-19*, replace ignition module.
 - b. If the DMM indicated INFINITY or a high resistance, proceed to Test 5.
5. Locate and disconnect the crank sensor on the left side of the engine block.
6. Connect one meter test lead to Wire 79A and the other meter test lead to Wire 0A on the sensor. Measure and record the resistance.

Table 3-19.

NOTE: If intermittent problem exists, a test for voltage while cranking and running can be performed using needle back probes.

Engine	Resistance Measurement		Cam AC Volts		Crank AC Volts	
	Cam Sensor	Crank Sensor	While Cranking	While Running	While Cranking	While Running
5.4L	3.10 K ohms	350 ohms	0.8 to 1.1 VAC	8.2 VAC	0.9 VAC	6.2 VAC
6.8L	340 ohms	350 ohms	0.8 to 1.1 VAC	8.2 VAC	0.9 VAC	6.2 VAC
G2.4L	1000 ohms	1000 ohms	0.3 to 0.03 VAC	1 VAC	0.4 VAC	3 VAC 1800 RPM 7 VAC 3600 RPM
1.5L	Pin 1 - 3, 432 ohms, Pins 2-3 0.694M	1000 ohms	2.2 VAC	2.49 VAC	0.4 VAC	7 VAC

- a. If the DMM indicated the resistance indicated above, repair or replace wiring between the ignition module and the crank sensor.
- b. If the DMM indicated INFINITY or a high resistance, replace crank sensor.

Results

Refer to the flow chart.

Test 112 – Test Oxygen Sensor

Tools Required

- Resistive load of 20kW or greater

Procedure

1. Locate and disconnect the oxygen sensor. Keep it accessible for the duration of this testing procedure.
2. Set a DMM to measure resistance.
3. Connect one meter test lead to terminal C of the sensor and the other meter test lead to terminal D. Measure and record the resistance.
 - a. If the DMM indicated INFINITY, replace sensor.
 - b. If the DMM indicate 15 ohms of resistance, proceed to step 5.



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Figure 3-74. Oxygen Sensor

4. Either connect a resistive load bank or have a similar load ready to transfer when required.
5. Set the DMM to measure DC voltage.
6. Connect one meter test lead to terminal A of the sensor and connect the other meter test lead to terminal B.
7. Set the AUTO-OFF-MANUAL switch to MANUAL.
8. Once engine is running and stabilized, transfer load to the generator.
9. With the generator running under load, measure and record the DC voltage indicated by the DMM.
 - a. If the DMM indicated a varying DC voltage between 0.3–0.9 VDC, proceed to step 11.
 - b. If the DMM did not indicate a varying DC voltage, replace oxygen sensor.

NOTE: Only a short window exists to test the wiring harness of approximately two minutes after the engine shuts off.

10. Set the AUTO-OFF-MANUAL switch to OFF.
11. Locate and disconnect the J1 connector (35 Pin) from the controller.
12. Set a DMM to measure resistance.
13. Connect one meter test lead to Wire 804 (J1-34 Nexus, J3-16 Evolution) and the other meter test lead to Wire 805 (J1-35 Nexus and J3-17 Evolution). Measure and record the resistance.

NOTE: This step is measuring the resistance of the sensor itself. With the engine shutdown this resistance will start low around 20 Ω and rise to an INFINITE value. A climbing resistance indicates the wire integrity is good.

- a. If the DMM indicated a resistance, refer to the flow chart.
- b. If the DMM did not indicate the proper resistance, repair or replace wiring between the controller connector and the oxygen sensor.

NOTE: Wires 804 and 805 of the Evolution controlled unit pass through the COP/COR connections as well.

Results

Refer to the flow chart.

Test 113—Test Air/Fuel Solenoid

Procedure

1. Locate the air/fuel solenoid (AFS) on the fuel regulator.
2. Set the AUTO-OFF-MANUAL switch to MANUAL.
3. Place a hand on the AFS to feel for pulsations.
 - a. If the solenoid is pulsating, replace controller.
 - b. If the solenoid is not pulsating, proceed to step 4.
4. Locate and disconnect the J1 and J2 connectors from the back of the controller.
5. Set a DMM to measure resistance.
6. Connect one meter test lead to Wire 808 (J2-2 Nexus and J2-1 Evolution) and the other meter test lead to Wire 15A (J2-23 Nexus and J1-9 Evolution). Measure and record the resistance.
 - a. If the DMM indicated approximately 27 ohms, refer to the flow chart.
 - b. If the DMM did not indicate the proper resistance, proceed to step 7.
7. Locate the air/fuel solenoid on the fuel regulator and disconnect the connector.

8. Connect meter test leads across the terminals of the air fuel solenoid. Measure and record the resistance.
 - a. If the DMM indicated, approximately 27 ohms, repair or replace wiring between the J1 or J2 connector and the air fuel solenoid.
 - b. If the DMM did not indicate the proper resistance, replace air/fuel solenoid.

NOTE: The circuits of the Evolution controlled unit pass through the COP/COR connections, and may be connected to the controller through splices. Trace the circuit thoroughly before condemning a wire.

Results

Refer to the flow chart.

Test 114—Coolant Sensor Circuit

The controller monitors the coolant sensor circuit for overheating. The coolant sensor is located near the thermostat and has one supply wire and one ground wire. The controller supplies a 3.3 VDC sensing voltage to the coolant sensor and monitors the changes in resistance based on the temperature of the engine. As the engine temperature goes up the resistance of the sensor goes down, pulling the supply voltage of the controller down. When the voltage reaches a predetermined level the High Temperature Alarm (E-Code 1400) is triggered. The engine begins overheating at approximately 246 °F (119 °C) with a resistance value of 102 ohms ($\pm 2.6\%$) and 2.17 VDC at the controller.

Procedure

1. Verify proper operation of the coolant sensor circuit by back probing between Wire 68 and Wire 0 at the controller to monitor voltage. As the engine warms up, use an external temperature measuring device, such as an infrared temperature gun, to monitor the engine temperature near the coolant sensor. Voltage will go down as the engine is warming up. When the engine temperature reaches 246 °F (119 °C) the voltage will be approximately 2.1 VDC.
2. With the controller connector disconnected, measure the resistance of the coolant sensor circuit between Wire 68 and Wire 0 at the controller connector and compare the resistance value [Table 3-20](#) based on the temperature at the sensor.

Results

1. If the voltage value matches the temperature reading and the unit shuts down High Temperature Alarm the coolant sensor circuit is working correctly. Check other areas for causing the overheating issue.

2. With the coolant sensor connected record the voltage at the controller. If the voltage is high 3.3 VDC check the wires, connections to the coolant sensor and the sensor itself and repair or replace as needed.
3. Disconnect the coolant sensor connector. The voltage should go to 3.3 VDC (± 0.2). If the voltage is still low verify that Wire 68 is not shorted to ground or shorted to another wire. If still low extract Wire 68 from the controller connector and measure the voltage out of the controller. If voltage is not 3.3 VDC (± 0.2) replace controller.
4. With the controller connector disconnected measure the resistance of the coolant circuit to ground. Compare the resistance value with Table 5-20 at the designated temperature value. If not within $\pm 2.6\%$ verify the condition of the wires and connections to the sensor. If the wires and connections are good take a measurement directly at the sensor terminals. If the sensor resistance value and the temperature of the sensor do not match [Table 3-20](#) replace the sensor.

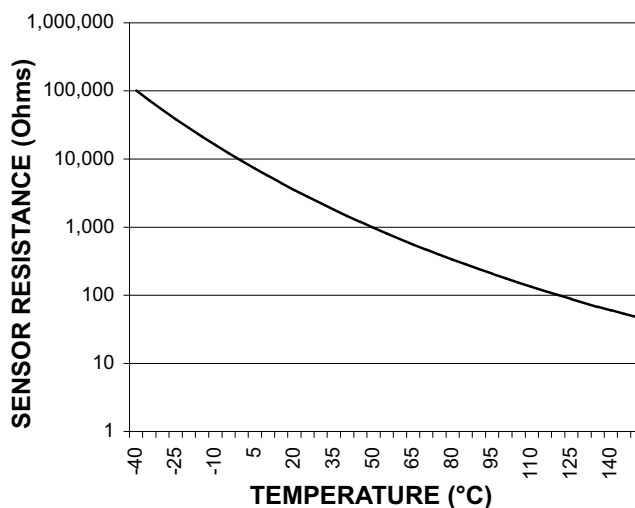


Figure 3-75. Unloaded Resistance vs Temperature Characteristic Chart

Table 3-20. Unloaded Resistance vs Temperature Characteristic Chart

Temperature °F (°C)	Resistance (Ohms)	Resistance (±%)	Accuracy (±%)
-40 (-40)	100,865	4.87	(±0.7)
-31 (35)	72,437	4.64	(±0.7)
-22 (-30)	52,594	4.43	(±0.7)
-13 (-25)	38,583	4.21	(±0.7)
-4 (-20)	28,582	4	(±0.7)
5 (-15)	21,371	3.8	(±0.7)
14 (-10)	16,120	3.6	(±0.6)
23 (-5)	12,261	3.4	(±0.6)
32 (0)	9399	3.21	(±0.6)
41 (5)	7263	3.06	(±0.6)
50 (10)	5658	2.92	(±0.6)
59 (15)	4441	2.78	(±0.6)
68 (20)	3511	2.64	(±0.6)
77 (25)	2795	2.5	(±0.6)
86 (30)	2240	2.45	(±0.6)
95 (35)	1806	2.4	(±0.6)
104 (40)	1465	2.36	(±0.6)
113 (45)	1195	2.31	(±0.6)
122 (50)	980	2.27	(±0.6)
131 (55)	809	2.23	(±0.6)
140 (60)	671	2.19	(±0.6)
149 (65)	559	2.15	(±0.6)
158 (70)	469	2.11	(±0.6)
167 (75)	395	2.07	(±0.6)
176 (80)	334	2.04	(±0.6)
185 (85)	283	2	(±0.6)
194 (90)	241.8	2.1	(±0.7)
203 (95)	207.1	2.21	(±0.7)
212 (100)	178	2.31	(±0.8)
221 (105)	153.6	2.42	(±0.8)
230 (110)	133.1	2.52	(±0.9)
239 (115)	115.7	2.61	(±0.9)
248 (120)	100.9	2.68	(±1)
257 (125)	88.3	2.75	(±1)
266 (130)	77.5	2.8	(±1.1)
275 (135)	68.3	2.84	(±1.1)
284 (140)	60.3	2.87	(±1.2)
293 (145)	53.4	2.89	(±1.2)
302 (150)	47.5	2.9	(±1.2)

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Section 4.1 Generator Adjustments

Calibrate Voltage Regulator

Discussion

When voltage output is too high, it is possible to adjust voltage output of the generator. To access this menu a password will be required to be entered into controller. Replacement controllers should not require calibration unless output is not within the specifications.

Procedure

1. Set a digital multimeter (DMM) to measure AC voltage.
2. Set up the DMM to measure output voltage on the breaker.

NOTE: Measure voltage at the input side of the breaker.

3. Open the main line circuit breaker (MLCB) on the generator.
4. Refer to the programing section for the specific panel being used. Use the voltage adjust for Evolution panel or the calibration for the Nexus panel to set the units voltage.
5. Set AUTO-OFF-MANUAL switch to MANUAL.

IMPORTANT NOTE: The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.

CAUTION

Equipment damage. Do not adust calibration factor below 990 or above 1040. Doing so could result in equipment damage.

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6. While the unit is running, use the up or down arrow buttons to adjust the calibration setting. A higher value will create a lower voltage at the breaker and vice versa a lower value will create a higher voltage at the breaker.
7. Once a desired output voltage has been achieved, press ENTER to save the new setting.

NOTE: The calibration setting will reset to being a password protected option after the controller is left idle.

Verification

While the unit is running, verify that the output voltage at the breaker is consistent within 5 volts to what the controller displays in the DEBUG menu under OUTPUTS.

Results

1. If during the verification process the output voltage at the breaker and the display match and the calibration setting was not adjusted outside of the window, stop testing.
2. If a correct voltage output was not achieved using the window specified, refer to “**Problem 1 – Test 4 Fixed Excitation Test.**”

Crank and Flywheel Sensor Installation and Adjustments (All Engines)

This instruction explains the procedure for setting the magnetic pick-up voltage output to its optimum value for each respective speed. The technician will need the harness magnetic pickup test kit part number #OG41800SRV to perform this adjustment (See [Figure 4-1](#)). The adjustment is performed with the engine running at rated speed.



Figure 4-1. Breakout Harness

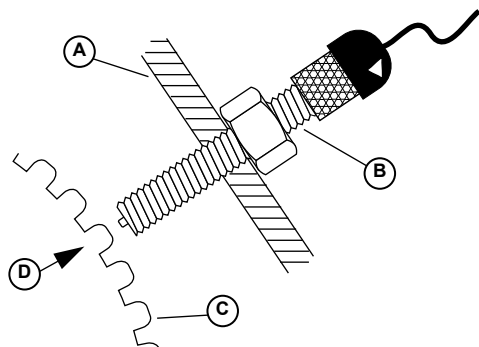
Procedure

1. Set the AUTO-OFF-MANUAL switch to OFF.
2. Disconnect the negative (-) battery cable from the battery.
3. Turn the fuel supply off to the unit.
4. With the magnetic pick-up removed, use a flashlight and verify that a flywheel tooth is directly below and centered in the magnetic pick-up hole. Use an appropriate tool on the crankshaft damper mounting bolt to rotate the crankshaft and flywheel in the direction of normal rotation. If access to crankshaft damper mounting bolt is not possible, then reconnect the battery and turn the engine over by toggling the manual switch to align the tooth underneath the hole.
5. See [Figure 4-2](#). Lightly screw the magnetic pick-up down until it contacts the top of the flywheel tooth.

WARNING

Equipment damage. Use approved methods for engine and generator rotation only. Rotating with blower blades or fan drive will result in equipment damage.

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003123

- A. Housing
B. Cam Sensor
C. Flywheel Ring Gear
D. Gap 1/2 to 3/4 of a turn

Figure 4-2. Crank Sensor (MPU1)

6. Back out the magnetic pick-up 1/2 to 3/4 of a turn.
7. Connect the breakout harness to the magnetic pick-up in-line with the engine control harness.

NOTE: The steps below in this procedure must be done with the breakout harness and with a Fluke 87 or equivalent multimeter.

8. Reconnect the negative (-) battery cable to the battery.
9. Turn the fuel supply back on to the unit.
10. Set the AUTO-OFF-MANUAL switch to MANUAL to verify the unit starts.

IMPORTANT NOTE: The engine will crank and possibly start when the AUTO-OFF-MANUAL switch is set to MANUAL.

- If the unit starts, proceed to step 11.
- If the unit does not start and if any alarms are displayed, verify steps 1–6 were performed correctly. Verify that the magnetic pick-up is producing AC voltage using the breakout harness while the engine is cranking. Turn the fuel supply off until magnetic pick-up voltage is obtained.

NOTE: The magnetic pick-up may need to be turned in or out a very small amount to get the magnetic pick-up to produce AC voltage.

11. Set the DMM to read AC voltage and insert leads into Wire 79 (positive) and Wire 0 (ground) on the breakout harness.

CAUTION

Equipment damage. Do not overtighten the magnetic pick-up. Contact between the pick-up and flywheel will damage the pick-up.

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12. With the unit running at rated speed (3600 RPM or 1800 RPM), slowly adjust the magnetic pick-up to provide the specific voltage for the applicable control board. Verify the part number of the control board before adjusting the magnetic pick-up to the appropriate voltage.

NOTE: Refer to **PIB08-15-S** for Magnetic Pickup Voltage Settings.

13. Tighten down the magnetic pick-up lock nut to prevent the magnetic pick-up from coming loose during running operations. Use Loctite (blue 232 removable), if available.
14. Verify the magnetic pick-up voltage at rated speed.
15. Turn the unit OFF and remove the breakout harness and reconnect the magnetic pick-up connector to the engine harness.

NOTE: When the magnetic pick-up has been removed, verify that there is no debris on the tip of the sensor. If there are any metal shavings on the tip, they may distort the signal to the controller. Remove the debris from the magnetic pick up tip and reinstall to the rated speed voltage set point.



003125

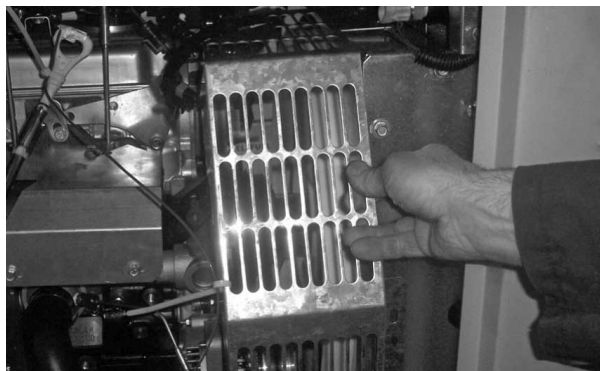
Figure 4-3. Metal Filings on Tip of Sensor

NOTE: The magnetic pick-up has a resistance of approximately 700–1000 ohms between the small red Wire 79 and the small black Wire 0 disconnected from the engine harness.

Cam Sensor Installation and Adjustments (2.4L Only)

Prepping the unit for this procedure

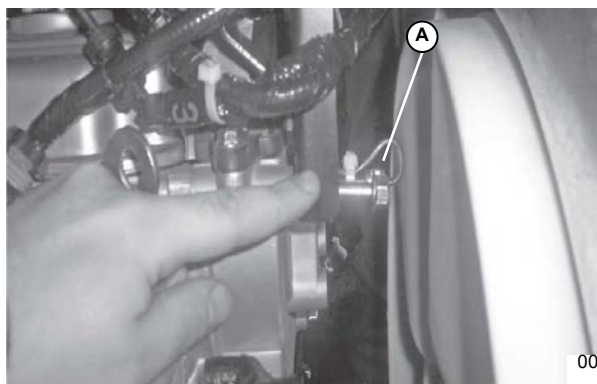
1. Remove both side doors from the enclosure.
2. Turn the AUTO-OFF-MANUAL switch to OFF.
3. Turn the fuel supply off to the unit.
4. Disconnect the positive (+) and negative (-) battery cables from the battery.
5. See **Figure 4-4**. Remove the 10 mm bolts from both fan housing guards on the radiator assembly.



003128

Figure 4-4. Fan Housing Guards

6. See [Figure 4-5](#). Remove the two ignition bracket bolts (A).
7. Cut any zip ties on the harness that will not allow the next step to be performed.



003128

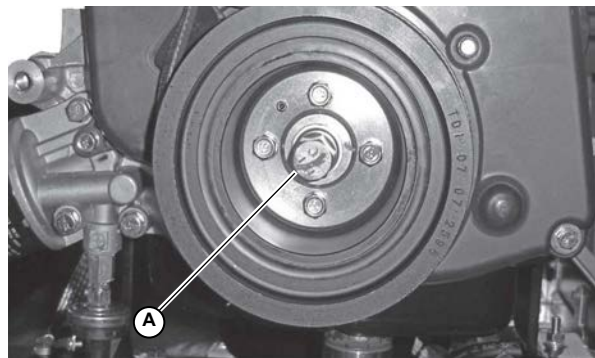
Figure 4-5. Ignition Bracket Bolts

8. See [Figure 4-6](#). Place the ignition coils and bracket on top of the valve cover and away from the timing belt cover.
9. See [Figure 4-6](#). Remove the top (black) timing belt cover (A) from the engine.



003130

Figure 4-6. Timing Belt Cover



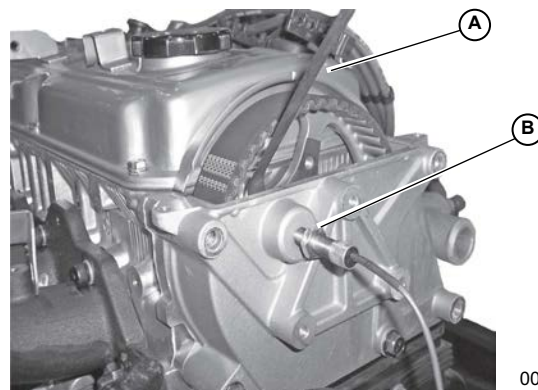
003131

A. Crankshaft Pulley

Figure 4-7. Crankshaft Pulley

Adjustment procedure

1. Slowly rotate the engine clockwise (tightening direction) on the crankshaft and align the cam pin to the cam sensor.
2. Using a brass or non-ferrous feeler gauge (0.015" or 0.381mm), verify the gap on the cam sensor to the cam pin and magnet.



003132

A. Feeler Gauge
B. Cam Sensor

Figure 4-8. Cam Sensor and Feeler Gauge (0.015" or 0.381mm)

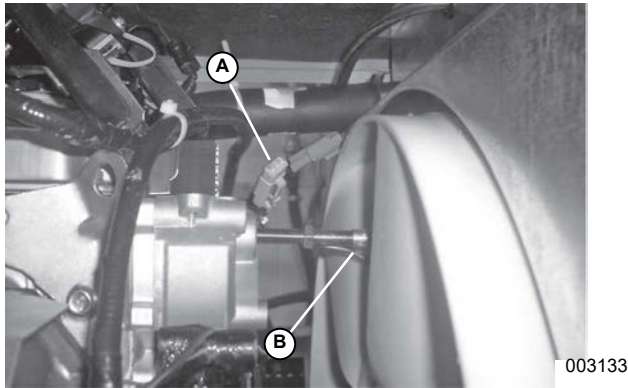
Results

1. If the gap is not within specifications, adjust cam sensor to the gap specifications mentioned above.
2. If the gap is within specifications, go to Step 9 under [Replacement Procedure](#).

Replacement Procedure

Initial set up for installing the cam sensor and cam sensor pin on the 2.4L Mitsubishi engine.

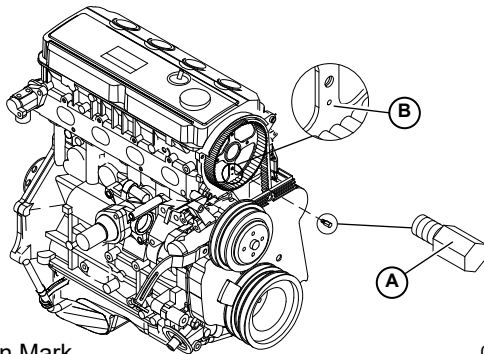
1. See [Figure 4-9](#). Remove the cam sensor from the middle of the timing cover.



A. Magnetic Pick-up Connector
B. Magnetic Pick-up

Figure 4-9. Removing Cam Sensor from Timing Cover

- See [Figure 4-10](#). Remove the cam pin (A) from the camshaft pulley (B).



A. Indication Mark
B. Cam Pin Flat Side

Figure 4-10. Cam Pin

- See [Figure 4-11](#). Clean the cam sprocket threads and cam pin threads with clean non-oil based solvent.



Figure 4-11. Cam Sprocket and Cam Pin Threads

- Remove excess solvent with a clean paper towel or cloth.
- See [Figure 4-11](#). Apply Loctite (blue 232 removable) to the cam pin threads (A) and lightly screw the cam pin into the camshaft pulley on the spoke of the pulley that has a dimple on it (B).

- Hand tighten the cam pin and then turn one flat side to the right.
- See [Figure 4-12](#). Using an inspection mirror, visually inspect that the cam pin is aligned with the cam sensor hole.

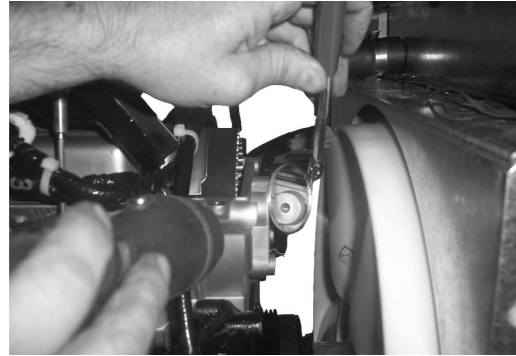


Figure 4-12. Cam Pin in Cam Sensor Hole

NOTE: See [Figure 4-13](#). Measure approximately 1 in from the tip of the cam sensor and apply a paint or magic marker line across the sensor. This line represents about how much of the cam sensor must be screwed into the timing belt housing until it contacts the cam pin.

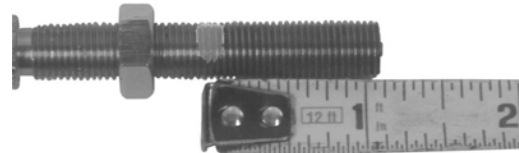


Figure 4-13. Cam Sensor Marking

- Lightly screw the cam sensor into the cam sensor hole until the marker line is reached on the cam sensor.
- Using a brass feeler gauge, set the cam sensor gap to 0.015 in \pm 0.001 in. (0.381 mm).
- See [Figure 4-14](#). Tighten the lock nut on the cam sensor and zip tie the wire (A) to the cam sensor (B).

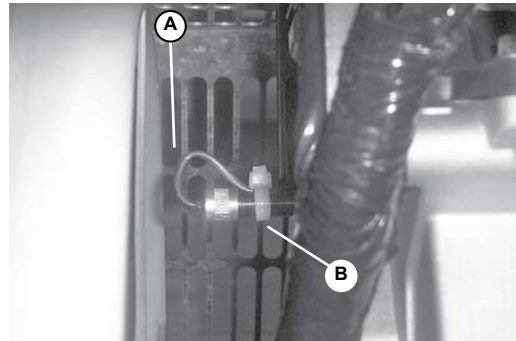


Figure 4-14. Magnetic Pick-Up Connection Wire

NOTE: If the cam sensor wire is not tied down properly, the radiator fan can damage and/or cut the wire on the cam sensor, causing the unit to shut down due to a loss of cam signal going to the ignition control module.

- See **Figure 4-15**. Install the upper timing belt cover (A) on the engine and torque the timing belt cover bolts (B) to 8 ft-lbs (11 Nm).

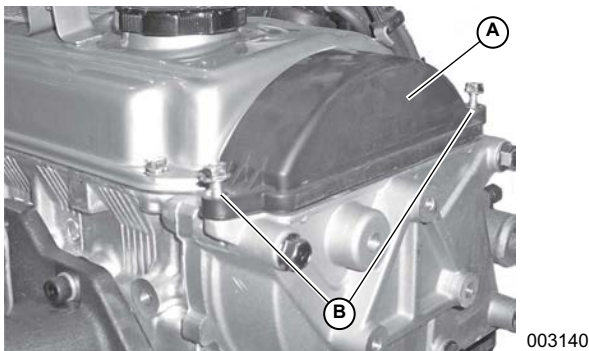


Figure 4-15. Timing Belt

- See **Figure 4-16**. Install the ignition bracket and bolts (C) with the ignition coils to the side of the timing belt cover. Torque ignition bracket bolts to 17 ft-lbs (24 Nm).

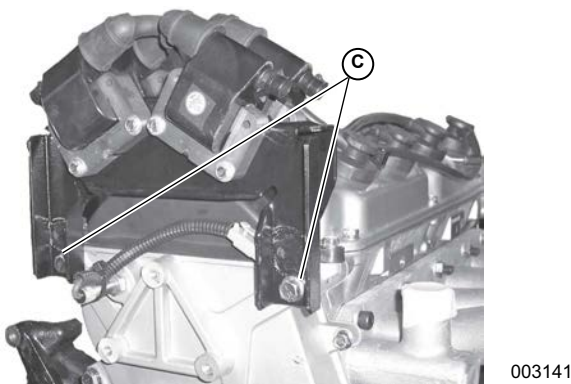


Figure 4-16. Ignition Bracket Bolts

- Reconnect the cam sensor connector to the engine harness.
- Zip tie any loose wiring to a clear and safe location.
- Install the fan housing guards to the radiator assembly.

Nexus Panel Replacement



Equipment damage. Do not run unit until Nexus panel has been properly configured. Failure to do so could cause severe equipment damage.

(000328)

IMPORTANT NOTE: This procedure is not to be used to attempt to change the voltage code of any unit. The commercial product is not intended to be changed from one voltage code to another. The voltage code and parameter group code in the panel must match the unit model the panel is installed on. If the panel is not configured to match the model of the unit it is installed on the unit will be damaged. Damage due to improper configuration of the panel is not warrantable.

Replacement Procedure

- Locate the unit data label and record the following information:

- kW
- Engine displacement (L)
- Voltage Code

The unit model code breakdown will provide the unit information.

Unit Model code breakdown example: QT 02724A__ X

The first three digits represent the kW rating: 027 = 27 kW
The next two digits represent the engine displacement in liters:

24 = 2.4L

The next letter identifies the voltage code of the unit:

A = A code, 120/240

~ A = 120/240, 1 Phase; G = 120/208, 3 Phase; J = 120/240, 3 Phase; K = 277/480, 3 Phase; M = 110/220, 1 Phase, 50 Hz.

The last letter designates if it is a catalyst equipped unit.

~ X = Non-catalyst C = Catalyst.

You will also need to know the fuel type the unit is using; it will be either NG (natural gas) or LP (liquid propane vapor).

- Refer to the appropriate SIB (service information bulletin) and record the voltage code (V-Code) and parameter Group for the generator model the panel is installed on. You will need this information in steps 6–7 of the configuration procedure.

V-Code = _____ Parameter Group = _____

NOTE: Make sure the panel AUTO-OFF-MANUAL switch is OFF when connecting and powering the panel.

- After the replacement panel has been mounted, connected, and powered up, the panel display will ask you to set the time and the exerciser function. The panel will not need to be re-registered.



Equipment damage. Do not run unit until Nexus panel has been properly configured. Failure to do so could cause severe equipment damage.

(000328)

Refer to **SIB10-11-NALL (Nexus)** or **SIB14-02-ELIQ (Evolution)**. Use the information from the unit data label to find the corresponding V-code and parameter group number (to be entered into the appropriate fields in the control panel).

NOTE: Emission column identifies if the generator is catalyst equipped.

Y = Catalyst

N = Non-Catalyst

AUX Shutdown

New specifications in Article 445.18(B) of the 2017 National Electrical Code (NEC) require generators to be equipped with an independent means of shutting down the prime mover (engine). The shutdown mechanism, when activated, requires a mechanical reset. Generators 15 kW and larger require two engine shutdown switches.

NOTE: Some Authorities Having Jurisdiction (AHJs) and local codes require Protector diesel generators to be equipped with an optional Emergency Stop Switch (E-stop). The E-stop is offered separately from this kit as model G0065100.

Firmware Update (if required)

The generator controller may require a firmware update. Firmware version 1.19 or later is required.

Verify controller firmware version. If an update is required, install latest version before testing engine shutdown switches.

1. Connect negative battery terminal and tighten nut.
2. Install 7.5 A fuse and configure install wizard.
3. With generator controller OFF, enter Edit menu.
4. Scroll through the options and select "Update Firmware." Press Enter.
5. Insert a USB drive with current firmware into controller port. Follow prompts.
6. After firmware has been updated, press "Escape" until sub menu screen displays.
7. Enter dealer menu.
8. Select "Dealer/Edit" menu.
9. Scroll through the options and select "Auxiliary Stop Setting."
10. Select "Auxiliary Shutdown."
11. Press Escape until submenu screen displays.

Activate Engine Shutdown Functionality

Verify firmware version of the controller is correct as specified in [Firmware Update \(if required\)](#). If an update is required, download and install the latest firmware before proceeding.

The controller must detect the installed switches to activate the engine shutdown functionality.

1. Verify controller is powered and generator is OFF.
2. Turn rocker switches ON to verify switches are disengaged.
3. Turn one rocker switch OFF. The controller should detect that the switch has been engaged and will display "Auxiliary Shutdown."
 - If alarm appears on controller screen, turn rocker switch ON and clear alarm.
 - If alarm does not appear on controller screen, engine shutdown switch is not functioning. Verify

firmware version meets requirements. Disconnect power and re-check wiring installation. Contact Generac Technical Support if the problem cannot be identified or if you need assistance.

4. Repeat steps 1–3 for second rocker switch.

Test Switch Operation

Test engine shutdown switches after installation to verify proper operation.

1. Verify rocker switches are ON.
2. Press MANUAL key on control panel keypad to start engine.
3. With engine running, press one of the engine shutdown switches to OFF. Engine should shut down immediately.
 - **If engine stops**, press engine shutdown switch to ON, clear alarm on controller, and restart engine to verify generator is operating normally. After verifying normal operation of first switch, verify operation of second switch.
 - **If engine does not stop**, engine shutdown switch is not functioning correctly. Stop generator through the control panel, and re-check wiring installation. Contact Generac Technical Support if the problem cannot be identified or if you need assistance.
4. Show homeowner how to operate engine shutdown switches. Remind him or her that the engine shutdown switches are not intended to be the primary means to shut down the generator under normal operating conditions. Accidental activation of an engine shutdown switch will prevent the generator from operating during a power outage.

Section 4.2 Torque Specs

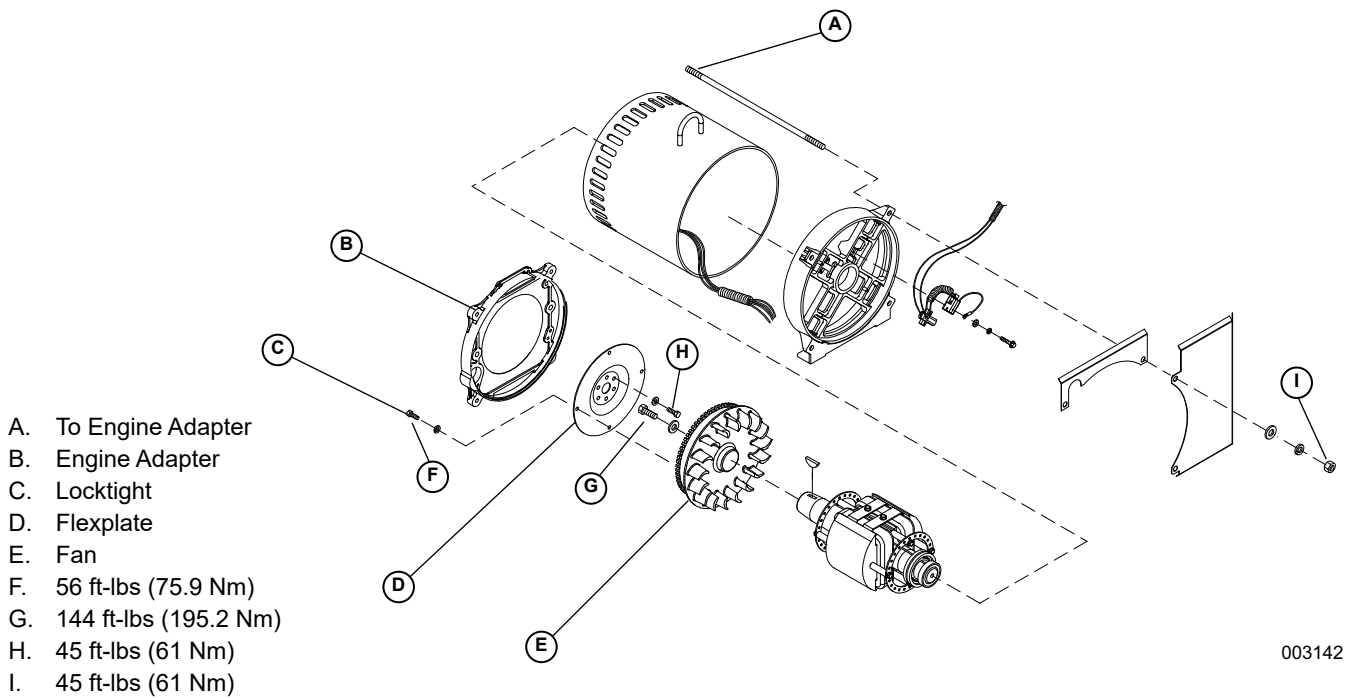


Figure 4-17. 35 kW–60 kW Alternator Torque Specs (Gaseous Units)

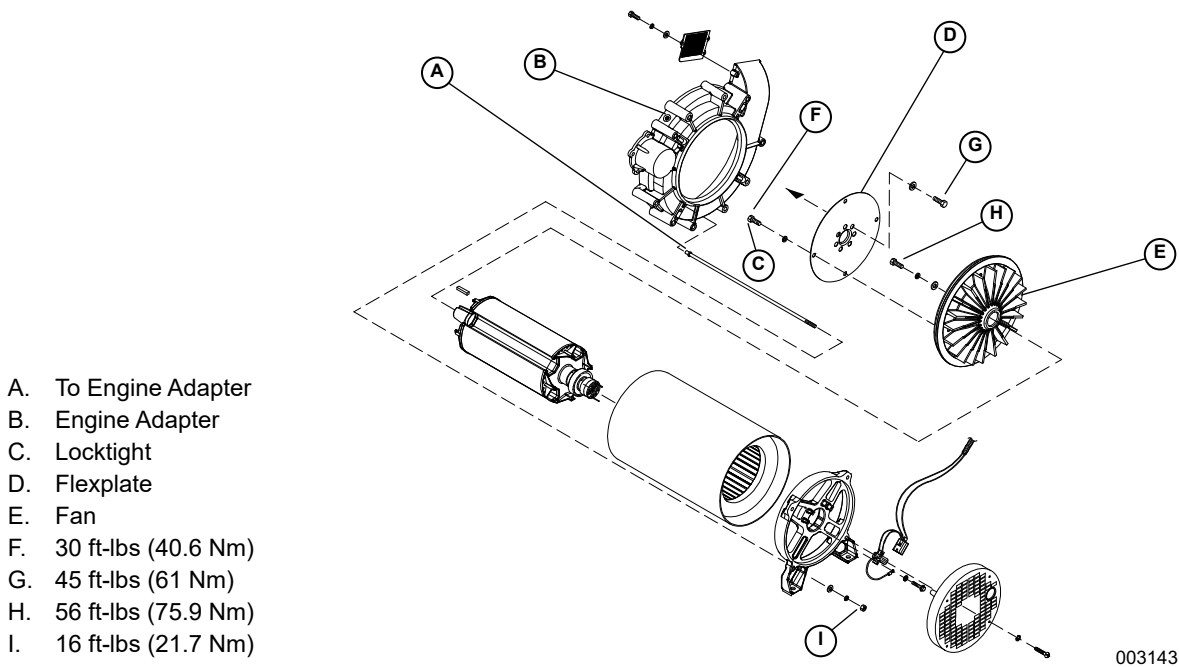
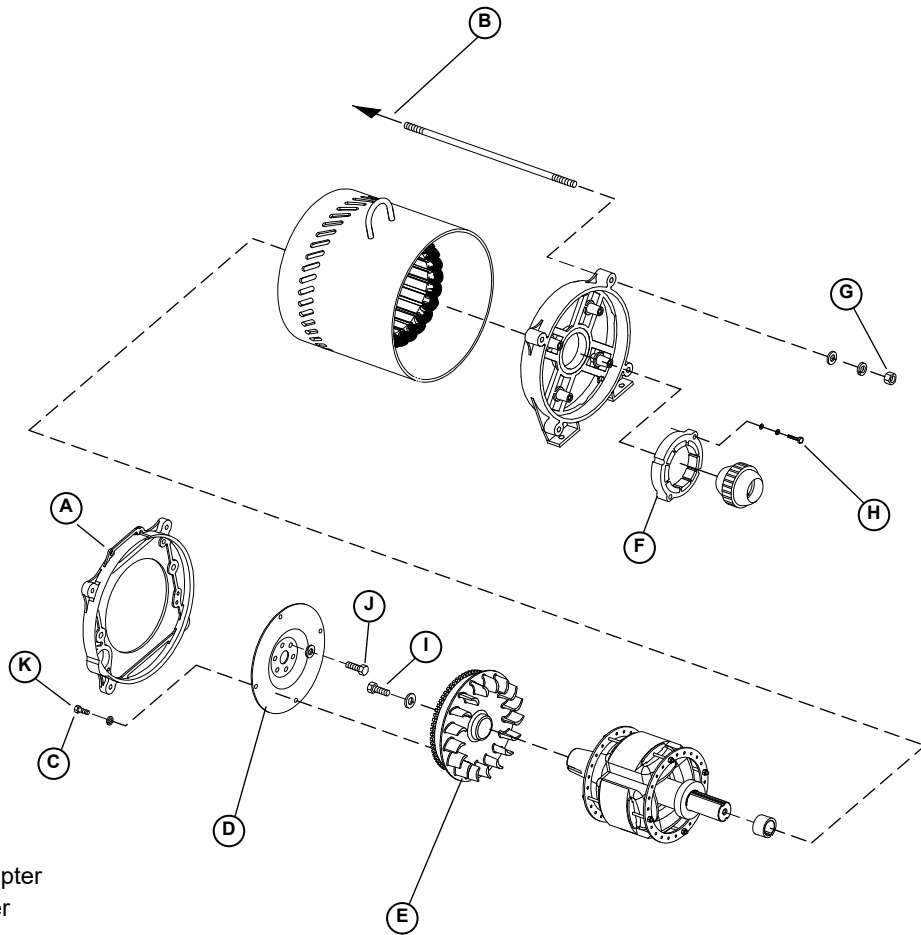


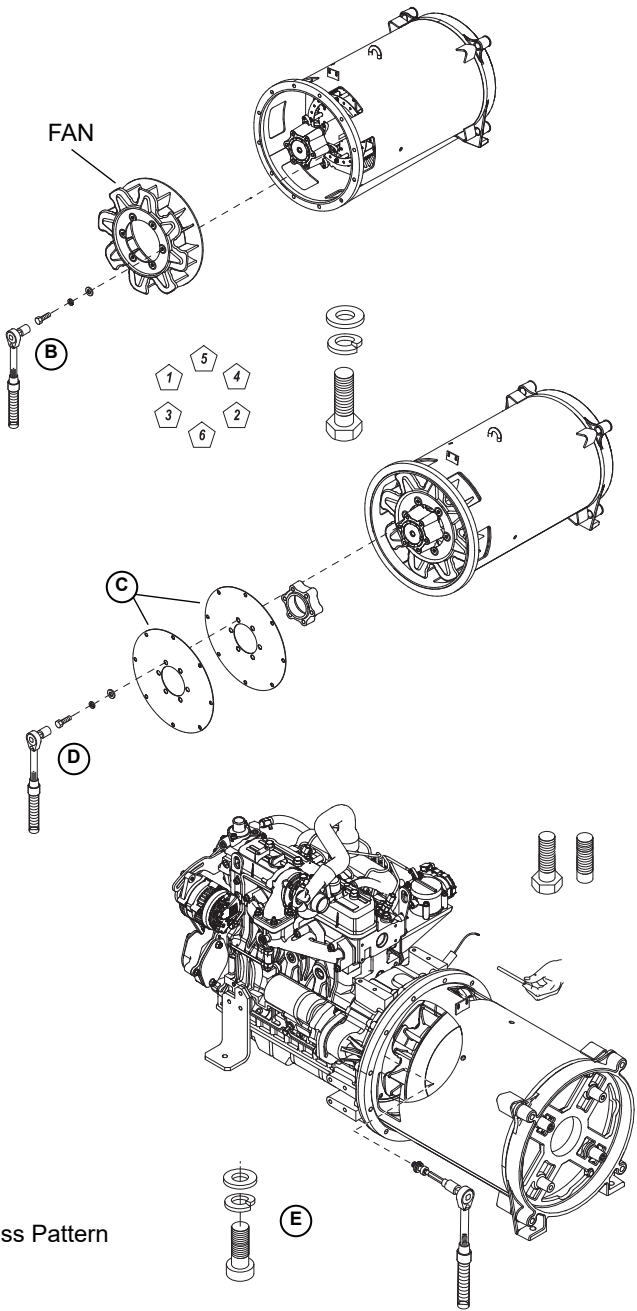
Figure 4-18. 22 kW–27 kW Alternator Torque Specs (Gaseous Units) / 15–20 kW (Diesel Units)



- A. To Engine Adapter
- B. Engine Adapter
- C. Locktight
- D. Flexplate
- E. Fan
- F. Exciter Field
- G. 45 ft-lbs (61 Nm) Criss-Cross Pattern
- H. 83 ft-lbs (112.5 Nm)
- I. 144 ft-lbs (195.2 Nm)
- J. 45 ft-lbs (61 Nm)
- K. 56 ft-lbs (75.9 Nm)

003144

Figure 4-19. 70–150 kW Alternator Torque Specs (Gaseous Units)



- A. Fan
- B. 25 ft-lbs (33.9 Nm) Criss-Cross Pattern
- C. Flexplates
- D. 72 ft-lbs (97.6 Nm)
- E. 46 ft-lbs (62.3 Nm)

003145

Figure 4-20. 30–50 kW Alternator Torque Specs (Diesel Units)

Section 4.2 Torque Specs

Thread	Class 5.8		Class 6.8		Class 8.8		Class 10.9		Class 12.9	
	Torque ft-lbs (Nm)		Torque ft-lbs (Nm)		Torque ft-lbs (Nm)		Torque ft-lbs (Nm)		Torque ft-lbs (Nm)	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
M4-0.7	17 (23)	13 (17.6)	20 (27.1)	15 (20.3)	27 (36.6)	20 (27.1)	38 (51.5)	29 (39.3)	45 (61)	33 (44.7)
M5-0.8	35 (47.5)	26 (25.2)	41 (55.5)	31 (42)	54 (73.2)	40 (54.2)	77 (104.4)	58 (78.6)	90 (122)	68 (92.2)
M6-1.0	60 (81.3)	45 (61)	69 (93.5)	52 (70.5)	92 (124.7)	69 (93.5)	131 (177.6)	98 (132.8)	153 (207.4)	115 (155.9)
M7-1.0	101 (136.9)	75 (101.6)	117 (158.6)	87 (117.9)	154 (208.8)	115 (155.9)	220 (298.3)	165 (223.7)	21 (28.4)	193 (261.6)
M8-1.0	156 (211.5)	117 (158.6)	181 (245.4)	136 (184.4)	20 (27.1)	179 (242.6)	28 (37.9)	21 (28.4)	33 (44.7)	25 (33.9)
M8-1.25	146 (197.9)	109 (147.7)	169 (229.1)	127 (172.1)	222 (300.9)	167 (226.4)	27 (36.6)	20 (27.1)	31 (42)	23 (31.1)
M10-1.0	27 (36.6)	20 (27.1)	31 (42)	23 (31.1)	41 (55.5)	31 (42)	59 (79.9)	44 (59.6)	69 (93.5)	51 (69.1)
M10-1.25	25 (33.9)	19 (25.7)	29 (39.3)	22 (29.8)	39 (52.8)	29 (39.3)	56 (75.9)	42 (56.9)	65 (88.1)	49 (66.4)
M10-1.5	24 (32.5)	18 (24.4)	28 (37.9)	21 (28.4)	37 (50.1)	28 (37.9)	53 (71.8)	39 (52.8)	61 (82.7)	46 (62.3)
M12-1.25	46 (62.3)	35 (47.5)	53 (71.8)	40 (54.2)	70 (94.9)	53 (71.8)	101 (136.9)	75 (101.6)	118 (159.9)	88 (119.3)
M12-1.5	44 (59.6)	33 (44.7)	51 (69.1)	38 (51.5)	67 (90.8)	50 (67.7)	96 (130.1)	72 (97.6)	112 (151.8)	84 (113.8)
M12-1.75	42 (56.9)	31 (42)	49 (66.4)	36 (48.8)	64 (86.7)	48 (65)	92 (124.7)	69 (93.5)	107 (145)	80 (108.4)
M14-1.5	73 (98.9)	54 (73.2)	84 (113.8)	63 (85.4)	111 (150.4)	83 (112.5)	159 (215.5)	119 (161.3)	185 (250.8)	139 (188.4)
M14-2.0	67 (90.8)	50 (67.7)	78 (105.7)	58 (78.6)	102 (138.2)	77 (104.4)	147 (199.3)	110 (149.1)	171 (231.8)	128 (173.5)
M16-1.5	112 (151.8)	84 (113.8)	129 (174.9)	97 (131.5)	176 (238.6)	132 (178.9)	244 (330.8)	183 (248.1)	285 (386.4)	214 (290.1)
M16-2.0	104 (141)	78 (105.7)	121 (164)	91 (123.3)	165 (223.7)	123 (166.7)	228 (309.1)	171 (231.8)	266 (360.6)	200 (271.1)
M18-1.5	163 (220.9)	122 (165.4)	188 (254.8)	141 (191.1)	257 (348.4)	192 (260.3)	355 (481.3)	266 (360.6)	415 (562.6)	311 (421.6)
M18-2.5	144 (195.2)	108 (146.4)	167 (226.4)	125 (169.4)	227 (307.7)	170 (230.4)	314 (425.7)	236 (319.9)	367 (497.5)	276 (374.2)
M20-1.5	227 (307.7)	170 (230.4)	236 (319.9)	197 (267)	358 (485.3)	269 (364.7)	496 (672.4)	372 (504.3)	579 (785)	434 (588.4)
M20-2.5	204 (276.5)	153 (207.4)	236 (319.9)	177 (239.9)	322 (436.5)	241 (326.7)	445 (603.3)	334 (452.8)	520 (705)	390 (528.7)
M22-1.5	306 (414.8)	230 (311.8)	355 (481.3)	266 (360.6)	484 (656.2)	363 (492.1)	669 (907)	502 (680.6)	782 (1060.2)	586 (794.5)
M22-2.5	278 (376.9)	208 (282)	322 (436.5)	241 (326.7)	439 (595.2)	329 (446)	607 (822.9)	455 (616.8)	709 (961.2)	532 (721.2)
M24-2.0	385 (521.9)	289 (391.8)	446 (604.6)	335 (454.1)	608 (824.3)	456 (618.2)	841 (1140.2)	631 (855.5)	983 (1332.7)	737 (999.2)
M24-3.0	352 (477.2)	264 (357.9)	407 (551.8)	306 (414.8)	556 (753.8)	417 (565.3)	769 (1042.6)	576 (780.9)	898 (1217.5)	674 (913.8)
M30-2.0	779 (1056.1)	584 (791.7)	902 (1222.9)	677 (917.8)	1230 (1667.6)	923 (1251.4)	1702 (2307.6)	1276 (1730)	1989 (2696.7)	1492 (2022.8)
M30-3.5	700 (949)	525 (711.8)	811 (1099.5)	608 (824.3)	1105 (1498.1)	829 (1123.9)	1529 (2073)	1147 (1555.1)	1787 (2422.8)	1340 (1816.7)
M36-3.0	1300 (1762.5)	975 (1321.9)	1505 (2040.5)	1129 (1530.7)	2053 (2783.4)	1540 (2087.9)	2840 (3850.5)	2130 (2887.8)	3318 (4498.6)	2489 (3374.6)
M36-4.0	1225 (1660.8)	918 (1244.6)	1418 (1922.5)	1063 (1441.2)	1933 (2620.8)	1450 (1965.9)	2675 (3626.8)	2006 (2719.7)	3126 (4238.2)	2344 (3178)

Thread	Grade 2		Grade 5		Grade 7		Grade 8	
	Torque ft-lbs (Nm)		Torque ft-lbs (Nm)		Torque ft-lbs (Nm)		Torque ft-lbs (Nm)	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
1/4-20	66 (89.4)	49 (66.4)	101 (136.9)	76 (103)	125 (169.4)	94 (127.4)	143 (193.8)	107 (145)
1/4-28	75 (101.6)	56 (75.9)	116 (157.2)	87 (117.9)	143 (193.8)	107 (145)	164 (222.3)	123 (166.7)
5/16-18	135 (183)	101 (136.9)	209 (283.3)	157 (212.8)	21 (28.4)	193 (261.6)	25 (33.9)	221 (299.6)
5/16-24	150 (203.3)	112 (151.8)	231 (313.1)	173 (234.5)	24 (32.5)	214 (290.1)	27 (36.6)	20 (27.1)
3/8-16	20 (27.1)	180 (244)	31 (42)	23 (31.1)	38 (51.5)	29 (39.3)	44 (59.6)	33 (44.7)
3/8-24	23 (31.1)	204 (276.5)	35 (47.5)	26 (25.2)	43 (58.3)	32 (43.3)	49 (66.4)	37 (50.1)
7/16-14	32 (43.3)	24 (32.5)	49 (66.4)	37 (50.1)	61 (82.7)	46 (62.3)	70 (94.9)	52 (70.5)
7/16-20	36 (48.8)	27 (36.6)	55 (74.5)	41 (55.5)	68 (92.2)	51 (69.1)	78 (105.7)	58 (78.6)
1/2-13	49 (66.4)	37 (50.1)	75 (101.6)	57 (77.2)	93 (126)	70 (94.9)	106 (143.7)	80 (108.4)
1/2-20	55 (74.5)	41 (55.5)	85 (115.2)	64 (86.7)	105 (142.3)	79 (107.1)	120 (162.6)	90 (122)
9/16-12	70 (94.9)	53 (71.8)	109 (147.7)	82 (111.1)	134 (181.6)	101 (136.9)	153 (207.4)	115 (155.9)
9/16-18	78 (105.7)	59 (79.9)	121 (164)	91 (123.3)	150 (203.3)	112 (151.8)	171 (231.8)	128 (173.5)
5/8-11	97 (131.5)	73 (98.9)	150 (203.3)	113 (153.2)	185 (250.8)	139 (188.4)	212 (287.4)	159 (215.5)
5/8-18	110 (149.1)	82 (111.1)	170 (230.4)	127 (172.1)	210 (284.7)	157 (212.8)	240 (325.3)	180 (244)
3/4-10	172 (233.2)	129 (174.9)	266 (360.6)	200 (271.1)	329 (446)	247 (334.8)	376 (509.7)	282 (382.3)
3/4-16	192 (260.3)	144 (195.2)	297 (402.6)	223 (302.3)	367 (497.5)	275 (372.8)	420 (569.4)	315 (427)
7/8-9	167 (226.4)	125 (169.4)	429 (581.6)	322 (436.5)	530 (718.5)	398 (539.6)	606 (821.6)	454 (615.5)
7/8-14	184 (249.4)	138 (187.1)	474 (642.6)	355 (481.3)	585 (793.1)	439 (595.2)	669 (907)	501 (679.2)
1 - 8	250 (338.9)	187 (253.5)	643 (871.7)	483 (654.8)	795 (1077.8)	596 (808)	908 (1231)	681 (923.3)
1 - 12	273 (370.1)	205 (277.9)	704 (954.4)	528 (715.8)	870 (1179.5)	653 (885.3)	994 (1347.6)	746 (1011.4)
1 1/8-7	354 (479.9)	266 (360.6)	794 (1076.5)	596 (808)	1127 (1528)	845 (1145.6)	1288 (1746.2)	966 (1309.7)
1 1/8-12	397 (538.2)	298 (404)	890 (1206.6)	668 (905.6)	1263 (1712.4)	948 (1285.3)	1444 (1957.8)	1083 (1468.3)
1 1/4-7	500 (677.9)	375 (508.4)	1120 (1518.5)	840 (1138.8)	1590 (2155.7)	1192 (1616.1)	1817 (2463.5)	1363 (1847.9)
1 1/4-12	553 (749.7)	415 (562.6)	1240 (1681.2)	930 (1260.9)	1760 (2386.2)	1320 (1789.6)	2012 (2727.9)	1509 (2045.9)
1 3/8-6	655 (888)	491 (665.7)	1469 (1991.7)	1101 (1492.7)	2084 (2825.5)	1563 (2119.1)	2381 (3228.2)	1786 (2421.4)
1 3/8-12	746 (1011.4)	559 (757.9)	1672 (2266.9)	1254 (1700.1)	2372 (3216)	1779 (2412)	2711 (3675.6)	2034 (2757.7)
1 1/2-6	869 (1178.2)	652 (883.9)	1949 (2642.4)	1462 (1982.2)	2766 (3750.1)	2075 (2813.3)	3161 (4285.7)	2371 (3214.6)
1 1/2-12	978 (1325.9)	734 (995.1)	2193 (2973.3)	1645 (2230.3)	3112 (4219.3)	2334 (3164.4)	3557 (4822.6)	2668 (3617.3)
1 3/4-5	1371 (1858.8)	1028 (1393.7)	3074 (4167.7)	2306 (3126.5)	4362 (5914)	3272 (4436.2)	4985 (6758.7)	3739 (5069.4)
2 - 4 1/2	2061 (2794.3)	1546 (2096)	4621 (6265.2)	3466 (4699.2)	6557 (8890.1)	4918 (6667.9)	7493 (10159.1)	5620 (7619.7)

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Section 5.1 *OK2086-A Wiring Diagram 2.3L, 2.4L and 3.4L Diesel Protector - Evolution*

Introduction

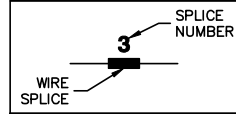
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

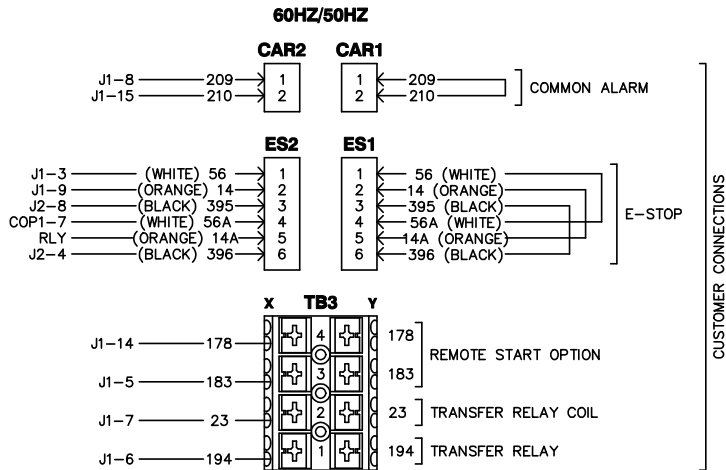
- | | |
|---|---|
| ALT_ - DC CHARGE ALTERNATOR | IP - INJECTOR PUMP |
| AS - ALTERNATOR STATOR | J_ - MAIN CONTROLLER CONNECTORS |
| BA - BRUSH ASSEMBLY | LD - LEAK DETECTOR |
| BCH_ - BATTERY CHARGER | LOS - LOW OIL PRESSURE SWITCH |
| CAR_ - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| COP1 - CROSSOVER PLUG 16-PIN (BULKHEAD) | MPU - MAGNETIC PICKUP |
| COP2 - CROSSOVER PLUG 12-PIN (BULKHEAD) | NB - NEUTRAL BLOCK |
| COR1 - CROSSOVER RECEPTACLE 16-PIN | PHC - PREHEAT CONTACTOR |
| COR2 - CROSSOVER RECEPTACLE 12-PIN | RLY - CONTROL RELAY |
| DB_ - DIODE BRIDGE | R - RESISTOR |
| ES_ - EMERGENCY STOP | SC - STARTER CONTACTOR |
| FLS - FUEL LEVEL SWITCH | SM - STARTER MOTOR |
| F_ - FUSE | TB_ - TERMINAL BLOCK |
| GA - GOVERNOR ACTUATOR | THMS - THERMISTOR (BATTERY AMBIENT TEMP.) |
| GND - GROUND CONNECTION | WLS - COOLANT LEVEL SENSOR |
| GP - GLOW PLUG | WTS - COOLANT TEMPERATURE SENSOR |

NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE

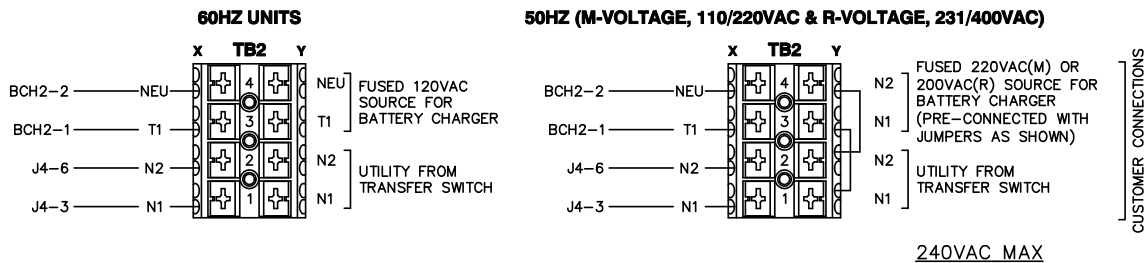


**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
LOW VOLTAGE CONNECTIONS**

NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

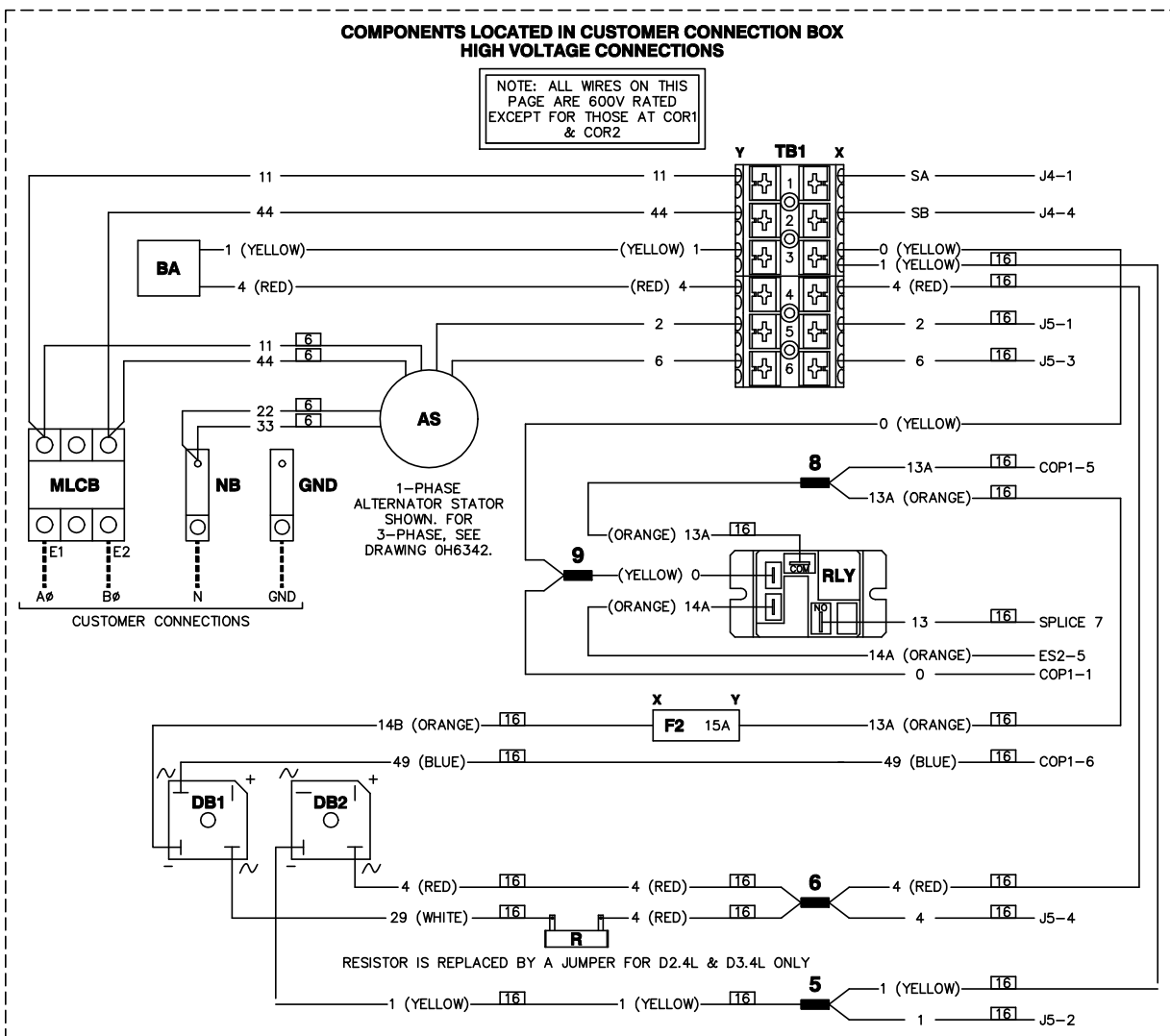


**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
HIGH VOLTAGE CONNECTIONS**



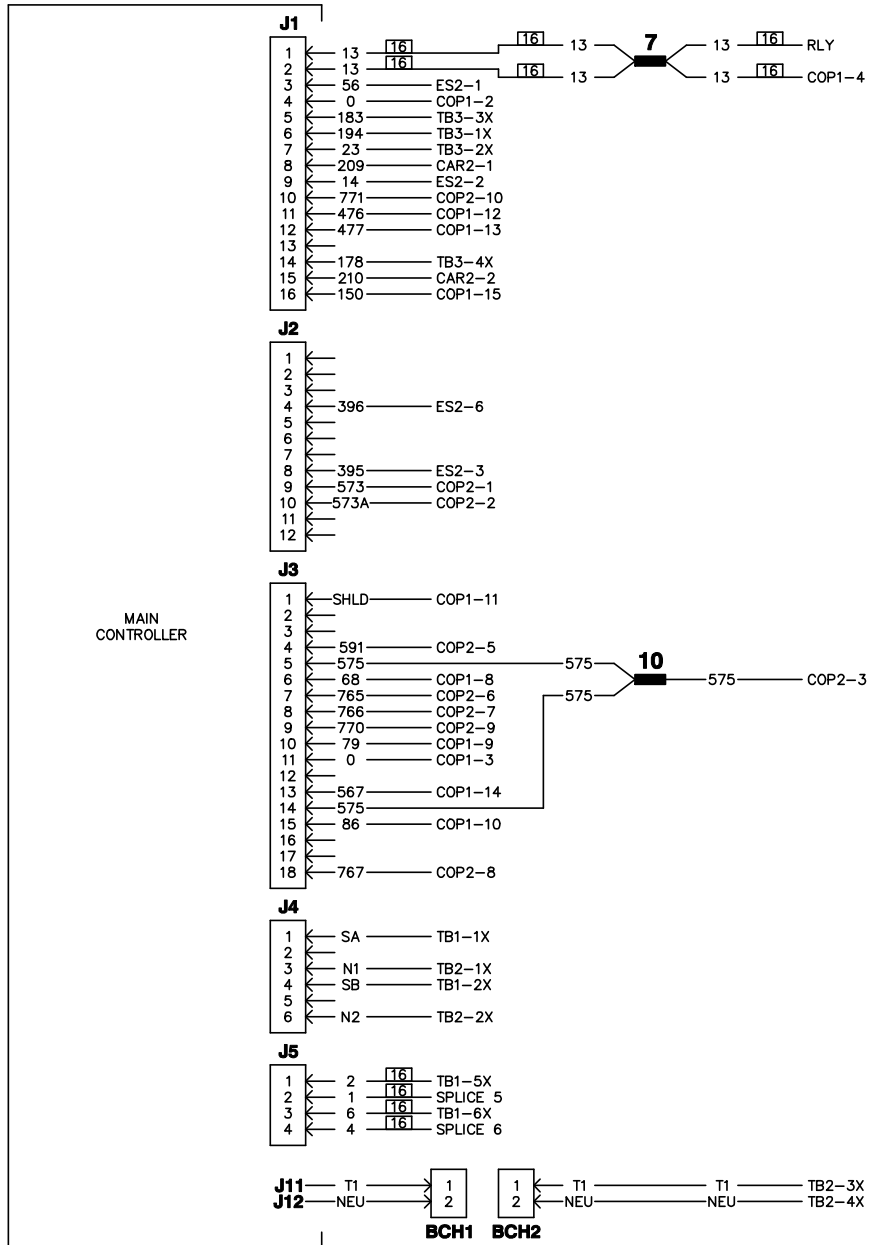
NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

GROUP G



GROUP G

COMPONENTS LOCATED IN CONTROL PANEL



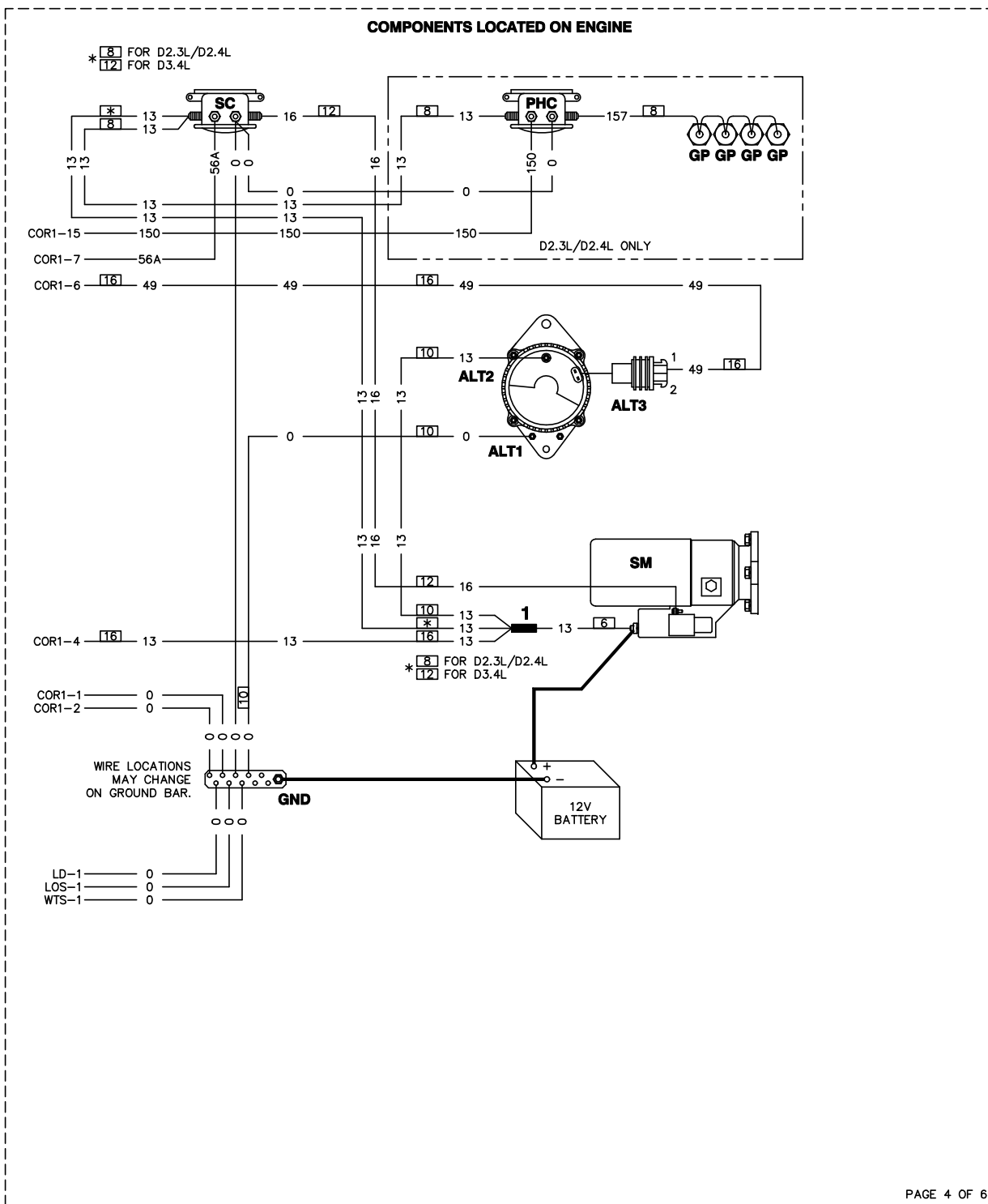
PAGE 3 OF 6

REVISION: -A-
DATE: 10/17/12

PAGE 3 OF 6

WIRING - DIAGRAM
D2.3L/D2.4L/D3.4L G16 CPL
DRAWING #: 0K2086

GROUP G



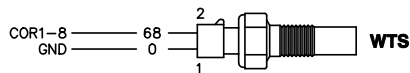
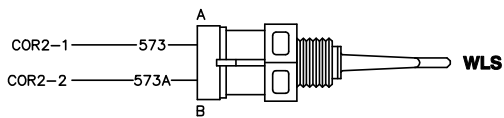
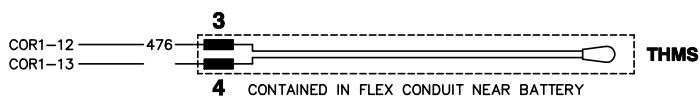
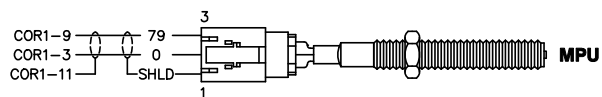
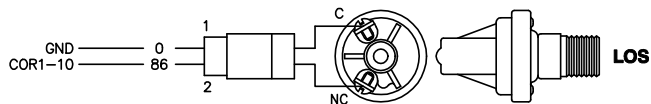
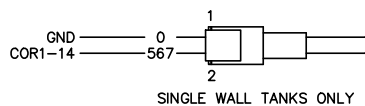
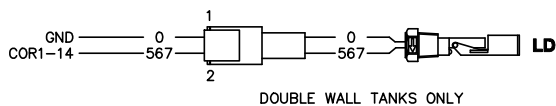
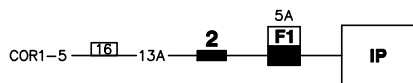
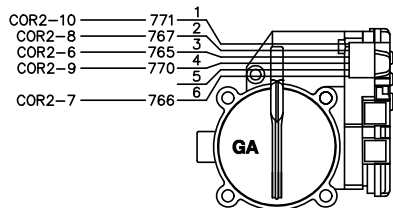
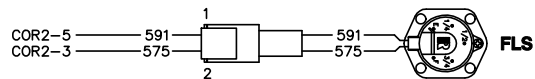
REVISION: -A-
 DATE: 10/17/12

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WIRING - DIAGRAM
 D2.3L/D2.4L/D3.4L G16 CPL
 DRAWING #: 0K2086

GROUP G

COMPONENTS LOCATED ON ENGINE



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REVISION: -A-
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WIRING - DIAGRAM
D2.3L/D2.4L/D3.4L G16 CPL
DRAWING #: 0K2086

GROUP G

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WIRING - DIAGRAM
D2.3L/D2.4L/D3.4L G16 CPL
DRAWING #: 0K2086

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Section 5.2 *0K2088-B Electrical Schematic 2.3L, 2.4L & 3.4L Diesel Protector - Evolution*

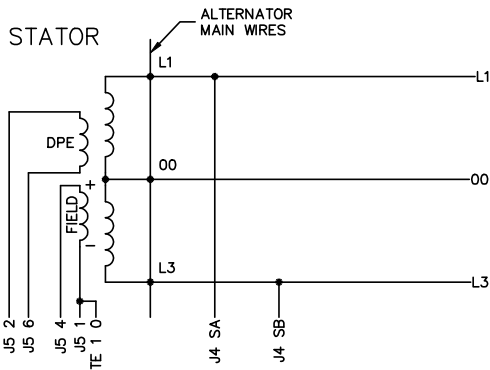
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

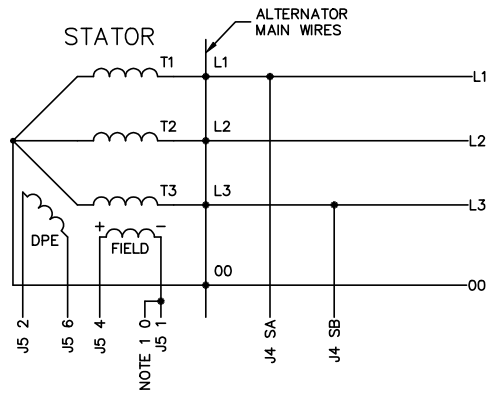
GROUP G

LEGEND

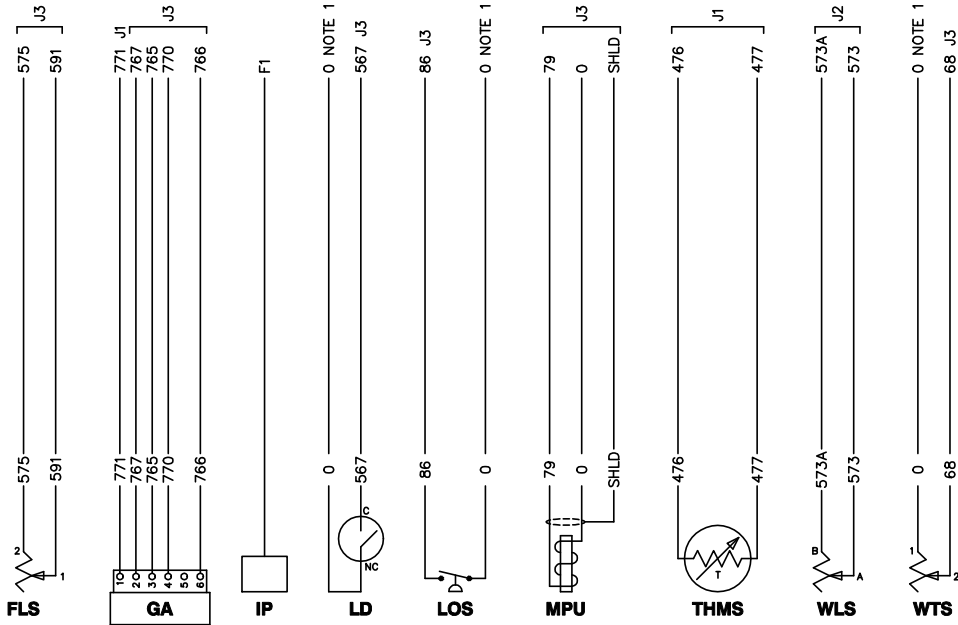
00 - NEUTRAL	F_ - FUSE	LOS - LOW OIL PRESSURE SWITCH	SM - STARTER MOTOR
ALT - DC CHARGE ALTERNATOR	FLS - FUEL LEVEL SENDER	MLCB - MAIN LINE CIRCUIT BREAKER	THMS - THERMISTOR
BAT - BATTERY	GA - GOVERNOR ACTUATOR	MPU - MAGNETIC PICKUP	WLS - COOLANT LEVEL SENSOR
BCH - BATTERY CHARGER	GP - GLOW PLUG	PHC - PREHEAT CONTACTOR	WTS - COOLANT TEMPERATURE SENSOR
DB - DIODE BRIDGE	IP - INJECTION PUMP	R - RESISTOR	
DPE - EXCITER	J_ - MAIN CONTROLLER CONN.	RLY - CONTROL RELAY	
ES1 - EMERGENCY STOP SWITCH	LD - LEAK DETECTOR	SC - STARTER CONTACTOR	



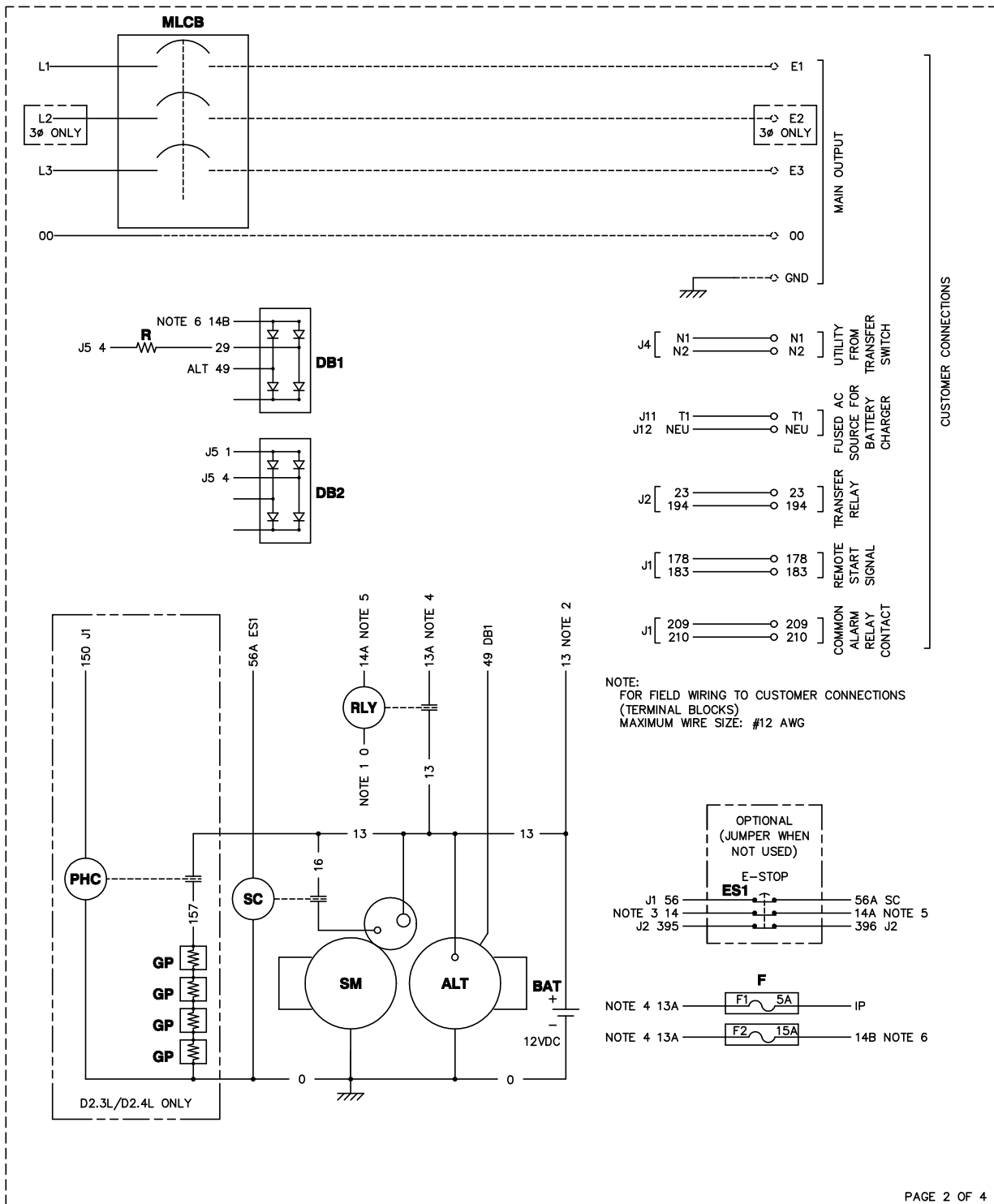
ALTERNATOR CONNECTIONS FOR 1φ UNITS



ALTERNATOR CONNECTIONS FOR 3φ UNITS



GROUP G



REVISION: J-6456-B
DATE: 9/6/13

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SCHEMATIC - DIAGRAM
D2.3L/D2.4L/D3.4L G16 CPL
DRAWING #: 0K2088

GROUP G

NOTES:

- 1) WIRE# 0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE# 13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE# 14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #13A IS UNFUSED +12VDC (BATTERY+) WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
- 5) WIRE# 14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
- 6) WIRE# 14B IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED 13A).

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	13	BATTERY+	NOTE 2
2	13	BATTERY+	NOTE 2
3	56	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209	CAR	COMMON ALARM
9	14	ES1	NOTE 3
10	771	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
14	178	CUST CON	REMOTE START
15	210	CAR	COMMON ALARM
16	150	PHC	PREHEAT

J2

PIN	WIRE	TO	FUNCTION
4	396	ES1	E-STOP RETURN
8	395	ES1	E-STOP SOURCE
9	573	WLS-A	COOLANT LEVEL SIGNAL
10	573A	WLS-B	COOLANT LEVEL SIGNAL RETURN

J3

PIN	WIRE	TO	FUNCTION
1	SHLD	MPU-1	FLYWHEEL SENSOR DRAIN
4	591	FLS-1	FUEL LEVEL RTN
5	575	FLS-2	FUEL LEVEL +
6	68	WTS-2	COOLANT TEMP SIGNAL
7	765	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770	GA-4	THROTTLE DRIVE HI
10	79	MPU-3	MPU SIGNAL (+)
11	0	MPU-2	MPU SIGNAL (-)
13	567	LD	LEAK DETECTOR
14	575	FLS-2	FUEL LEVEL +
15	86	LOS-NC	LOW OIL PRESSURE SIGNAL
18	767	GA-6	THROTTLE POSITION FEEDBACK RETURN

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

GROUP G

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DATE: 9/6/13

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SCHEMATIC - DIAGRAM
D2.3L/D2.4L/D3.4L G16 CPL
DRAWING #: 0K2088

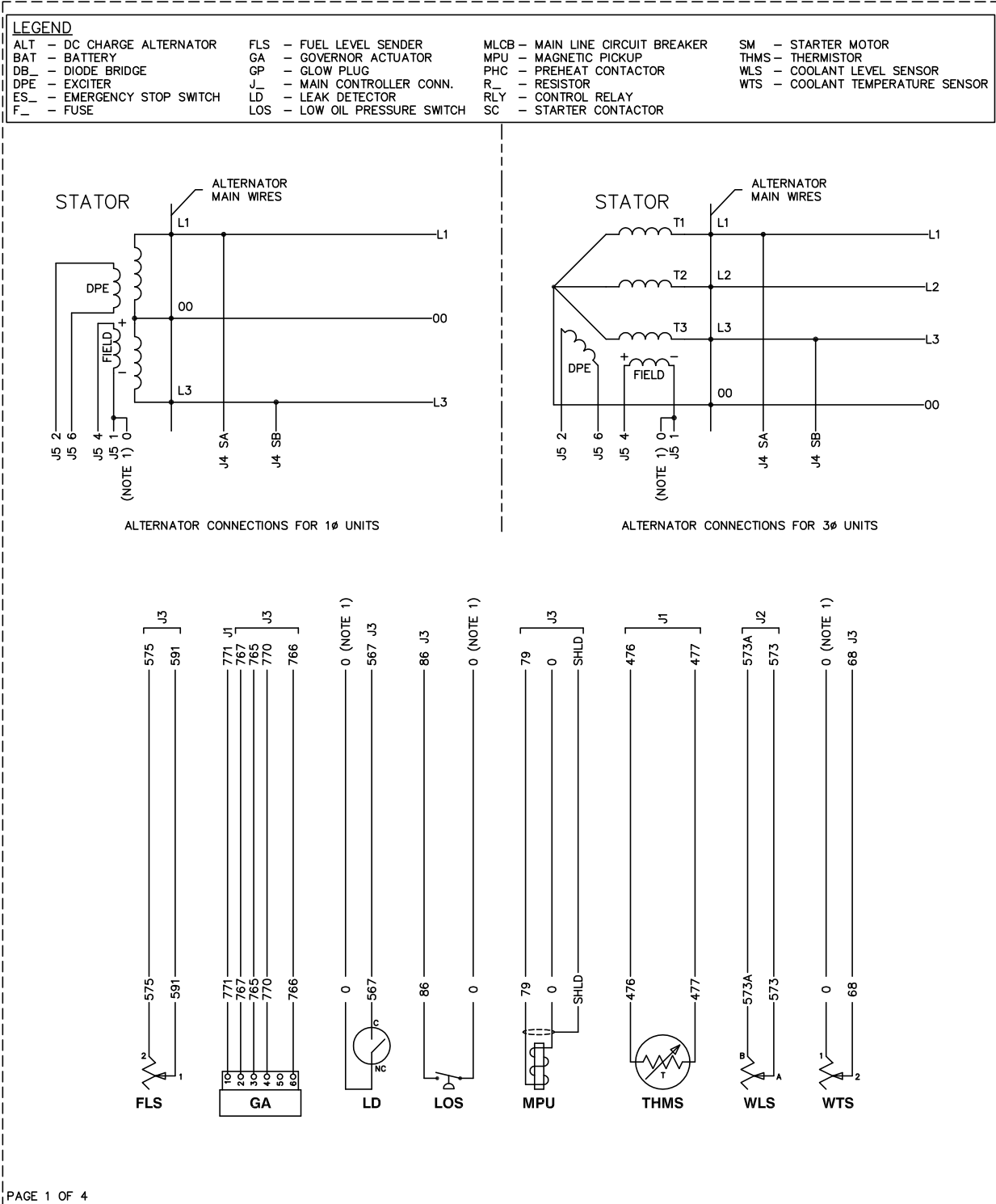
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Section 5.3 10000014620-A Electrical Schematic D2.5L/D3.3L G2 CPL

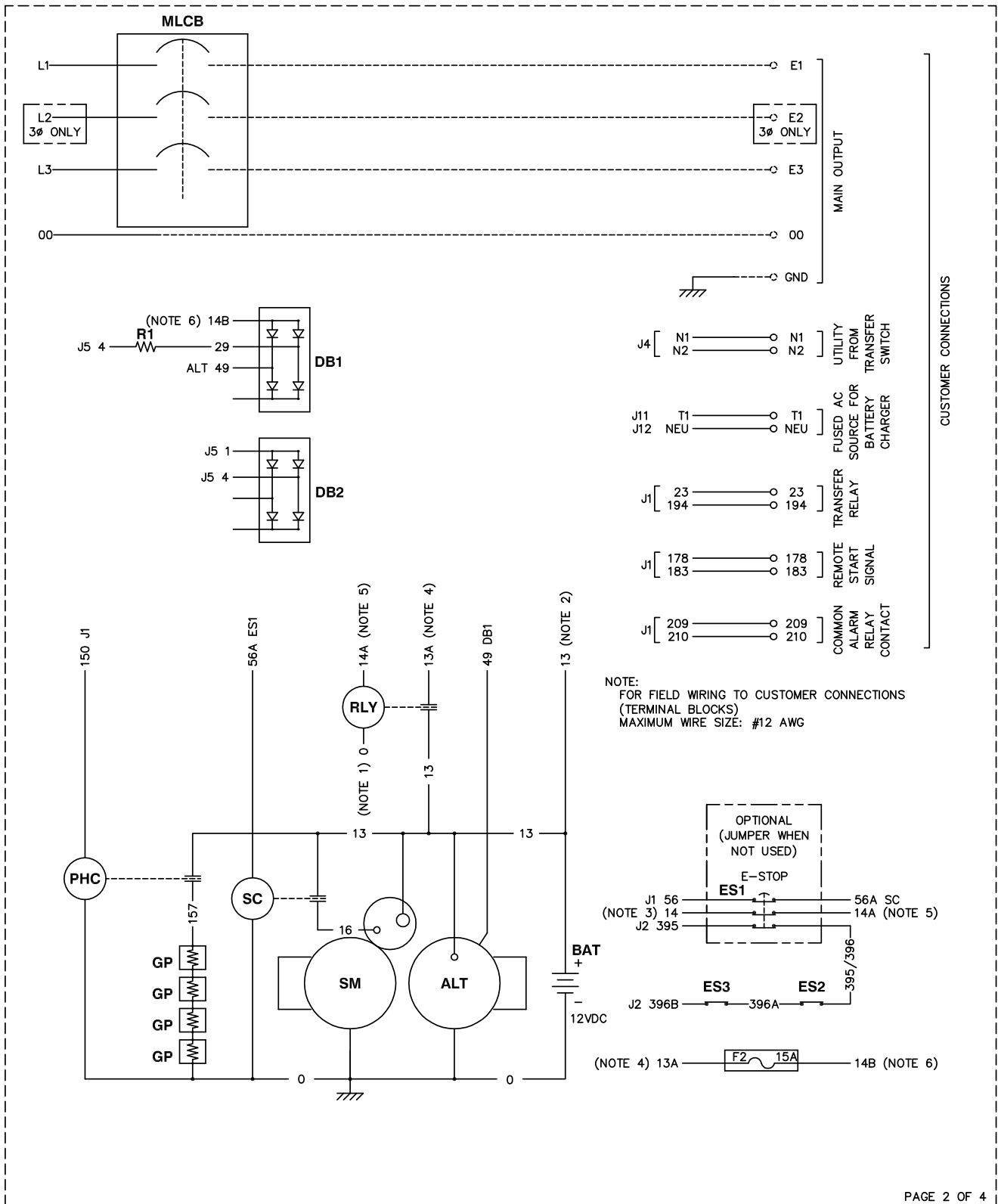
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G



GROUP G



REVISION: A
DATE: 8/3/17

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SCHMATIC - DIAGRAM
D2.5L/D3.3L G2 CPL
DRAWING #: 10000014620

GROUP G

- NOTES:
- 1) WIRE# 0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 - 2) WIRE# 13 IS UNFUSED +12VDC (BATTERY+).
 - 3) WIRE# 14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 - 4) WIRE #13A IS UNFUSED +12VDC (BATTERY+) WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
 - 5) WIRE# 14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
 - 6) WIRE# 14B IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED 13A).

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	13	BATTERY+	NOTE 2
2	13	BATTERY+	NOTE 2
3	56/56A	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209/210	CAR	COMMON ALARM
9	14/14A	ES1	NOTE 3
10	771	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
14	178	CUST CON	REMOTE START
15	209/210	CAR	COMMON ALARM
16	150	PHC	PREHEAT

J2

PIN	WIRE	TO	FUNCTION
4	396B	ES3	E-STOP RETURN
6	SHLD*	EGC (CUT)	CAN COMMUNICATION SHIELD
8	395/396	ES1	E-STOP SOURCE
9	573	WLS-A	COOLANT LEVEL SIGNAL
10	573A	WLS-B	COOLANT LEVEL SIGNAL RETURN
11	743*	EGC J1-7	CAN COMMUNICATION HIGH
12	744*	EGC J1-6	CAN COMMUNICATION LOW

*CAN COMMUNICATION AND ELECTRONIC GOVERNOR RELAY WIRES ARE NOT USED ON D2.5L & D3.3L, USED ON D2.2L ONLY.

J3

PIN	WIRE	TO	FUNCTION
1	SHLD	MPU-1	MAG PICKUP SENSOR DRAIN
4	591	FLS-1	FUEL LEVEL RTN
5	575	FLS-2	FUEL LEVEL +
6	68	WTS-2	COOLANT TEMP SIGNAL
7	765	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770	GA-4	THROTTLE DRIVE HI
10	79	MPU-3	MAG PICKUP SIGNAL (+)
11	0	MPU-2	MAG PICKUP SIGNAL (-)
13	567	LD	LEAK DETECTOR
14	575	FLS-2	FUEL LEVEL +
15	86	LOS-NC	LOW OIL PRESSURE SIGNAL
18	767	GA-2	THROTTLE POSITION FEEDBACK RETURN

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

J13

PIN	WIRE	TO	FUNCTION
6	25*	EGCR-85	ELECTRONIC GOVERNOR RELAY COIL +

GROUP G

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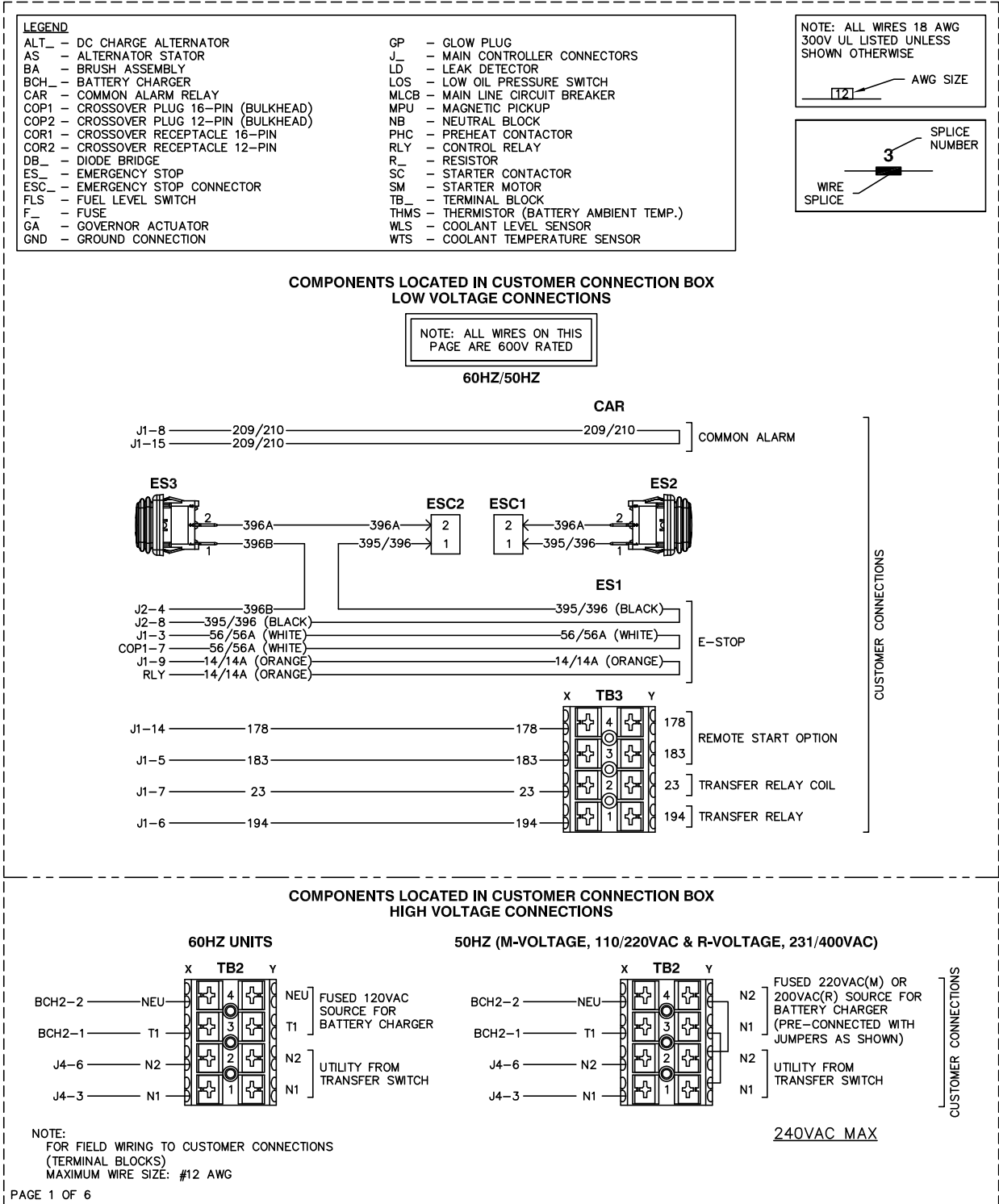
SCHEMATIC - DIAGRAM
D2.5L/D3.3L G2 CPL
DRAWING #: 10000014620

Section 5.4 10000014610-A Wiring Diagram D2.5L/D3.3L G2 CPL

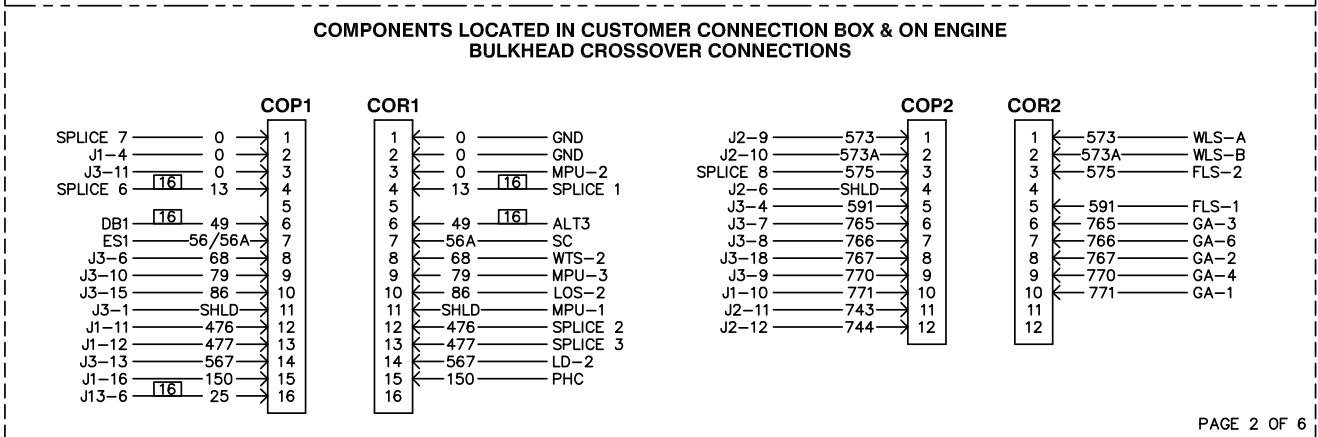
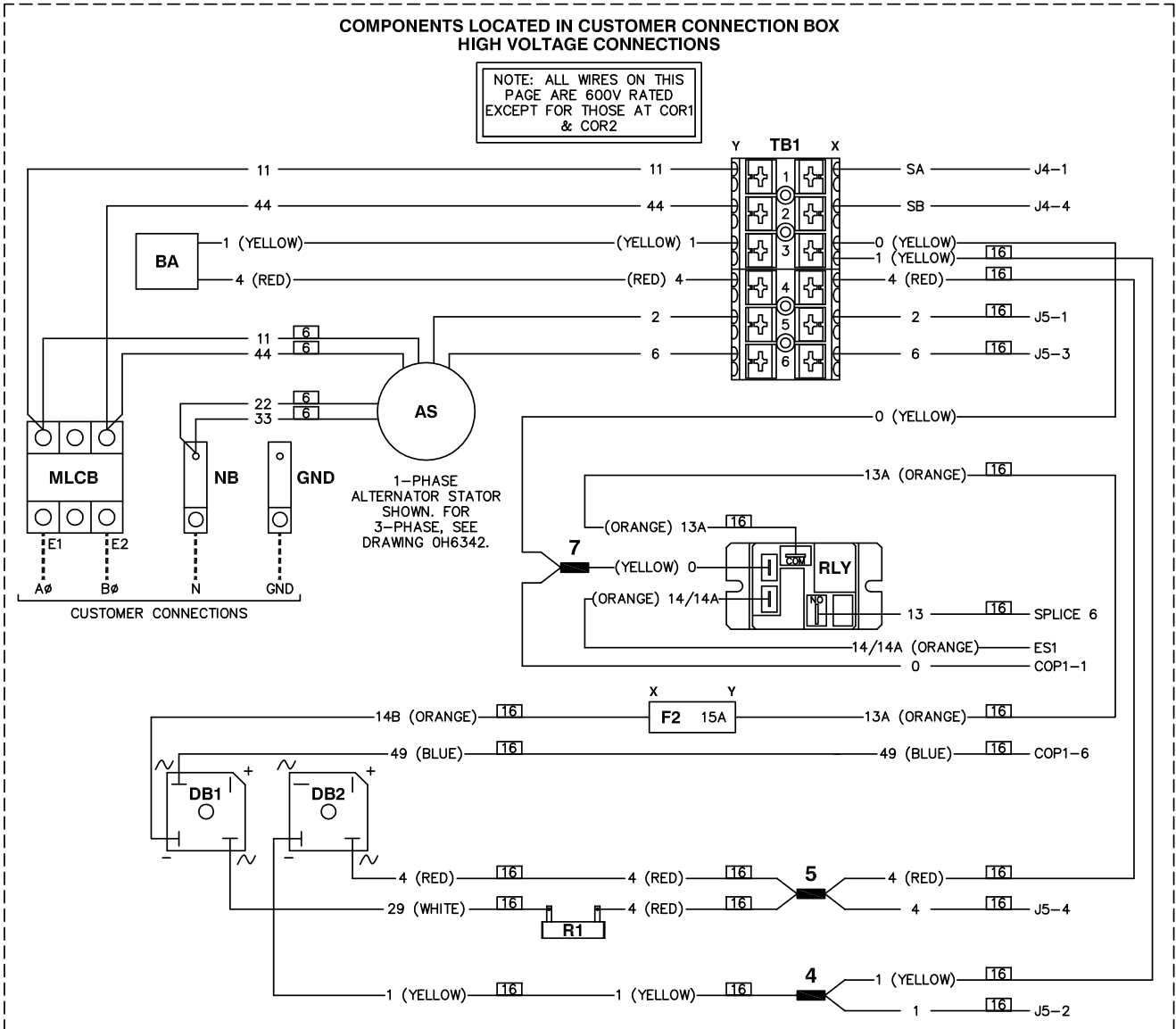
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The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

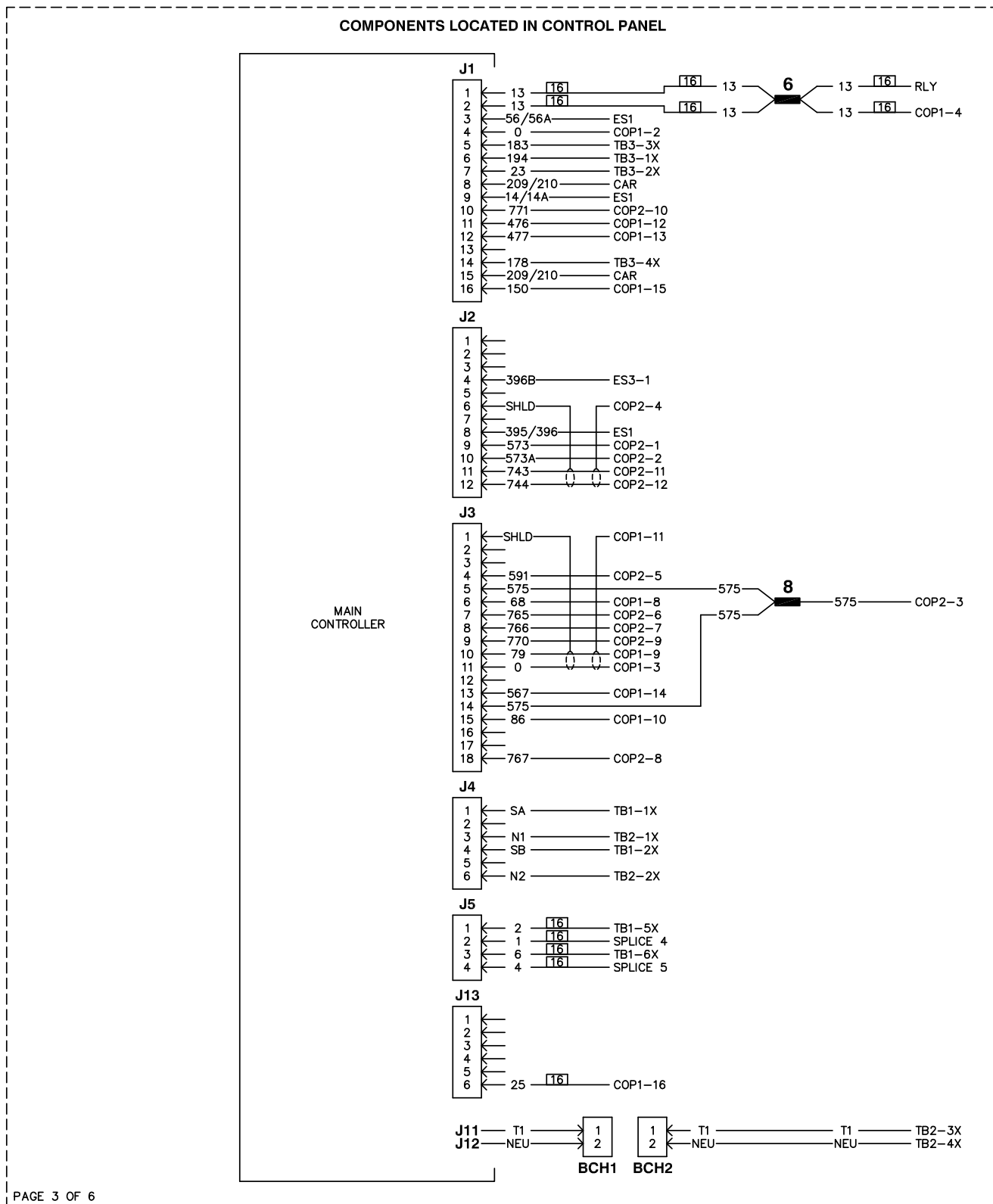
GROUP G



GROUP G



GROUP G



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WIRING - DIAGRAM

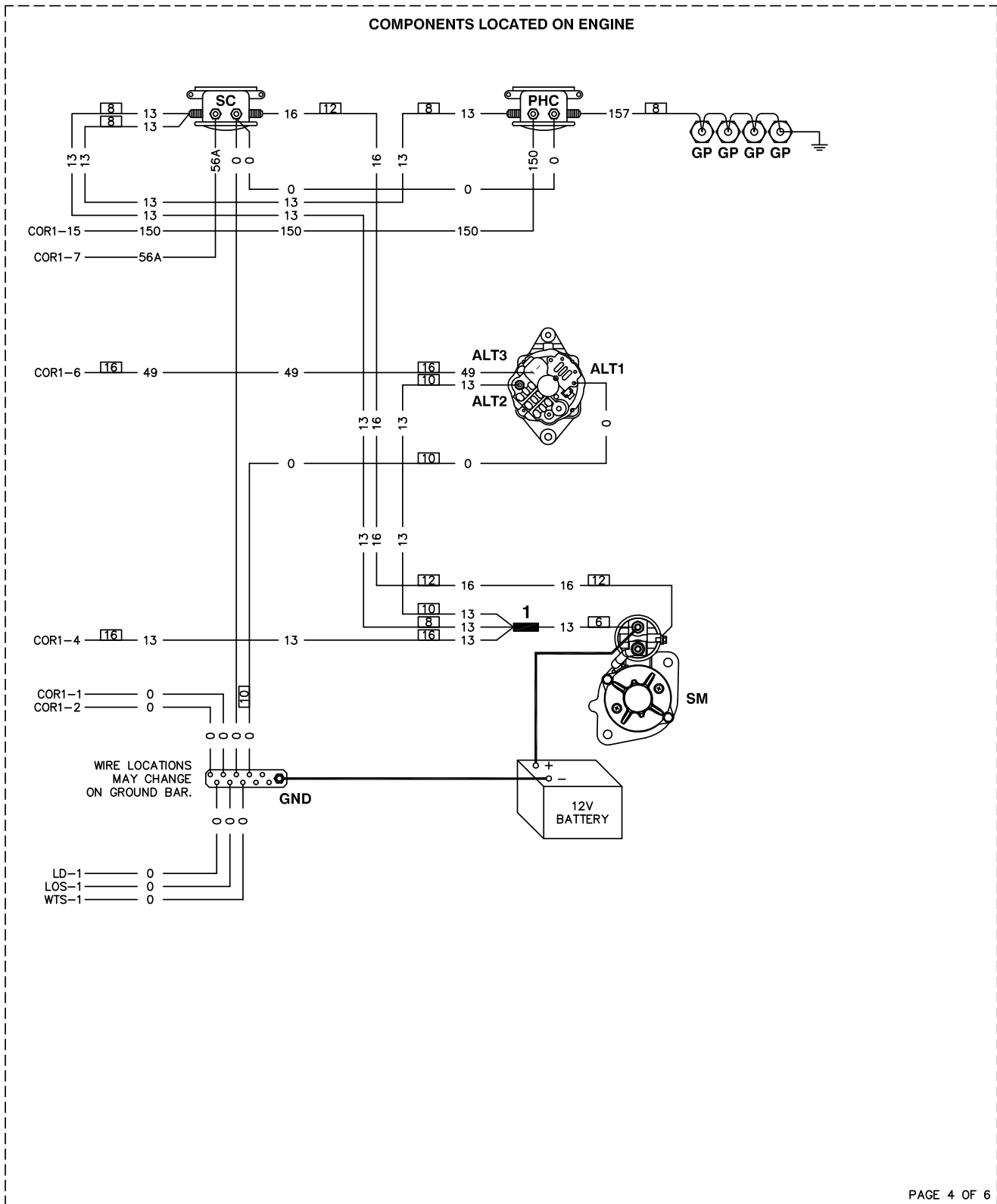
D2.5L/D3.3L G2 CPL

REVISION: A
DATE: 8/3/17

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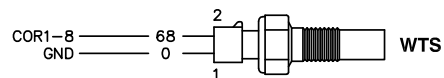
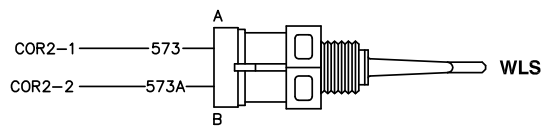
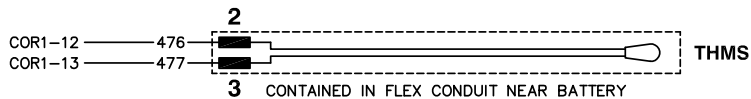
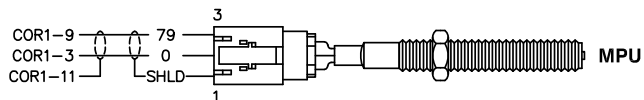
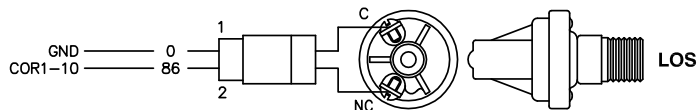
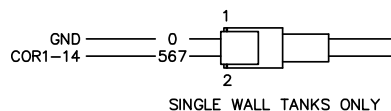
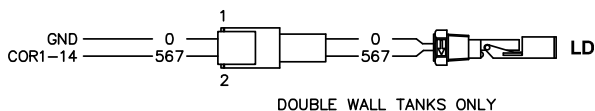
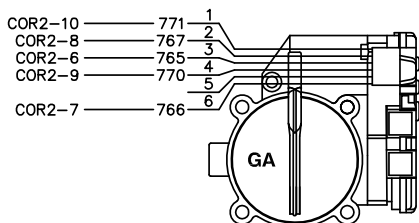
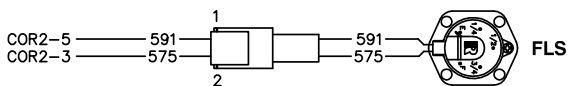
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GROUP G



GROUP G

COMPONENTS LOCATED ON ENGINE



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WIRING - DIAGRAM
D2.5L/D3.3L G2 CPL
DRAWING #: 10000014610

GROUP G

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REVISION: A
DATE: 8/3/17

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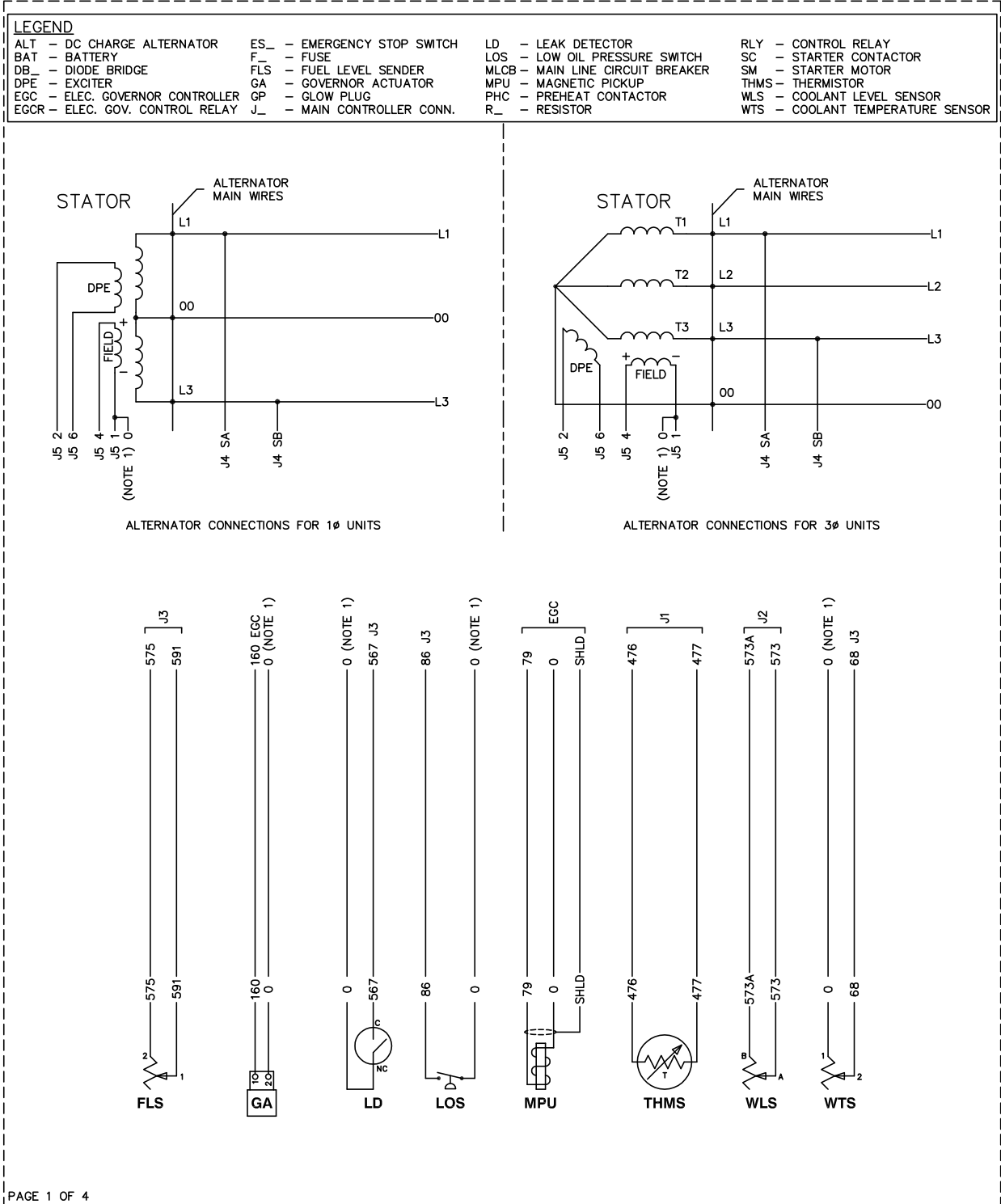
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D2.5L/D3.3L G2 CPL
DRAWING #: 10000014610

Section 5.5 1000019325-A Electrical Schematic D2.2L G2 CPL

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

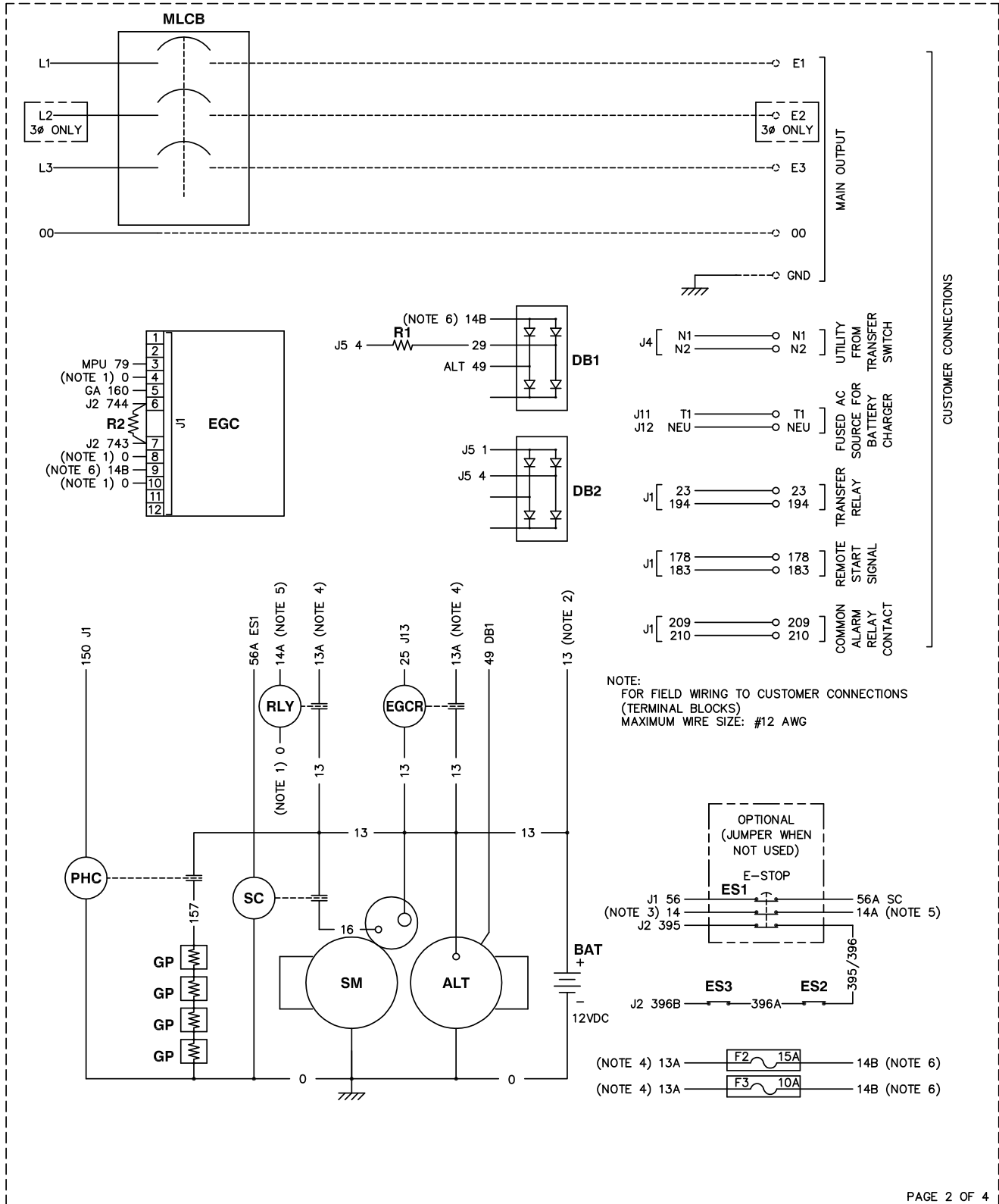


REVISION: A
DATE: 10/23/17

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SCHEMATIC - DIAGRAM
D2.2L G2 CPL
DRAWING #: 1000019325

GROUP G



GROUP G

- NOTES:
 1) WIRE# 0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 2) WIRE# 13 IS UNFUSED +12VDC (BATTERY+).
 3) WIRE# 14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 4) WIRE #13A IS UNFUSED +12VDC (BATTERY+) WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
 5) WIRE# 14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
 6) WIRE# 14B IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED 13A).

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	13	BATTERY+	NOTE 2
2	13	BATTERY+	NOTE 2
3	56/56A	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209/210	CAR	COMMON ALARM
9	14/14A	ES1	NOTE 3
10	771*	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
14	178	CUST CON	REMOTE START
15	209/210	CAR	COMMON ALARM
16	150	PHC	PREHEAT

J2

PIN	WIRE	TO	FUNCTION
4	396B	ES3-1	E-STOP RETURN
6	SHLD	EGC (CUT)	CAN COMMUNICATION SHIELD
8	395/396	ES1	E-STOP SOURCE
9	573	WLS-A	COOLANT LEVEL SIGNAL
10	573A	WLS-B	COOLANT LEVEL SIGNAL RETURN
11	743	EGC J1-7	CAN COMMUNICATION HIGH
12	744	EGC J1-6	CAN COMMUNICATION LOW

*WIRES USED ON D2.5L & D3.3L ONLY. MAG PICK-UP AND GOVERNOR ACTUATOR WIRES ARE IN ITS OWN CIRCUIT FOR THE D2.2L.

J3

PIN	WIRE	TO	FUNCTION
1	SHLD*	MPU-1	MAG PICKUP SENSOR DRAIN
4	591	FLS-1	FUEL LEVEL RETURN
5	575	FLS-2	FUEL LEVEL +
6	68	WTS-2	COOLANT TEMP SIGNAL
7	765*	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766*	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770*	GA-4	THROTTLE DRIVE HI
10	79*	MPU-3	MAG PICKUP SIGNAL (+)
11	0*	MPU-2	MAG PICKUP SIGNAL (-)
13	567	LD-2	LEAK DETECTOR
14	575	FLS-2	FUEL LEVEL +
15	86	LOS-2	LOW OIL PRESSURE SIGNAL
18	767*	GA-2	THROTTLE POSITION FEEDBACK RETURN

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

J13

PIN	WIRE	TO	FUNCTION
6	25	EGCR-85	ELECTRONIC GOVERNOR RELAY COIL +

GROUP G

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SCHEMATIC - DIAGRAM
D2.2L G2 CPL
DRAWING #: 10000019325

REVISION: A
DATE: 10/23/17

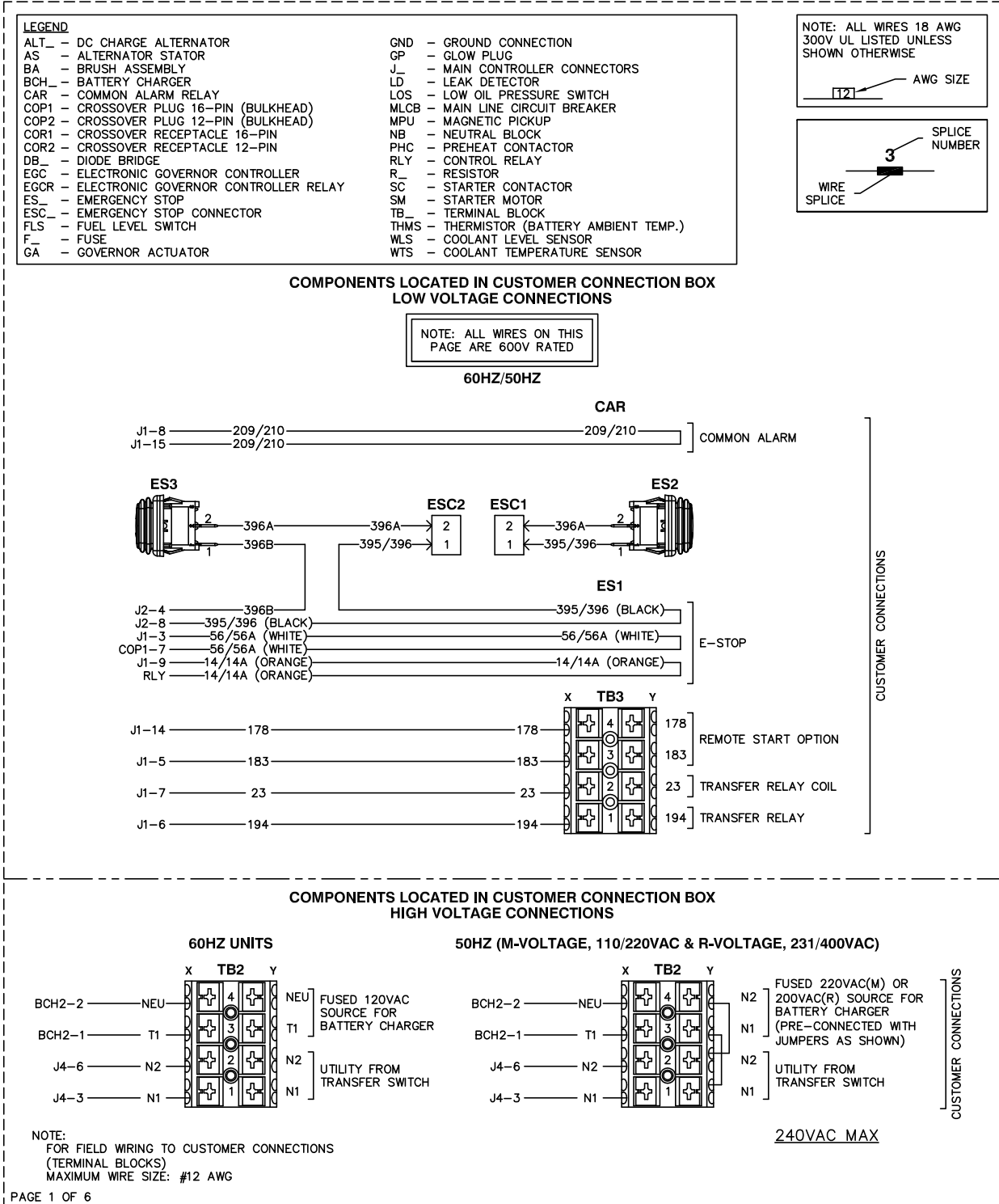
PAGE 4 OF 4

Section 5.6 10000019333-A Wiring Diagram D2.2L G2 CPL

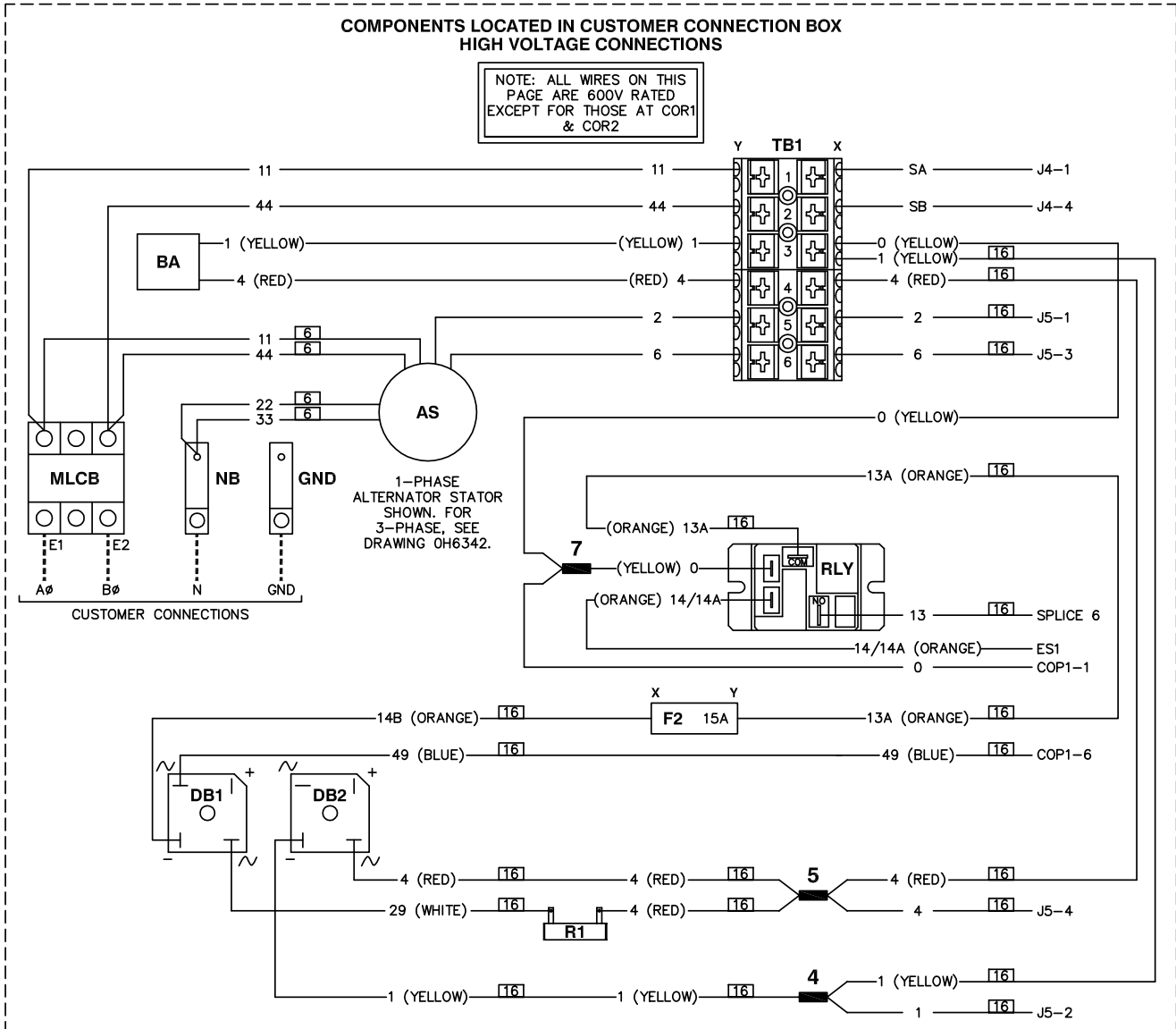
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

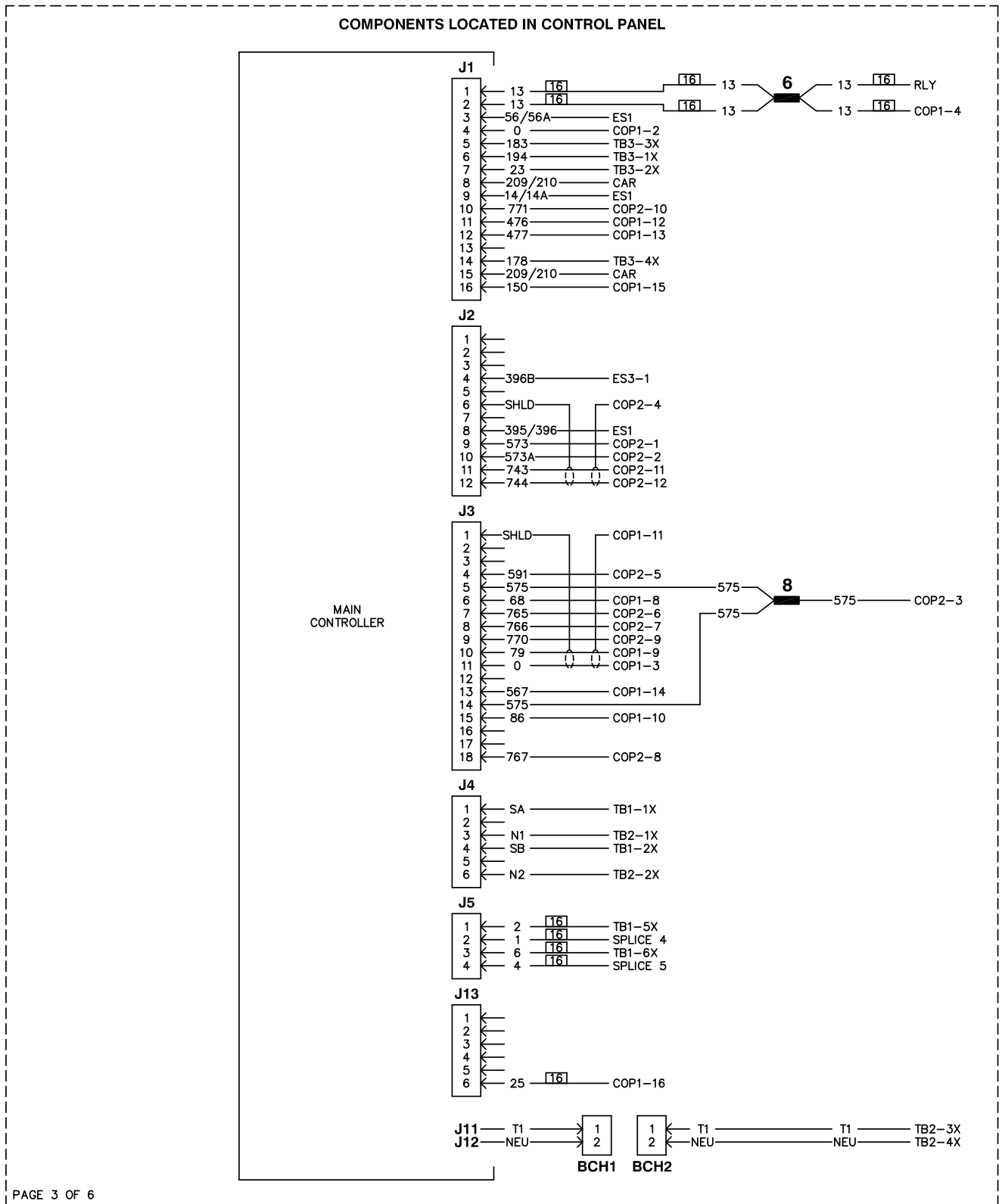
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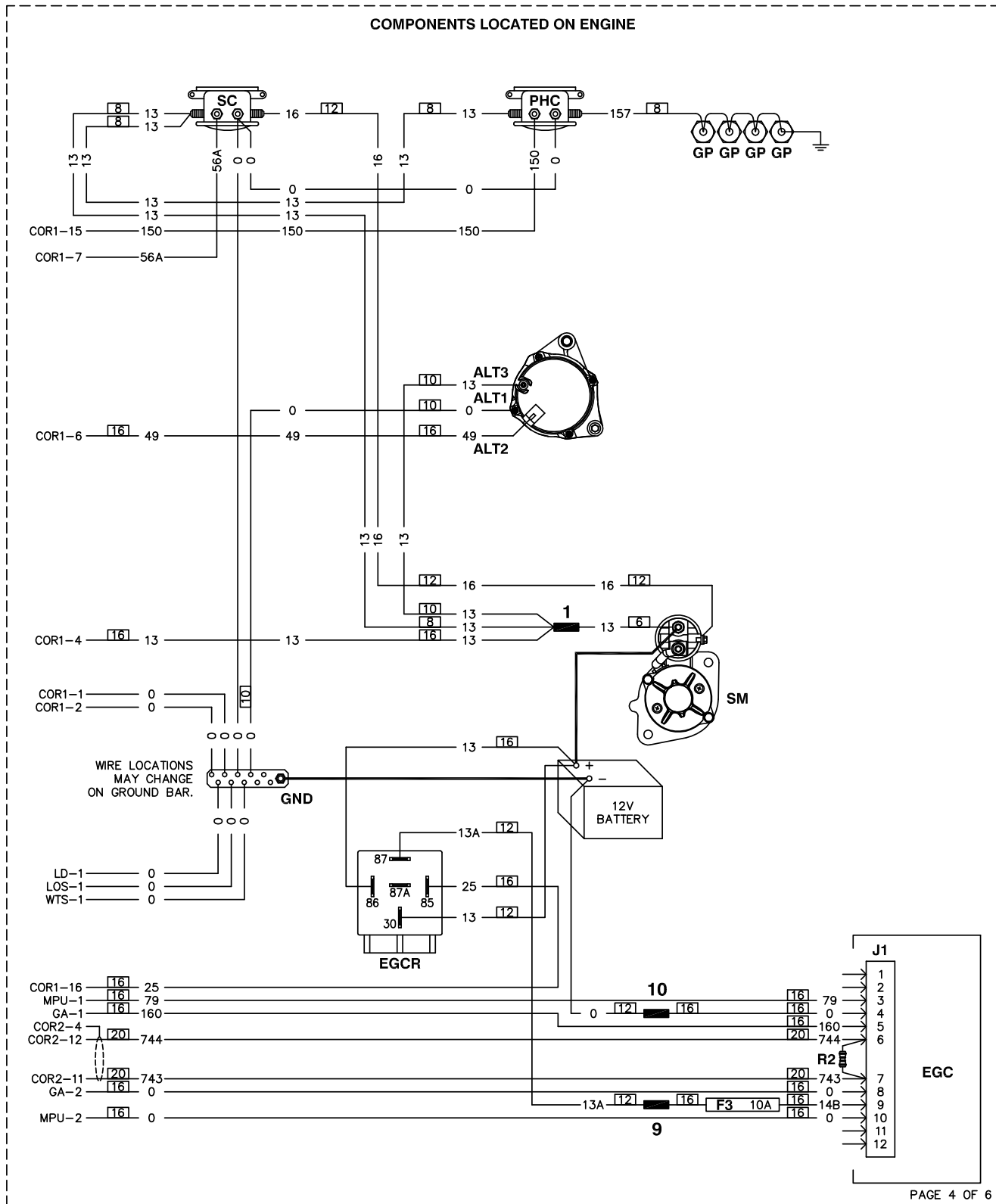
GROUP G



GROUP G



GROUP G



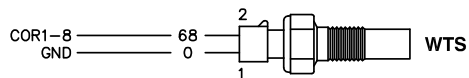
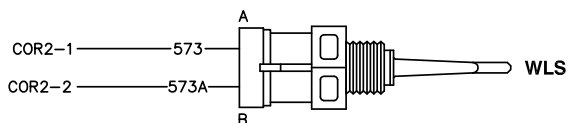
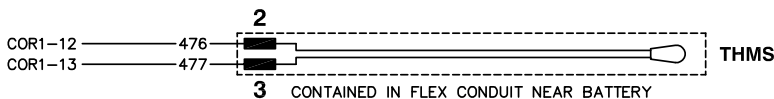
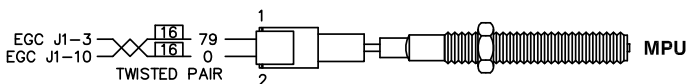
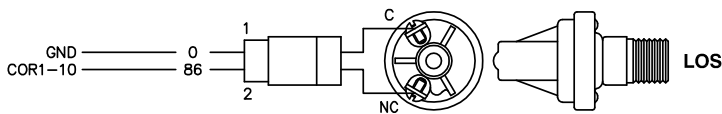
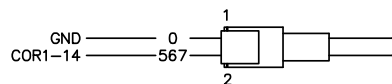
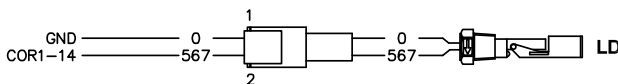
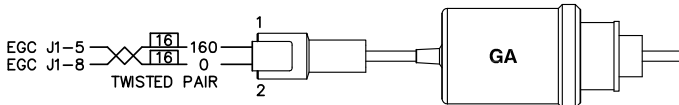
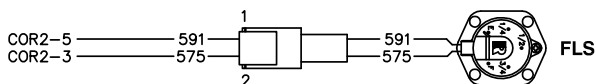
WIRING - DIAGRAM

D2.2L G2 CPL

DRAWING #: 10000019333

GROUP G

COMPONENTS LOCATED ON ENGINE



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REVISION: A
DATE: 10/23/17

PAGE 5 OF 6

WIRING - DIAGRAM
D2.2L G2 CPL
DRAWING #: 10000019333

GROUP G

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PAGE 6 OF 6

WIRING - DIAGRAM
D2.2L G2 CPL

REVISION: A
DATE: 10/23/17

PAGE 6 OF 6

DRAWING #: 10000019333

Section 5.7 *OK8579-B Wiring Diagram 1.5L Gaseous Protector - Evolution*

Introduction

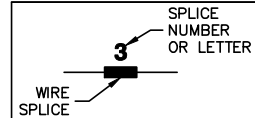
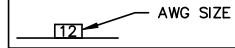
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

- | | |
|---|---|
| ALT - DC CHARGE ALTERNATOR | FSP - FUEL SOLENOID PLUG |
| AS - ALTERNATOR STATOR | FSR - FUEL SOLENOID RECEPTACLE |
| BA - BRUSH ASSEMBLY | GA - GOVERNOR ACTUATOR |
| BAT - BATTERY | GND - GROUND CONNECTION |
| BCH_ - BATTERY CHARGER | J_ - MAIN CONTROLLER CONNECTORS |
| CAM - CAMSHAFT SENSOR | LFP - LOW FUEL PRESSURE SWITCH |
| CAR - COMMON ALARM RELAY | LOS - LOW OIL PRESSURE SWITCH |
| COP1 - CROSSOVER PLUG 16-PIN (BULKHEAD) | MLCB - MAIN LINE CIRCUIT BREAKER |
| COP2 - CROSSOVER PLUG 12-PIN (BULKHEAD) | MPU - MAGNETIC PICKUP |
| COP3 - CROSSOVER PLUG 10-PIN (BULKHEAD) | NB - NEUTRAL BLOCK |
| COR1 - CROSSOVER RECEPTACLE 16-PIN | RLY - CONTROL RELAY |
| COR2 - CROSSOVER RECEPTACLE 12-PIN | R - RESISTOR |
| COR3 - CROSSOVER RECEPTACLE 10-PIN | SC - STARTER CONTACTOR |
| CYL_ - CYLINDER IGNITION COIL | SM - STARTER MOTOR |
| DB_ - DIODE BRIDGE | TB_ - TERMINAL BLOCK |
| DCVR - DC VOLTAGE REGULATOR | THMS - THERMISTOR (BATTERY AMBIENT TEMP.) |
| ES - EMERGENCY STOP | WLS - COOLANT LEVEL SENSOR |
| F_ - FUSE | WTS - COOLANT TEMPERATURE SENSOR |
| FS_ - FUEL SOLENOID | |

NOTE: ALL WIRES 18 AWG
BLACK 300V UL LISTED
UNLESS SHOWN OTHERWISE

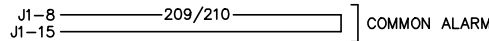


**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
LOW VOLTAGE CONNECTIONS**

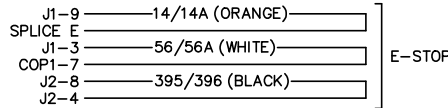
NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

60HZ/50HZ

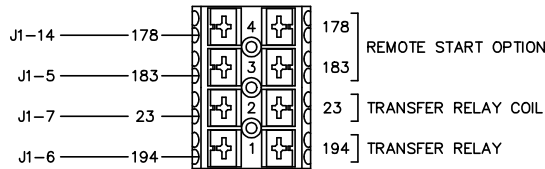
CAR



ES



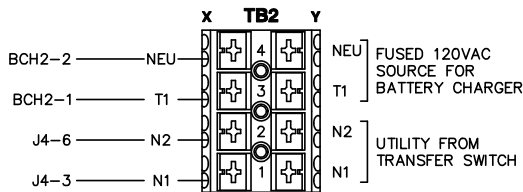
TB3



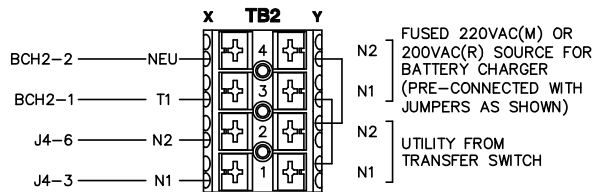
CUSTOMER CONNECTIONS

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
HIGH VOLTAGE CONNECTIONS**

60HZ UNITS



50HZ (M-VOLTAGE, 110/220VAC & R-VOLTAGE, 231/400VAC)

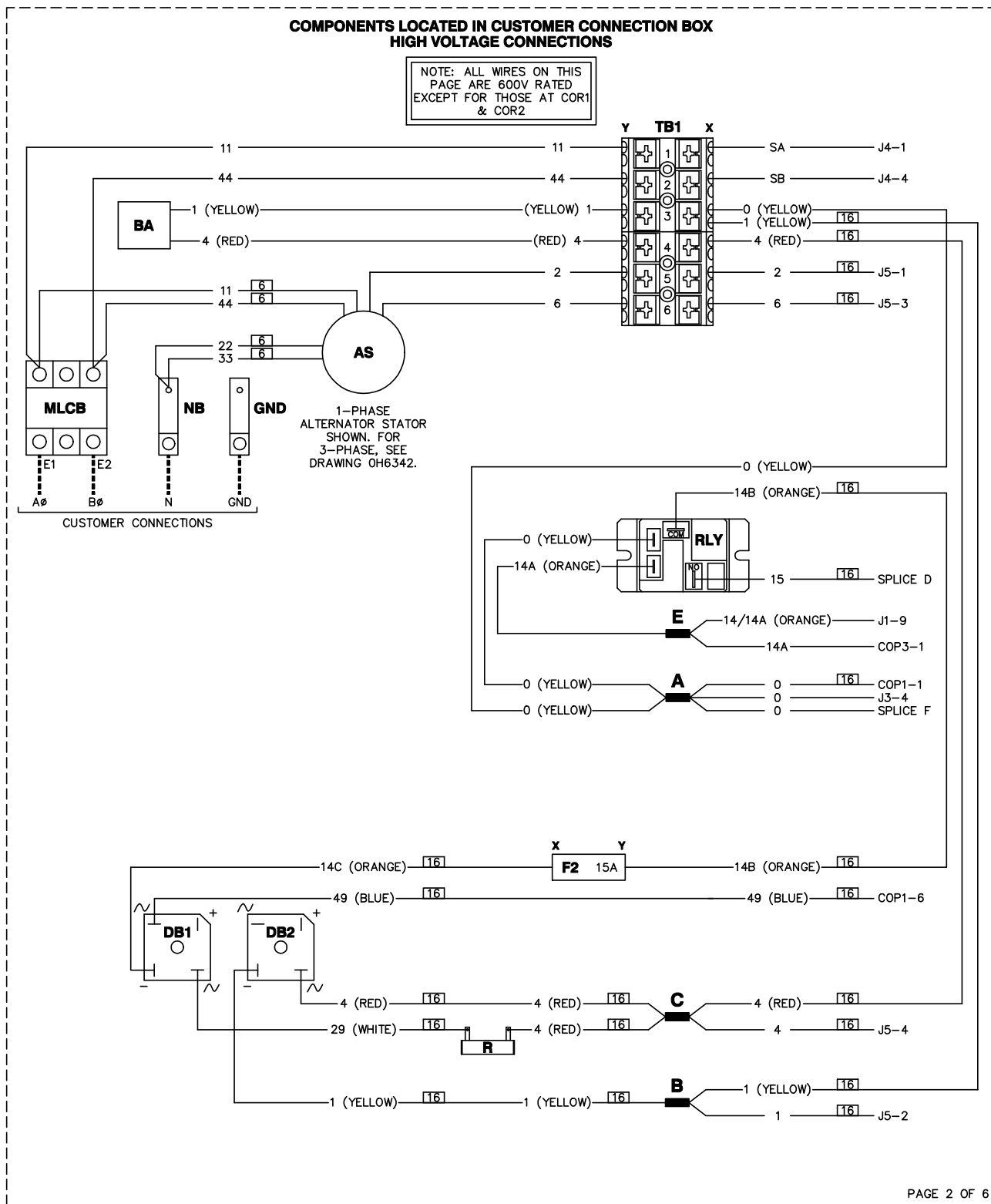


240VAC MAX

CUSTOMER CONNECTIONS

NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

GROUP G



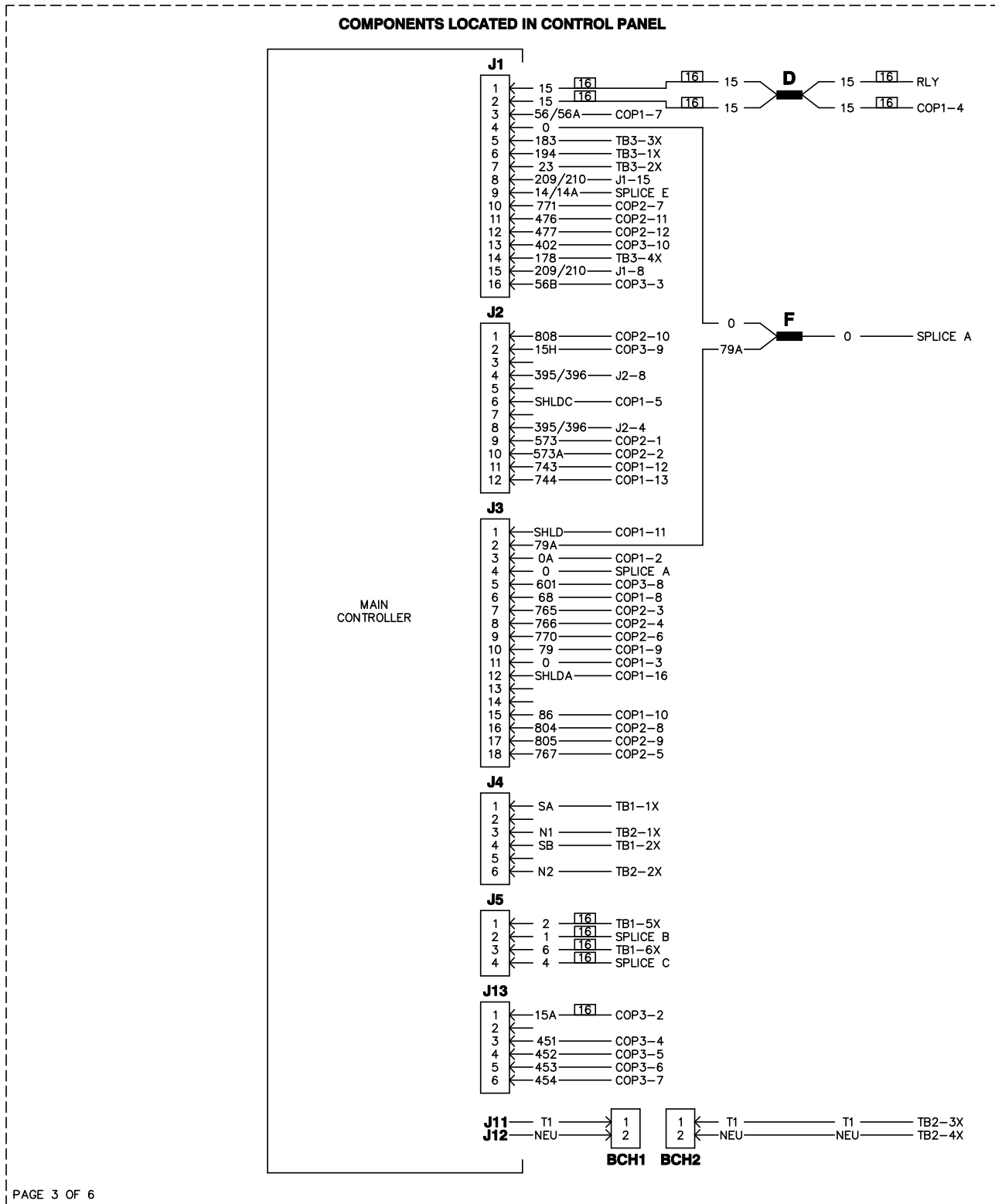
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DATE: 8/4/15

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**WIRING - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8579**

GROUP G



PAGE 3 OF 6

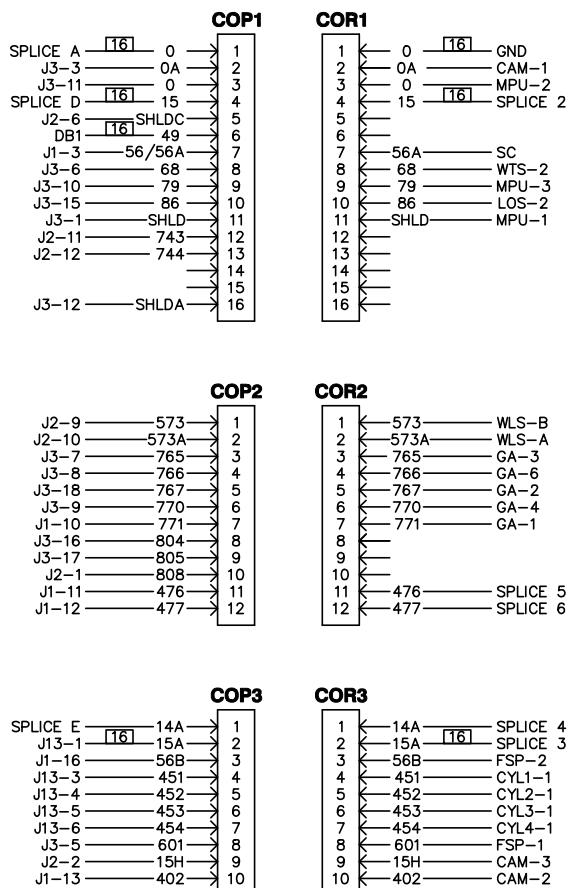
REVISION: K-3541-B
DATE: 8/4/15

PAGE 3 OF 6

WIRING - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8579

GROUP G

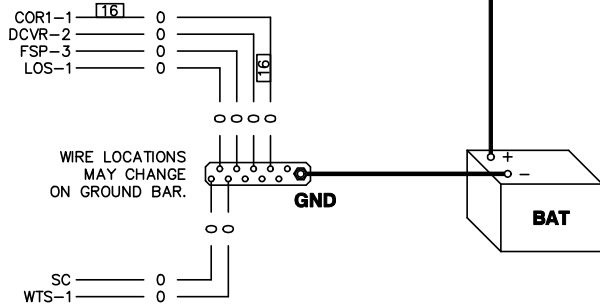
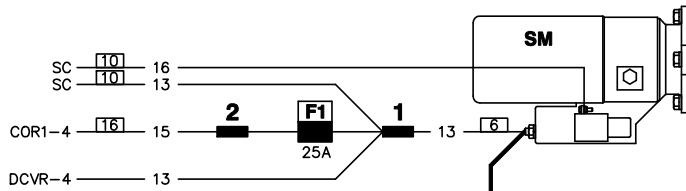
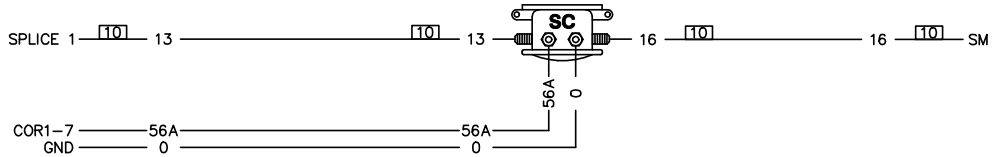
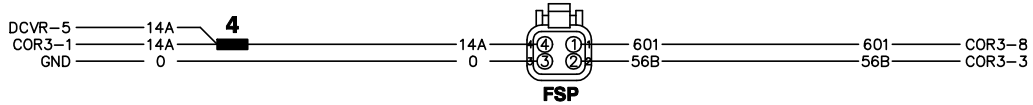
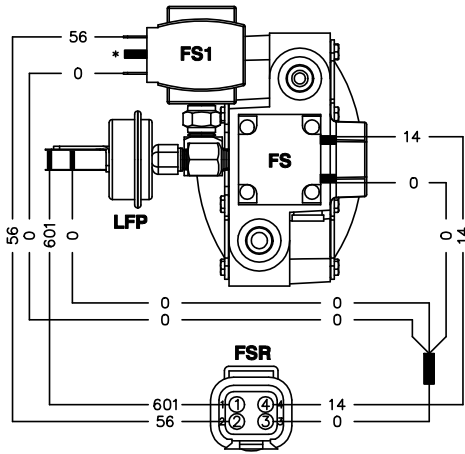
COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX & ON ENGINE BULKHEAD CROSSOVER CONNECTIONS



GROUP G

COMPONENTS LOCATED ON ENGINE

* CENTER TERMINAL NOT USED



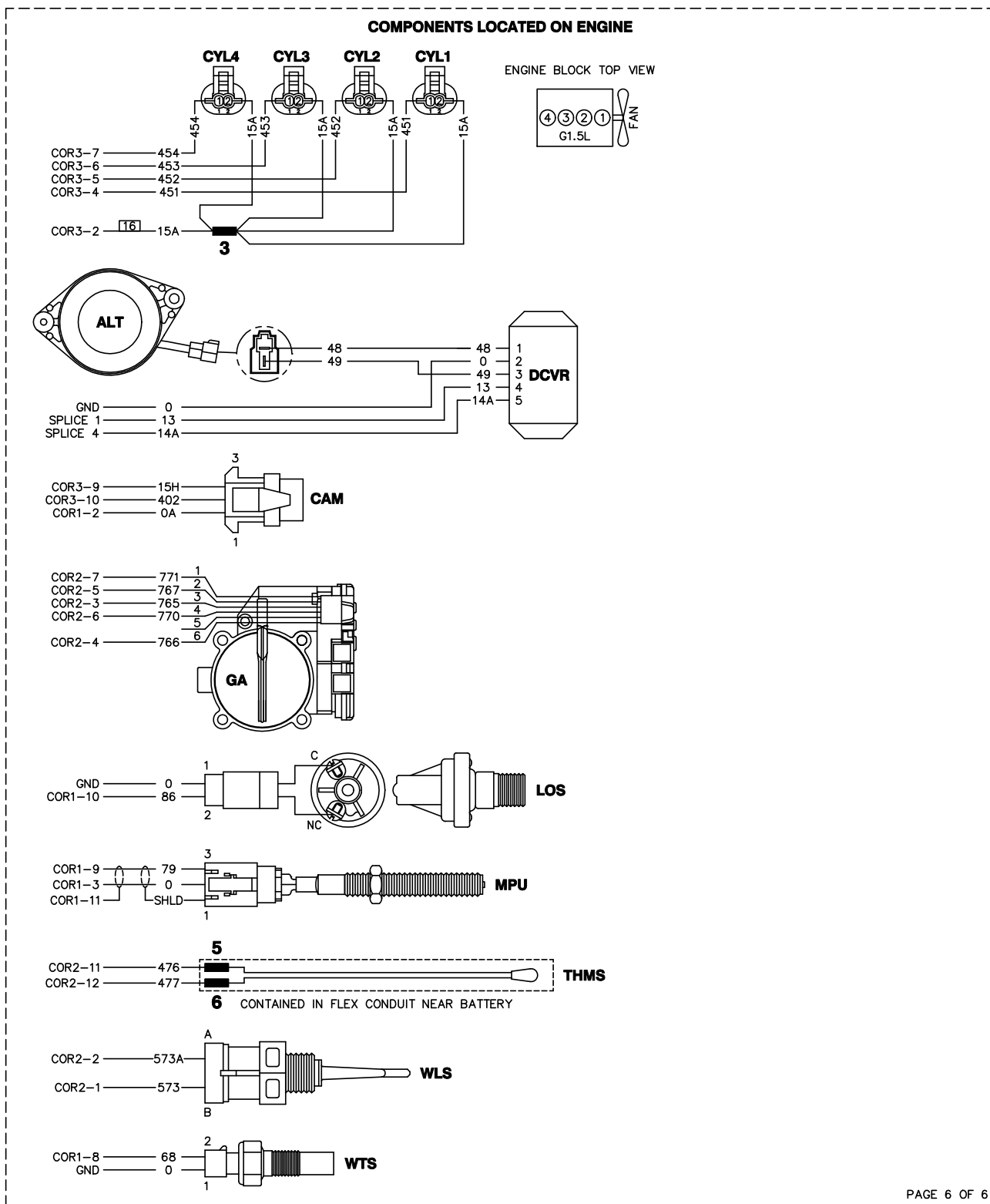
PAGE 5 OF 6

WIRING - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8579

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DATE: 8/4/15

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GROUP G



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DATE: 8/4/15

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WIRING - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8579

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Section 5.8 *OK8580-A Electrical Schematic 1.5L Gaseous Protector - Evolution*

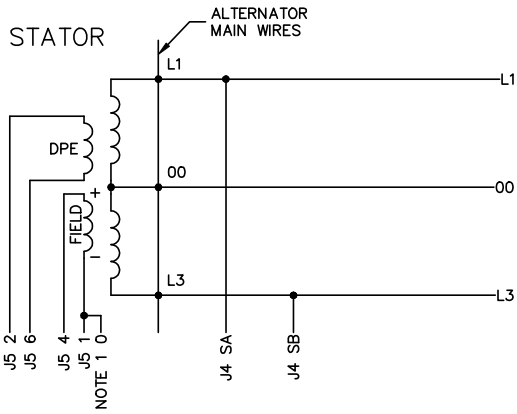
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

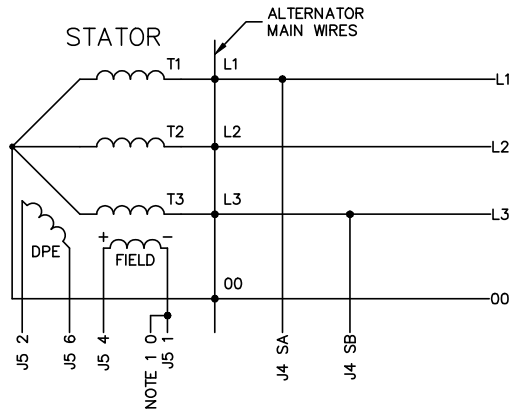
GROUP G

LEGEND

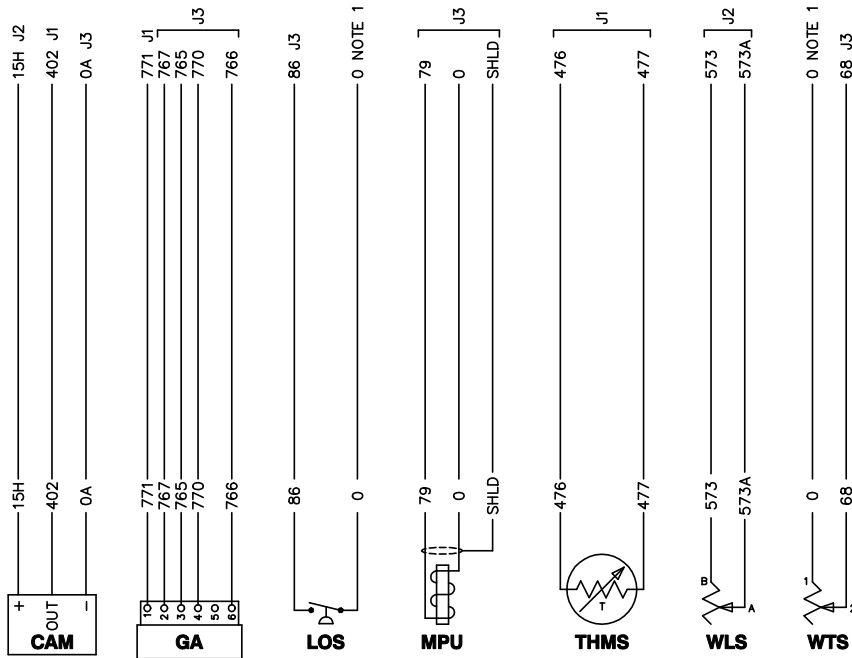
- | | | |
|-------------------------------|--------------------------------------|---|
| ALT - DC CHARGE ALTERNATOR | FS_ - FUEL SOLENOID | SC - STARTER CONTACTOR |
| BAT - BATTERY | GA - GOVERNOR ACTUATOR | SM - STARTER MOTOR |
| CAM - CAMSHAFT SENSOR | J_ - ENGINE CONTROL MODULE CONNECTOR | SP_ - SPARK PLUG |
| CYL_ - CYLINDER IGNITION COIL | LFP - LOW FUEL PRESSURE SWITCH | THMS - THERMISTOR (BATTERY AMBIENT TEMP.) |
| DB_ - DIODE BRIDGE | LOS - LOW OIL PRESSURE SWITCH | WLS - COOLANT LEVEL SENDER |
| DCVR - DC VOLTAGE REGULATOR | MLCB - MAIN LINE CIRCUIT BREAKER | WTS - COOLANT TEMPERATURE SENDER |
| DPE - EXCITER | MPU - MAGNETIC PICKUP | |
| F1 - FUSE INLINE | R - RESISTOR | |



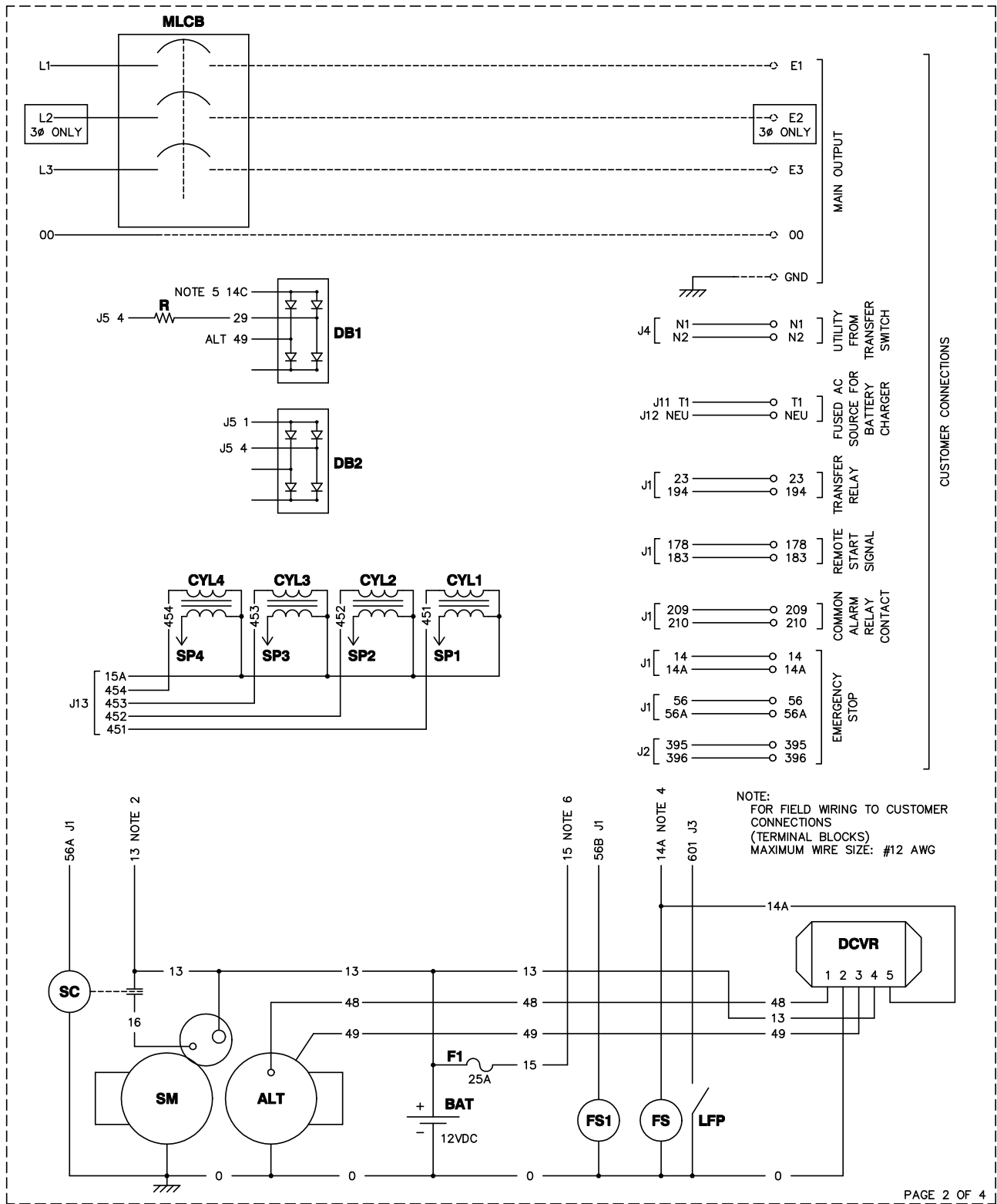
ALTERNATOR CONNECTIONS FOR 1 ϕ UNITS



ALTERNATOR CONNECTIONS FOR 3 ϕ UNITS



GROUP G



NOTE:
FOR FIELD WIRING TO CUSTOMER
CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

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SCHEMATIC - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8580

GROUP G

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	15	F1	NOTE 6
2	15	F1	NOTE 6
3	56/56A	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209/210	CAR	COMMON ALARM RELAY
9	14/14A	ES1	NOTE 3/NOTE 4
10	771	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
13	402	CAM-2	HALL-EFFECT CAMSHAFT SENSOR SIGNAL
14	178	CUST CON	REMOTE START
15	209/210	CAR	COMMON ALARM RELAY
16	56B	FS1	START CONTACTOR CONTROL

J2

PIN	WIRE	TO	FUNCTION
2	15H	CAM-3	HALL-EFFECT CAMSHAFT SENSOR +
4	395/396	ES1	EMERGENCY STOP
8	395/396	ES1	EMERGENCY STOP
9	573	WLS-B	COOLANT LEVEL SIGNAL
10	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN

J3

PIN	WIRE	TO	FUNCTION
1	SHLD	MPU-1	FLYWHEEL SENSOR DRAIN
2	79A	GND	NOTE 1
3	0A	CAM-1	HALL-EFFECT CAMSHAFT SENSOR -
4	0	GND	NOTE 1
5	601	LFP	LOW FUEL PRESSURE
6	68	WTS-2	COOLANT TEMPERATURE SIGNAL
7	765	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770	GA-4	THROTTLE DRIVE HI
10	79	MPU-3	FLYWHEEL SENSOR +
11	0	MPU-2	FLYWHEEL SENSOR -
15	86	LOS-NC	LOW OIL PRESSURE SIGNAL
18	767	GA-2	THROTTLE POSITION FEEDBACK RETURN

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

J13

PIN	WIRE	TO	FUNCTION
1	15A	CYL1-CYL4	NOTE 7
3	451	CYL1	IGNITION COIL DRIVE 1
4	452	CYL2	IGNITION COIL DRIVE 2
5	453	CYL3	IGNITION COIL DRIVE 3
6	454	CYL4	IGNITION COIL DRIVE 4

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
- 5) WIRE #14C IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED WIRE #15 & SWITCHED WIRE #14A).
- 6) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 7) WIRE #15A IS FUSED +12VDC FOR THE IGNITION COILS.

GROUP G



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DATE: 8/8/14

PAGE 4 OF 4

SCHEMATIC - DIAGRAM
G1.5L G11 PROTECTOR
DRAWING #: 0K8580

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Section 5.9 *0K7685-A Wiring Diagram 2.4L Gaseous Protector - Evolution*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND	
AFS - AIR/FUEL SOLENOID	FSP - FUEL SOLENOID PLUG
ALT - DC CHARGE ALTERNATOR	FSR - FUEL SOLENOID RECEPTACLE
AS - ALTERNATOR STATOR	GA - GOVERNOR ACTUATOR
BA - BRUSH ASSEMBLY	GND - GROUND CONNECTION
BAT - BATTERY	J - MAIN CONTROLLER CONNECTORS
BCH - BATTERY CHARGER	LFP - LOW FUEL PRESSURE SWITCH
CAR - COMMON ALARM RELAY	LOS - LOW OIL PRESSURE SWITCH
COP1 - CROSSOVER PLUG 16-PIN (BULKHEAD)	MLCB - MAIN LINE CIRCUIT BREAKER
COP2 - CROSSOVER PLUG 12-PIN (BULKHEAD)	MPU - MAGNETIC PICKUP
COP3 - CROSSOVER PLUG 10-PIN (BULKHEAD)	NB - NEUTRAL BLOCK
COR1 - CROSSOVER RECEPTACLE 16-PIN	OS - OXYGEN SENDER
COR2 - CROSSOVER RECEPTACLE 12-PIN	RLY - CONTROL RELAY
COR3 - CROSSOVER RECEPTACLE 10-PIN	R - RESISTOR
CYL - CYLINDER IGNITION COIL	SC - STARTER CONTACTOR
DB - DIODE BRIDGE	SM - STARTER MOTOR
EC - EMISSIONS CONNECTOR	TB - TERMINAL BLOCK
ES - EMERGENCY STOP	THMS - THERMISTOR (BATTERY AMBIENT TEMP.)
F - FUSE	WLS - COOLANT LEVEL SENSOR
FS - FUEL SOLENOID	WTS - COOLANT TEMPERATURE SENSOR

NOTE: ALL WIRES 18 AWG
BLACK 300V UL LISTED
UNLESS SHOWN OTHERWISE

12 AWG SIZE

3
SPLICE NUMBER OR LETTER

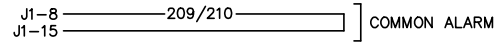
WIRE SPLICE

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
LOW VOLTAGE CONNECTIONS**

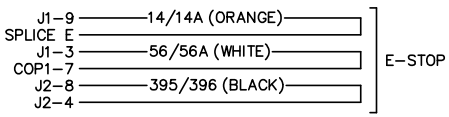
NOTE: ALL WIRES ON THIS PAGE ARE 600V RATED

60HZ/50HZ

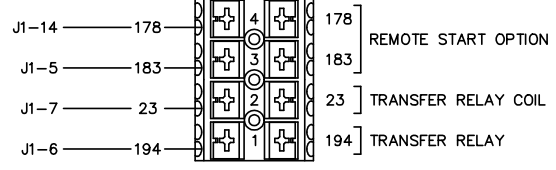
CAR



ES



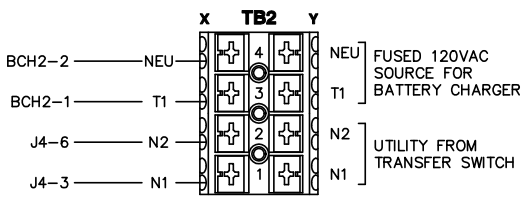
TB3



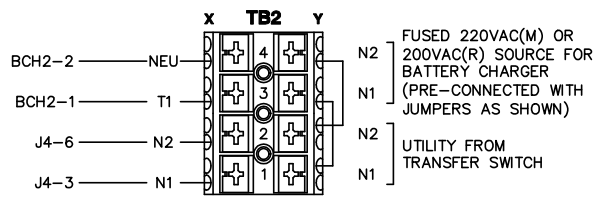
CUSTOMER CONNECTIONS

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
HIGH VOLTAGE CONNECTIONS**

60HZ UNITS



50HZ (M-VOLTAGE, 110/220VAC & R-VOLTAGE, 231/400VAC)

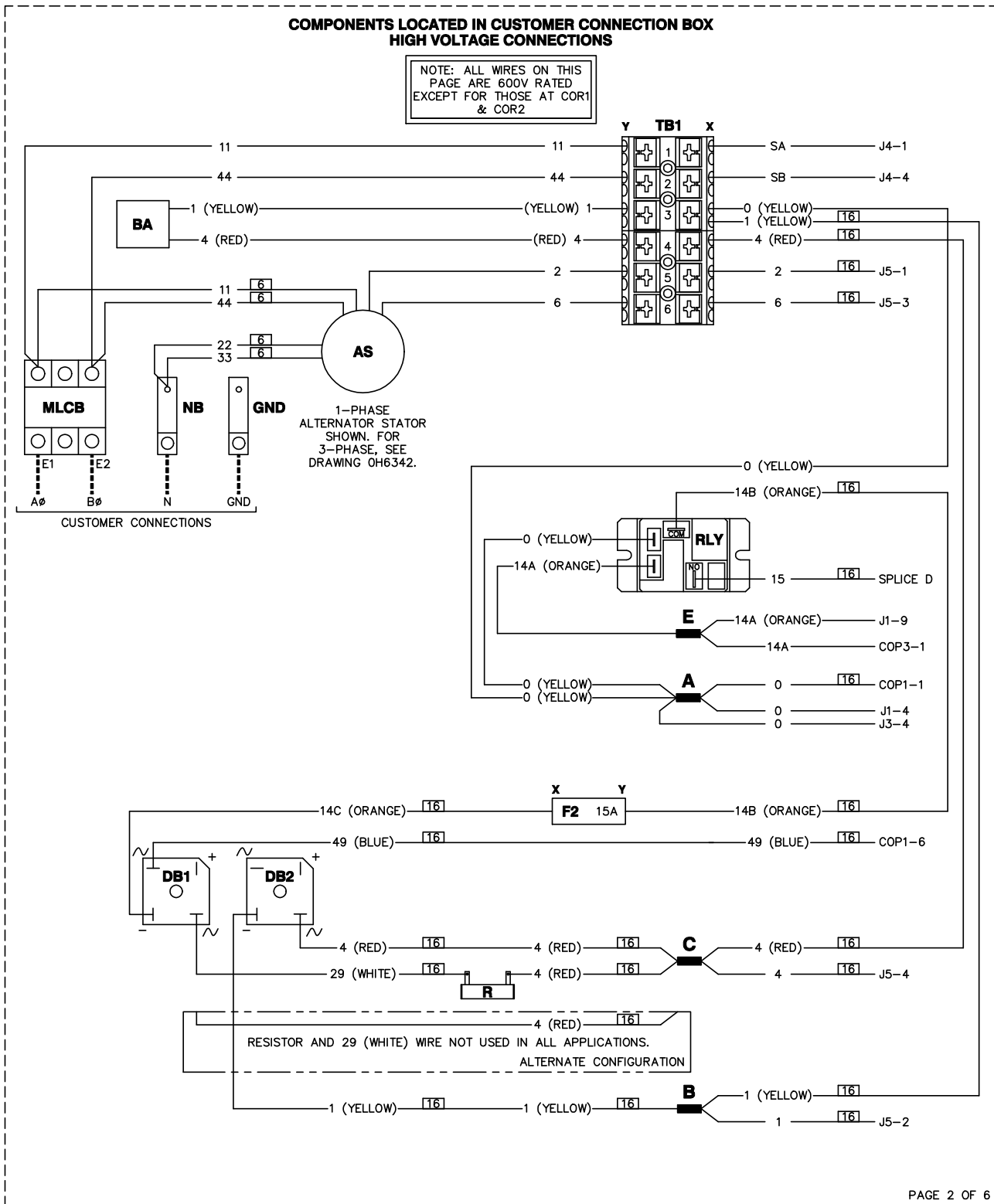


240VAC MAX

CUSTOMER CONNECTIONS

NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

GROUP G

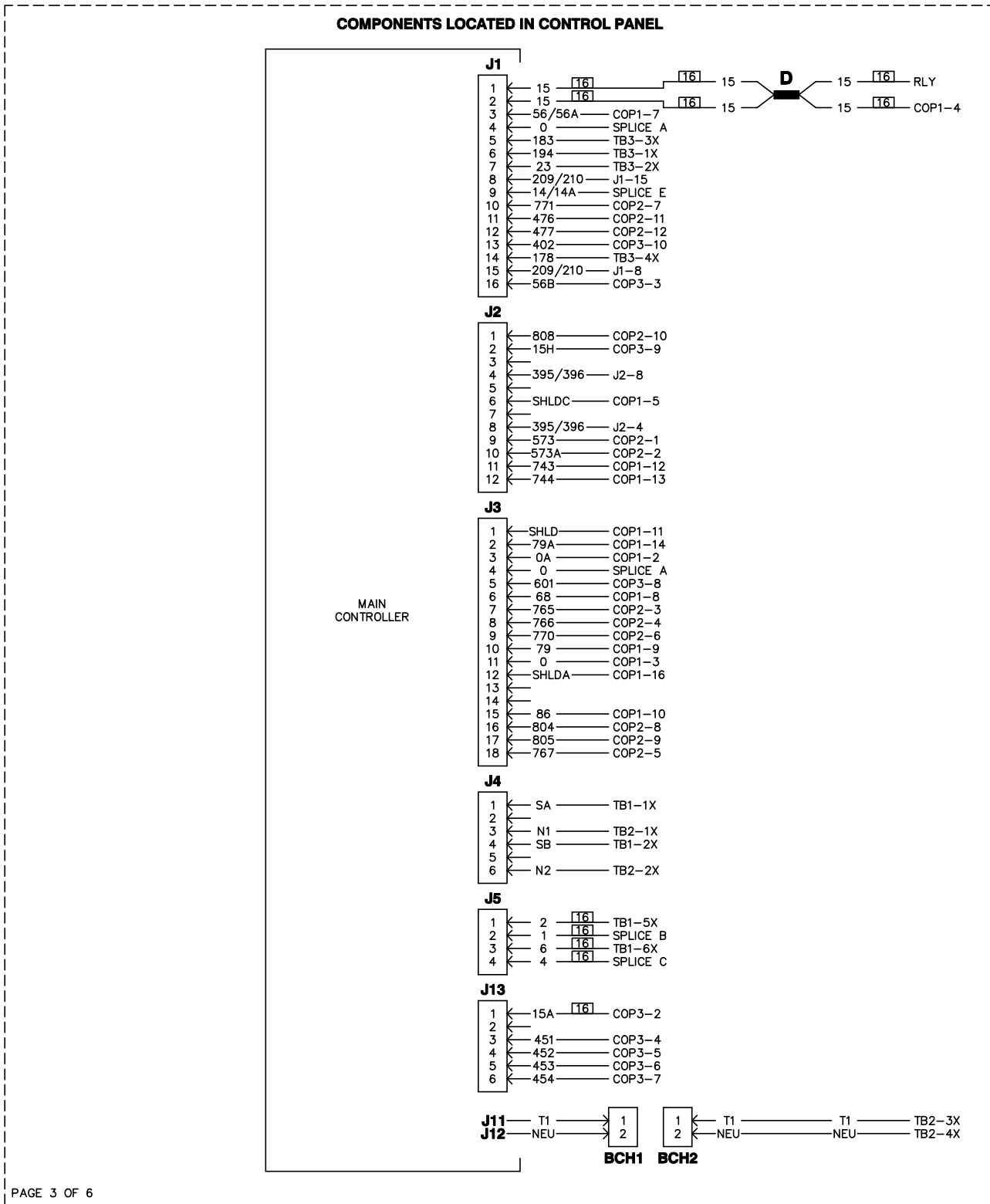


REVISION: -A-
DATE: 2/6/14

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**WIRING - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7685**

GROUP G



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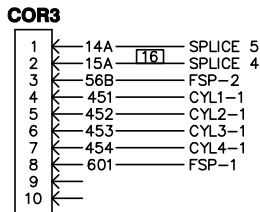
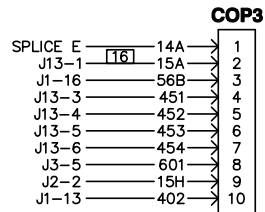
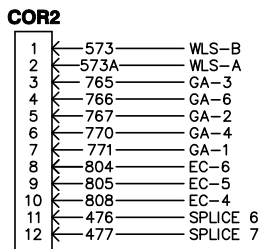
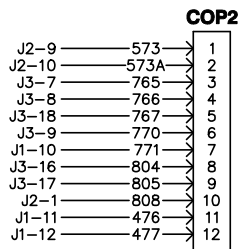
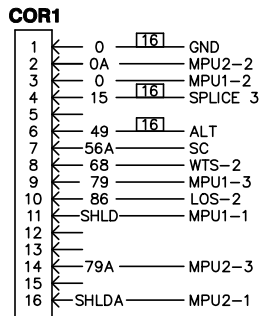
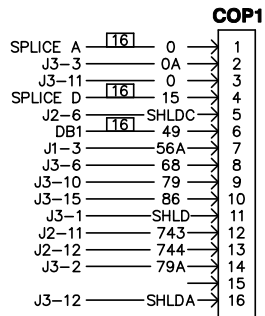
REVISION: -A-
 DATE: 2/6/14

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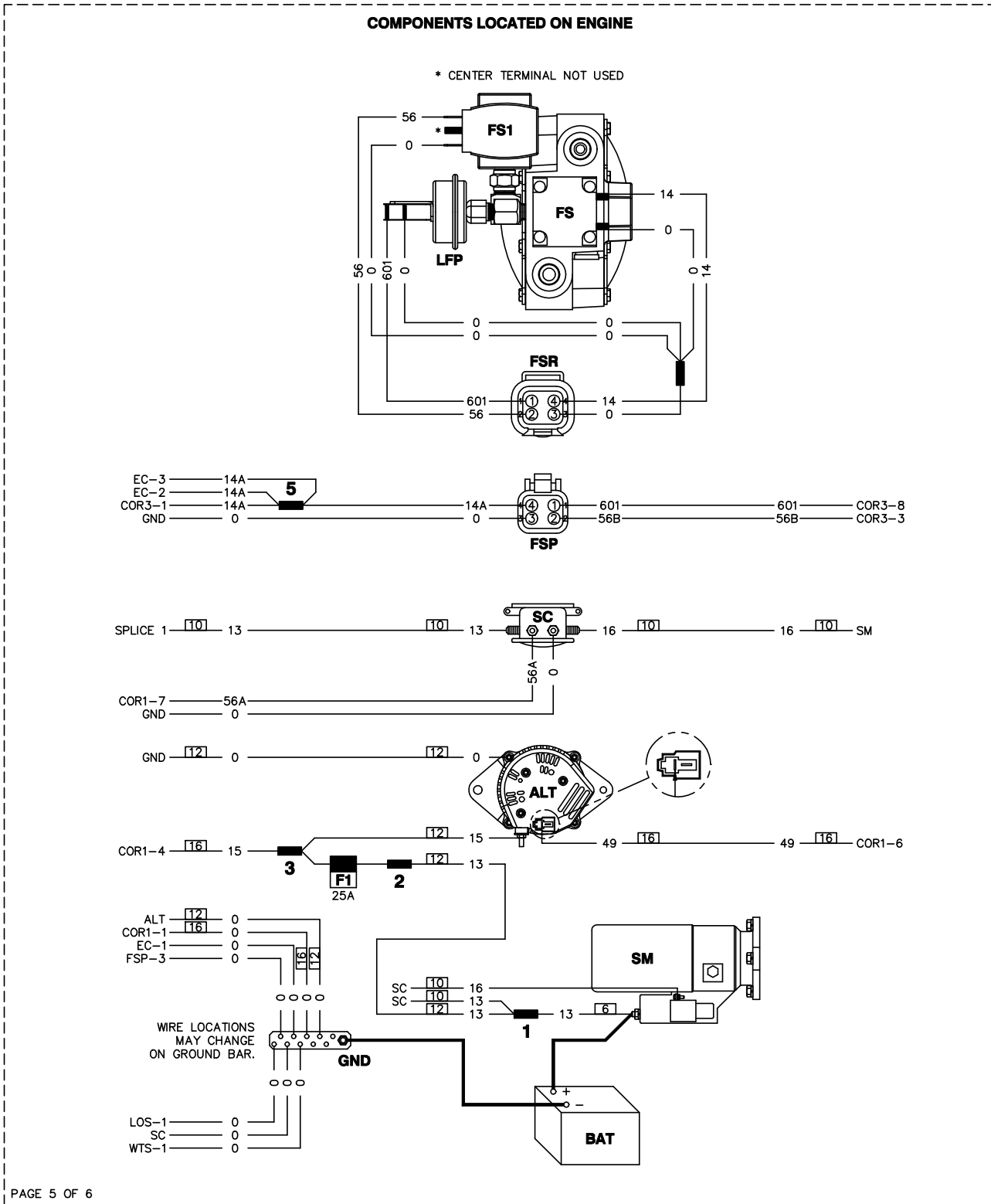
WIRING - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7685

GROUP G

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX & ON ENGINE
BULKHEAD CROSSOVER CONNECTIONS**



GROUP G



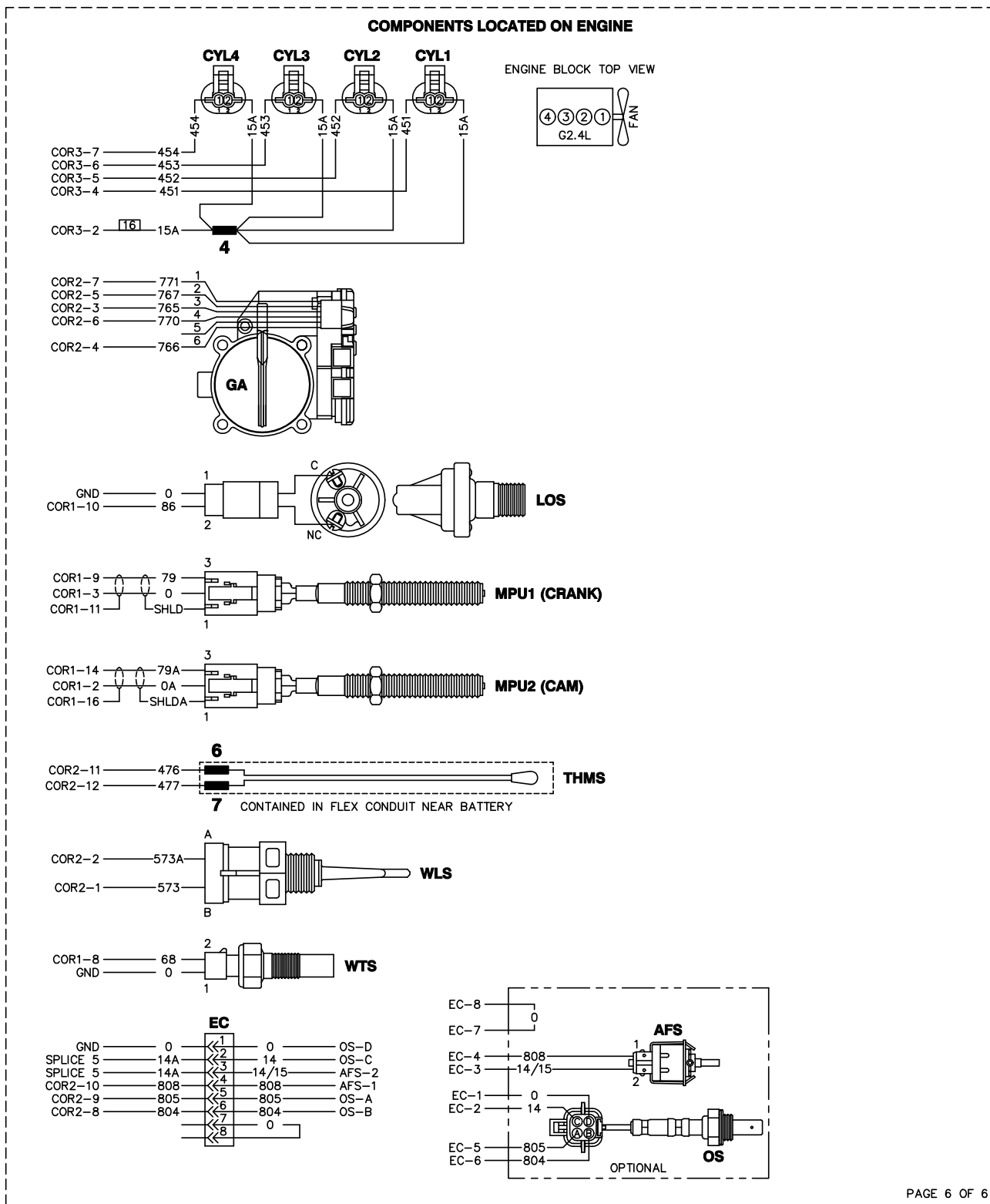
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WIRING - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7685

GROUP G



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REVISION: -A-
DATE: 2/6/14

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WIRING - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7685

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Section 5.10 *OK7686-A Electrical Schematic 2.4L Gaseous Protector - Evolution*

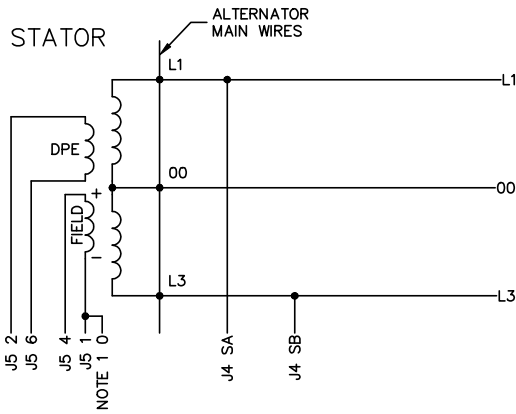
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

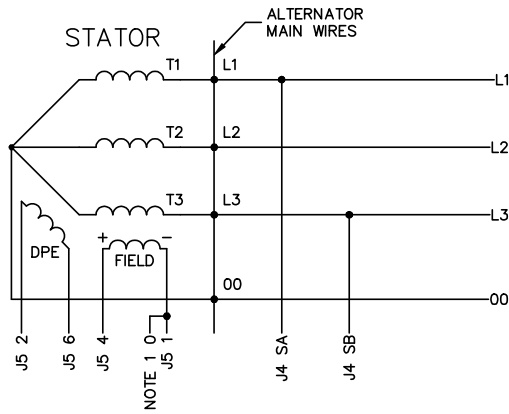
GROUP G

LEGEND

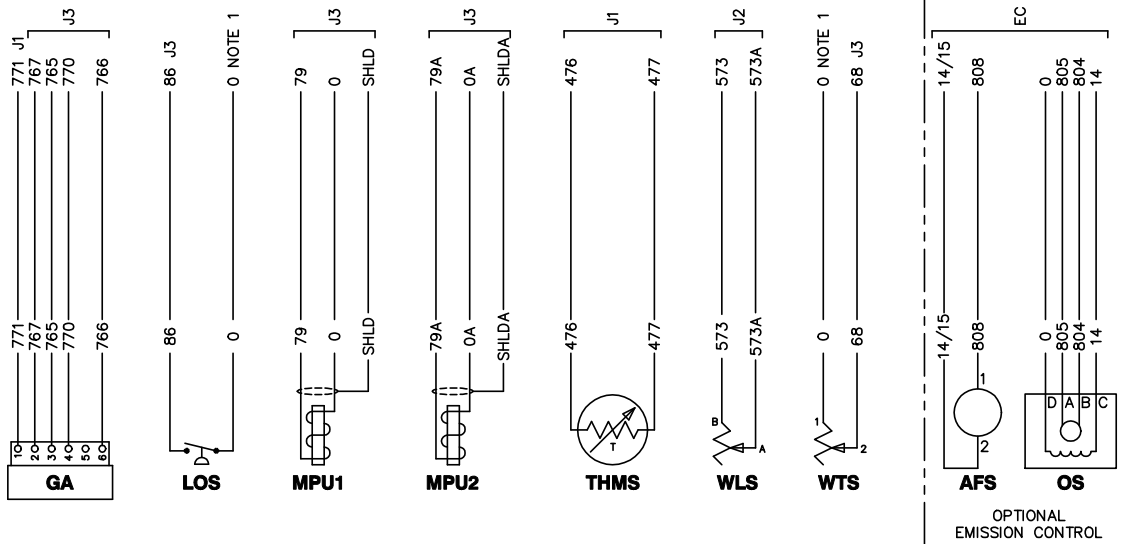
AFS - AIR/FUEL SOLENOID	FS_ - FUEL SOLENOID	R - RESISTOR
ALT - DC CHARGE ALTERNATOR	GA - GOVERNOR ACTUATOR	SC - STARTER CONTACTOR
BAT - BATTERY	J_ - ENGINE CONTROL MODULE CONNECTOR	SM - STARTER MOTOR
CYL_ - CYLINDER IGNITION COIL	LFP - LOW FUEL PRESSURE SWITCH	SP_ - SPARK PLUG
DB_ - DIODE BRIDGE	LOS - LOW OIL PRESSURE SWITCH	THMS - THERMISTOR (BATTERY AMBIENT TEMP.)
DPE - EXCITER	MLCB - MAIN LINE CIRCUIT BREAKER	WLS - COOLANT LEVEL SENDER
EC - EMISSIONS CONNECTOR	MPU_ - MAGNETIC PICKUP	WTS - COOLANT TEMPERATURE SENDER
F1 - FUSE INLINE	OS - OXYGEN SENDER	



ALTERNATOR CONNECTIONS FOR 1φ UNITS



ALTERNATOR CONNECTIONS FOR 3φ UNITS



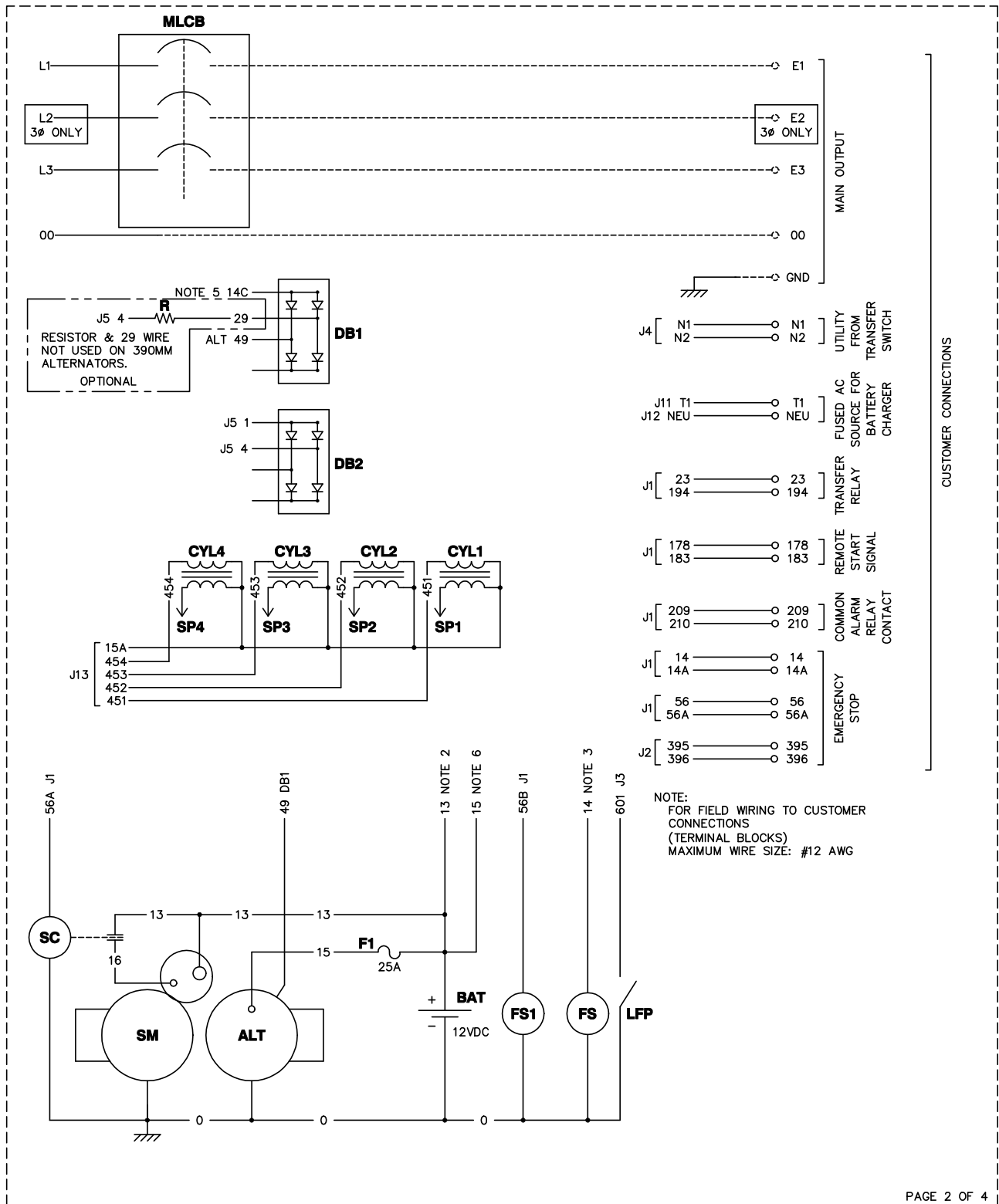
PAGE 1 OF 4

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DATE: 8/14/14

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SCHEMATIC - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7686

GROUP G



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DATE: 8/14/14

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SCHEMATIC - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7686

GROUP G

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	15	F1	NOTE 6
2	15	F1	NOTE 6
3	56/56A	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209/210	CAR	COMMON ALARM RELAY
9	14/14A	ES1	NOTE 3/NOTE 4
10	771	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
14	178	CUST CON	REMOTE START
15	209/210	CAR	COMMON ALARM RELAY
16	56B	FS1	START CONTACTOR CONTROL

J2

PIN	WIRE	TO	FUNCTION
1	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
4	395/396	ES1	EMERGENCY STOP
8	395/396	ES1	EMERGENCY STOP
9	573	WLS-B	COOLANT LEVEL SIGNAL
10	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN

J3

PIN	WIRE	TO	FUNCTION
1	SHLD	MPU1-1	FLYWHEEL SENSOR DRAIN
2	79A	MPU2-3	CAM SENSOR +
3	0A	MPU2-2	CAM SENSOR -
4	0	GND	NOTE 1
5	601	LFP	LOW FUEL PRESSURE
6	68	WTS-2	COOLANT TEMPERATURE SIGNAL
7	765	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770	GA-4	THROTTLE DRIVE HI
10	79	MPU1-3	FLYWHEEL SENSOR +
11	0	MPU1-2	FLYWHEEL SENSOR -
12	SHLDA	MPU2-1	CAM SENSOR DRAIN
15	86	LOS-NC	LOW OIL PRESSURE SIGNAL
16	804	EC-6	OXYGEN SENSOR +
17	805	EC-5	OXYGEN SENSOR RETURN
18	767	GA-2	THROTTLE POSITION FEEDBACK RETURN

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

J13

PIN	WIRE	TO	FUNCTION
1	15A	CYL1-CYL4	NOTE 7
3	451	CYL1	IGNITION COIL DRIVE 1
4	452	CYL2	IGNITION COIL DRIVE 2
5	453	CYL3	IGNITION COIL DRIVE 3
6	454	CYL4	IGNITION COIL DRIVE 4

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
- 5) WIRE #14C IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED WIRE #15 & SWITCHED WIRE #14A).
- 6) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 7) WIRE #15A IS FUSED +12VDC FOR THE IGNITION COILS.

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14A	J1-9	NOTE 4
3	14A	J1-9	NOTE 4
4	808	J2-1	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J3-17	OXYGEN SENSOR RETURN
6	804	J3-16	OXYGEN SENSOR +

GROUP G

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SCHEMATIC - DIAGRAM
G2.4L G2 PROTECTOR
DRAWING #: 0K7686

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Section 5.11 *OK8088-A Wiring Diagram 5.4L Gaseous Protector - Evolution*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND	
AFS	- AIR/FUEL SOLENOID
ALT	- DC CHARGE ALTERNATOR
AS	- ALTERNATOR STATOR
BA	- BRUSH ASSEMBLY
BAT	- BATTERY
BCH_	- BATTERY CHARGER
CAM	- CAMSHAFT SENSOR
CSS	- CRANKSHAFT SENSOR
CAR	- COMMON ALARM RELAY
COP1	- CROSSOVER PLUG 16-PIN (BULKHEAD)
COP2	- CROSSOVER PLUG 12-PIN (BULKHEAD)
COP3	- CROSSOVER PLUG 10-PIN (BULKHEAD)
COR1	- CROSSOVER RECEPTACLE 16-PIN
COR2	- CROSSOVER RECEPTACLE 12-PIN
COR3	- CROSSOVER RECEPTACLE 10-PIN
CYL_	- CYLINDER IGNITION COIL
DB_	- DIODE BRIDGE
EC	- EMISSIONS CONNECTOR
ES	- EMERGENCY STOP
F_	- FUSE
FS_	- FUEL SOLENOID
FSP	- FUEL SOLENOID PLUG
FSR	- FUEL SOLENOID RECEPTACLE
GA	- GOVERNOR ACTUATOR
GND	- GROUND CONNECTION
ICMJ_	- IGNITION CONTROL MODULE
J_	- MAIN CONTROLLER CONNECTORS
LFP	- LOW FUEL PRESSURE SWITCH
LOS	- LOW OIL PRESSURE SWITCH
MLCB	- MAIN LINE CIRCUIT BREAKER
MPU	- MAGNETIC PICKUP
NB	- NEUTRAL BLOCK
OS	- OXYGEN SENDER
RLY	- CONTROL RELAY
SC	- STARTER CONTACTOR
SM	- STARTER MOTOR
TB_	- TERMINAL BLOCK
THMS	- THERMISTOR (BATTERY AMBIENT TEMP.)
WLS	- COOLANT LEVEL SENSOR
WTS	- COOLANT TEMPERATURE SENSOR

NOTE: ALL WIRES 18 AWG
BLACK 300V UL LISTED
UNLESS SHOWN OTHERWISE

SPLICE NUMBER OR LETTER

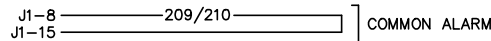
WIRE SPLICE

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
LOW VOLTAGE CONNECTIONS**

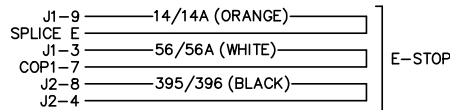
NOTE: ALL WIRES ON THIS PAGE ARE 600V RATED

60HZ/50HZ

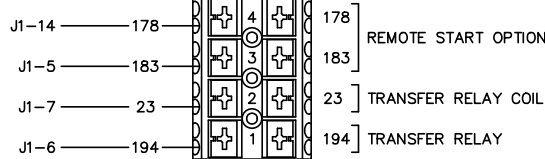
CAR



ES



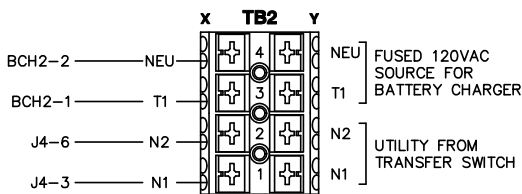
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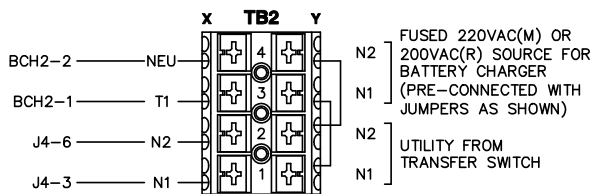
CUSTOMER CONNECTIONS

**COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX
HIGH VOLTAGE CONNECTIONS**

60HZ UNITS



50HZ (M-VOLTAGE, 110/220VAC & R-VOLTAGE, 231/400VAC)

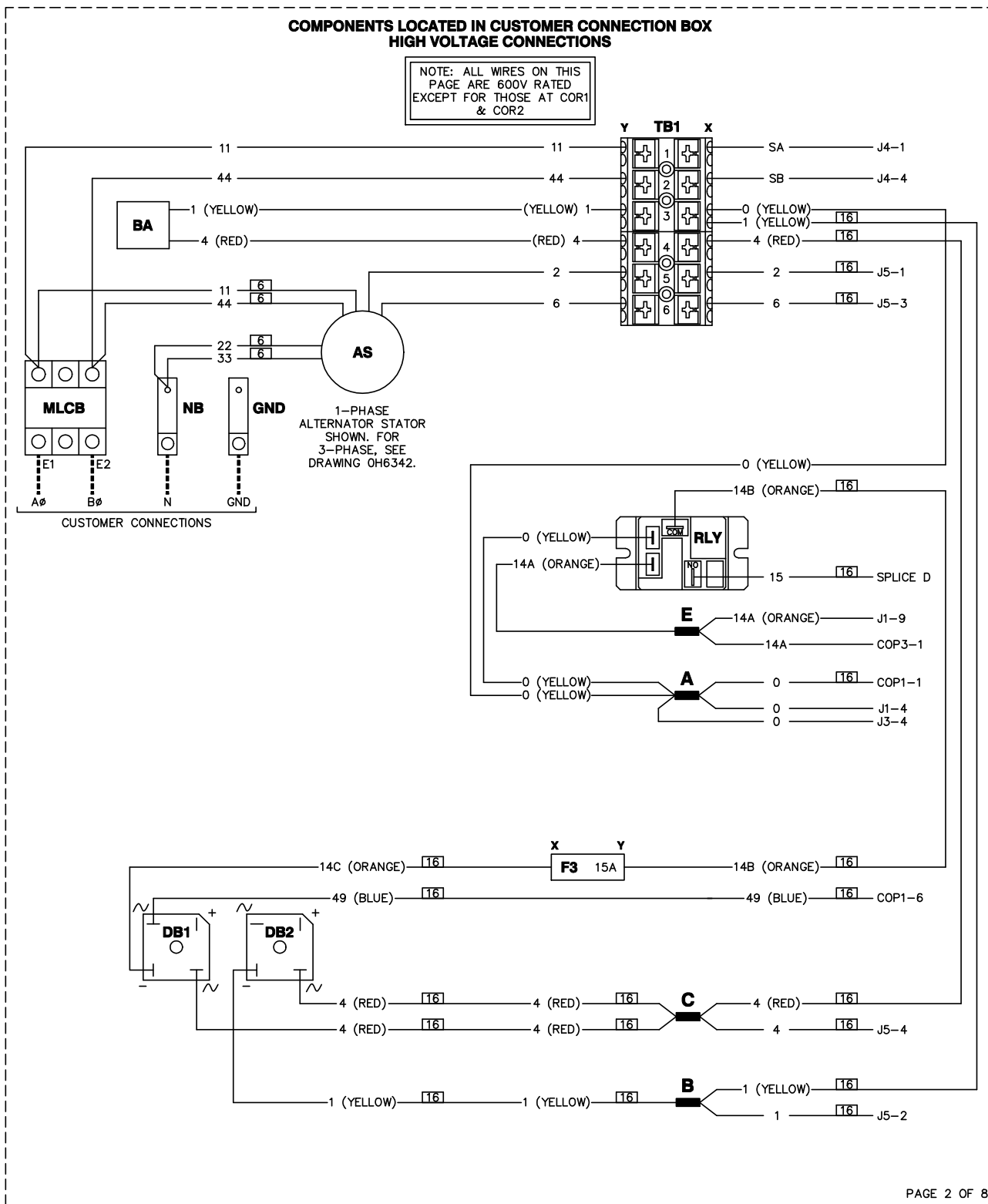


240VAC MAX

CUSTOMER CONNECTIONS

NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

GROUP G

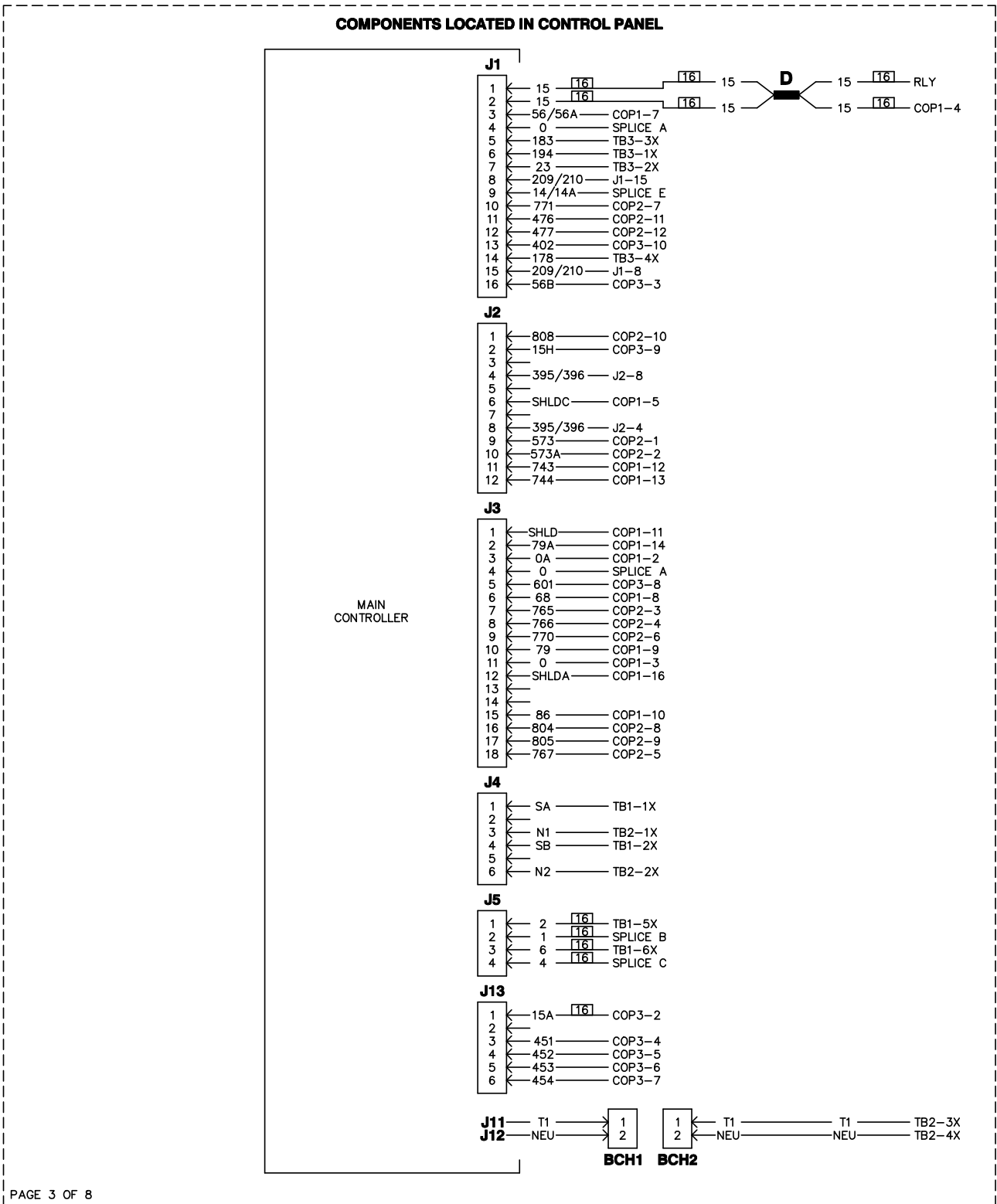


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DATE: 3/12/14

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**WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088**

GROUP G



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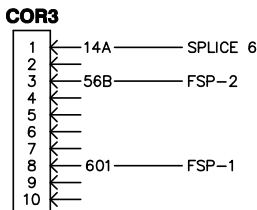
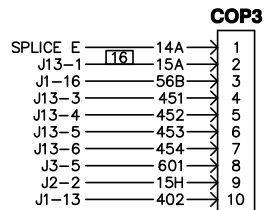
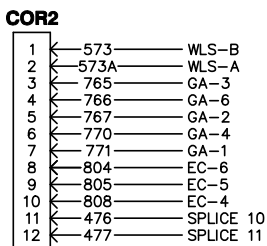
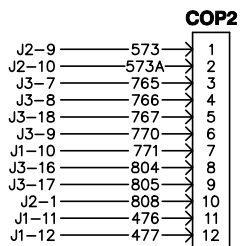
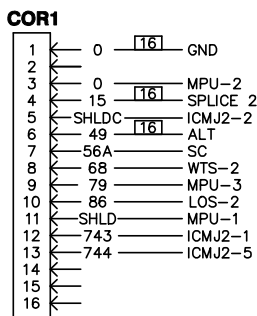
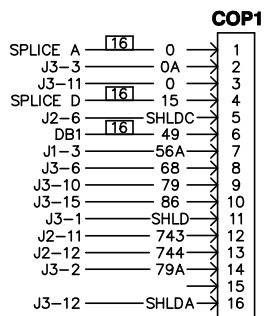
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DATE: 3/12/14

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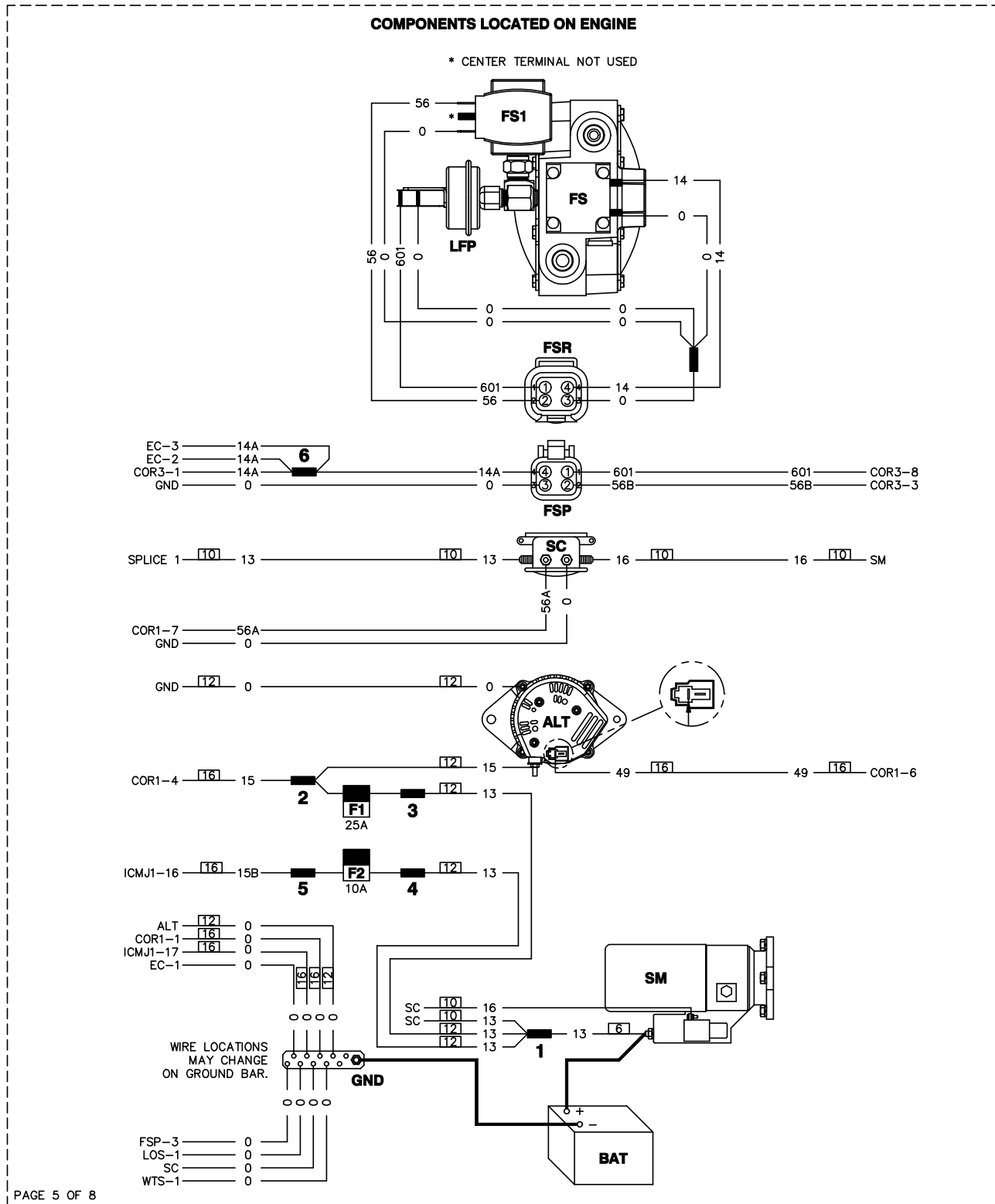
WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088

GROUP G

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX & ON ENGINE BULKHEAD CROSSOVER CONNECTIONS



GROUP G



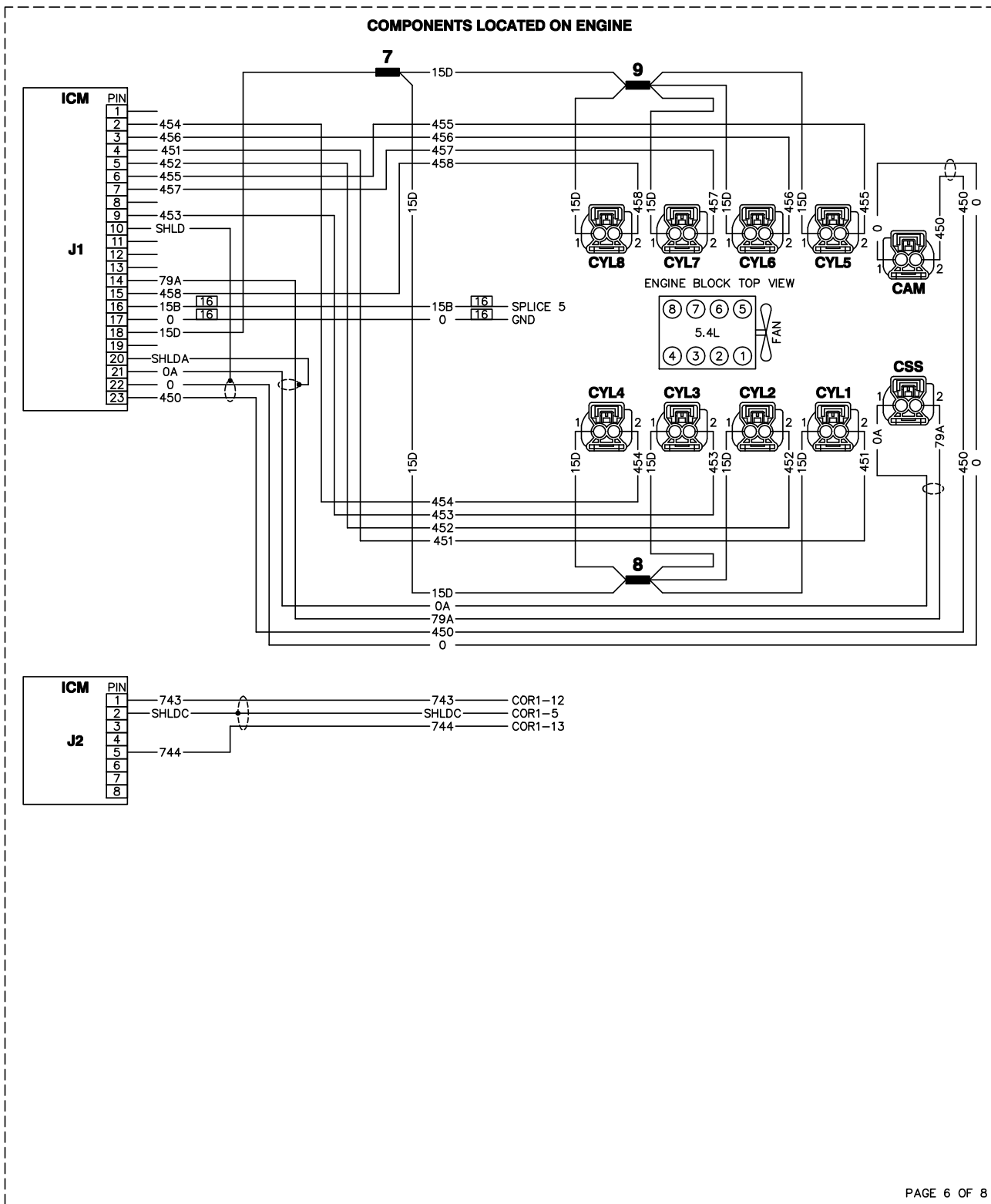
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WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088

GROUP G



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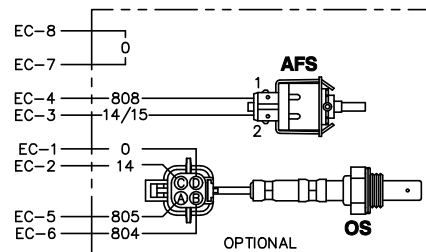
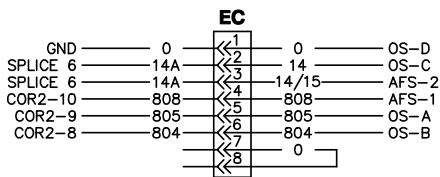
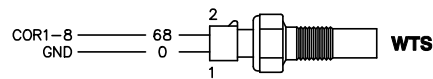
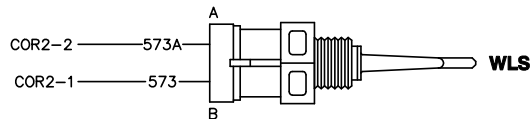
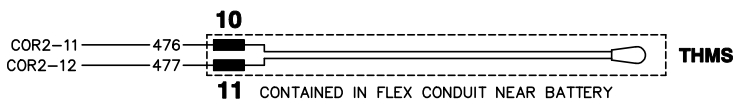
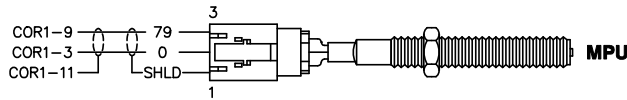
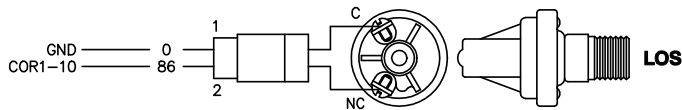
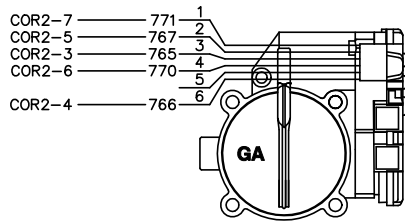
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WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088

GROUP G

COMPONENTS LOCATED ON ENGINE



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REVISION: -A-
DATE: 3/12/14

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WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088

GROUP G

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DATE: 3/12/14

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WIRING - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8088

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Section 5.12 *OK8089-A Electrical Schematic 5.4L Gaseous Protector - Evolution*

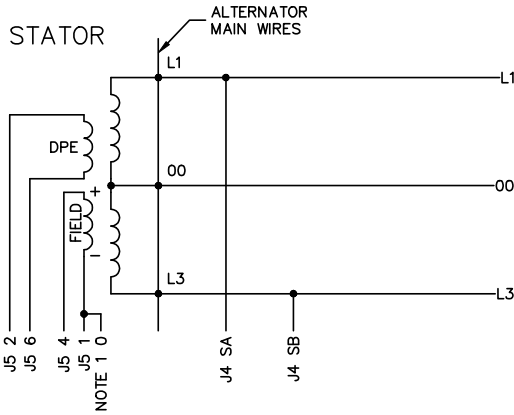
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

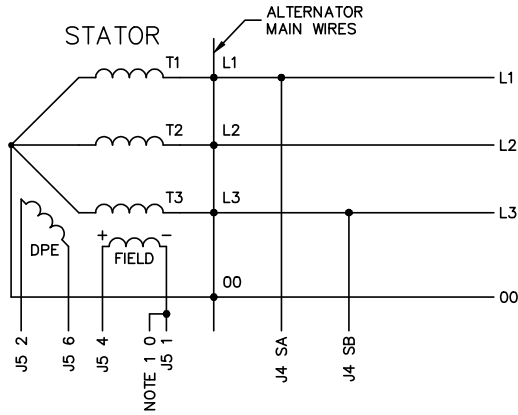
GROUP G

LEGEND

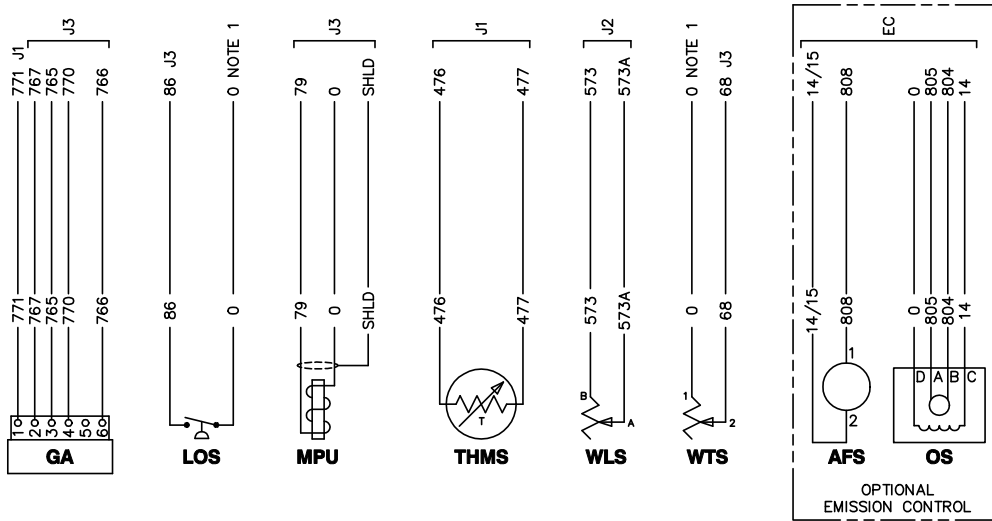
- | | | |
|-------------------------------|--------------------------------------|---|
| AFS - AIR/FUEL SOLENOID | F_ - FUSE INLINE | OS - OXYGEN SENDER |
| ALT - DC CHARGE ALTERNATOR | FS_ - FUEL SOLENOID | SC - STARTER CONTACTOR |
| BAT - BATTERY | GA - GOVERNOR ACTUATOR | SM - STARTER MOTOR |
| CAM - CAMSHAFT SENSOR | ICM_ - IGNITION CONTROL MODULE | SP_ - SPARK PLUG |
| CSS - CRANKSHAFT SENSOR | J_ - ENGINE CONTROL MODULE CONNECTOR | THMS - THERMISTOR (BATTERY AMBIENT TEMP.) |
| CYL_ - CYLINDER IGNITION COIL | LFP - LOW FUEL PRESSURE SWITCH | WLS - COOLANT LEVEL SENDER |
| DB_ - DIODE BRIDGE | LOS - LOW OIL PRESSURE SWITCH | WTS - COOLANT TEMPERATURE SENDER |
| DPE - EXCITER | MLCB - MAIN LINE CIRCUIT BREAKER | |
| EC - EMISSIONS CONNECTOR | MPU - MAGNETIC PICKUP | |



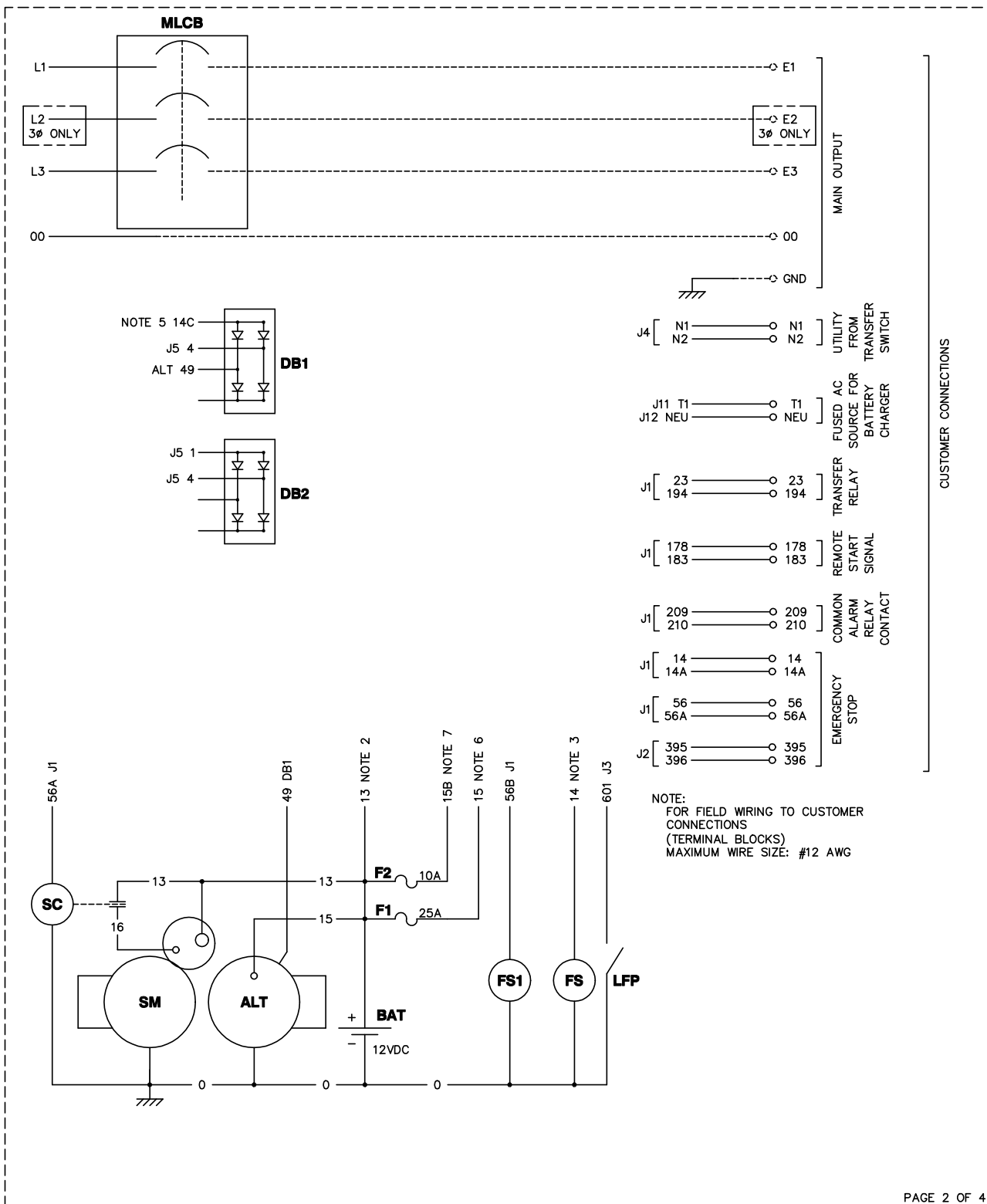
ALTERNATOR CONNECTIONS FOR 1 ϕ UNITS



ALTERNATOR CONNECTIONS FOR 3 ϕ UNITS



GROUP G



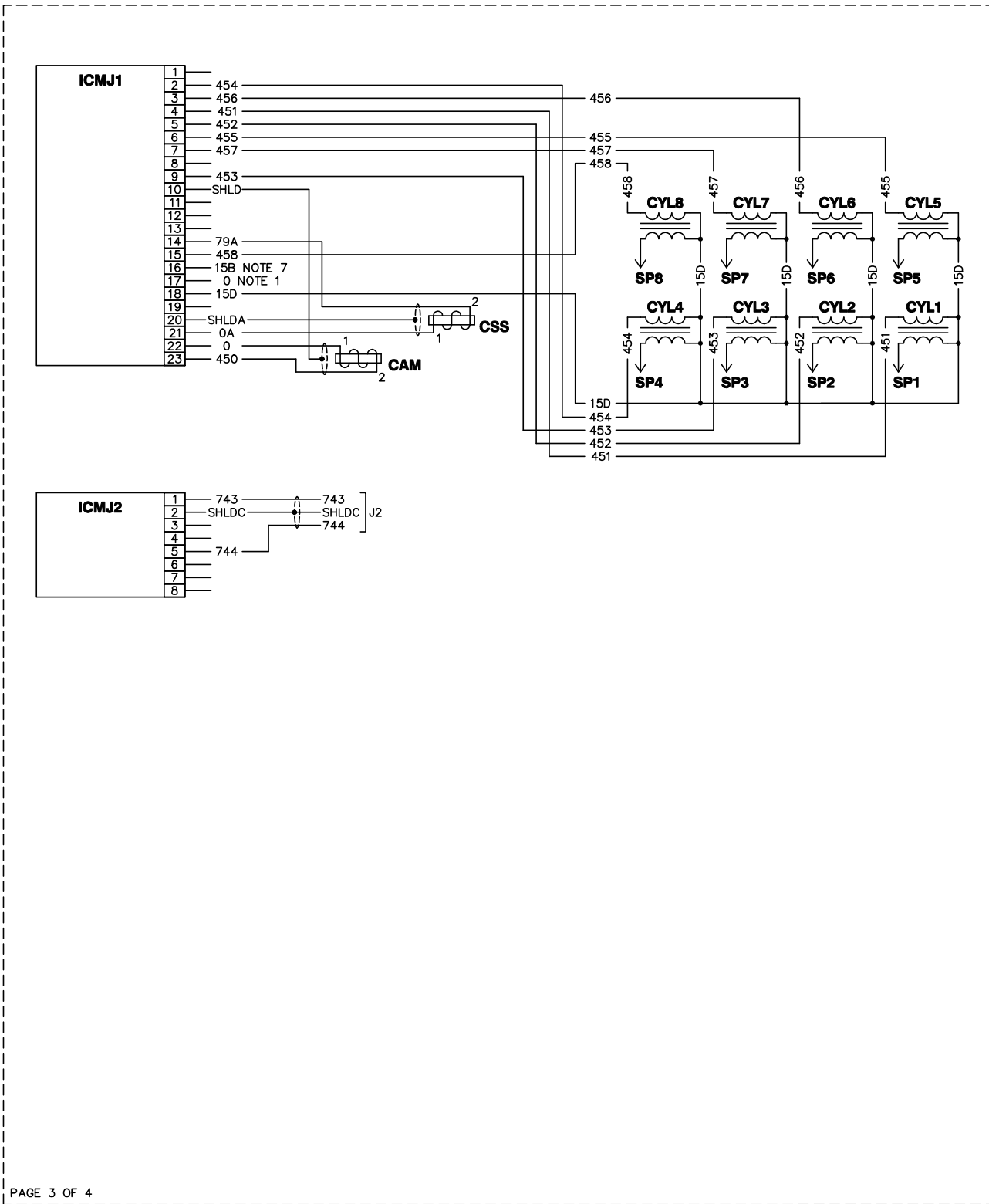
PAGE 2 OF 4

SCHEMATIC - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8089

REVISION: -A-
 DATE: 8/15/14

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GROUP G



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SCHEMATIC - DIAGRAM
G5.4L G3 PROTECTOR
DRAWING #: 0K8089

REVISION: -A-
 DATE: 8/15/14

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GROUP G

- NOTES:
- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 - 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
 - 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 - 4) WIRE #14A IS LOW CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED.
 - 5) WIRE #14C IS HIGH CURRENT FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING AND E-STOP IS NOT ACTIVATED (FUSED WIRE #15 & SWITCHED WIRE #14A).
 - 6) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
 - 7) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
 - 8) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
7	457	CYL7	IGNITION COIL DRIVE 7
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
15	458	CYL8	IGNITION COIL DRIVE 8
16	15B	F2	NOTE 7
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 8
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J2-11	CAN BUS HIGH
2	SHLDC	J2-6	CAN BUS DRAIN
5	744	J2-12	CAN BUS LOW

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14A	J1-9	NOTE 4
3	14A	J1-9	NOTE 4
4	808	J2-1	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J3-17	OXYGEN SENSOR RETURN
6	804	J3-16	OXYGEN SENSOR +

MAIN CONTROLLER CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	15	F1	NOTE 6
2	15	F1	NOTE 6
3	56/56A	ES1	STARTER OUTPUT
4	0	GND	NOTE 1
5	183	CUST CON	REMOTE START
6	194	CUST CON	TRANSFER RELAY COIL +
7	23	CUST CON	TRANSFER RELAY COIL CONTROL
8	209/210	CAR	COMMON ALARM RELAY
9	14/14A	ES1	NOTE 3/NOTE 4
10	771	GA-1	THROTTLE DRIVE LO
11	476	THMS	THERMISTOR (BATTERY CHARGER)
12	477	THMS	THERMISTOR (BATTERY CHARGER)
14	178	CUST CON	REMOTE START
15	209/210	CAR	COMMON ALARM RELAY
16	56B	FS1	STARTING FUEL SOLENOID CONTROL

J4

PIN	WIRE	TO	FUNCTION
1	SA	MLCB	OUTPUT VOLTAGE SENSING A
3	N1	CUST CON	UTILITY VOLTAGE SENSING 1
4	SB	MLCB	OUTPUT VOLTAGE SENSING B
6	N2	CUST CON	UTILITY VOLTAGE SENSING 2

J5

PIN	WIRE	TO	FUNCTION
1	2	DPE	EXCITER OUTPUT
2	1	FIELD	FIELD (BRUSH) -
3	6	DPE	EXCITER RETURN
4	4	FIELD	FIELD (BRUSH) +

J2

PIN	WIRE	TO	FUNCTION
1	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
4	395/396	ES1	EMERGENCY STOP
6	SHLDC	ICMJ2-2	CAN BUS DRAIN
8	395/396	ES1	EMERGENCY STOP
9	573	WLS-B	COOLANT LEVEL SIGNAL
10	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
11	743	ICMJ2-1	CAN BUS HIGH
12	744	ICMJ2-5	CAN BUS LOW

J3

PIN	WIRE	TO	FUNCTION
1	SHLD	MPU-1	FLYWHEEL SENSOR DRAIN
4	0	GND	NOTE 1
5	601	LFP	LOW FUEL PRESSURE
6	68	WTS-2	COOLANT TEMPERATURE SIGNAL
7	765	GA-3	THROTTLE POSITION FEEDBACK SOURCE
8	766	GA-6	THROTTLE POSITION FEEDBACK SIGNAL
9	770	GA-4	THROTTLE DRIVE HI
10	79	MPU-3	FLYWHEEL SENSOR +
11	0	MPU-2	FLYWHEEL SENSOR -
15	86	LOS-NC	LOW OIL PRESSURE SIGNAL
16	804	EC-6	OXYGEN SENSOR +
17	805	EC-5	OXYGEN SENSOR RETURN
18	767	GA-2	THROTTLE POSITION FEEDBACK RETURN

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Section 5.13 *OJ4556-A Wiring Diagram 1.5L Gaseous - Nexus*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

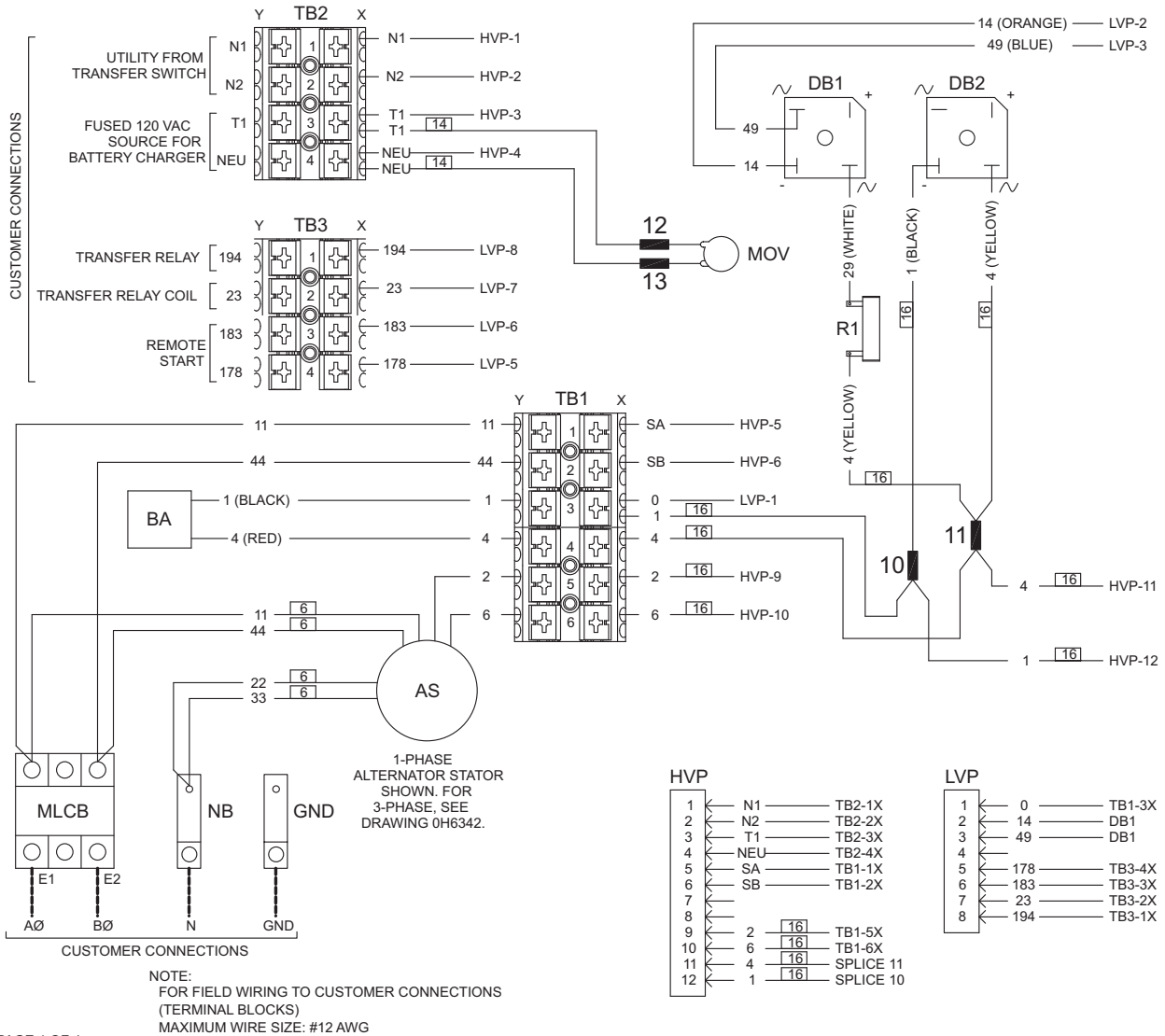
LEGEND

- | | |
|---|---|
| ALT - DC CHARGE ALTERNATOR | HVR - HIGH VOLTAGE RECEPTACLE 12-PIN |
| AS - ALTERNATOR STATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BAT - BATTERY | LFP - LOW FUEL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LOS - LOW OIL PRESSURE SWITCH |
| CAM - CAMSHAFT SENSOR | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAR - COMMON ALARM RELAY | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CB - CIRCUIT BREAKER | MLCB - MAIN LINE CIRCUIT BREAKER |
| CYL - CYLINDER IGNITION COIL | MOV - METAL OXIDE VARISTOR |
| DB - DIODE BRIDGE | MP1 - MAGNETIC PICKUP |
| DCVR - DC VOLTAGE REGULATOR | NB - NEUTRAL BLOCK |
| F1 - FUSE INLINE (25A ATO) | R1 - RESISTOR |
| FS - FUEL SOLENOID | SC - STARTER CONTACTOR |
| FSP - FUEL SOLENOID PLUG | SM - STARTER MOTOR |
| FSR - FUEL SOLENOID RECEPTACLE | TB - TERMINAL BLOCK |
| GND - GROUND CONNECTION | WLS - COOLANT LEVEL SENDER |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WTS - COOLANT TEMPERATURE SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | |

NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE

NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX



PAGE 1 OF 4

REVISION: -A-
DATE: 4/19/11

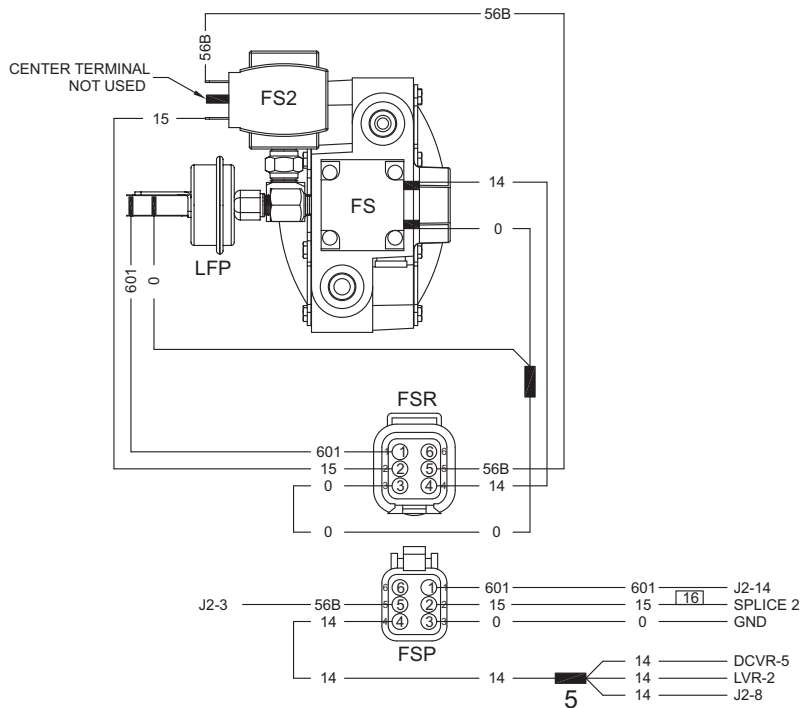
WIRING - DIAGRAM
G1.5L G11
DRAWING #: 0J4556

GROUP G

COMPONENTS LOCATED ON ENGINE

J1

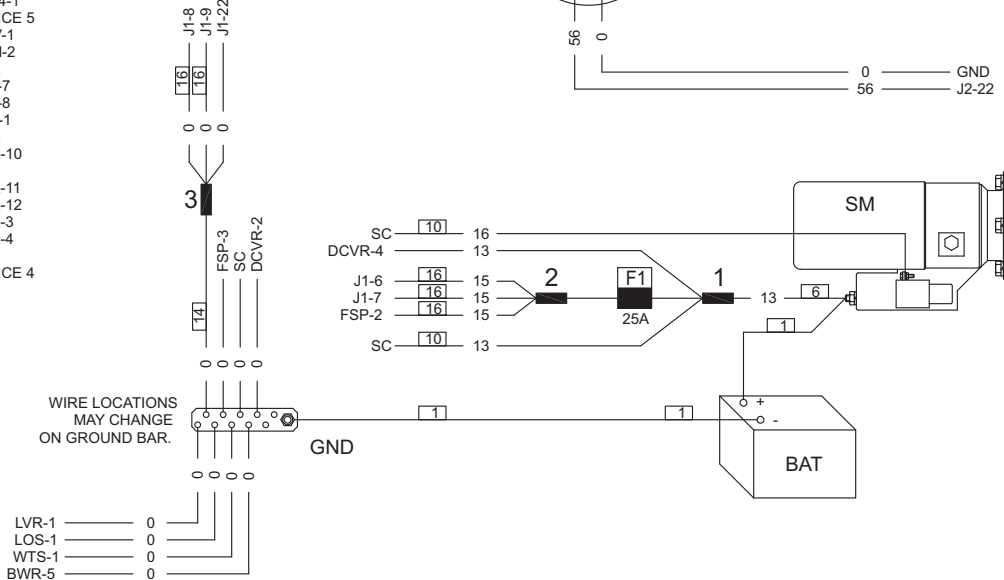
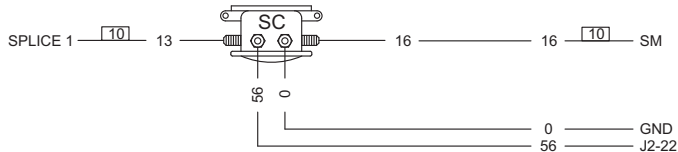
1	178	LVR-5
2		
3		
4	817	BWR-2
5	818	BWR-3
6	15	SPLICE 2
7	15	SPLICE 2
8	0	SPLICE 3
9	0	SPLICE 3
10	0	MP1-2
11	0A	CAM-1
12	820	BWR-1
13	SA	HVR-5
14	183	LVR-6
15		
16	SHLD	MP1-1
17	819	BWR-4
18	767	GOV-2
19	765	GOV-3
20	766	GOV-6
21	68	WTS-2
22	0	SPLICE 3
23	79	MP1-3
24	SB	HVR-6
25	N1	HVR-1
26	N2	HVR-2
27		
28		
29		
30	15H	CAM-3
31	573A	WLS-A
32	573	WLS-B
33	86	LOS-2
34		
35		



J2

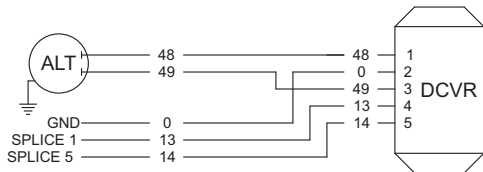
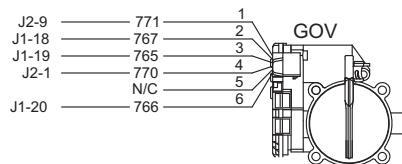
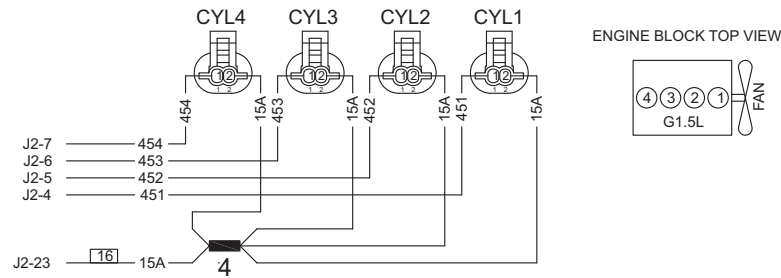
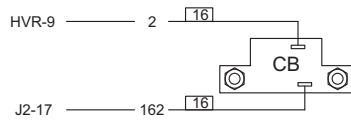
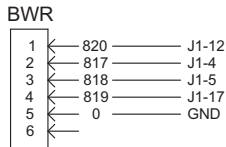
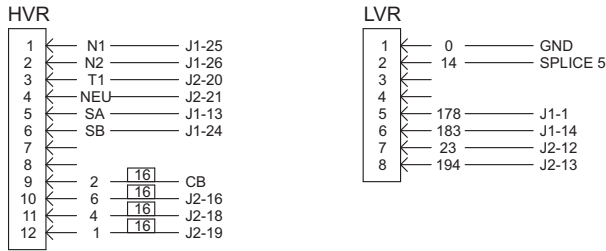
1	770	GOV-4
2		
3	56B	FSP-5
4	451	CYL1-1
5	452	CYL2-1
6	453	CYL3-1
7	454	CYL4-1
8	14	SPLICE 5
9	771	GOV-1
10	402	CAM-2
11	209	CAR
12	23	LVR-7
13	194	LVR-8
14	601	FSP-1
15	210	CAR
16	6	HVR-10
17	162	CB
18	4	HVR-11
19	1	HVR-12
20	T1	HVR-3
21	NEU	HVR-4
22	56	SC
23	15A	SPLICE 4

LOCATED BACK OF CUSTOMER CONNECTION BOX



GROUP G

COMPONENTS LOCATED ON ENGINE



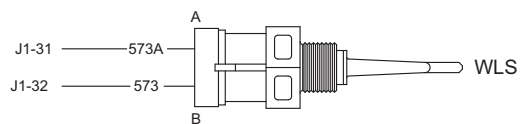
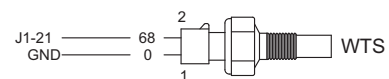
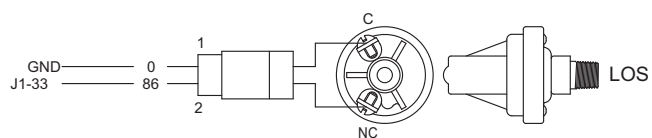
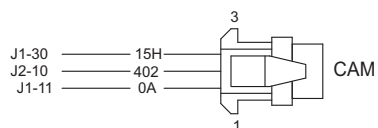
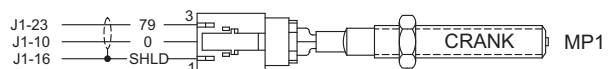
PAGE 3 OF 4

REVISION: -A-
DATE: 4/19/11

WIRING - DIAGRAM
G1.5L G11
DRAWING #: 0J4556

GROUP G

COMPONENTS LOCATED ON ENGINE



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REVISION: -A-
 DATE: 4/19/11

WIRING - DIAGRAM
 G1.5L G11
 DRAWING #: 0J4556

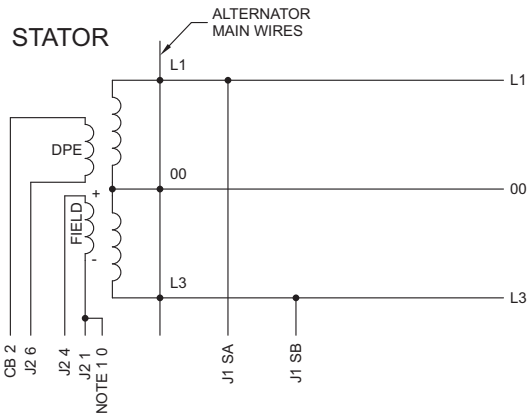
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Section 5.14 *OJ4555-A Electrical Schematic 1.5L Gaseous - Nexus*

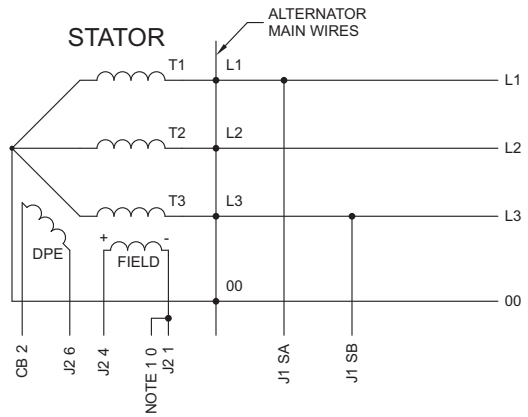
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

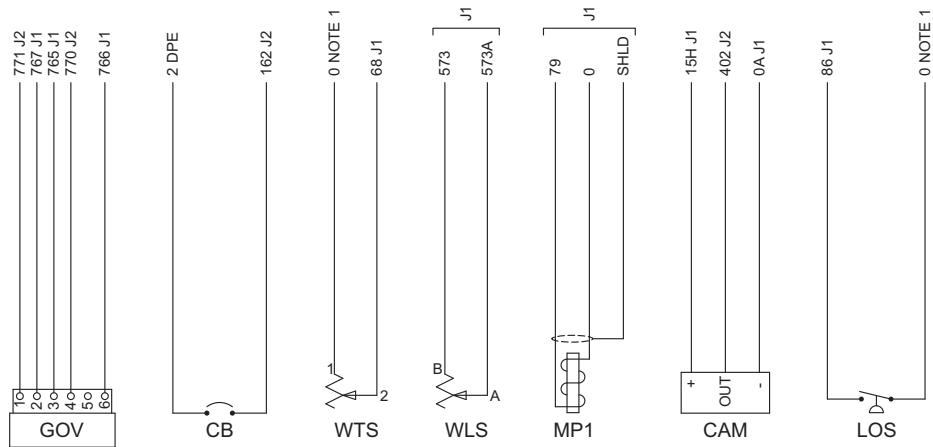
GROUP G



ALTERNATOR CONNECTIONS FOR 1Ø UNITS



ALTERNATOR CONNECTIONS FOR 3Ø UNITS



PAGE 1 OF 4

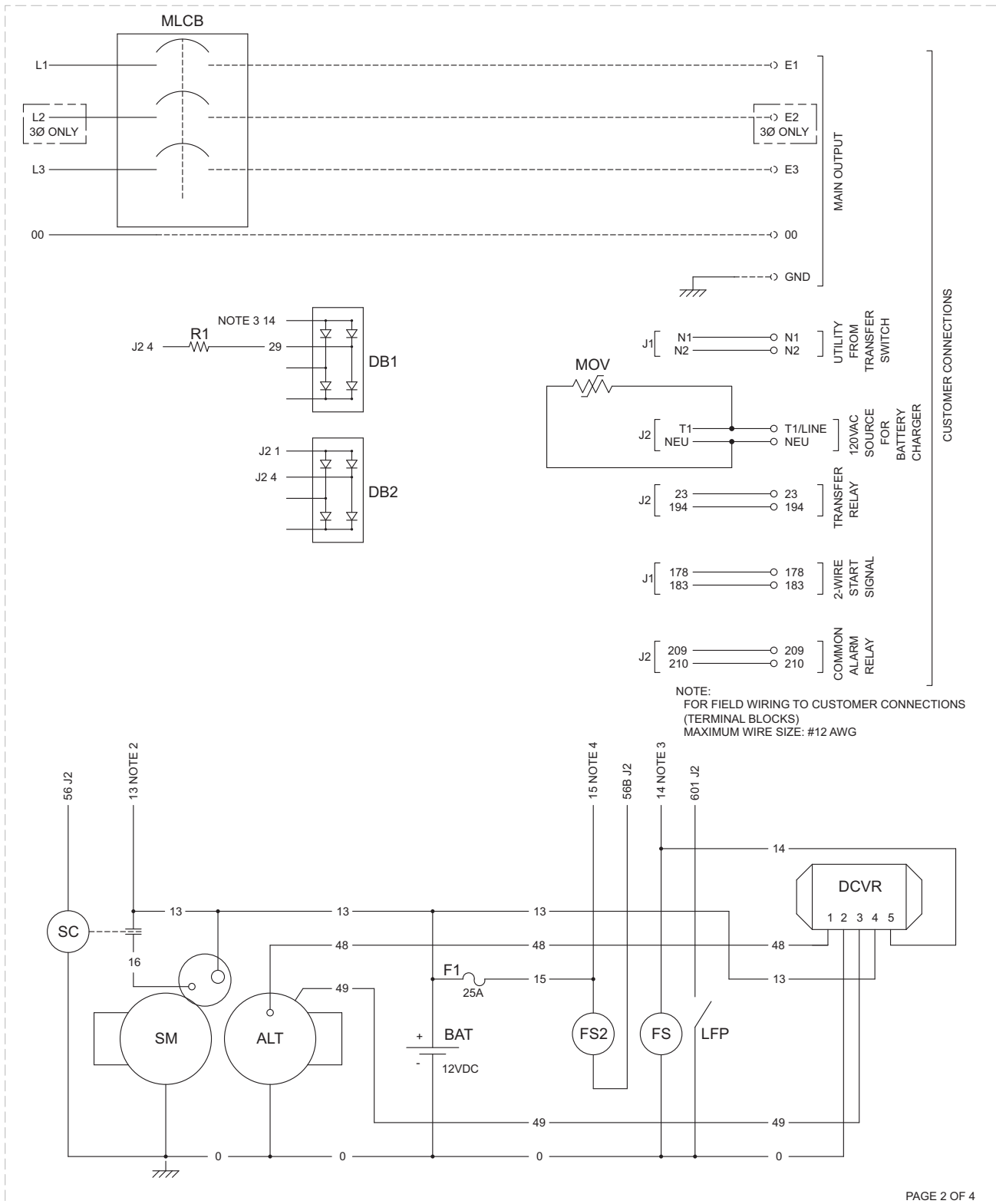
REVISION: -A-
DATE: 4/19/11

SCHEMATIC - DIAGRAM

G1.5L G11

DRAWING #: 0J4555

GROUP G

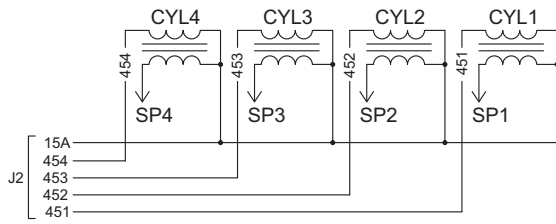


PAGE 2 OF 4

SCHMATIC - DIAGRAM
G1.5L G11
DRAWING #: 0J4555

REVISION: -A-
DATE: 4/19/11

GROUP G



PAGE 3 OF 4

REVISION: -A-
DATE: 4/19/11

SCHEMATIC - DIAGRAM
G1.5L G11
DRAWING #: 0J4555

GROUP G

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION AND FOR THE IGNITION COILS.

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
11	0A	CAM-1	HALL-EFFECT CAMSHAFT SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
22	0	GND	NOTE 1
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
30	15H	CAM-3	HALL-EFFECT CAMSHAFT SENSOR +
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	453	CYL3	IGNITION COIL DRIVE 3
7	454	CYL4	IGNITION COIL DRIVE 4
8	14	DB1/FS	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
10	402	CAM-2	HALL-EFFECT CAMSHAFT SENSOR SIGNAL
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	CYL1-CYL4	NOTE 5

LEGEND

00 - NEUTRAL	DCVR - DC VOLTAGE REGULATOR	MOV - METAL OXIDE VARISTOR
ALT - DC CHARGE ALTERNATOR	DPE - EXCITER	MP1 - MAGNETIC PICKUP
BAT - BATTERY	F1 - FUSE INLINE	R1 - RESISTOR
BWR - BASIC WIRELESS RECEPTACLE	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
CAM - CAMSHAFT SENSOR	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SM - STARTER MOTOR
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	SP - SPARK PLUG
CYL_ - CYLINDER IGNITION COIL	LOS - LOW OIL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
DB_ - DIODE BRIDGE	MLCB - MAIN LINE CIRCUIT BREAKER	WTS - COOLANT TEMPERATURE SENDER

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REVISION: -A-
DATE: 4/19/11

SCHEMATIC - DIAGRAM
G1.5L G11
DRAWING #: 0J4555

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Section 5.15 *0H6685-C Wiring Diagram 1.6L Gaseous - Nexus*

Introduction

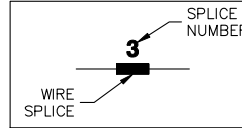
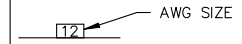
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

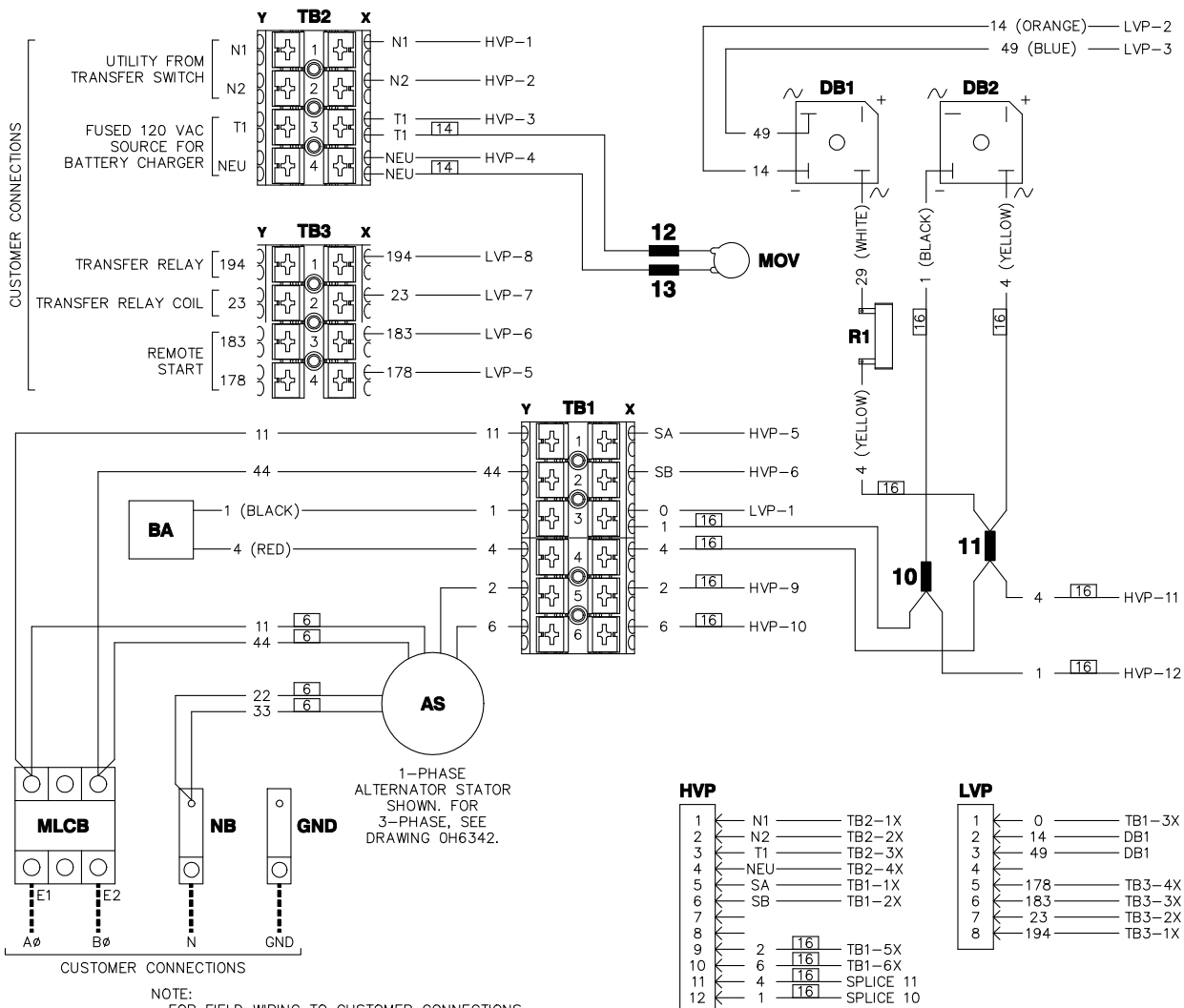
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|---|---|
| AFS - AIR/FUEL SOLENOID | HVR - HIGH VOLTAGE RECEPTACLE 12-PIN |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAM - CAMSHAFT SENSOR | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CAR - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| CB - CIRCUIT BREAKER | MOV - METAL OXIDE VARISTOR |
| CP - COIL PACK | MP1 - MAGNETIC PICKUP |
| DB - DIODE BRIDGE | NB - NEUTRAL BLOCK |
| DCVR - DC VOLTAGE REGULATOR | OS - OXYGEN SENDER |
| EC - EMISSIONS CONNECTOR | R1 - RESISTOR |
| F1 - FUSE INLINE (25A ATO) | SC - STARTER CONTACTOR |
| FS - FUEL SOLENOID | SM - STARTER MOTOR |
| GND - GROUND CONNECTION | TB - TERMINAL BLOCK, CAGE CLAMP |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WLS - COOLANT LEVEL SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WTS - COOLANT TEMPERATURE SENDER |

NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE

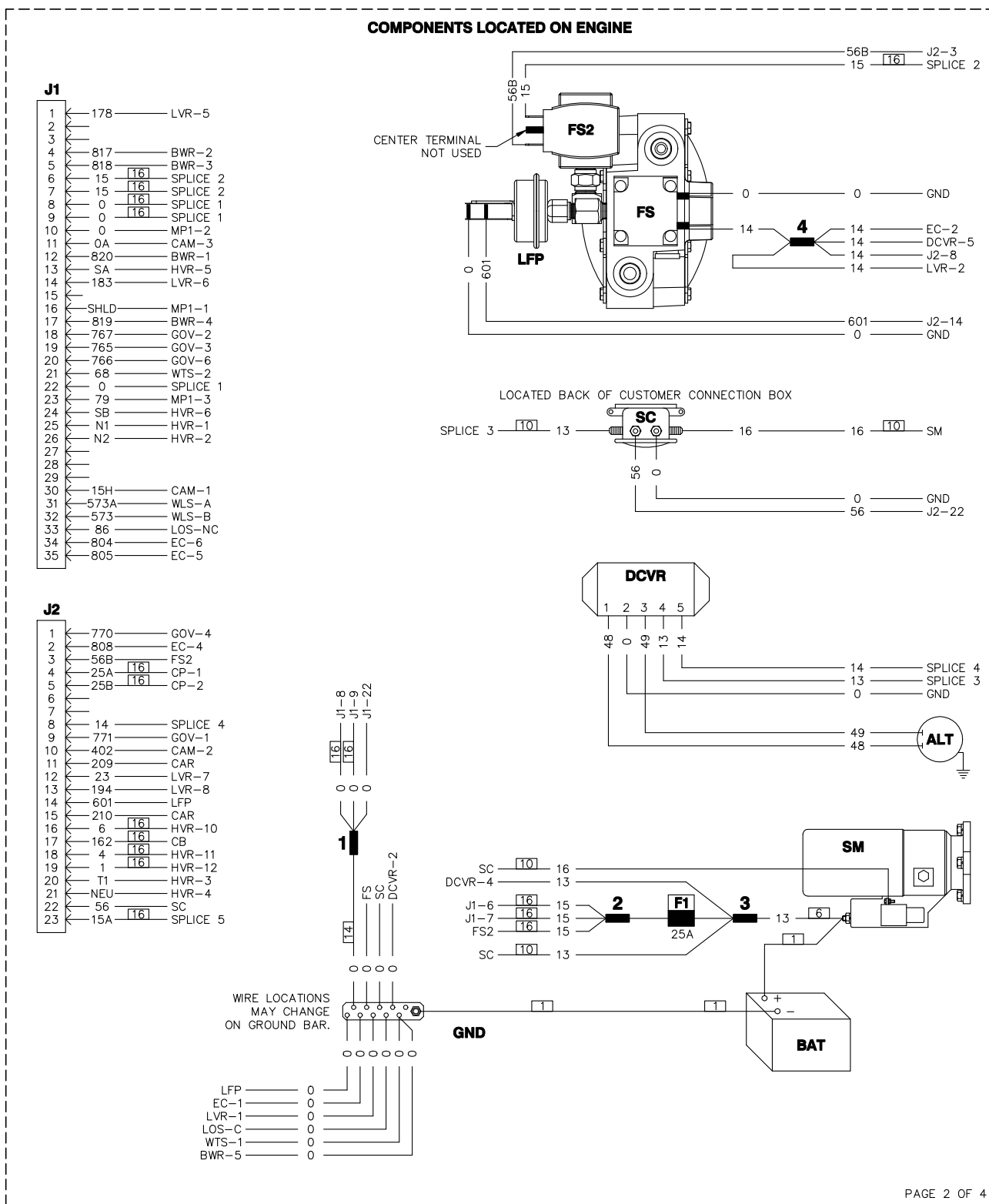


NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX



GROUP G



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REVISION: H-7738-C

DATE: 10/29/10

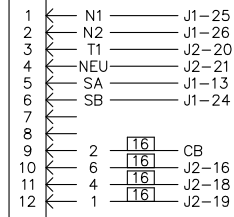
PAGE 2 OF 4

WIRING - DIAGRAM
G1.6L G11 NEXUS
DRAWING #: 0H6685

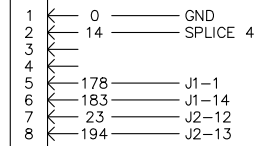
GROUP G

COMPONENTS LOCATED ON ENGINE

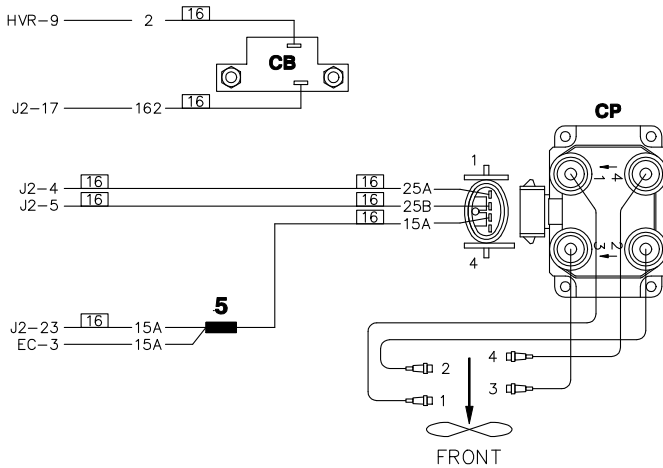
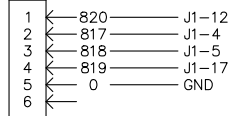
HVR



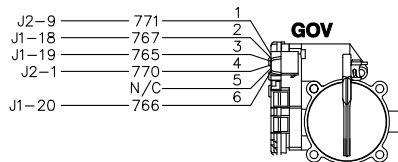
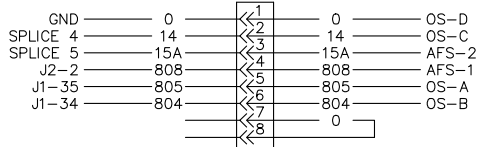
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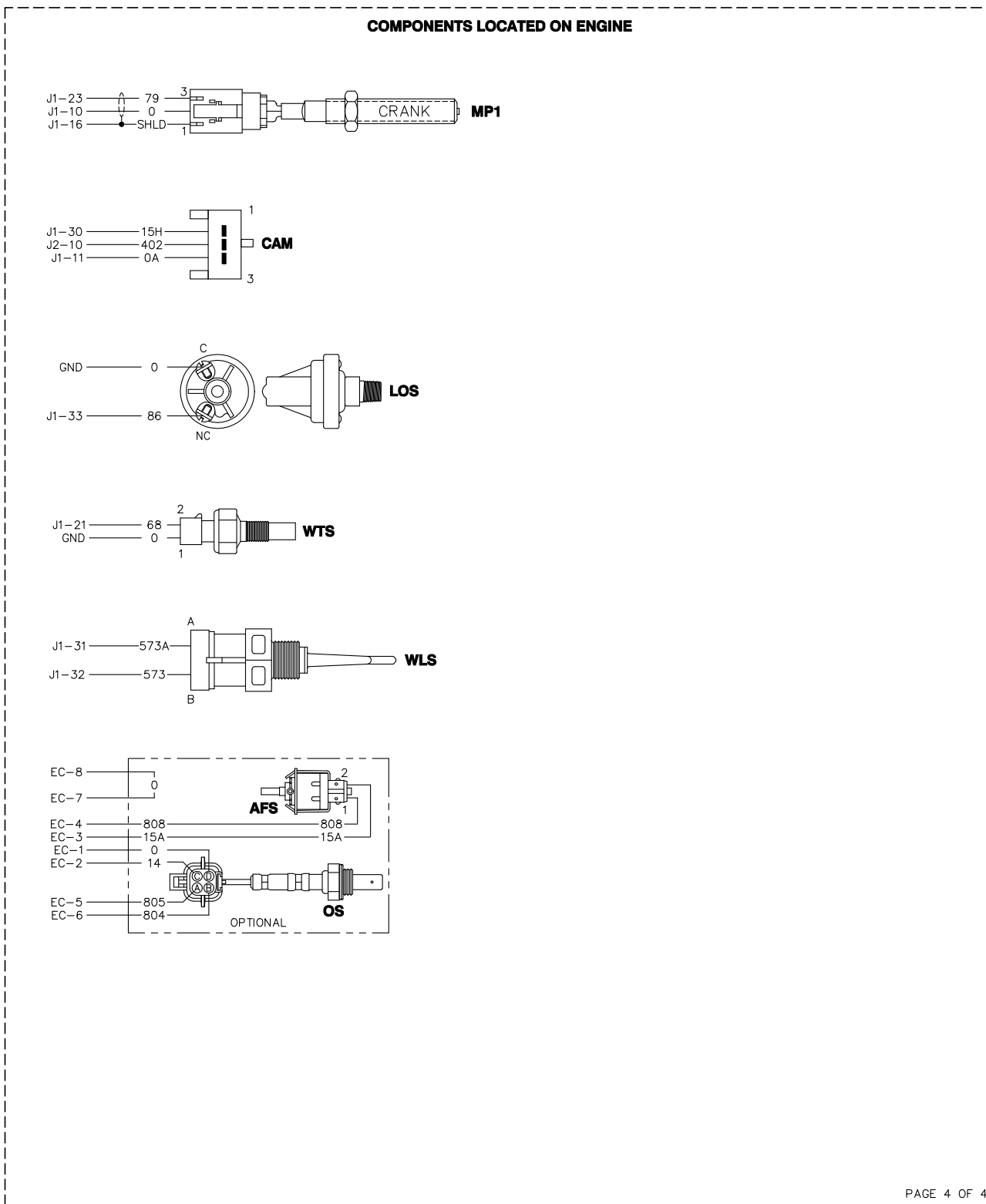
BWR



EC



GROUP G



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 DATE: 10/29/10

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WIRING - DIAGRAM
 G1.6L G11 NEXUS
 DRAWING #: 0H6685

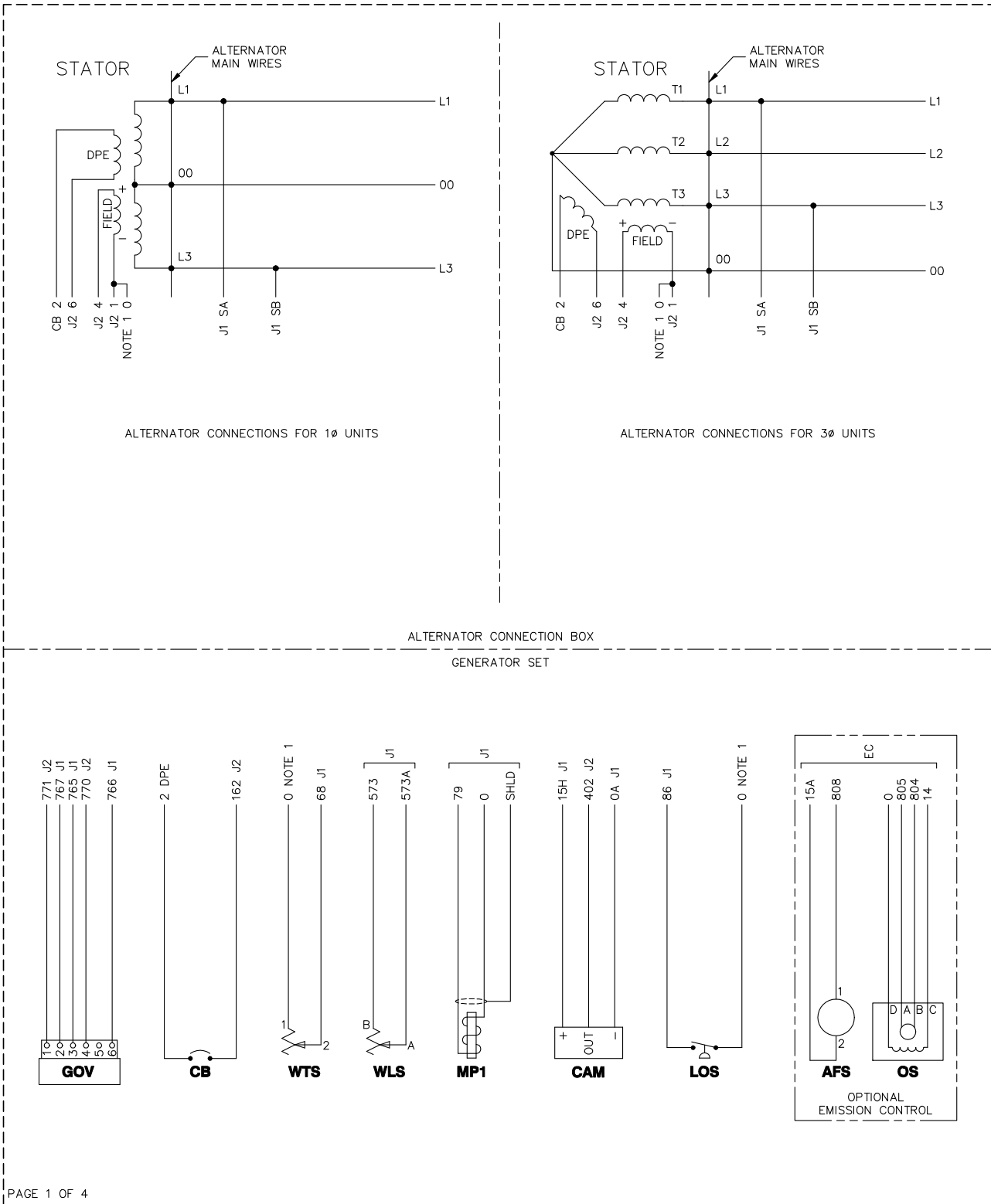
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Section 5.16 *0H6684-C Electrical Schematic 1.6L Gaseous - Nexus*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G



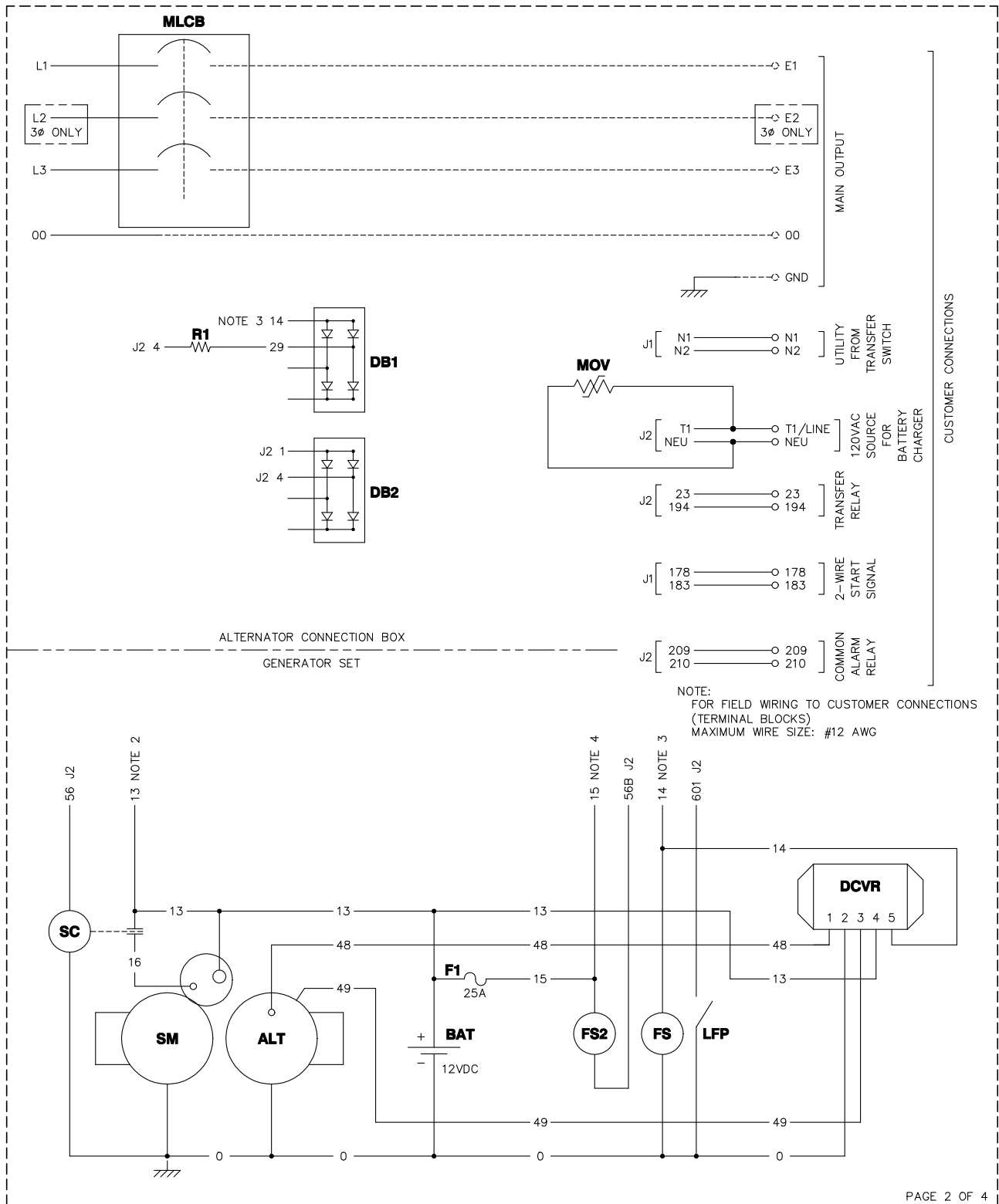
PAGE 1 OF 4

REVISION: H-7738-C
DATE: 10/29/10

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SCHEMATIC - DIAGRAM
G1.6L G11 NEXUS
DRAWING #: 0H6684

GROUP G



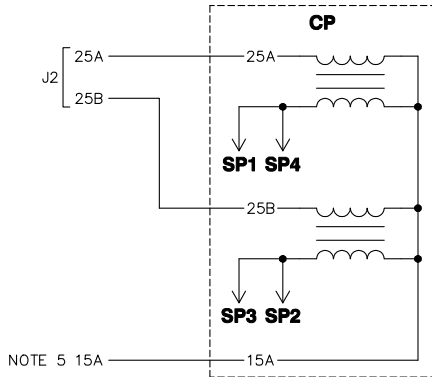
PAGE 2 OF 4

SCHEMATIC - DIAGRAM
G1.6L G11 NEXUS
DRAWING #: 0H6684

REVISION: H-7738-C
DATE: 10/29/10

PAGE 2 OF 4

GROUP G



PAGE 3 OF 4

REVISION: H-7738-C
DATE: 10/29/10

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SCHEMATIC - DIAGRAM
G1.6L G11 NEXUS
DRAWING #: 0H6684

GROUP G

NOTES:
 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION AND FOR THE IGNITION COILS.

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
11	0A	CAM-3	HALL-EFFECT CAMSHAFT SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
22	0	GND	NOTE 1
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
30	15H	CAM-1	HALL-EFFECT CAMSHAFT SENSOR +
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
4	25A	CP-1	IGNITION COIL DRIVE 1 AND 4
5	25B	CP-2	IGNITION COIL DRIVE 2 AND 3
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
10	402	CAM-2	HALL-EFFECT CAMSHAFT SENSOR SIGNAL
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3/CP-3	NOTE 5

LEGEND

00 - NEUTRAL	DCVR - DC VOLTAGE REGULATOR	MOV - METAL OXIDE VARISTOR
AFS - AIR/FUEL SOLENOID	DPE - EXCITER	MP1 - MAGNETIC PICKUP
ALT - DC CHARGE ALTERNATOR	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
BAT - BATTERY	F1 - FUSE INLINE	R1 - RESISTOR
BWR - BASIC WIRELESS RECEPTACLE	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
CAM - CAMSHAFT SENSOR	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SM - STARTER MOTOR
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	SP_ - SPARK PLUG
CP - COIL PACK	LOS - LOW OIL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
DB_ - DIODE BRIDGE	MLCB - MAIN LINE CIRCUIT BREAKER	WTS - COOLANT TEMPERATURE SENDER

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Section 5.17 *0H6341-D Wiring Diagram 2.4L Gaseous - Nexus*

Introduction

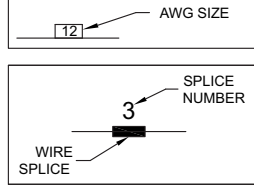
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

- | | |
|---|---|
| AFS - AIR/FUEL SOLENOID | HVR - HIGH VOLTAGE RECEPTACLE 12-PIN |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAR - COMMON ALARM RELAY | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CB - CIRCUIT BREAKER | MLCB - MAIN LINE CIRCUIT BREAKER |
| CYL - CYLINDER IGNITION COIL | MOV - METAL OXIDE VARISTOR |
| DB - DIODE BRIDGE | MP - MAGNETIC PICKUP |
| EC - EMISSIONS CONNECTOR | NB - NEUTRAL BLOCK |
| F1 - FUSE INLINE (25AATO) | OS - OXYGEN SENDER |
| FS - FUEL SOLENOID | R1 - RESISTOR |
| FSP - FUEL SOLENOID PLUG | SC - STARTER CONTACTOR |
| FSR - FUEL SOLENOID RECEPTACLE | SM - STARTER MOTOR |
| GND - GROUND CONNECTION | TB - TERMINAL BLOCK, CAGE CLAMP |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WLS - COOLANT LEVEL SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WTS - COOLANT TEMPERATURE SENDER |

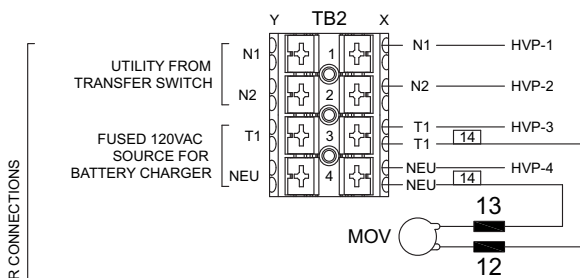
NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE



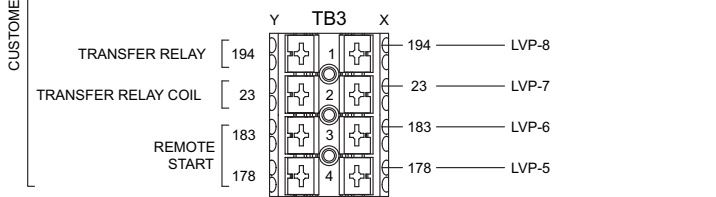
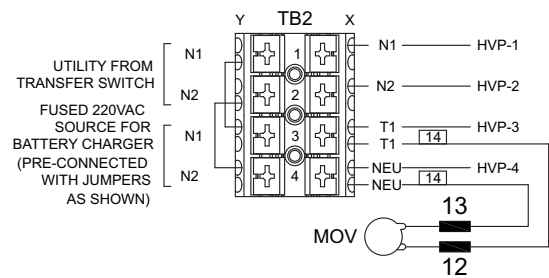
NOTE: ALL WIRES ON THIS
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COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX

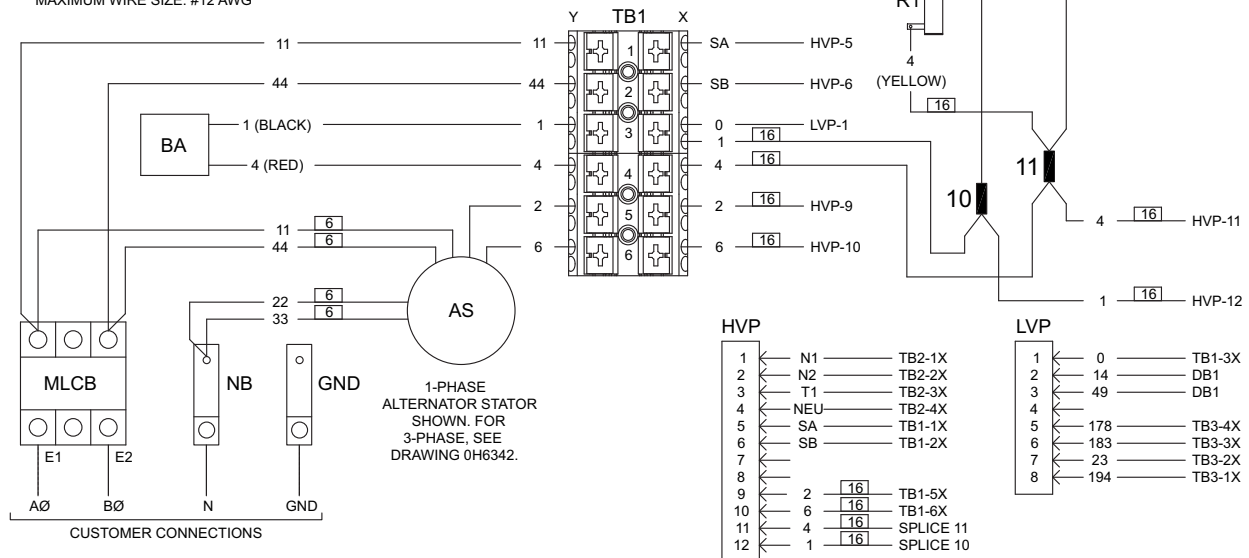
60HZ UNITS



50HZ (M-VOLTAGE, 220VAC)



NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG



PAGE 1 OF 4

REVISION: H-8455-D
DATE: 3/7/11

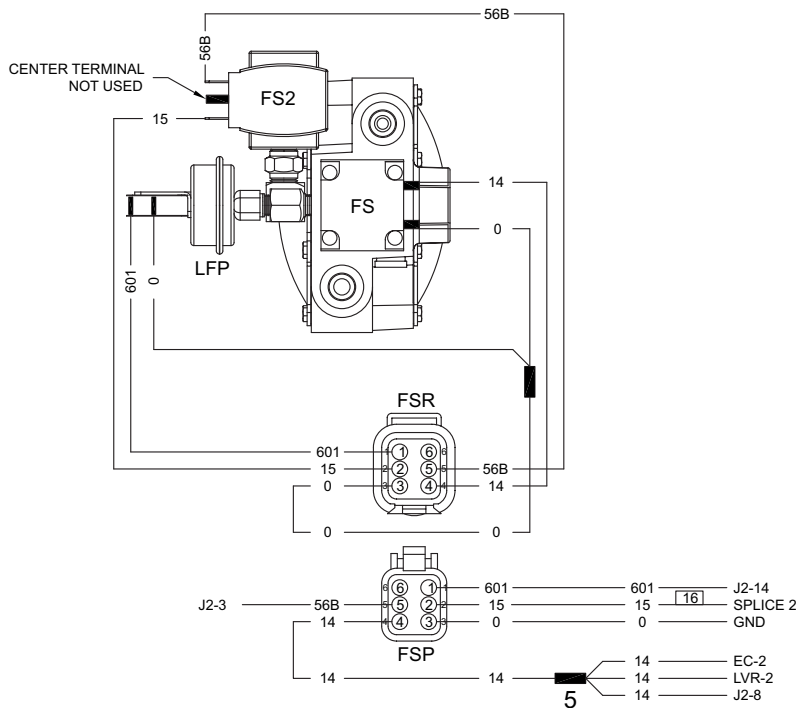
WIRING - DIAGRAM
G2.4L G2 NEXUS
DRAWING #: 0H6341

GROUP G

COMPONENTS LOCATED ON ENGINE

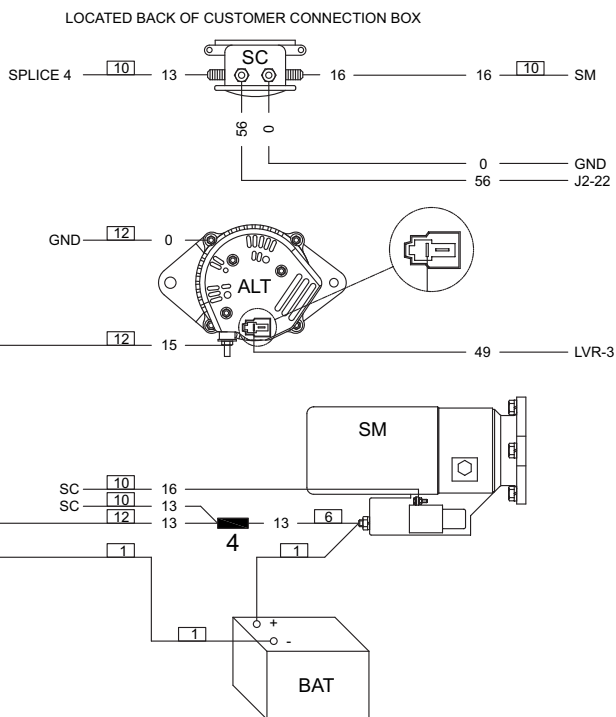
J1

1	178	LVR-5
2		
3		
4	817	BWR-2
5	818	BWR-3
6	15	SPLICE 2
7	15	SPLICE 2
8	0	SPLICE 1
9	0	SPLICE 1
10	0	MP1-2
11	0A	MP2-2
12	820	BWR-1
13	SA	HVR-5
14	183	LVR-6
15	SHLDA	MP2-1
16	SHLD	MP1-1
17	819	BWR-4
18	767	GOV-2
19	765	GOV-3
20	766	GOV-6
21	68	WTS-2
22	79A	MP2-3
23	79	MP1-3
24	SB	HVR-6
25	N1	HVR-1
26	N2	HVR-2
27		
28		
29		
30		
31	573A	WLS-A
32	573	WLS-B
33	86	LOS-NC
34	804	EC-6
35	805	EC-5



J2

1	770	GOV-4
2	808	EC-4
3	56B	FSP-5
4	451	CYL1-1
5	452	CYL2-1
6	453	CYL3-1
7	454	CYL4-1
8	14	SPLICE 5
9	771	GOV-1
10		
11	209	CAR
12	23	LVR-7
13	194	LVR-8
14	601	FSP-1
15	210	CAR
16	6	HVR-10
17	162	CB
18	4	HVR-11
19	1	HVR-12
20	T1	HVR-3
21	NEU	HVR-4
22	56	SC
23	15A	SPLICE 6



PAGE 2 OF 4

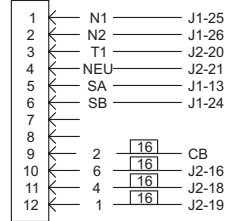
REVISION: H-8455-D
DATE: 3/7/11

WIRING - DIAGRAM
G2.4L G2 NEXUS
DRAWING #: 0H6341

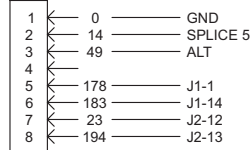
GROUP G

COMPONENTS LOCATED ON ENGINE

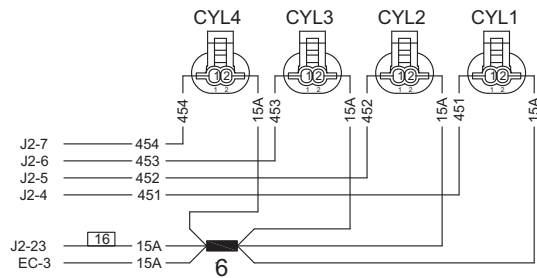
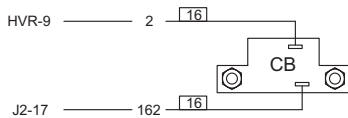
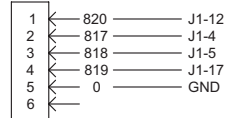
HVR



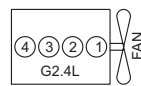
LVR



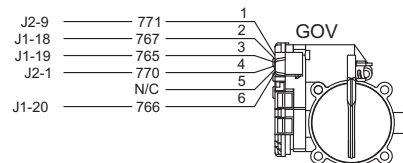
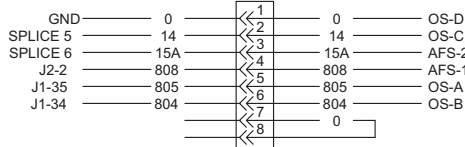
BWR



ENGINE BLOCK TOP VIEW



EC



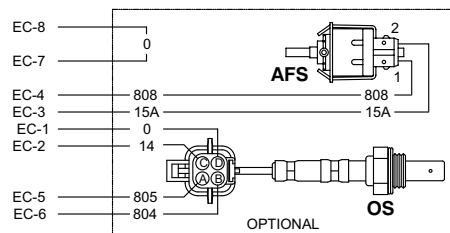
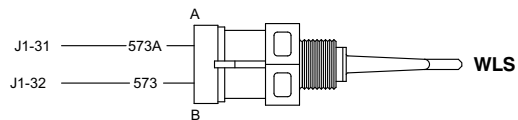
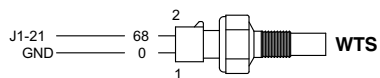
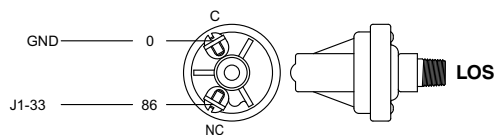
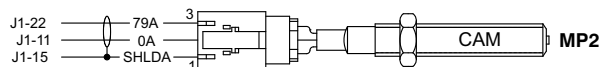
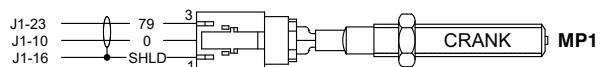
PAGE 3 OF 4

REVISION: H-8455-D
DATE: 3/7/11

WIRING - DIAGRAM
G2.4L G2 NEXUS
DRAWING #: 0H6341

GROUP G

COMPONENTS LOCATED ON ENGINE



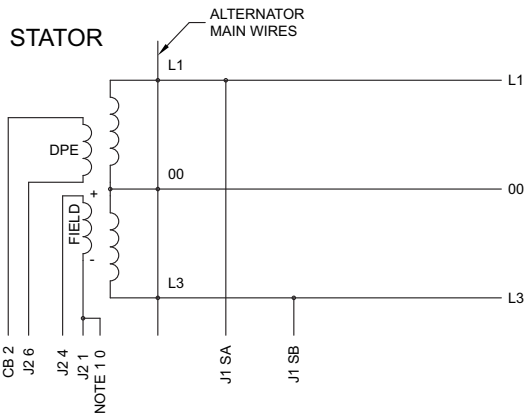
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Section 5.18 *0H6340-D Electrical Schematic 2.4L Gaseous - Nexus*

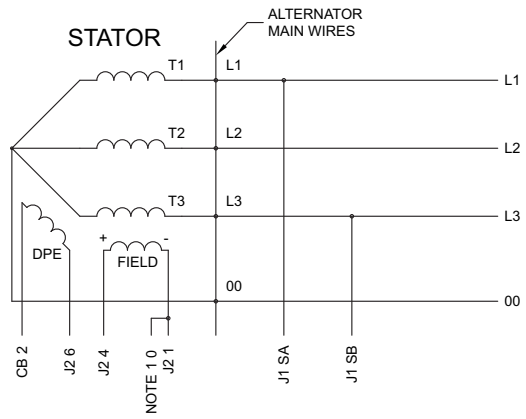
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G



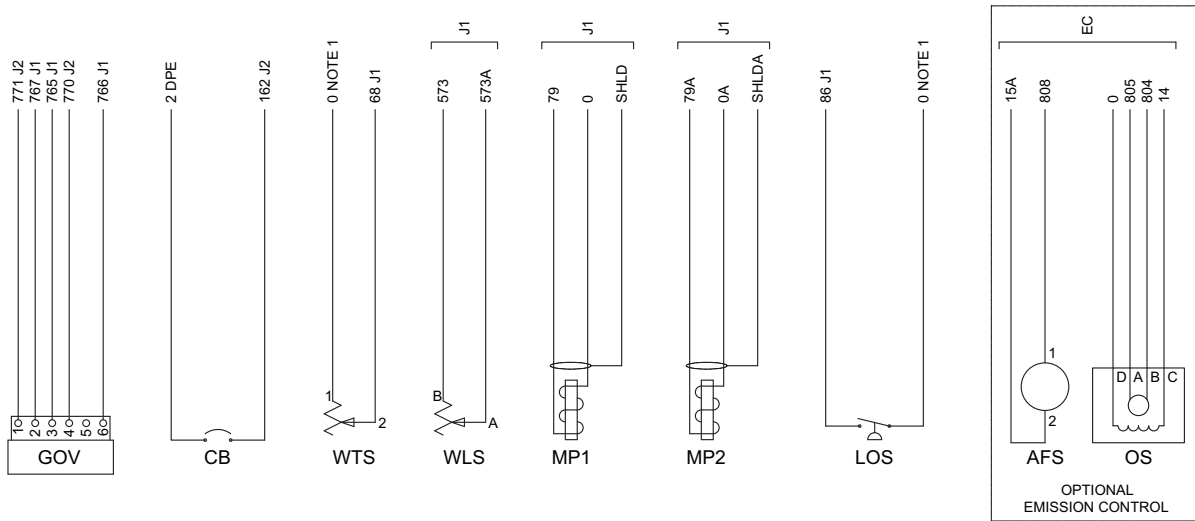
ALTERNATOR CONNECTIONS FOR 1Ø UNITS



ALTERNATOR CONNECTIONS FOR 3Ø UNITS

ALTERNATOR CONNECTION BOX

GENERATOR SET

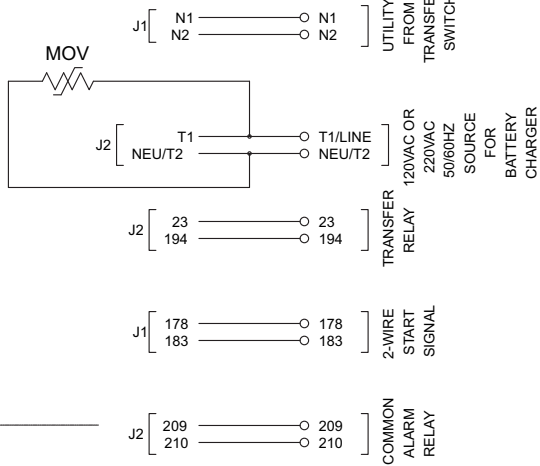
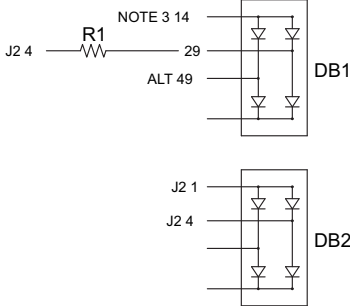
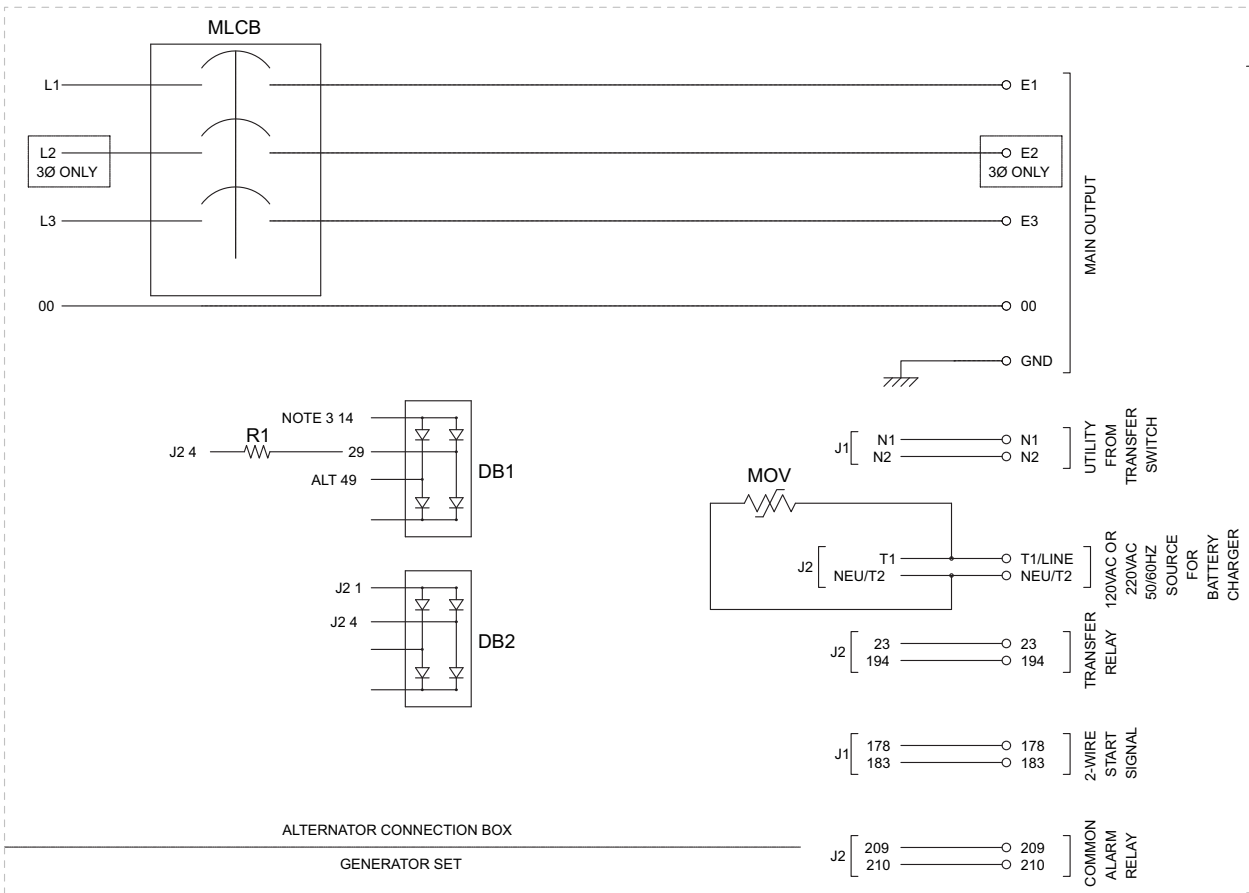


PAGE 1 OF 4

REVISION: H-8455-D
DATE: 3/7/11

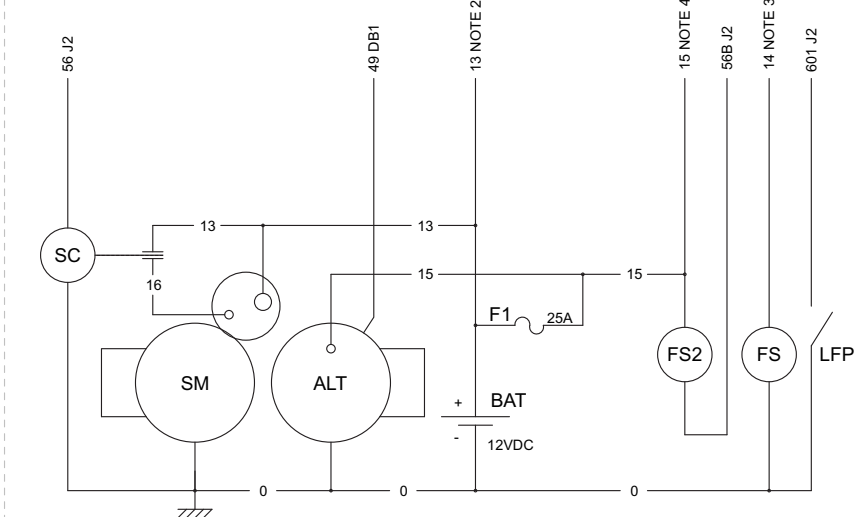
SCHMATIC - DIAGRAM
G2.4L G2 NEXUS
DRAWING #: 0H6340

GROUP G

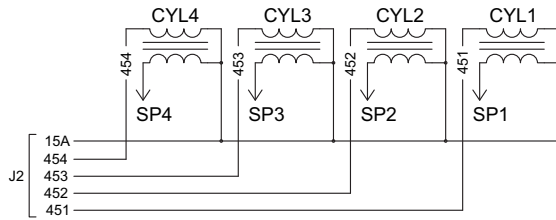


ALTERNATOR CONNECTION BOX
GENERATOR SET

NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG



GROUP G



PAGE 3 OF 4

REVISION: H-8455-D
DATE: 3/7/11

SCHEMATIC - DIAGRAM
G2.4L G2 NEXUS
DRAWING #: 0H6340

GROUP G

NOTES:
 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION AND FOR THE IGNITION COILS.

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-1	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
11	0A	MP2-2	CAM SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
15	SHLDA	MP2-1	CAM SENSOR DRAIN
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
22	79A	MP2-3	CAM SENSOR +
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	453	CYL3	IGNITION COIL DRIVE 3
7	454	CYL4	IGNITION COIL DRIVE 4
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3/CYL1-CYL4	NOTE 5

LEGEND

- | | | |
|---------------------------------|-------------------------------------|----------------------------------|
| 00 - NEUTRAL | EC - EMISSIONS CONNECTOR | OS - OXYGEN SENDER |
| AFS - AIR/FUEL SOLENOID | F1 - FUSE INLINE | R1 - RESISTOR |
| ALT - DC CHARGE ALTERNATOR | FS - FUEL SOLENOID | SC - STARTER CONTACTOR |
| BAT - BATTERY | GOV - ELECTRONIC GOVERNOR ACTUATOR | SHLD - SHIELD |
| BWR - BASIC WIRELESS RECEPTACLE | J - ENGINE CONTROL MODULE CONNECTOR | SM - STARTER MOTOR |
| CAR - COMMON ALARM RELAY | LFP - LOW FUEL PRESSURE SWITCH | SP - SPARK PLUG |
| CB - CIRCUIT BREAKER | LOS - LOW OIL PRESSURE SWITCH | WLS - COOLANT LEVEL SENDER |
| CYL - CYLINDER IGNITION COIL | MLCB - MAIN LINE CIRCUIT BREAKER | WTS - COOLANT TEMPERATURE SENDER |
| DB - DIODE BRIDGE | MOV - METAL OXIDE VARISTOR | |
| DPE - EXCITER | MP - MAGNETIC PICKUP | |

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Section 5.19 *0H6683-C Wiring Diagram 4.2L Gaseous - Nexus*

Introduction

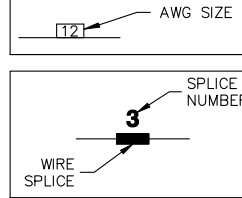
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

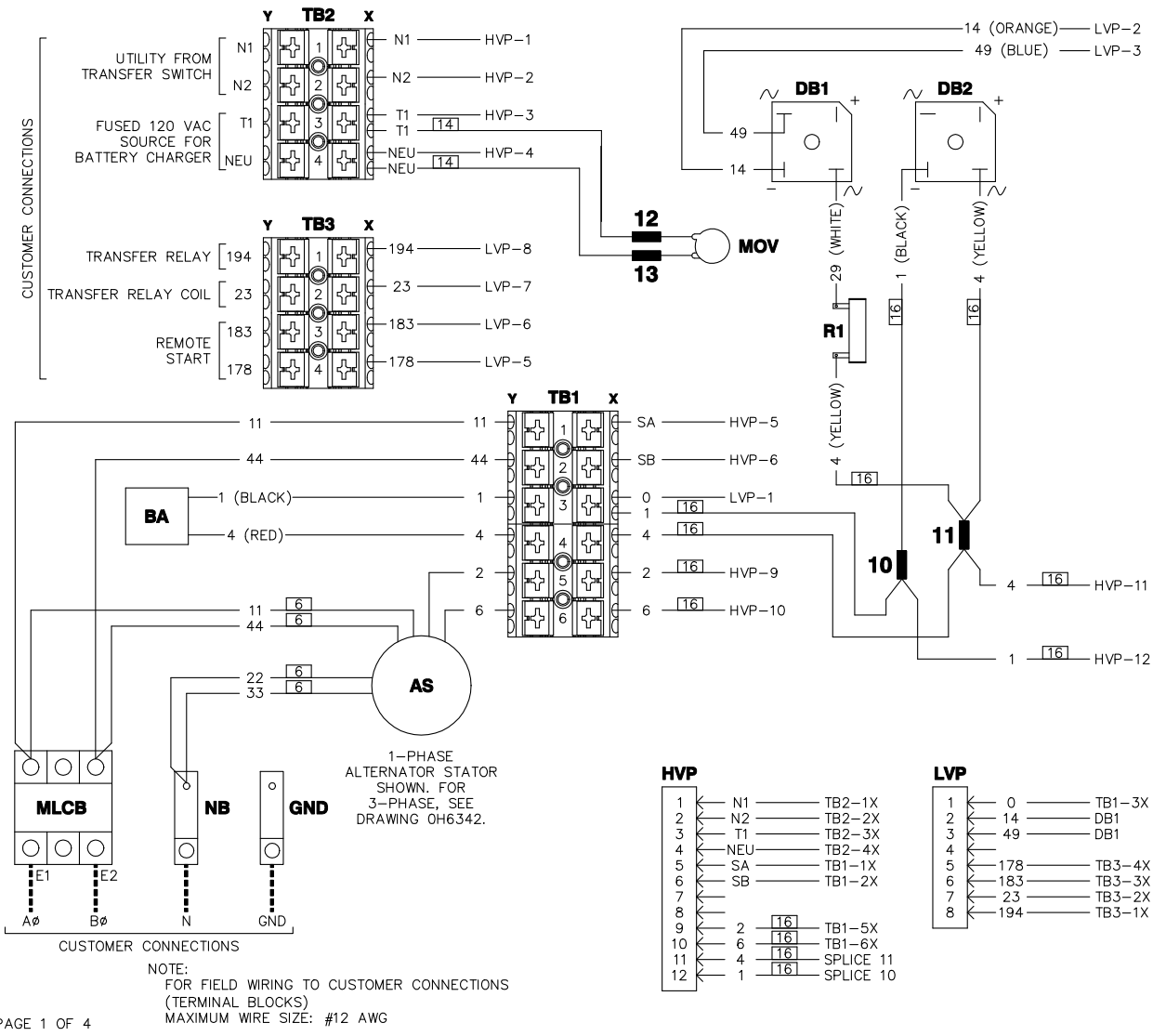
- | | |
|---|---|
| AFS - AIR/FUEL SOLENOID | ICM - IGNITION CONTROL MODULE |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAM - CAMSHAFT SENSOR | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CAR - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| CB - CIRCUIT BREAKER | MOV - METAL OXIDE VARISTOR |
| CSS - CRANKSHAFT SENSOR | MP1 - MAGNETIC PICKUP |
| CYL - CYLINDER IGNITION COIL | NB - NEUTRAL BLOCK |
| DB - DIODE BRIDGE | OS - OXYGEN SENDER |
| EC - EMISSIONS CONNECTOR | R1 - RESISTOR |
| F - FUSE INLINE | SC - STARTER CONTACTOR |
| FS - FUEL SOLENOID | SM - STARTER MOTOR |
| GND - GROUND CONNECTION | TB - TERMINAL BLOCK, CAGE CLAMP |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WLS - COOLANT LEVEL SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WTS - COOLANT TEMPERATURE SENDER |
| HVR - HIGH VOLTAGE RECEPTACLE 12-PIN | |

NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE



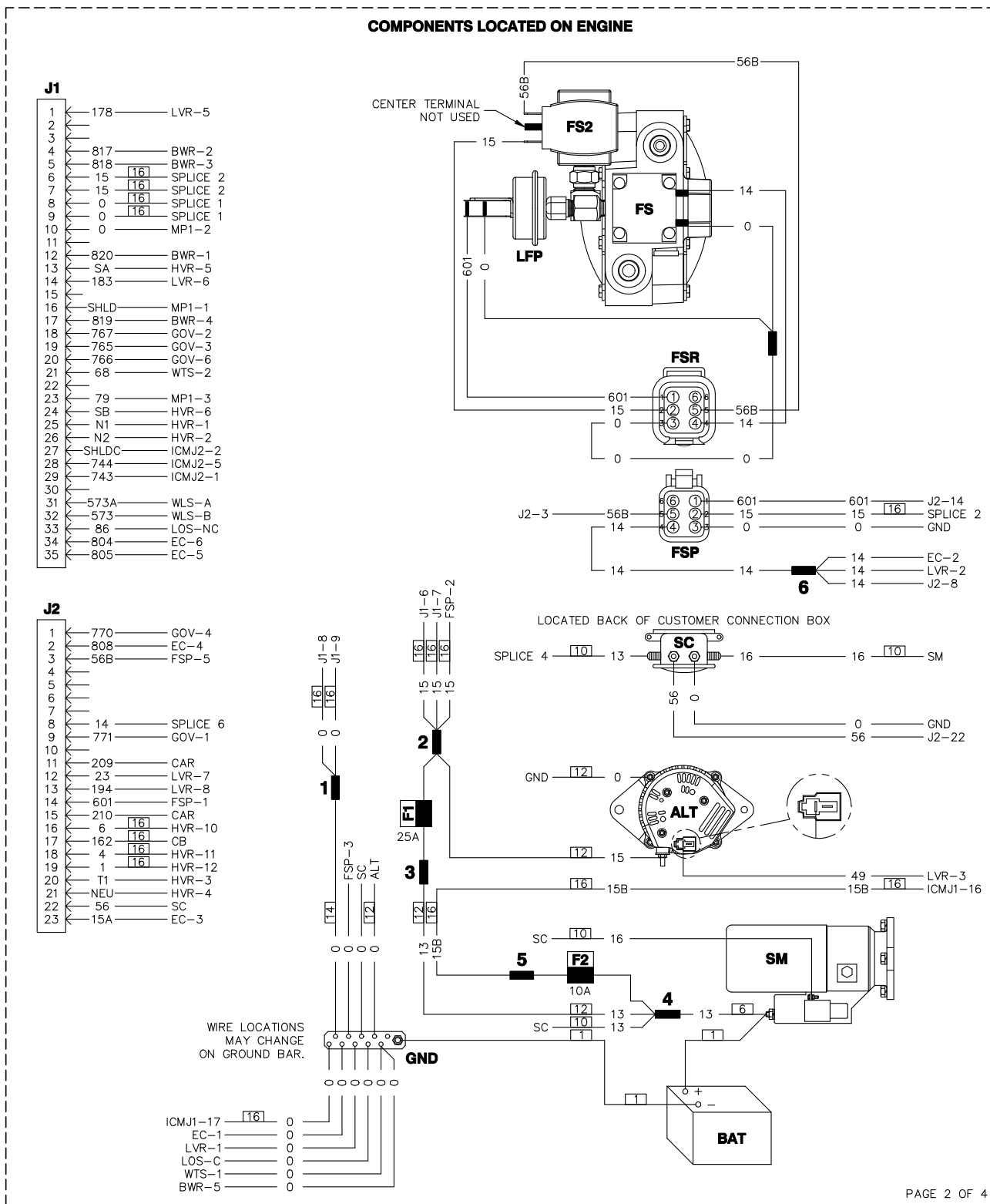
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COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX



NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

GROUP G



REVISION: H-7738-C
 DATE: 10/29/10

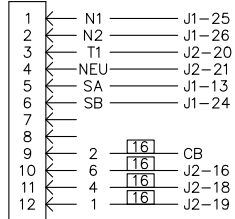
PAGE 2 OF 4

WIRING - DIAGRAM
 G4.2L G3 NEXUS
 DRAWING #: 0H6683

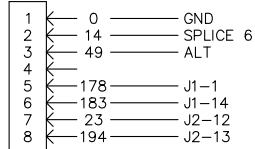
GROUP G

COMPONENTS LOCATED ON ENGINE

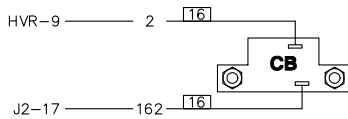
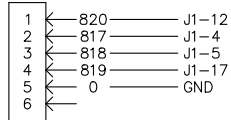
HVR



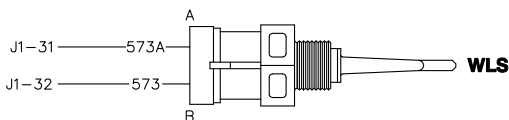
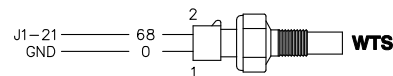
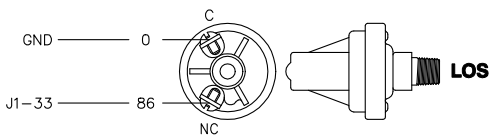
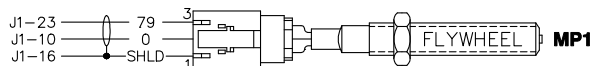
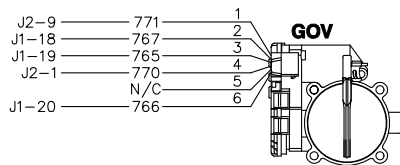
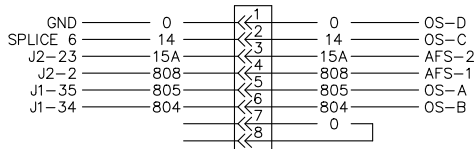
LVR



BWR



EC



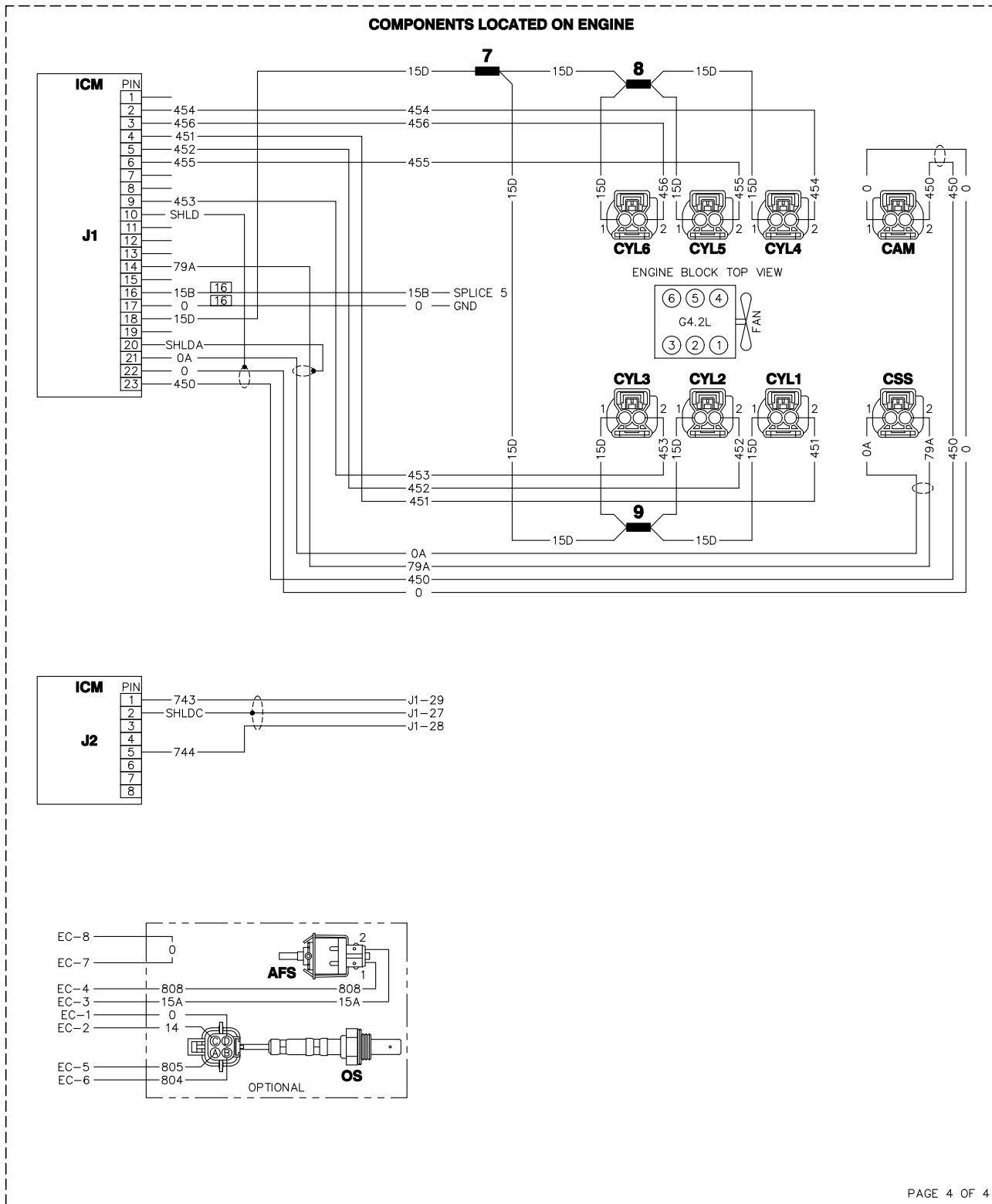
PAGE 3 OF 4

REVISION: H-7738-C
DATE: 10/29/10

PAGE 3 OF 4

WIRING - DIAGRAM
G4.2L G3 NEXUS
DRAWING #: 0H6683

GROUP G



PAGE 4 OF 4

REVISION: H-7738-C
 DATE: 10/29/10

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WIRING - DIAGRAM
G4.2L G3 NEXUS
DRAWING #: 0H6683

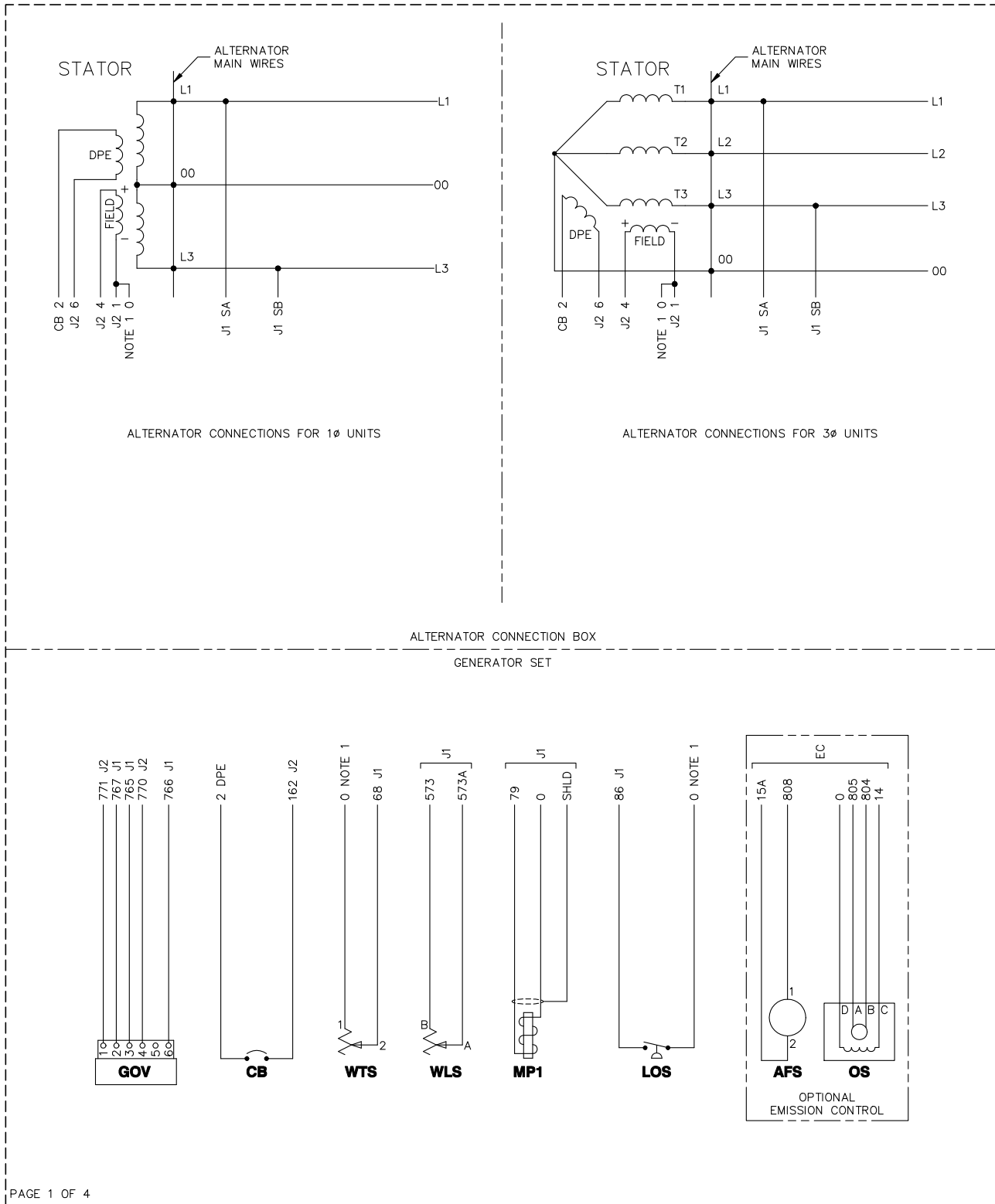
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Section 5.20 *0H6682-C Electrical Schematic 4.2L Gaseous - Nexus*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G



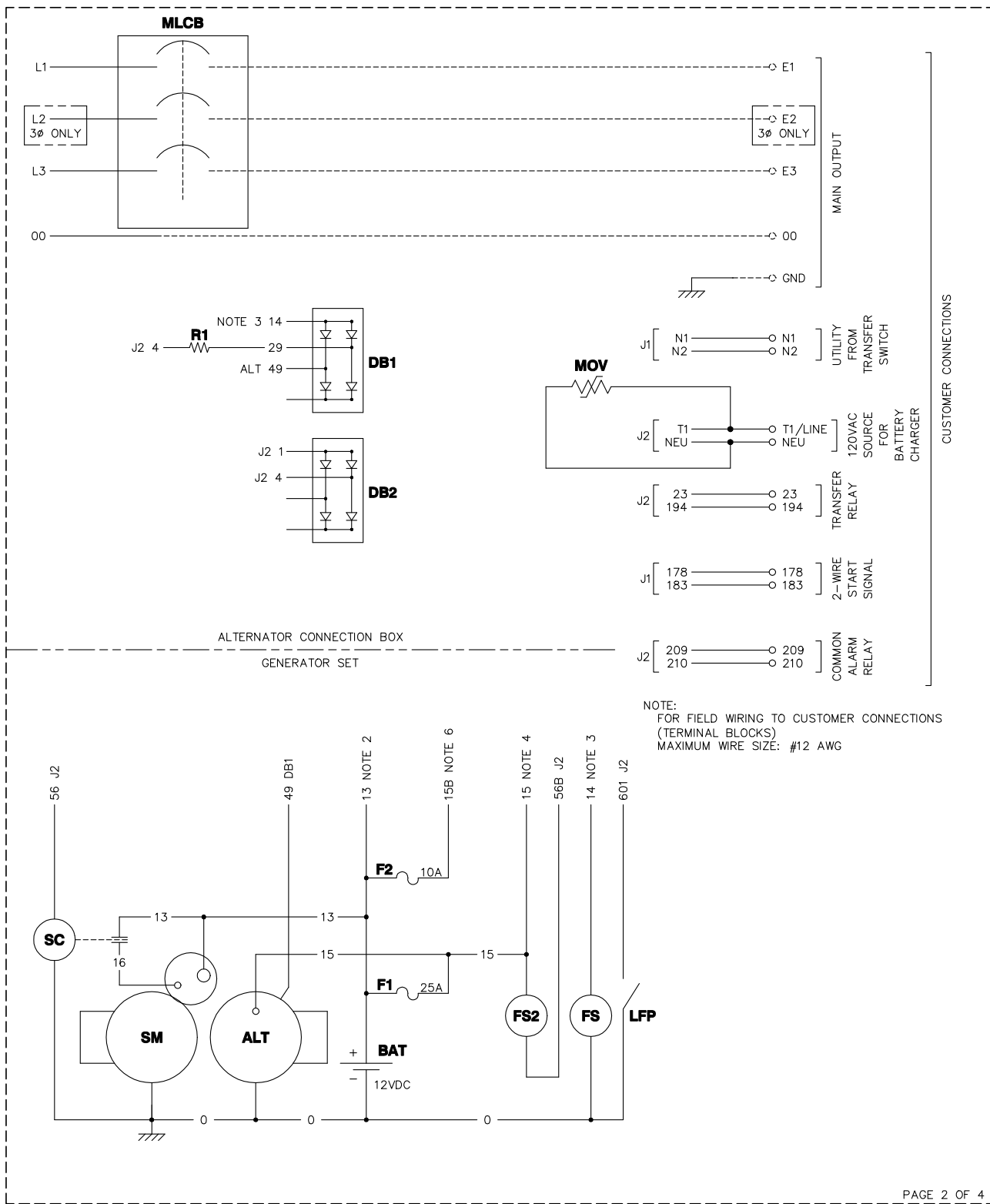
PAGE 1 OF 4

REVISION: H-7738-C
DATE: 10/29/10

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SCHEMATIC - DIAGRAM
G4.2L G3 NEXUS
DRAWING #: 0H6682

GROUP G



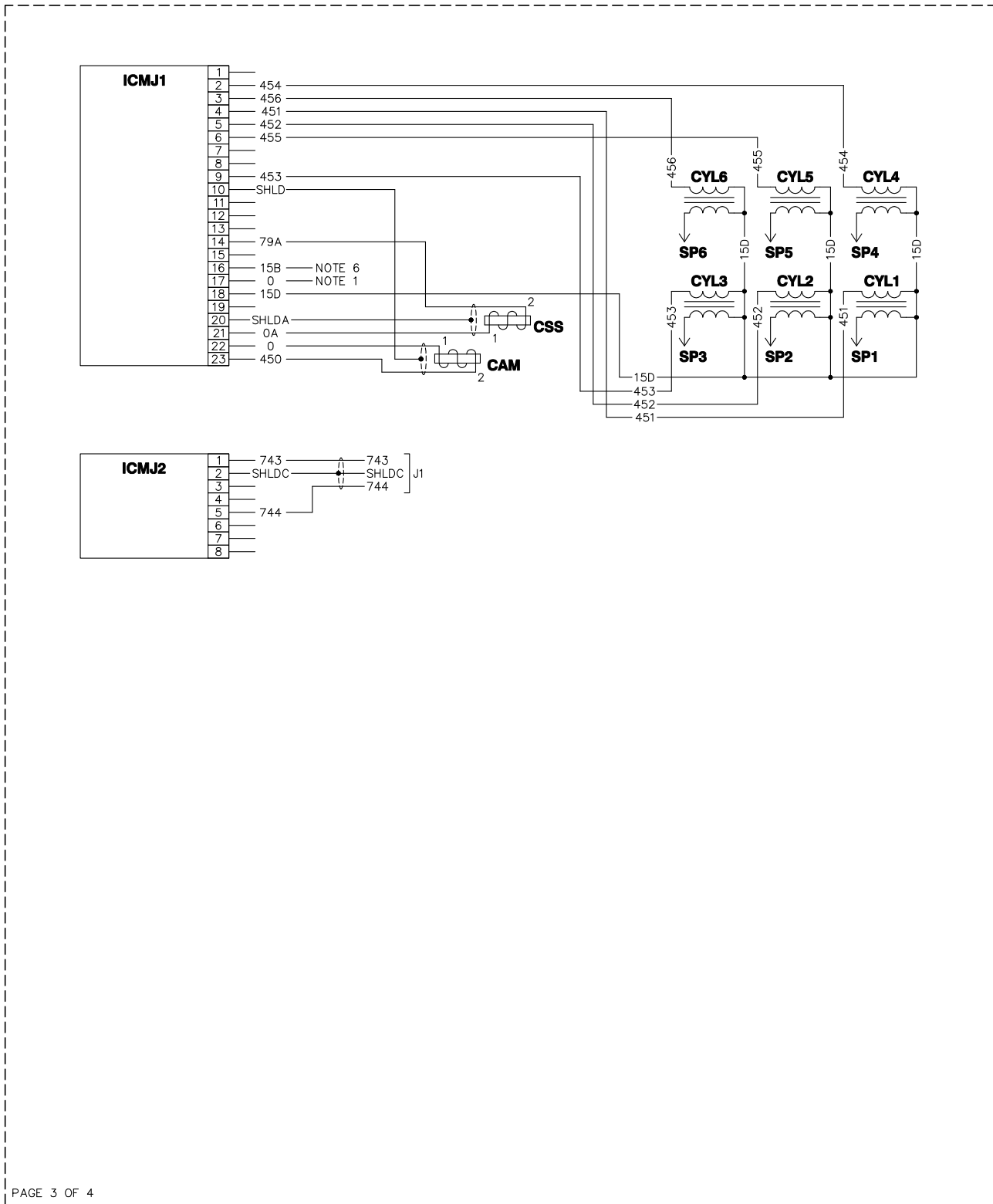
PAGE 2 OF 4

SCHEMATIC - DIAGRAM
G4.2L G3 NEXUS
DRAWING #: 0H6682

REVISION: H-7738-C
 DATE: 10/29/10

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GROUP G



PAGE 3 OF 4

SCHEMATIC - DIAGRAM
G4.2L G3 NEXUS
DRAWING #: 0H6682

REVISION: H-7738-C
DATE: 10/29/10

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GROUP G

NOTES:
 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F_ - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SP_ - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL_ - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB_ - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

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Section 5.21 *0H9099-A Wiring Diagram 4.6L Gaseous - Nexus*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

- | | |
|---|---|
| AFS - AIR/FUEL SOLENOID | ICMJ_ - IGNITION CONTROL MODULE |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG B-PIN (BULKHEAD) |
| CAM - CAMSHAFT SENSOR | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CAR - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| CB - CIRCUIT BREAKER | MOV - METAL OXIDE VARISTOR |
| CSS - CRANKSHAFT SENSOR | MPU - MAGNETIC PICKUP |
| CYL - CYLINDER IGNITION COIL | NB - NEUTRAL BLOCK |
| DB - DIODE BRIDGE | OS - OXYGEN SENDER |
| EC - EMISSIONS CONNECTOR | R1 - RESISTOR |
| F - FUSE INLINE | SC - STARTER CONTACTOR |
| FS - FUEL SOLENOID | SM - STARTER MOTOR |
| GND - GROUND CONNECTION | TB - TERMINAL BLOCK, CAGE CLAMP |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WLS - COOLANT LEVEL SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WTS - COOLANT TEMPERATURE SENDER |
| HVR - HIGH VOLTAGE RECEPTACLE 12-PIN | |

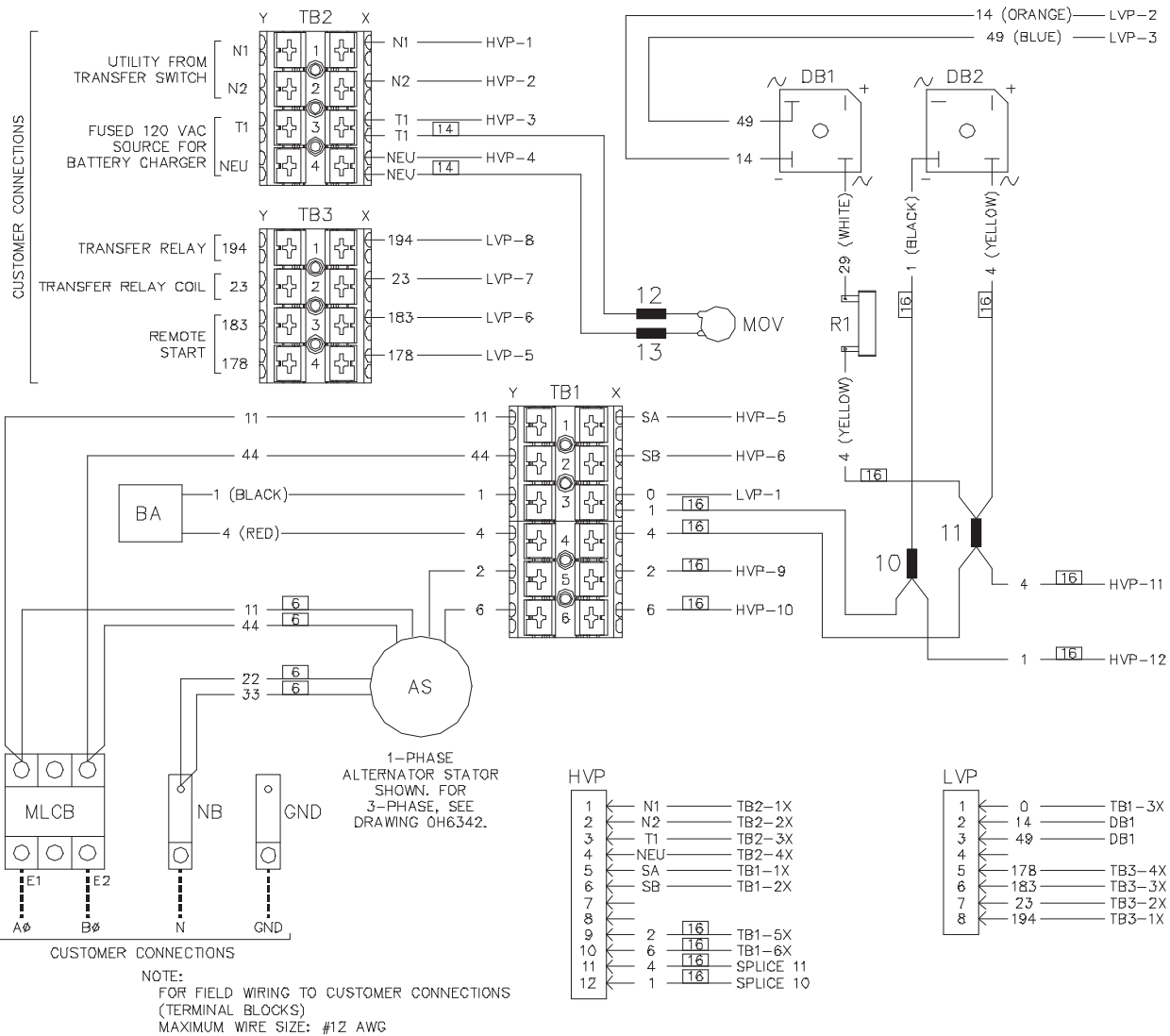
NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE

SPLICE NUMBER

WIRE SPLICE

NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX

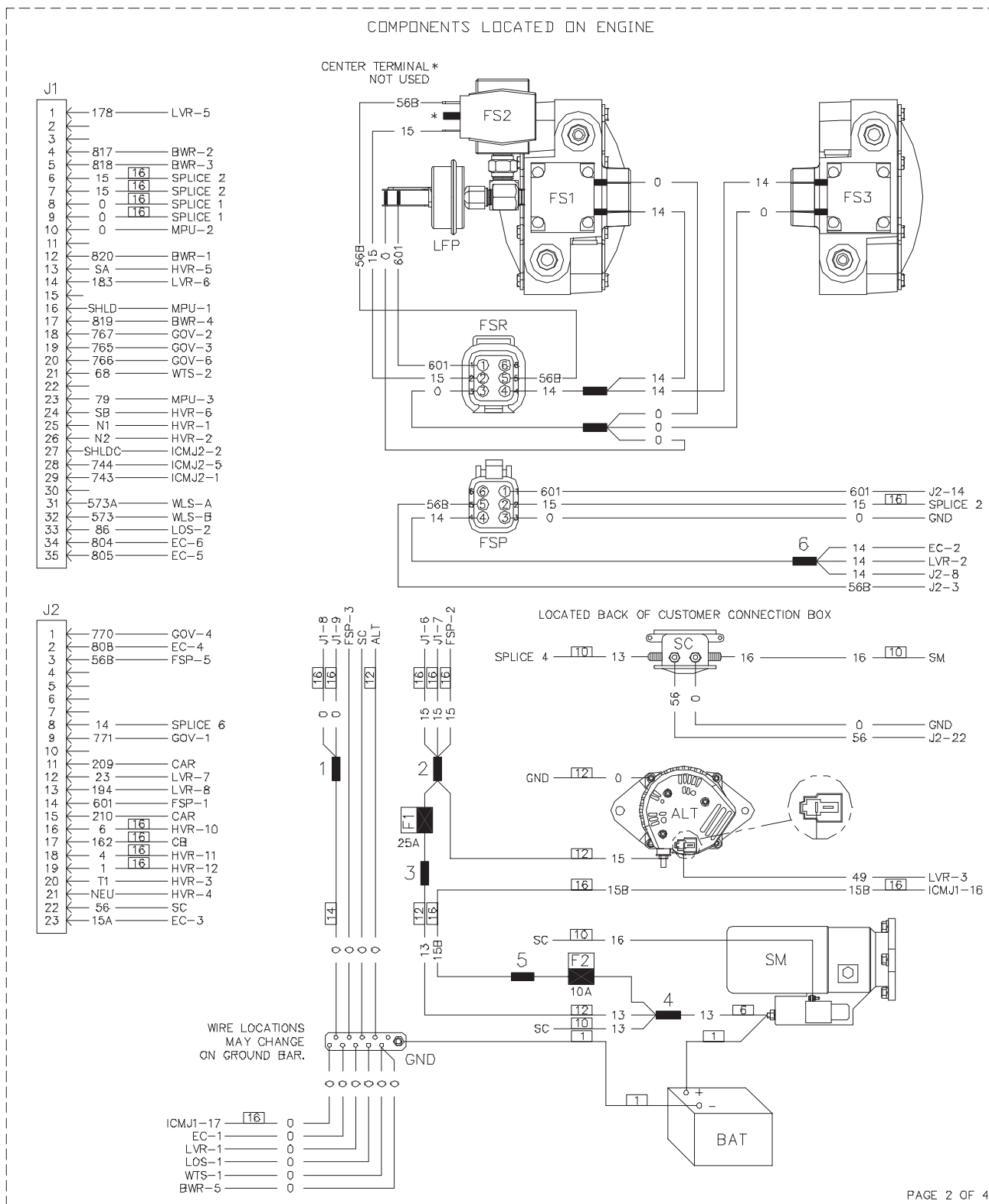


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REVISION: -A-
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WIRING - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9099

GROUP G



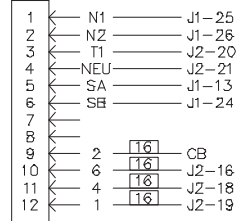
REVISION: -A-
DATE: 5/17/10

WIRING - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9099

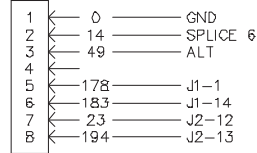
GROUP G

COMPONENTS LOCATED ON ENGINE

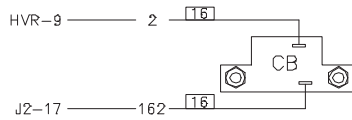
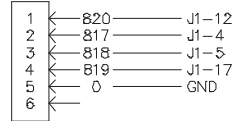
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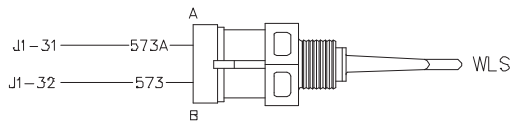
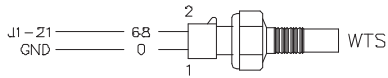
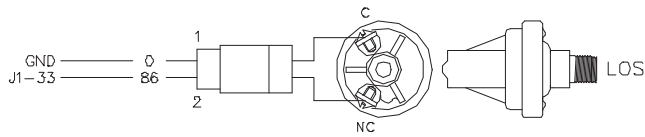
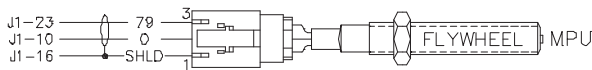
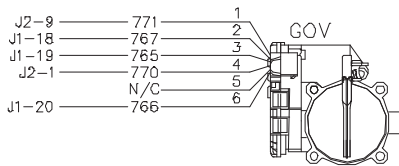
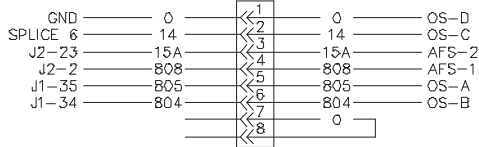
LVR



BWR



EC

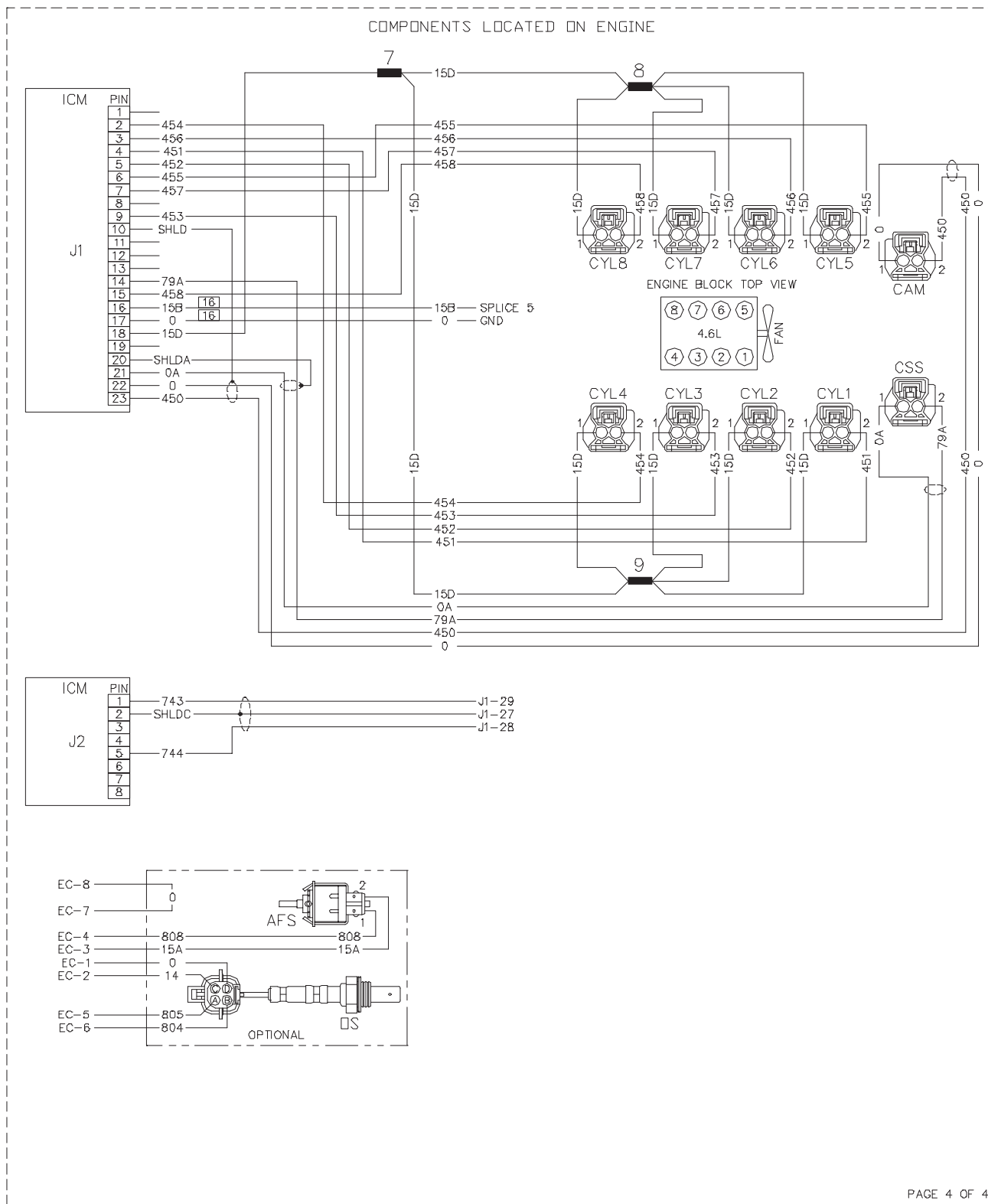


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REVISION: -A-
DATE: 5/17/10

WIRING - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9099

GROUP G



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REVISION: -A-
DATE: 5/17/10

WIRING - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9099

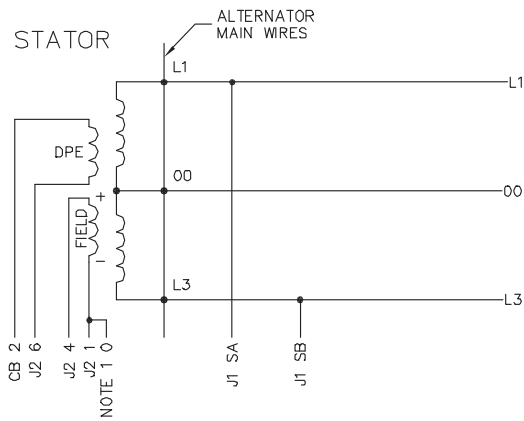
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Section 5.22 *0H9098-A Electrical Schematic 4.6L Gaseous - Nexus*

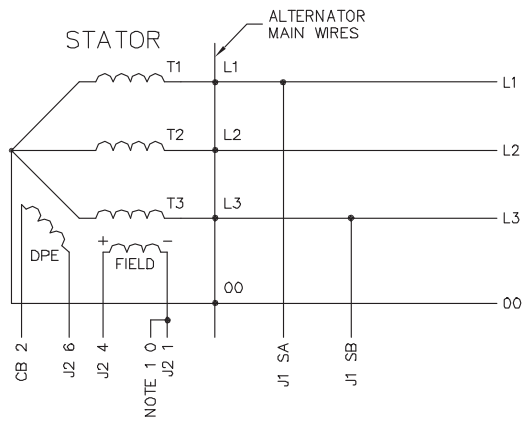
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

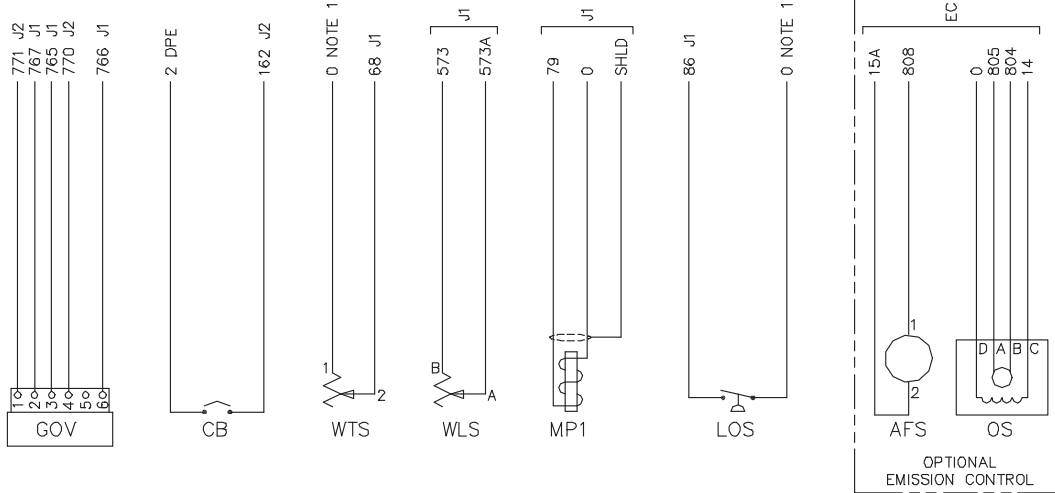
GROUP G



ALTERNATOR CONNECTIONS FOR 1 ϕ UNITS



ALTERNATOR CONNECTIONS FOR 3 ϕ UNITS

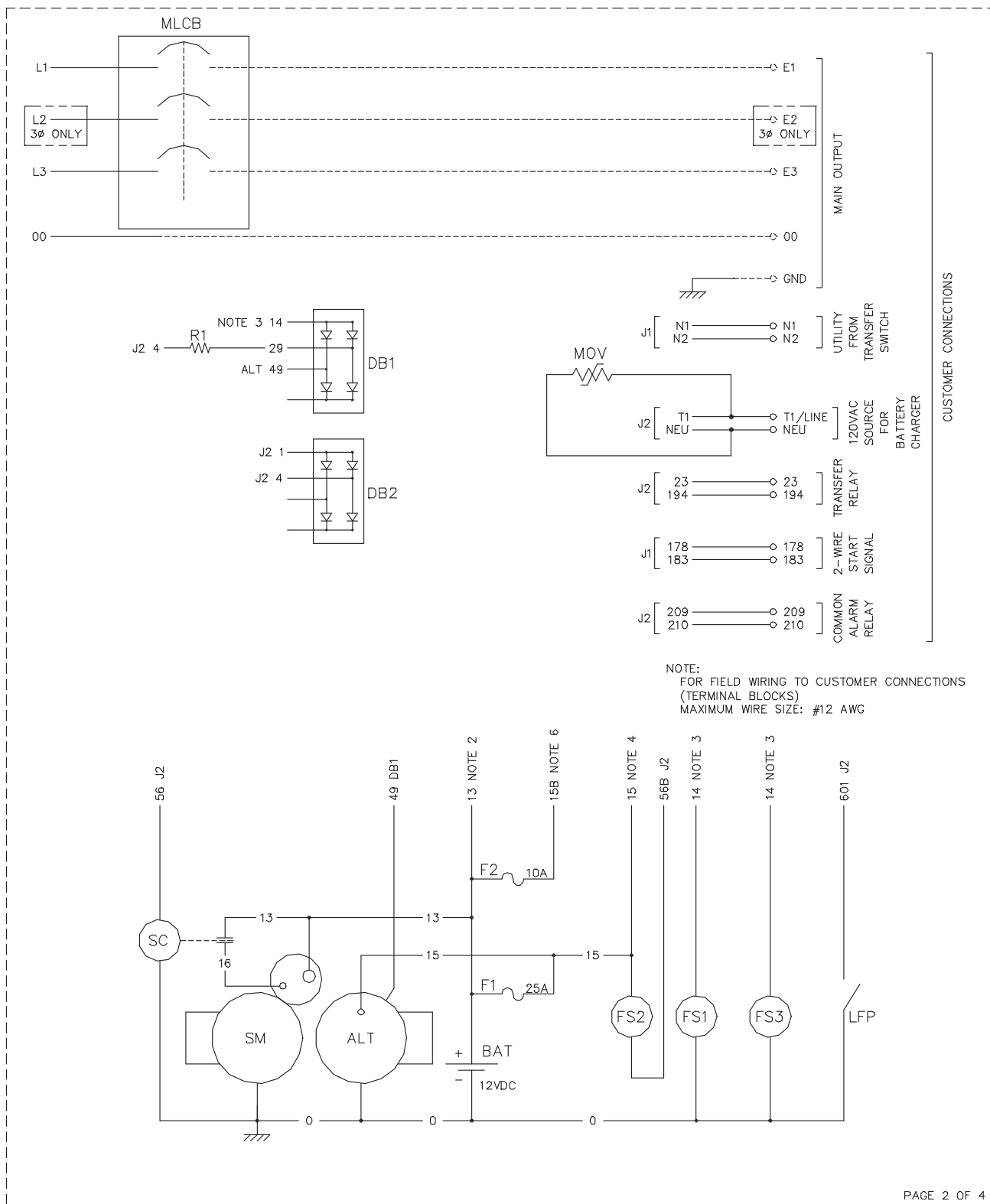


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SCHEMATIC - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: OH9098

REVISION: -A-
DATE: 9/20/10

GROUP G

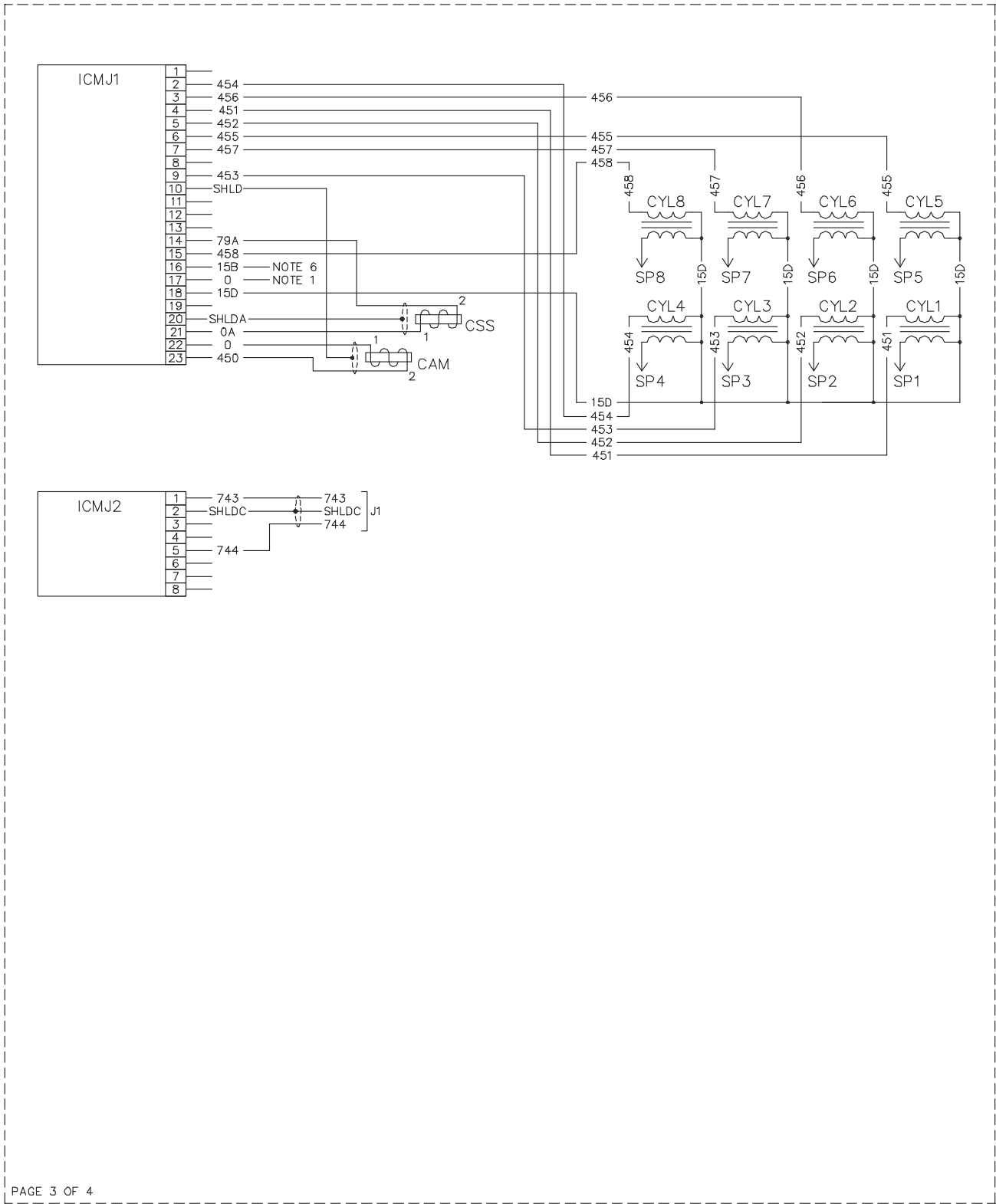


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REVISION: -A-
DATE: 9/20/10

SCHEMATIC — DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9098

GROUP G



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REVISION: -A-
DATE: 9/20/10

SCHMATIC - DIAGRAM
G4.6L G3 NEXUS
DRAWING #: 0H9098

GROUP G

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
7	457	CYL7	IGNITION COIL DRIVE 7
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
15	458	CYL8	IGNITION COIL DRIVE 8
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL8	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
- 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
- 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F_ - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SP - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL_ - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB_ - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

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REVISION: -A-
DATE: 9/20/10

SCHMATIC - DIAGRAM
G4.6L C3 NEXUS
DRAWING #: 0H9098

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Section 5.23 *OJ6685-A Wiring Diagram 5.4L Gaseous - Nexus*

Introduction

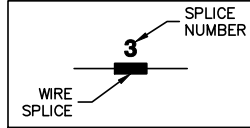
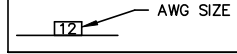
The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

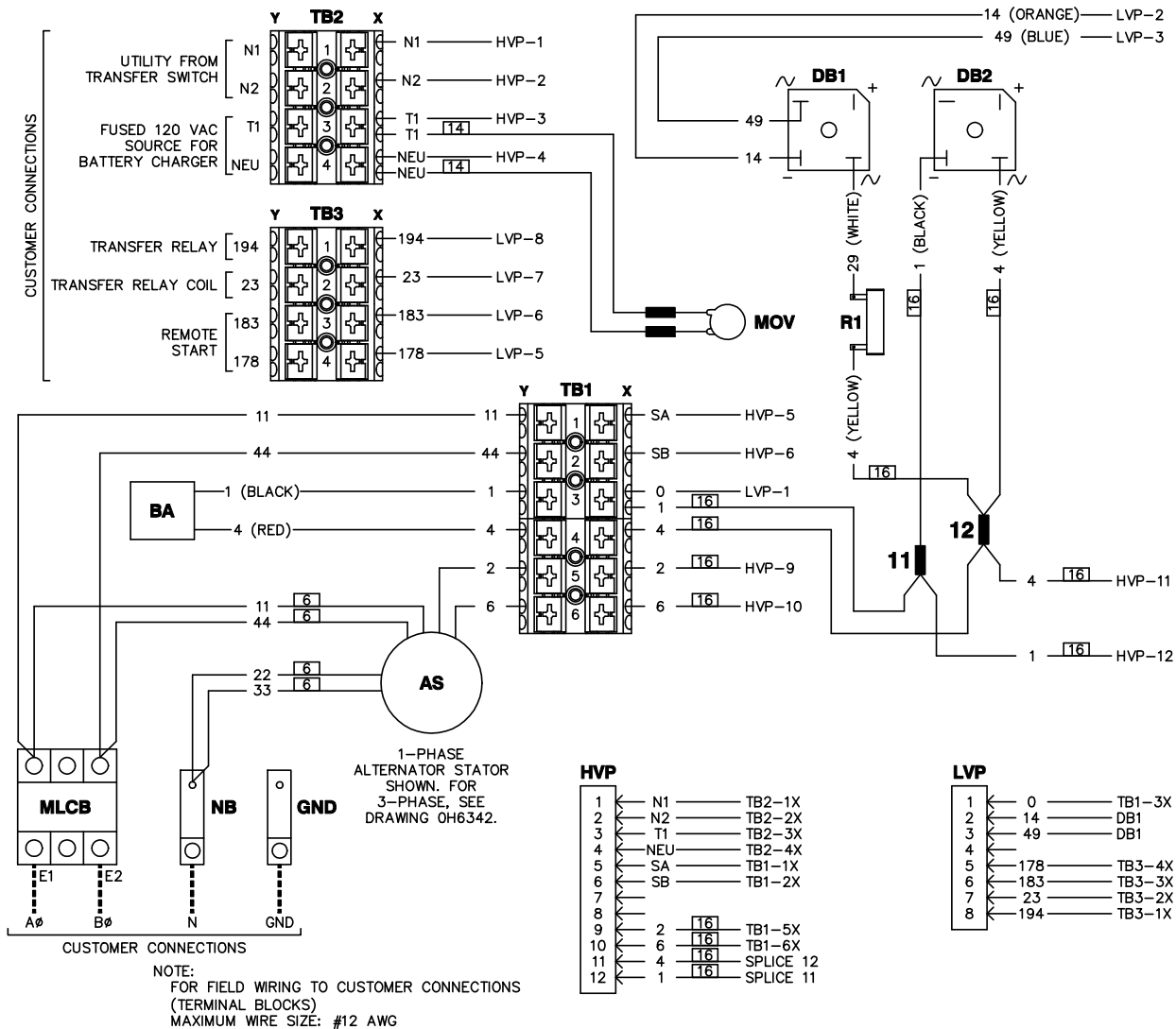
- | | |
|---|---|
| AFS - AIR/FUEL SOLENOID | ICMJ_ - IGNITION CONTROL MODULE |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAM - CAMSHAFT SENSOR | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CAR - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| CB - CIRCUIT BREAKER | MOV - METAL OXIDE VARISTOR |
| CSS - CRANKSHAFT SENSOR | MPU - MAGNETIC PICKUP |
| CYL_ - CYLINDER IGNITION COIL | NB - NEUTRAL BLOCK |
| DB_ - DIODE BRIDGE | OS - OXYGEN SENDER |
| EC - EMISSIONS CONNECTOR | R1 - RESISTOR |
| F_ - FUSE INLINE | SC - STARTER CONTACTOR |
| FS_ - FUEL SOLENOID | SM - STARTER MOTOR |
| GND - GROUND CONNECTION | TB_ - TERMINAL BLOCK, CAGE CLAMP |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | WLS - COOLANT LEVEL SENDER |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WTS - COOLANT TEMPERATURE SENDER |
| HVR - HIGH VOLTAGE RECEPTACLE 12-PIN | |

NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE



NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX



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WIRING - DIAGRAM

G5.4L G3

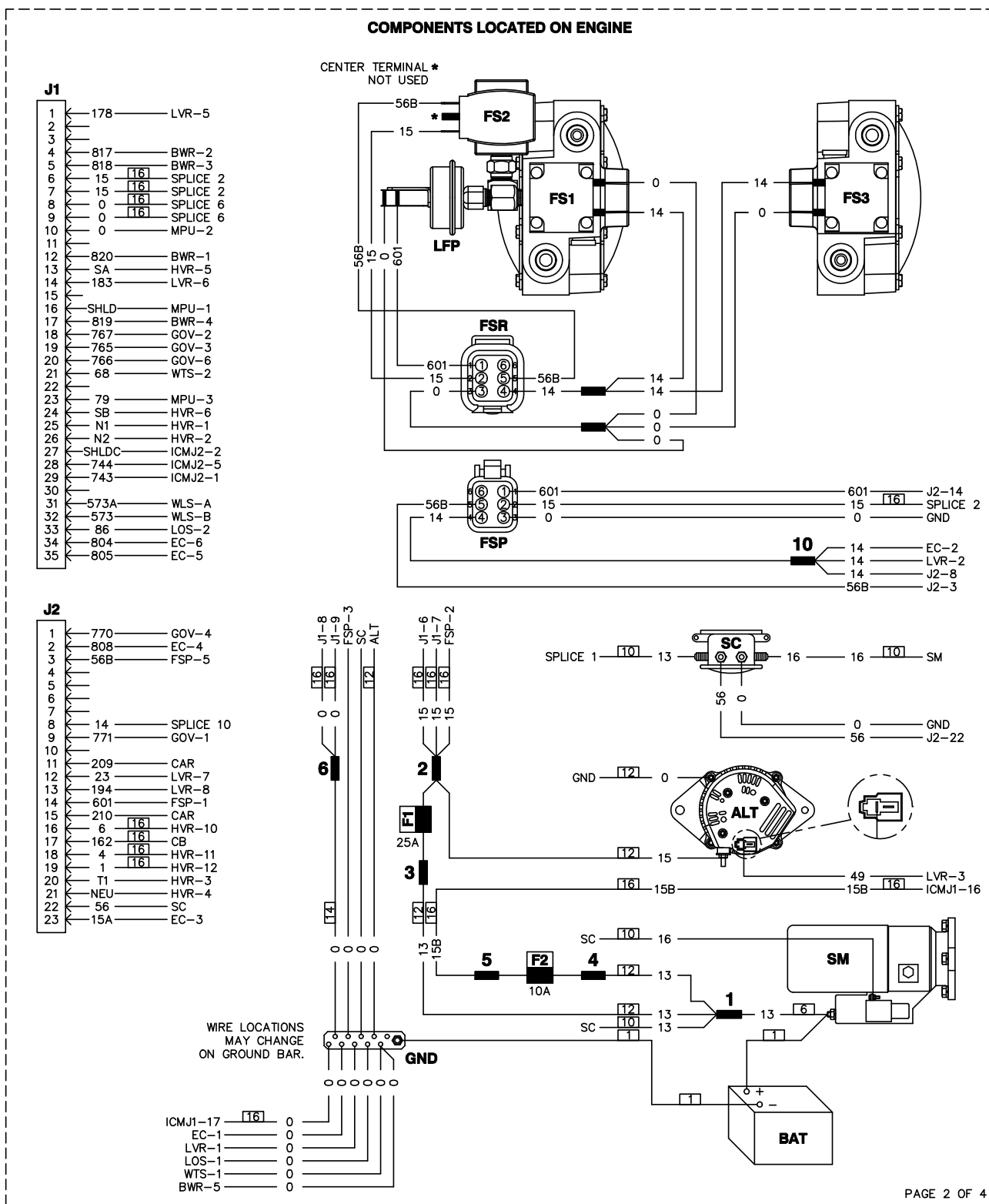
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REVISION: -A-

DATE: 8/11/11

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GROUP G



REVISION: -A-
 DATE: 8/11/11

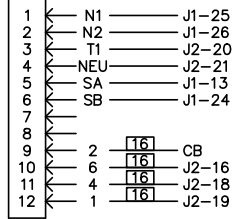
PAGE 2 OF 4

WIRING - DIAGRAM
 G5.4L G3
 DRAWING #: 0J6685

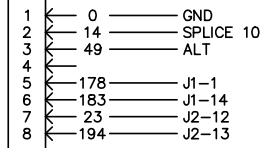
GROUP G

COMPONENTS LOCATED ON ENGINE

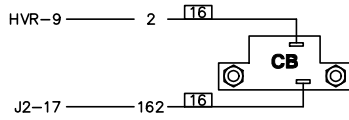
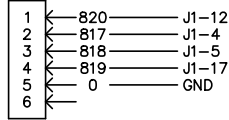
HVR



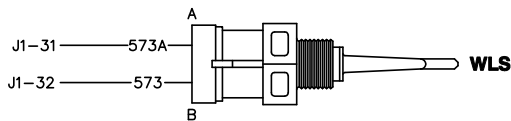
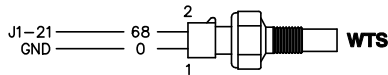
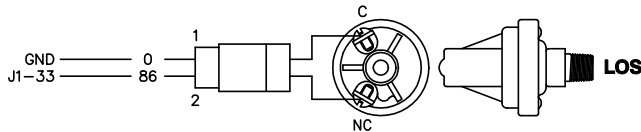
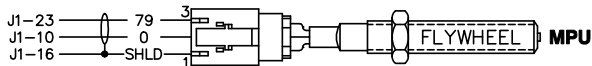
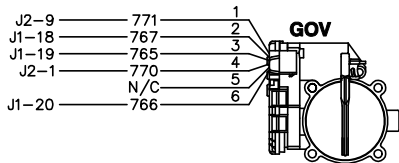
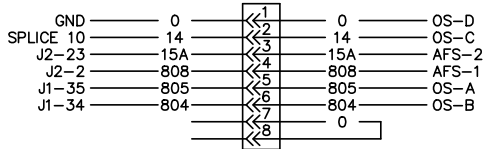
LVR



BWR



EC



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WIRING - DIAGRAM

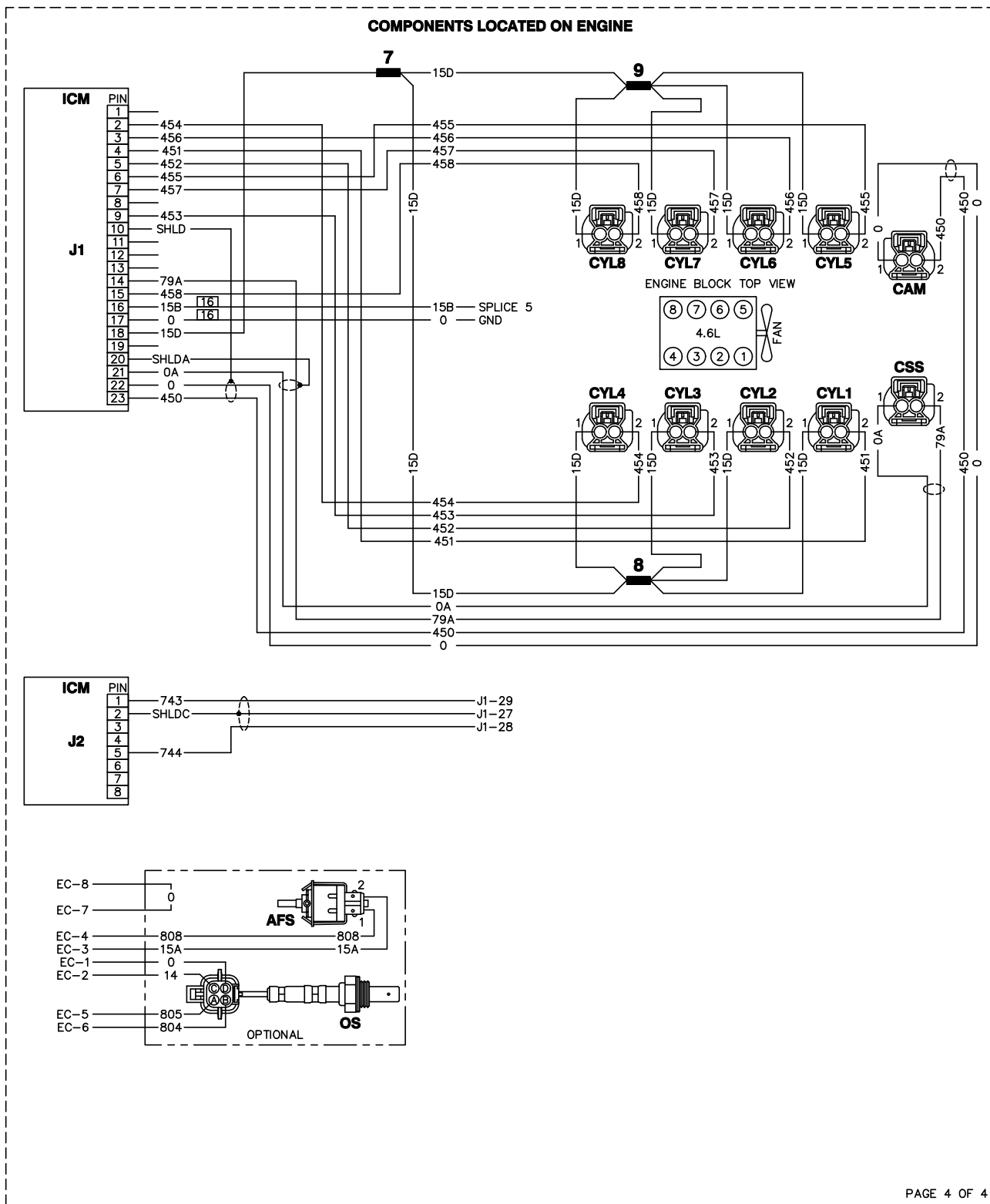
G5.4L G3

DRAWING #: 0J6685

REVISION: -A-
DATE: 8/11/11

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GROUP G



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REVISION: -A-
 DATE: 8/11/11

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WIRING - DIAGRAM
 G5.4L G3
 DRAWING #: 0J6685

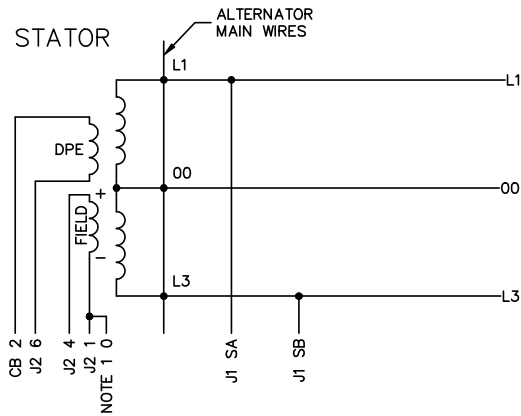
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Section 5.24 *OJ6686-A Electrical Schematic 5.4L Gaseous - Nexus*

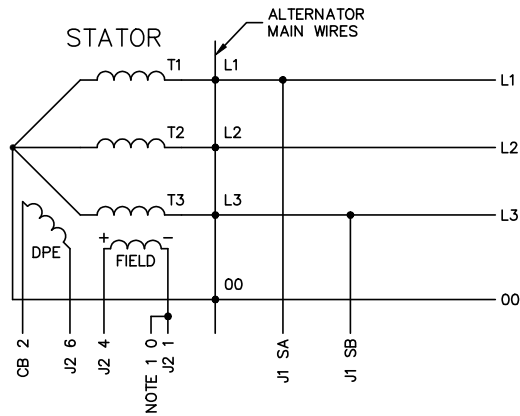
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

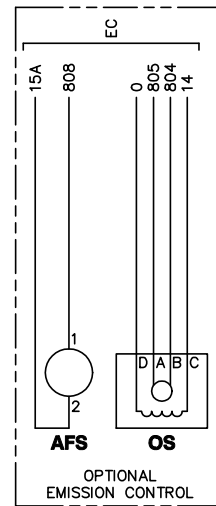
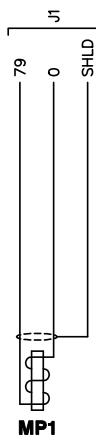
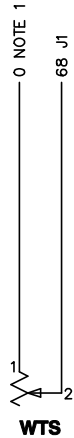
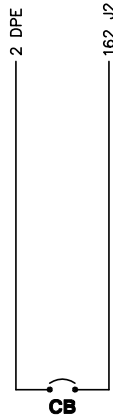
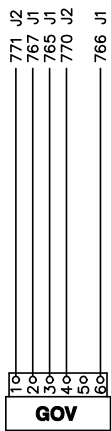
GROUP G



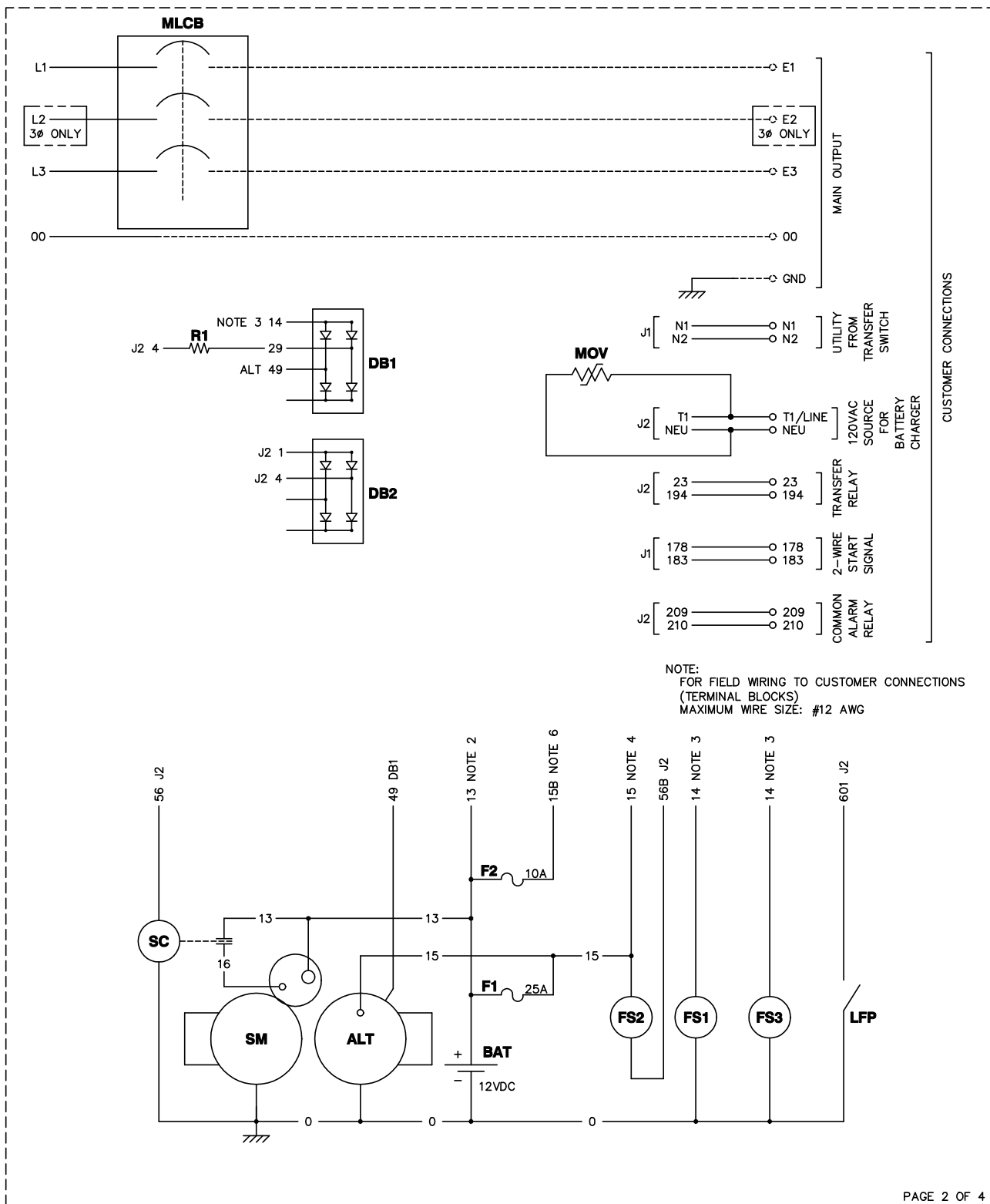
ALTERNATOR CONNECTIONS FOR 1φ UNITS



ALTERNATOR CONNECTIONS FOR 3φ UNITS



GROUP G



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SCHEMATIC - DIAGRAM

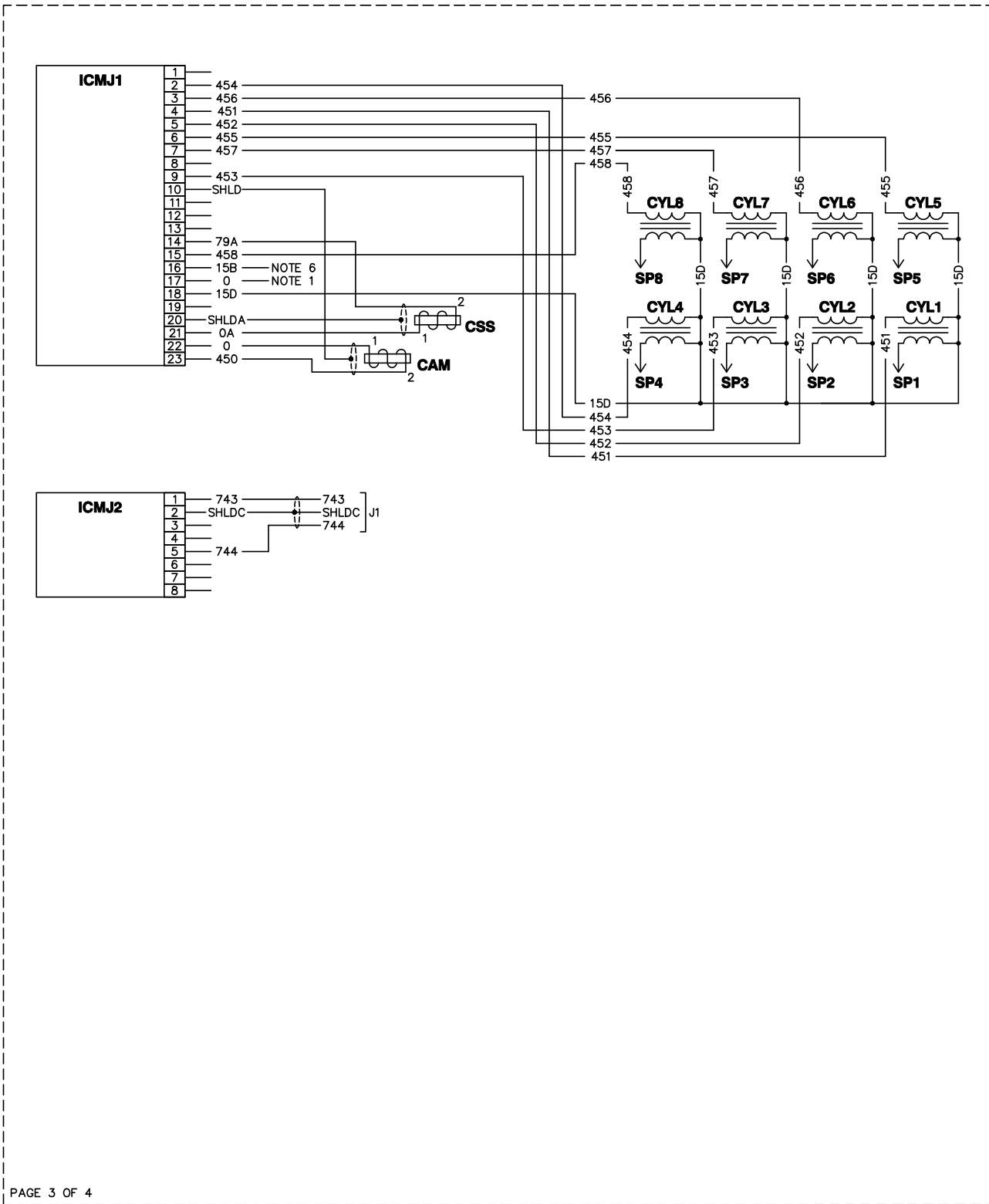
G5.4L G3

DRAWING #: 0J6686

REVISION: -A-
DATE: 8/11/11

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GROUP G



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SCHEMATIC - DIAGRAM

G5.4L G3

DRAWING #: 0J6686

REVISION: -A-
DATE: 8/11/11

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GROUP G

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
7	457	CYL7	IGNITION COIL DRIVE 7
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
15	458	CYL8	IGNITION COIL DRIVE 8
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
- 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
- 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

EC CONNECTOR

PIN	WIRE	TO	FUNCTION
1	0	GND	NOTE 1
2	14	J2-8	NOTE 3
3	15A	J2-23	NOTE 5
4	808	J2-2	AIR/FUEL RATIO SOLENOID DRIVER
5	805	J1-35	OXYGEN SENSOR RETURN
6	804	J1-34	OXYGEN SENSOR +

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	EC-6	OXYGEN SENSOR +
35	805	EC-5	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	EC-4	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	EC-3	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	MP1 - MAGNETIC PICKUP
AFS - AIR/FUEL SOLENOID	EC - EMISSIONS CONNECTOR	OS - OXYGEN SENDER
ALT - DC CHARGE ALTERNATOR	F_ - FUSE INLINE	R1 - RESISTOR
BAT - BATTERY	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BWR - BASIC WIRELESS RECEPTACLE	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
CAM - CAMSHAFT SENSOR	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAR - COMMON ALARM RELAY	J_ - ENGINE CONTROL MODULE CONNECTOR	SP_ - SPARK PLUG
CB - CIRCUIT BREAKER	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CSS - CRANKSHAFT SENSOR	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CYL_ - CYLINDER IGNITION COIL	MLCB - MAIN LINE CIRCUIT BREAKER	
DB_ - DIODE BRIDGE	MOV - METAL OXIDE VARISTOR	

PAGE 4 OF 4

SCHEMATIC - DIAGRAM

G5.4L G3

REVISION: -A-

DATE: 8/11/11

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DRAWING #: 0J6686

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Section 5.25 *0H9101-A Wiring Diagram 6.8L Gaseous - Nexus*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

GROUP G

LEGEND

- | | |
|---|---|
| AFS - AIR/FUEL SOLENOID | ICMJ_ - IGNITION CONTROL MODULE |
| ALT - DC CHARGE ALTERNATOR | J1 - ENGINE CONTROL MODULE 35-PIN CONNECTOR |
| AS - ALTERNATOR STATOR | J2 - ENGINE CONTROL MODULE 23-PIN CONNECTOR |
| BA - BRUSH ASSEMBLY | LFP - LOW FUEL PRESSURE SWITCH |
| BAT - BATTERY | LOS - LOW OIL PRESSURE SWITCH |
| BWR - BASIC WIRELESS RECEPTACLE | LVP - LOW VOLTAGE PLUG 8-PIN (BULKHEAD) |
| CAM - CAMSHAFT SENSOR | LVR - LOW VOLTAGE RECEPTACLE 8-PIN |
| CAR - COMMON ALARM RELAY | MLCB - MAIN LINE CIRCUIT BREAKER |
| CB - CIRCUIT BREAKER | MOV - METAL OXIDE VARISTOR |
| CSS - CRANKSHAFT SENSOR | MPU - MAGNETIC PICKUP |
| CYL_ - CYLINDER IGNITION COIL | NB - NEUTRAL BLOCK |
| DB_ - DIODE BRIDGE | OS - OXYGEN SENDER |
| F_ - FUSE INLINE | R1 - RESISTOR |
| FS_ - FUEL SOLENOID | SC - STARTER CONTACTOR |
| GND - GROUND CONNECTION | SM - STARTER MOTOR |
| GOV - ELECTRONIC GOVERNOR ACTUATOR | TB_ - TERMINAL BLOCK, CAGE CLAMP |
| HVP - HIGH VOLTAGE PLUG 12-PIN (BULKHEAD) | WLS - COOLANT LEVEL SENDER |
| HVR - HIGH VOLTAGE RECEPTACLE 12-PIN | WTS - COOLANT TEMPERATURE SENDER |

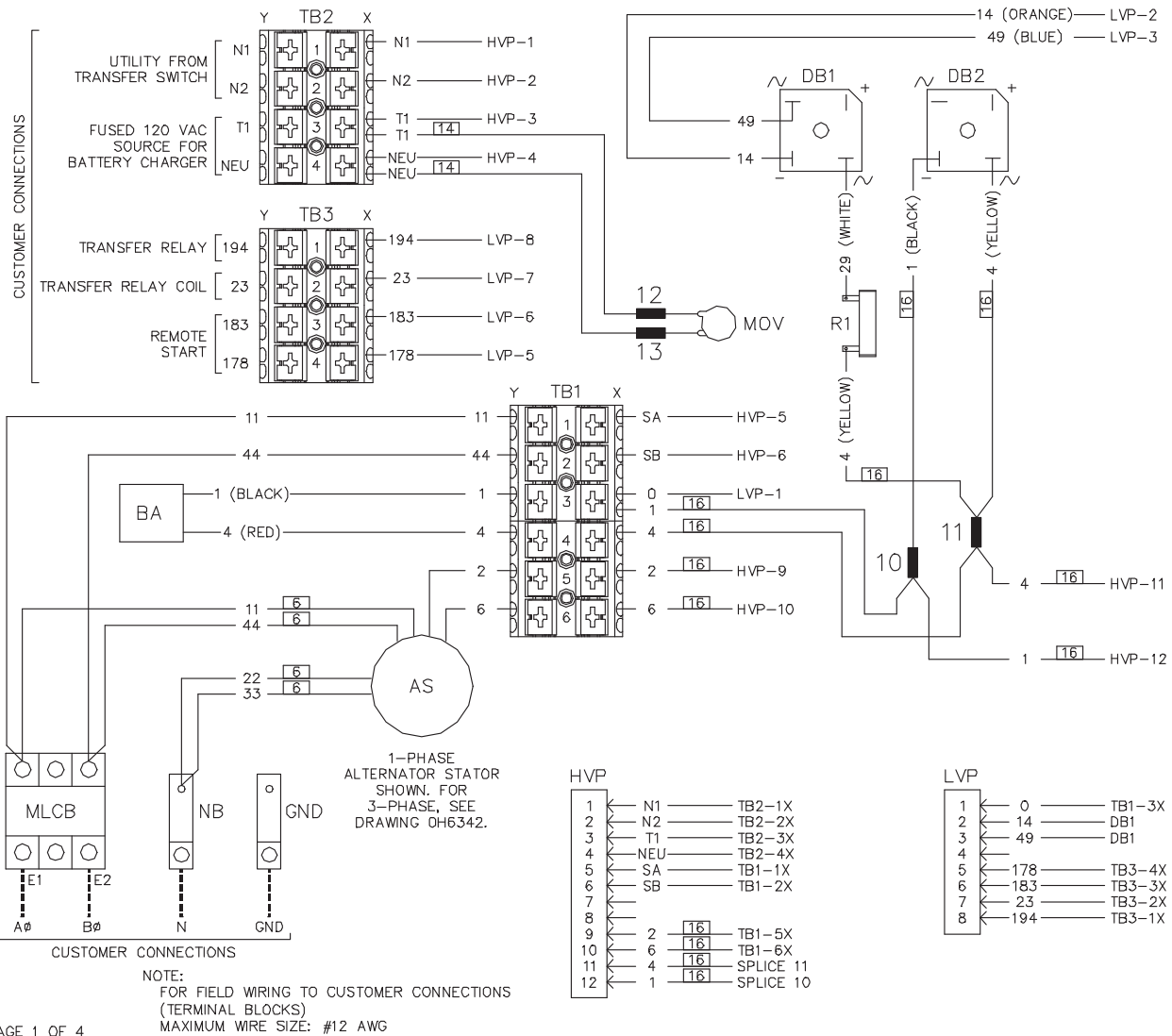
NOTE: ALL WIRES 18 AWG
300V UL LISTED UNLESS
SHOWN OTHERWISE

SPLICE NUMBER

WIRE SPLICE

NOTE: ALL WIRES ON THIS
PAGE ARE 600V RATED

COMPONENTS LOCATED IN CUSTOMER CONNECTION BOX

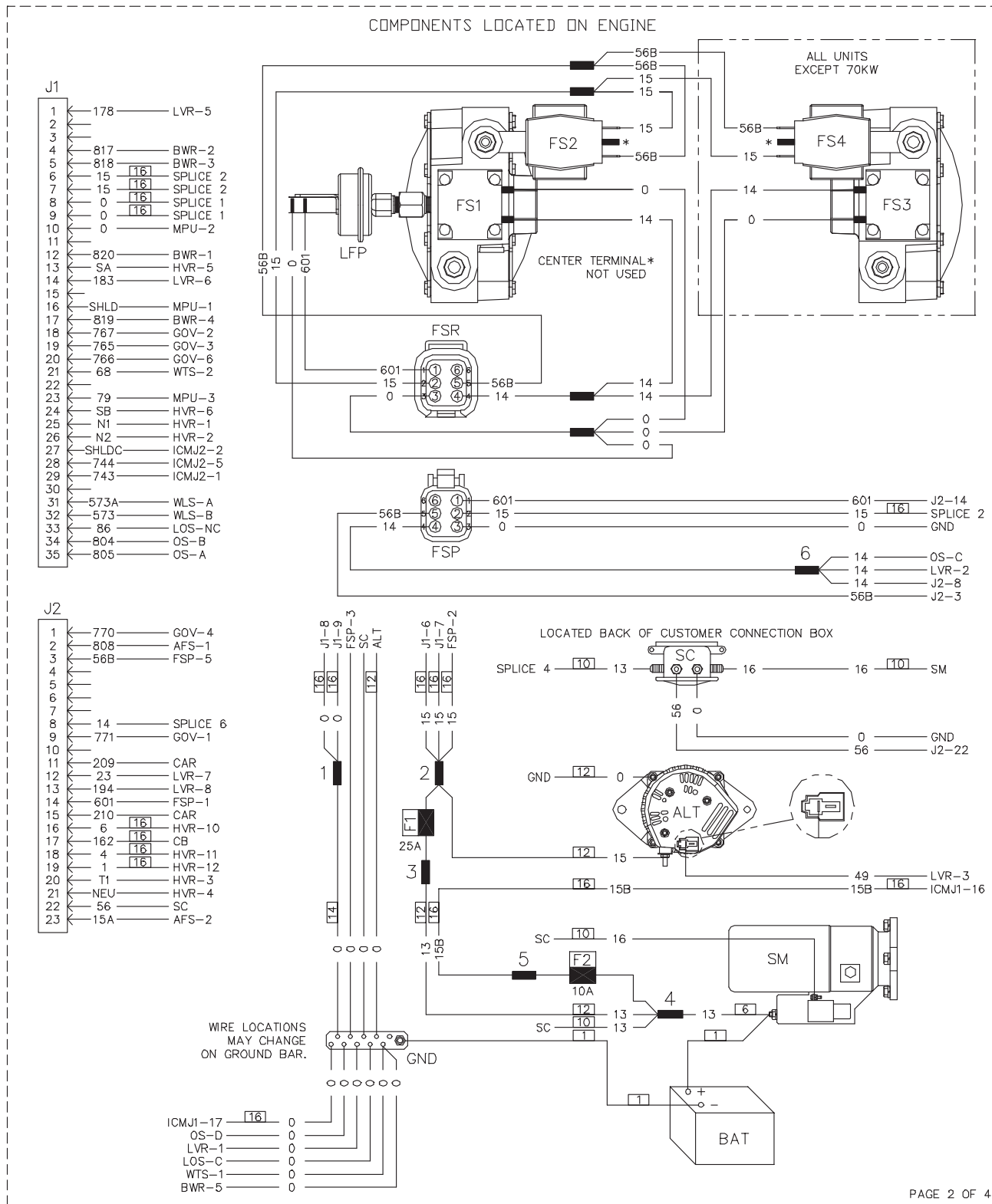


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REVISION: -A-
DATE: 5/17/10

WIRING - DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9101

GROUP G



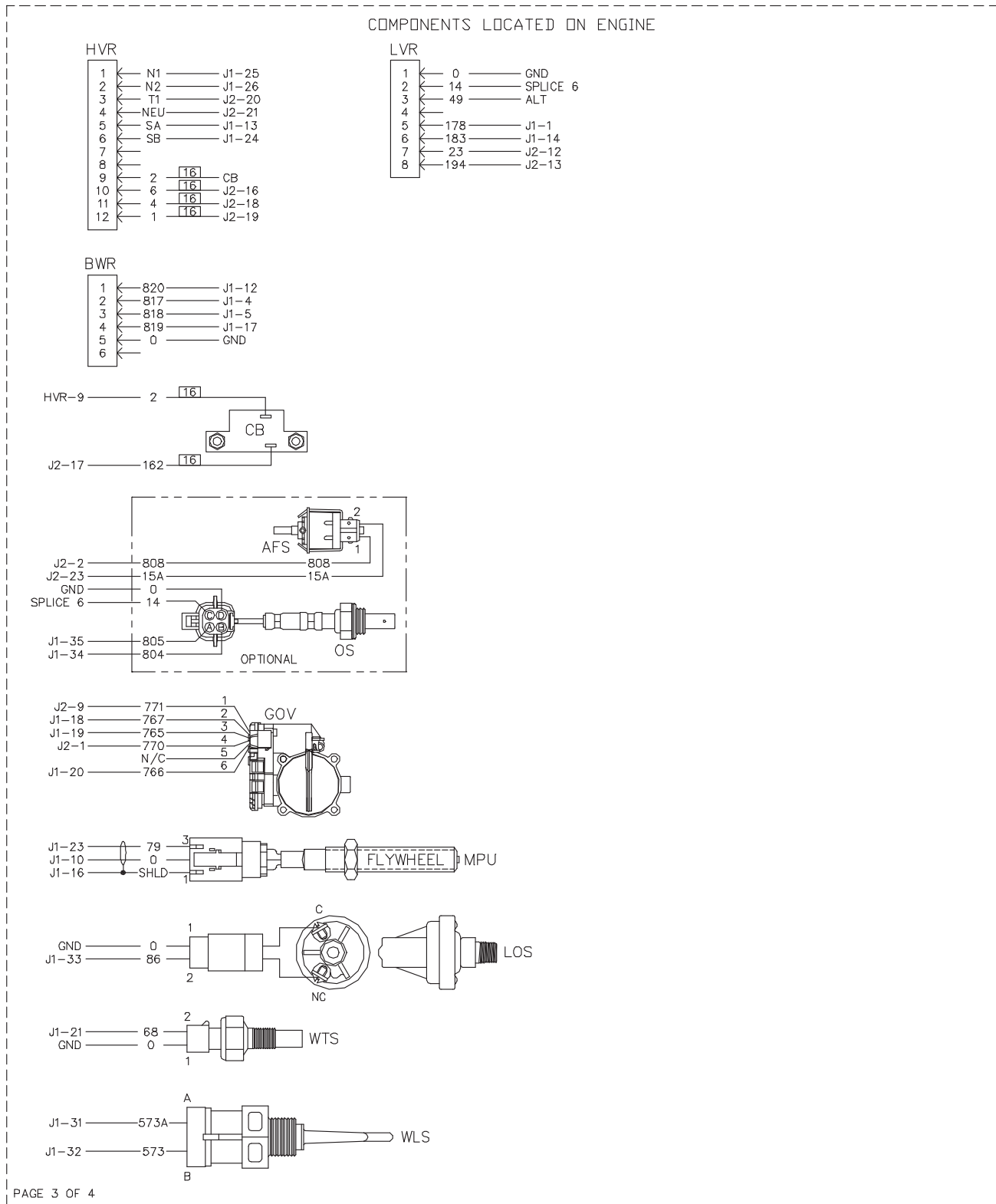
- J1**
- 1 178 LVR-5
 - 2
 - 3
 - 4 817 BWR-2
 - 5 818 BWR-3
 - 6 15 [16] SPLICE 2
 - 7 15 [16] SPLICE 2
 - 8 0 [16] SPLICE 1
 - 9 0 [16] SPLICE 1
 - 10 0 MPU-2
 - 11
 - 12 820 BWR-1
 - 13 SA HVR-5
 - 14 183 LVR-6
 - 15
 - 16 SHLD MPU-1
 - 17 819 BWR-4
 - 18 767 GOV-2
 - 19 765 GOV-3
 - 20 766 GOV-6
 - 21 68 WTS-2
 - 22
 - 23 79 MPU-3
 - 24 SB HVR-6
 - 25 N1 HVR-1
 - 26 N2 HVR-2
 - 27 SHLDC ICMJ2-2
 - 28 744 ICMJ2-5
 - 29 743 ICMJ2-1
 - 30
 - 31 573A WLS-A
 - 32 573 WLS-B
 - 33 86 LOS-NC
 - 34 804 OS-B
 - 35 805 OS-A

- J2**
- 1 770 GOV-4
 - 2 808 AFS-1
 - 3 56B FSP-5
 - 4
 - 5
 - 6
 - 7
 - 8 14 SPLICE 6
 - 9 771 GOV-1
 - 10
 - 11 209 CAR
 - 12 23 LVR-7
 - 13 194 LVR-8
 - 14 601 FSP-1
 - 15 210 CAR
 - 16 6 [16] HVR-10
 - 17 162 [16] CB
 - 18 4 [16] HVR-11
 - 19 1 [16] HVR-12
 - 20 T1 HVR-3
 - 21 NEU HVR-4
 - 22 56 SC
 - 23 15A AFS-2

- ICMJ1-17 [16] 0
- OS-D 0
- LVR-1 0
- LOS-C 0
- WTS-1 0
- BWR-5 0

REVISION: -A-
DATE: 5/17/10

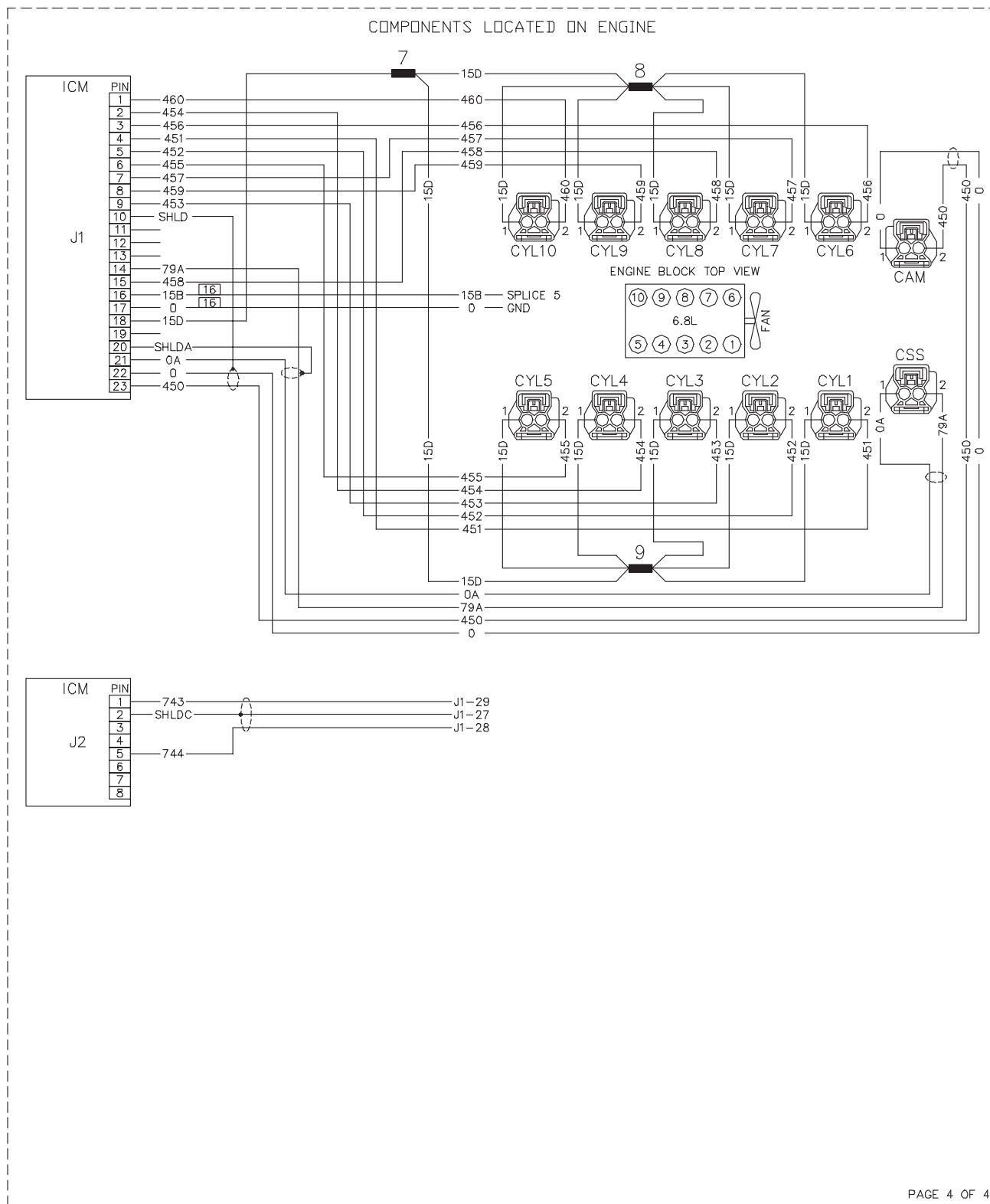
GROUP G



REVISION: -A-
DATE: 5/17/10

WIRING - DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9101

GROUP G



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REVISION: -A-
DATE: 5/17/10

WIRING — DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9101

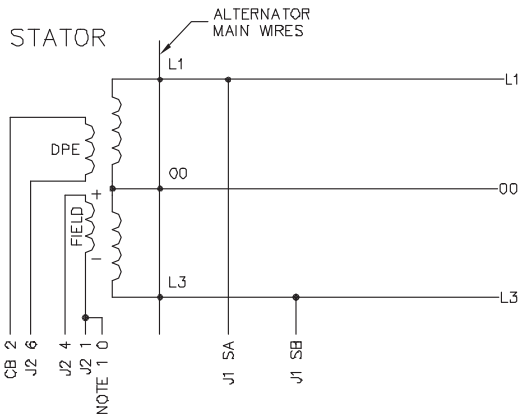
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Section 5.26 *0H9100-A Electrical Schematic 6.8L Gaseous - Nexus*

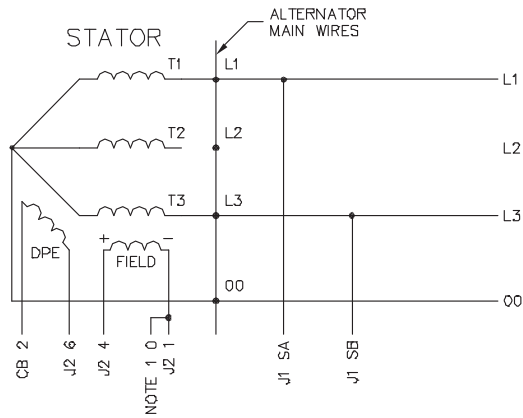
Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

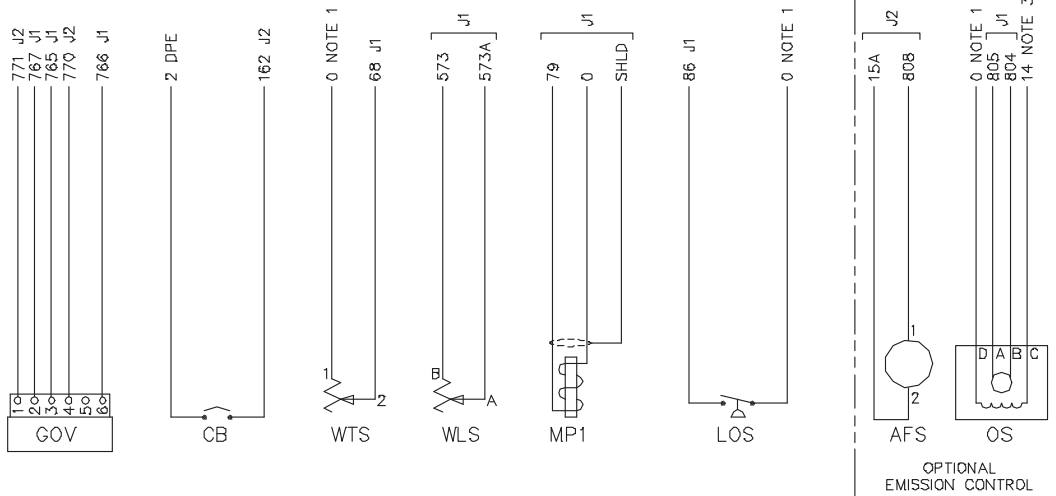
GROUP G



ALTERNATOR CONNECTIONS FOR 1φ UNITS



ALTERNATOR CONNECTIONS FOR 3φ UNITS

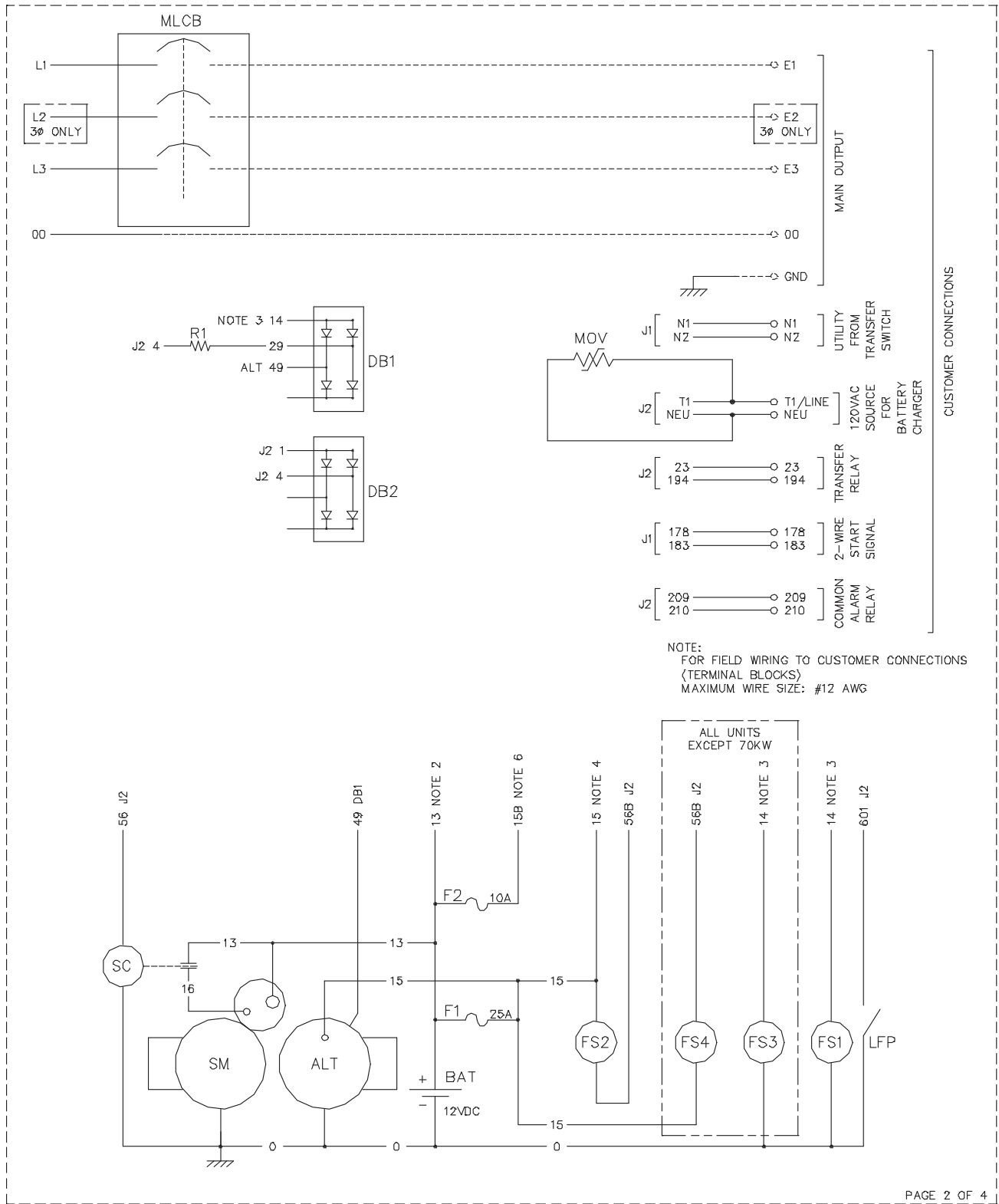


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REVISION: -A-
DATE: 9/16/10

SCHMATIC - DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9100

GROUP G

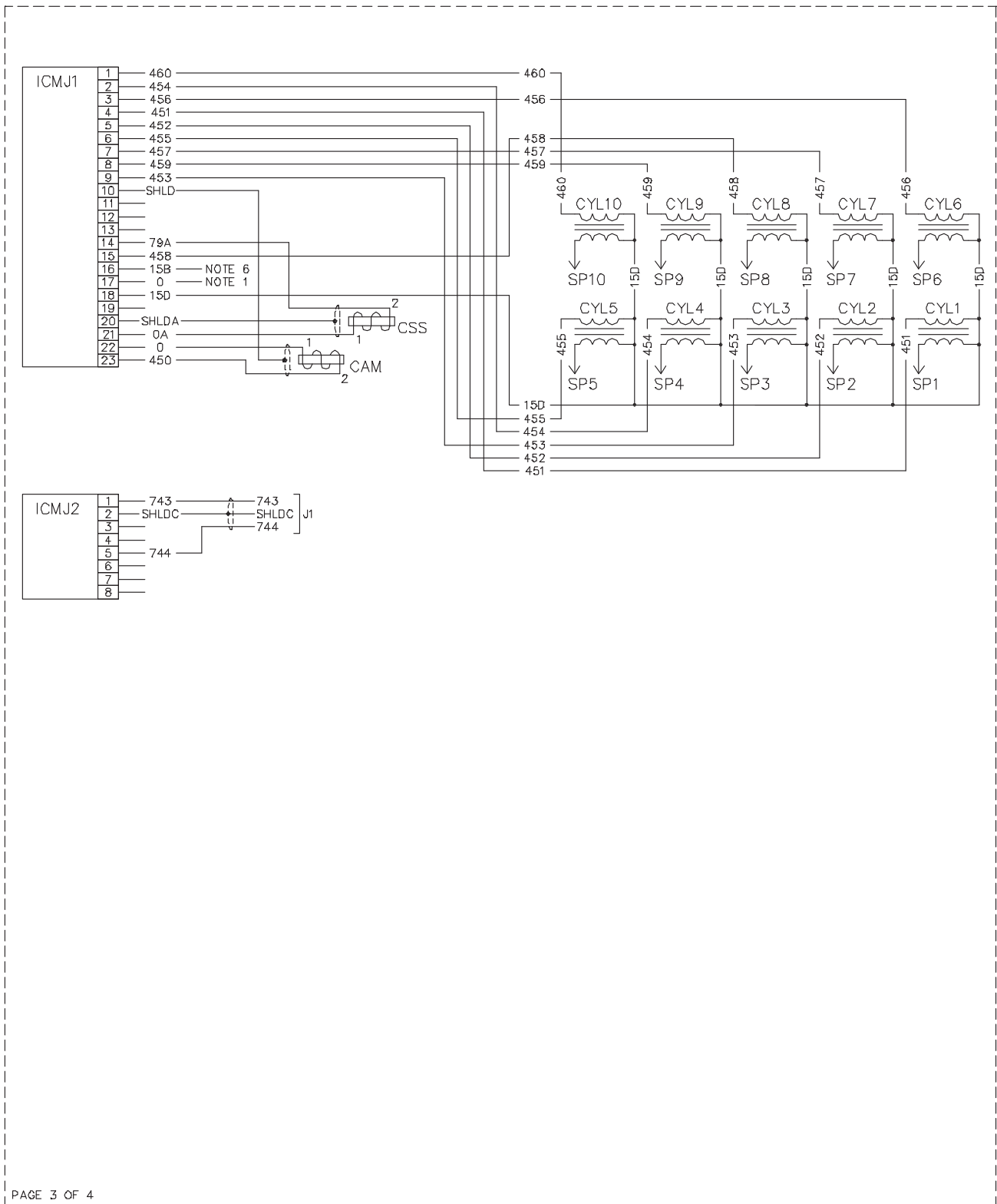


NOTE:
FOR FIELD WIRING TO CUSTOMER CONNECTIONS
(TERMINAL BLOCKS)
MAXIMUM WIRE SIZE: #12 AWG

SCHEMATIC – DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9100

REVISION: –A–
DATE: 9/16/10

GROUP G



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REVISION: -A-
DATE: 9/16/10

SCHMATIC - DIAGRAM
G6.8L G3 NEXUS
DRAWING #: 0H9100

GROUP G

BWR CONNECTOR

PIN	WIRE	TO	FUNCTION
1	820	J1-12	+5V POWER FOR BASIC REMOTE
2	817	J1-4	REMOTE DISPLAY SYSTEM READY
3	818	J1-5	REMOTE DISPLAY ALARM
4	819	J1-17	REMOTE DISPLAY MAINTENANCE
5	0	GND	NOTE 1

ICMJ1 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	460	CYL10	IGNITION COIL DRIVE 10
2	454	CYL4	IGNITION COIL DRIVE 4
3	456	CYL6	IGNITION COIL DRIVE 6
4	451	CYL1	IGNITION COIL DRIVE 1
5	452	CYL2	IGNITION COIL DRIVE 2
6	455	CYL5	IGNITION COIL DRIVE 5
7	457	CYL7	IGNITION COIL DRIVE 7
8	459	CYL9	IGNITION COIL DRIVE 9
9	453	CYL3	IGNITION COIL DRIVE 3
10	SHLD	CUT	CAMSHAFT SENSOR DRAIN
14	79A	CSS-2	CRANKSHAFT SENSOR +
15	458	CYL8	IGNITION COIL DRIVE 8
16	15B	F2	NOTE 6
17	0	GND	NOTE 1
18	15D	CYL1-CYL6	NOTE 7
20	SHLDA	CUT	CRANKSHAFT SENSOR DRAIN
21	0A	CSS-1	CRANKSHAFT SENSOR -
22	0	CAM-1	CAMSHAFT SENSOR -
23	450	CAM-2	CAMSHAFT SENSOR +

NOTES:

- 1) WIRE #0 IS CHASSIS GROUND (BATTERY-) UNLESS NOTED OTHERWISE.
- 2) WIRE #13 IS UNFUSED +12VDC (BATTERY+).
- 3) WIRE #14 IS FUSED +12VDC WHEN GENERATOR IS CRANKING OR RUNNING.
- 4) WIRE #15 IS FUSED +12VDC FOR GENERAL USE.
- 5) WIRE #15A IS FUSED +12VDC FOR THE AIR/FUEL SOLENOID OPTION.
- 6) WIRE #15B IS FUSED +12VDC FOR THE IGNITION CONTROL MODULE.
- 7) WIRE #15D IS FUSED +12VDC FOR THE IGNITION COILS.

ICMJ2 CONNECTOR

PIN	WIRE	TO	FUNCTION
1	743	J1-29	CAN BUS HIGH
2	SHLDC	J1-27	CAN BUS DRAIN
5	744	J1-28	CAN BUS LOW

ENGINE CONTROL MODULE CONNECTIONS

J1

PIN	WIRE	TO	FUNCTION
1	178	CUST CON	REMOTE START RETURN
4	817	BWR-2	REMOTE DISPLAY SYSTEM READY
5	818	BWR-3	REMOTE DISPLAY ALARM
6	15	F1	NOTE 4
7	15	F1	NOTE 4
8	0	GND	NOTE 1
9	0	GND	NOTE 1
10	0	MP1-2	FLYWHEEL SENSOR -
12	820	BWR-1	+5V POWER FOR BASIC REMOTE
13	SA	MLCB	OUTPUT VOLTAGE SENSING A
14	183	CUST CON	REMOTE START
16	SHLD	MP1-1	FLYWHEEL SENSOR DRAIN
17	819	BWR-4	REMOTE DISPLAY MAINTENANCE
18	767	GOV-2	THROTTLE POSITION FEEDBACK RETURN
19	765	GOV-3	THROTTLE POSITION FEEDBACK SOURCE
20	766	GOV-6	THROTTLE POSITION FEEDBACK SIGNAL
21	68	WTS-2	COOLANT TEMP SIGNAL
23	79	MP1-3	FLYWHEEL SENSOR +
24	SB	MLCB	OUTPUT VOLTAGE SENSING B
25	N1	CUST CON	UTILITY VOLTAGE SENSING 1
26	N2	CUST CON	UTILITY VOLTAGE SENSING 2
27	SHLDC	ICMJ2-2	CAN BUS DRAIN
28	744	ICMJ2-5	CAN BUS LOW
29	743	ICMJ2-1	CAN BUS HIGH
31	573A	WLS-A	COOLANT LEVEL SIGNAL RETURN
32	573	WLS-B	COOLANT LEVEL SIGNAL
33	86	LOS-NC	LOW OIL PRESSURE SIGNAL
34	804	OS-B	OXYGEN SENSOR +
35	805	OS-A	OXYGEN SENSOR RETURN

J2

PIN	WIRE	TO	FUNCTION
1	770	GOV-4	THROTTLE DRIVE HI
2	808	AFS-1	AIR/FUEL RATIO SOLENOID DRIVER
3	56B	FS2	STARTING FUEL SOLENOID CONTROL
8	14	DB1/FS/EC-2	NOTE 3
9	771	GOV-1	THROTTLE DRIVE LO
11	209	CAR	COMMON ALARM RELAY
12	23	CUST CON	TRANSFER RELAY COIL CONTROL
13	194	CUST CON	TRANSFER RELAY COIL +
14	601	LFP	LOW FUEL PRESSURE
15	210	CAR	COMMON ALARM RELAY
16	6	DPE	EXCITER RETURN
17	162	CB	EXCITER OUTPUT (BREAKER PROTECTED)
18	4	FIELD	FIELD (BRUSH) +
19	1	FIELD	FIELD (BRUSH) -
20	T1	CUST CON	120VAC SOURCE FOR BATTERY CHARGER
21	NEU	CUST CON	120VAC RETURN FOR BATTERY CHARGER
22	56	SC	STARTER CONTACTOR DRIVER
23	15A	AFS-2	NOTE 5

LEGEND

00 - NEUTRAL	DPE - EXCITER	OS - OXYGEN SENDER
AFS - AIR/FUEL SOLENOID	F_ - FUSE INLINE	R1 - RESISTOR
ALT - DC CHARGE ALTERNATOR	FS_ - FUEL SOLENOID	SC - STARTER CONTACTOR
BAT - BATTERY	GOV - ELECTRONIC GOVERNOR ACTUATOR	SHLD - SHIELD
BWR - BASIC WIRELESS RECEPTACLE	ICM_ - IGNITION CONTROL MODULE	SM - STARTER MOTOR
CAM - CAMSHAFT SENSOR	J_ - ENGINE CONTROL MODULE CONNECTOR	SP_ - SPARK PLUG
CAR - COMMON ALARM RELAY	LFP - LOW FUEL PRESSURE SWITCH	WLS - COOLANT LEVEL SENDER
CB - CIRCUIT BREAKER	LOS - LOW OIL PRESSURE SWITCH	WTS - COOLANT TEMPERATURE SENDER
CSS - CRANKSHAFT SENSOR	MLCB - MAIN LINE CIRCUIT BREAKER	
CYL_ - CYLINDER IGNITION COIL	MOV - METAL OXIDE VARISTOR	
DB_ - DIODE BRIDGE	MP1 - MAGNETIC PICKUP	

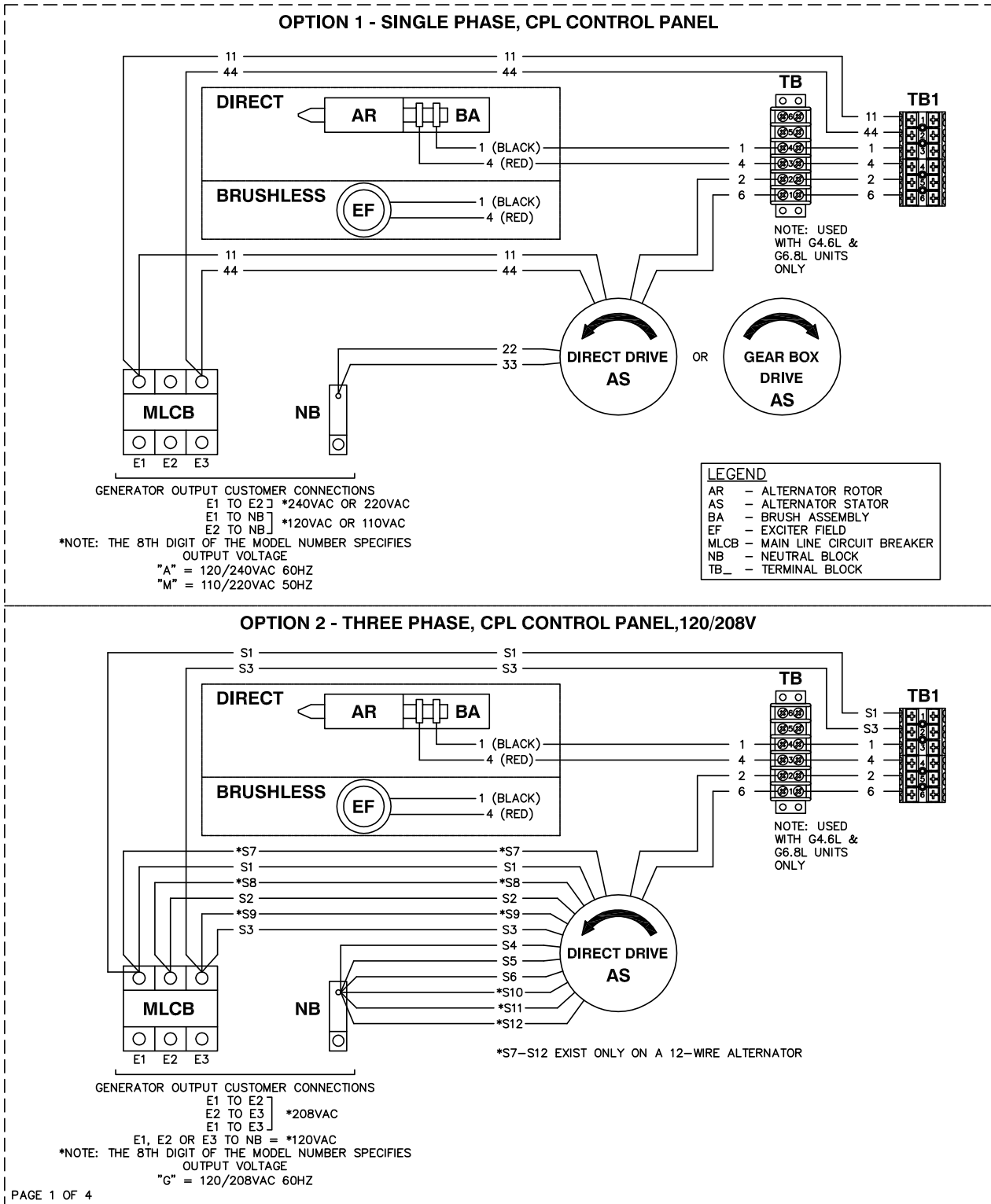
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Section 5.27 *0H6342-F Alternator Configurations*

Introduction

The diagrams in this section are provided for general reference only. For unit specific diagrams refer to the Service and Support page at the manufacturer's website.

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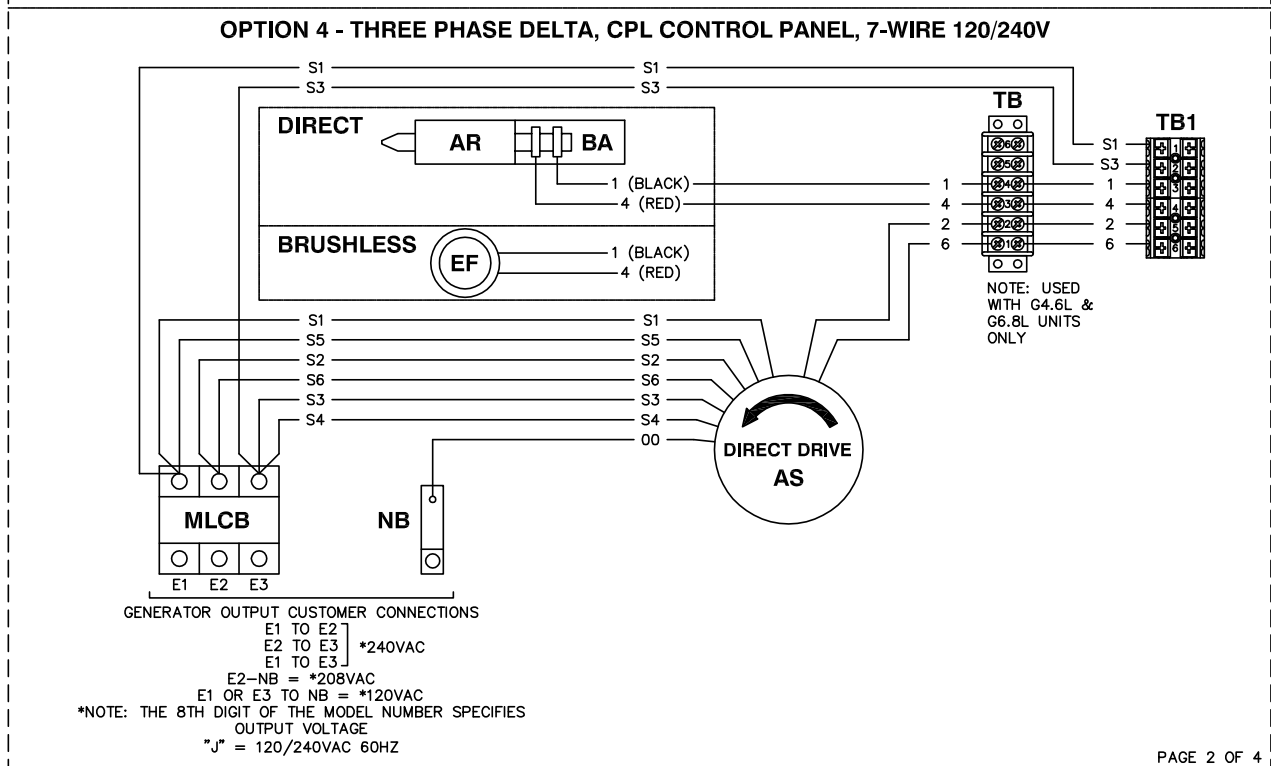
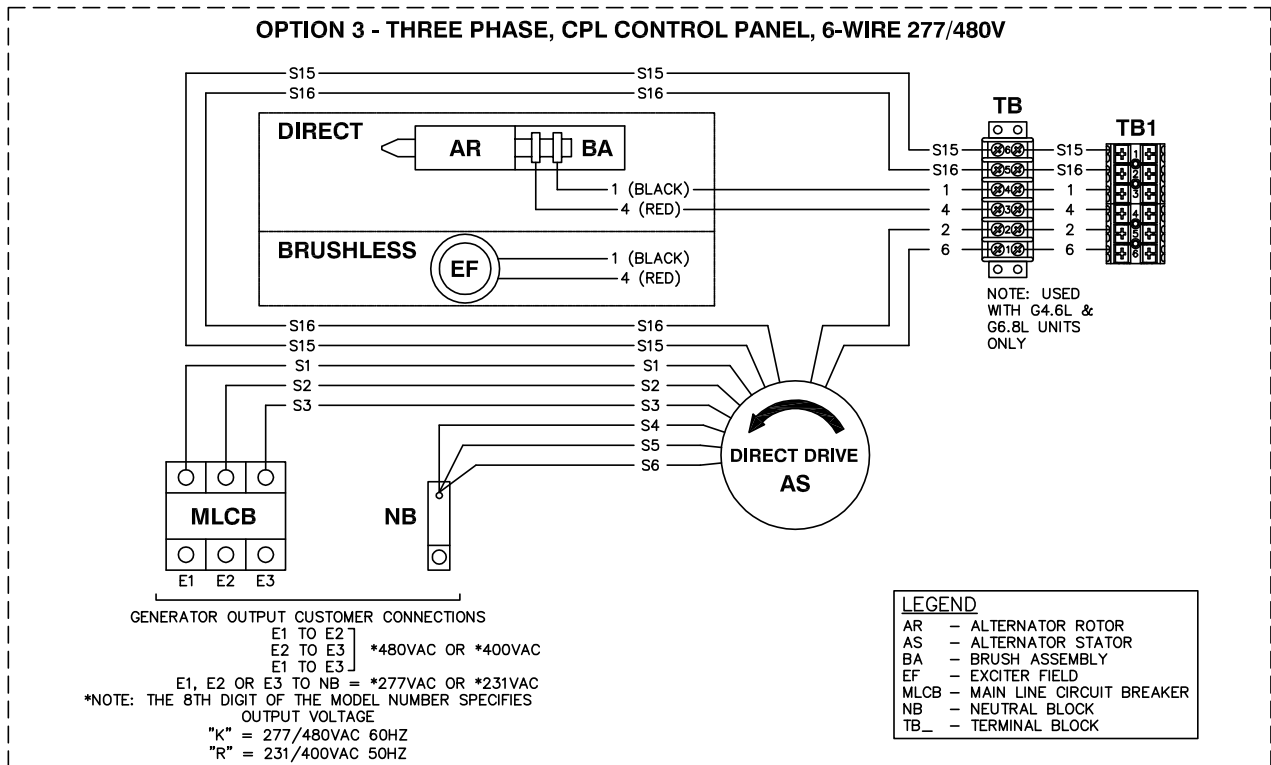


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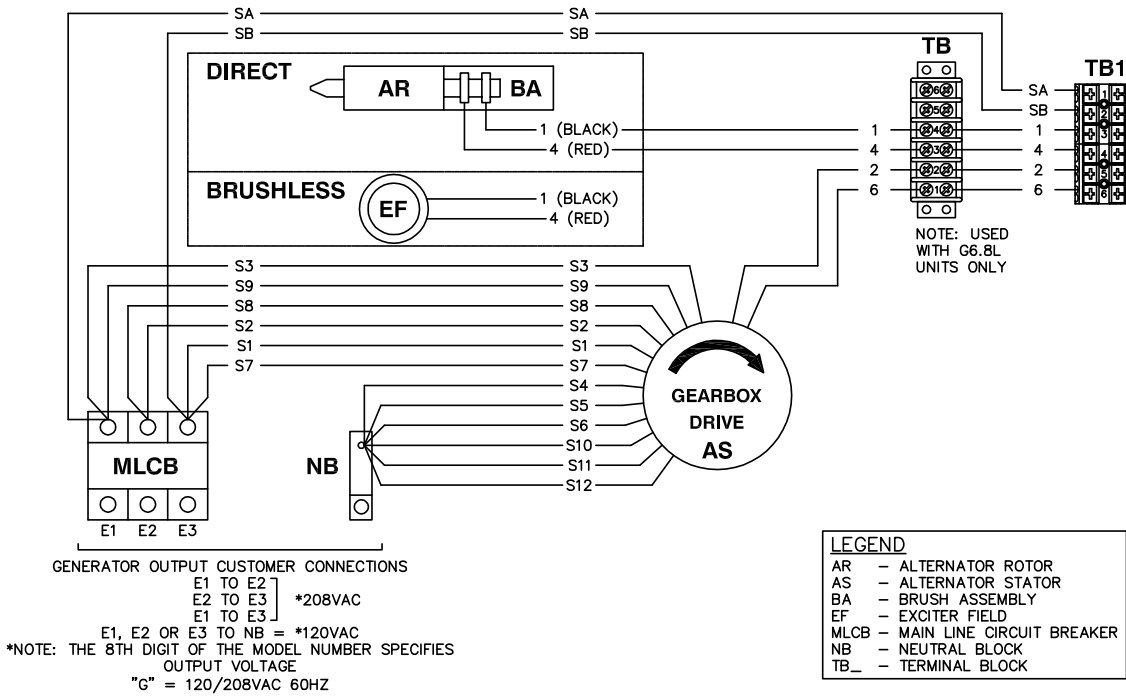
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CPL ALTERNATOR
DRAWING #: 0H6342

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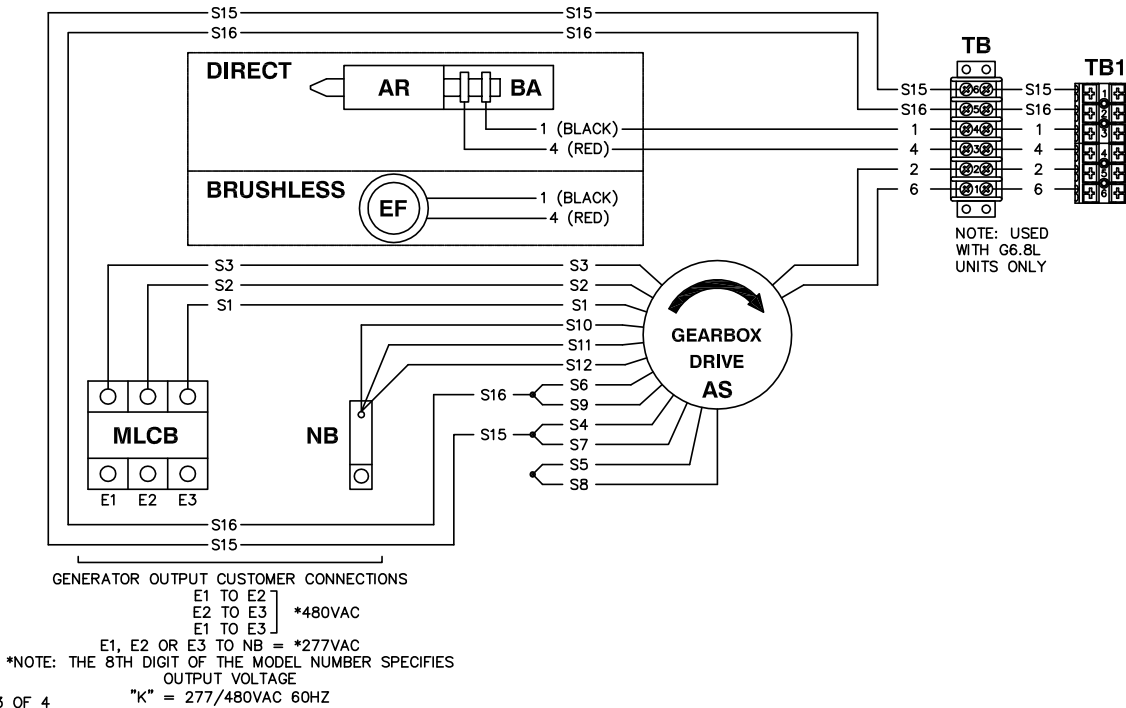


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OPTION 5 - THREE PHASE, CPL CONTROL PANEL, GEARBOX (REVERSE ROTATION)



OPTION 6 - THREE PHASE, CPL CONTROL PANEL, GEARBOX (REVERSE ROTATION)

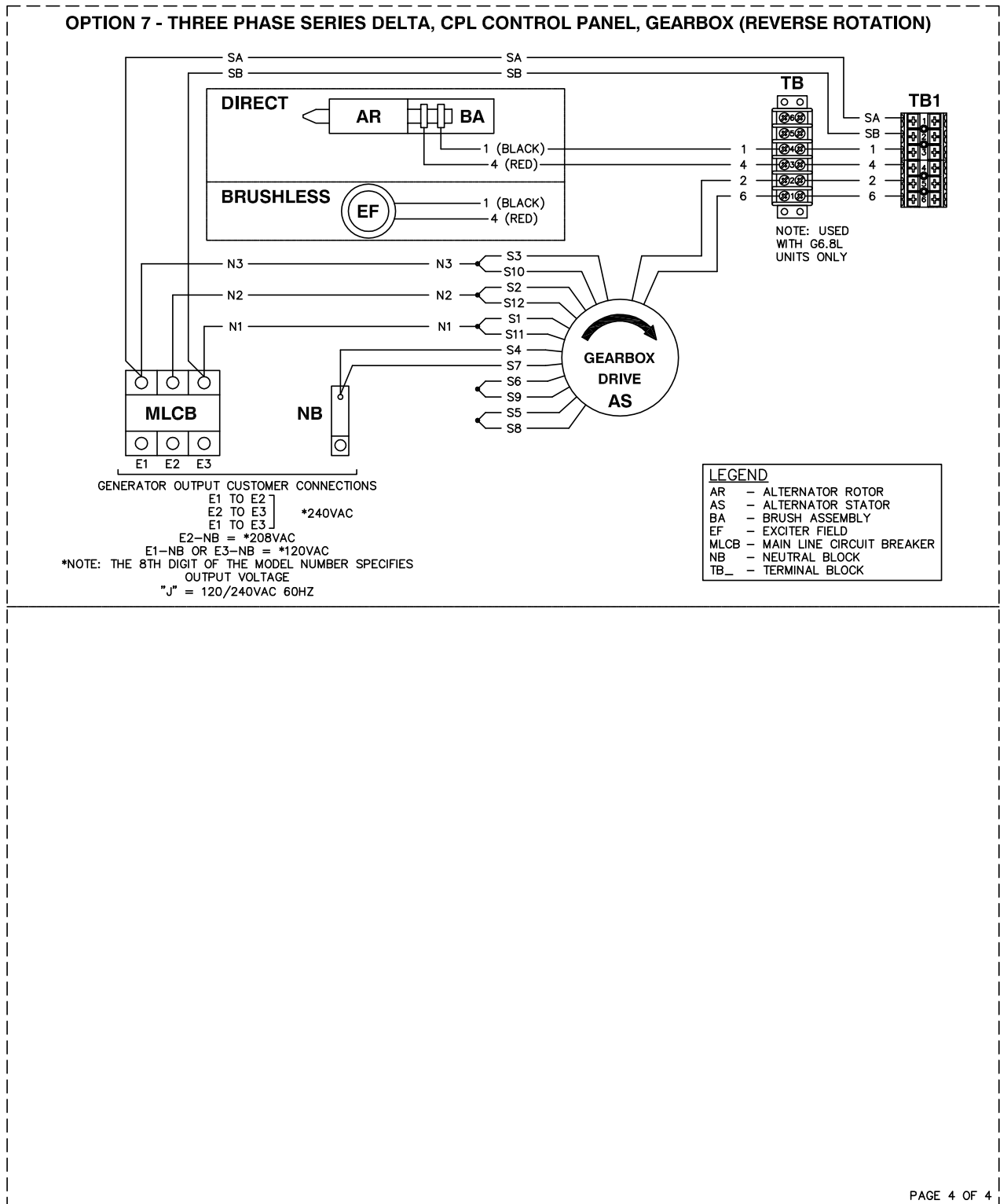


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Section 6.1 Diesel Checks and Tests

Diesel Engine Theory

The diesel engine is an internal combustion engine in which the heat of compression in the cylinder is used to ignite the injected fuel and air mixture. This is different than a gas or spark-ignited engine which uses a spark plug to ignite the fuel-air mixture. The diesel engine has the highest thermal efficiency of any practical internal combustion engine, due to its very high expansion ratio and inherent lean burn. Diesel engines can have a thermal efficiency that exceeds 50% in optimum conditions, however a thermal efficiency of 40–45% is normal.

Diesel and spark ignited engines are similar in construction; they both have pistons, cylinders, connecting rods, and crank and cam shafts. The diesel engine has an injector in place of the spark plug and the materials used in construction are heavier and denser to deal with the higher compression ratio and horsepower output.

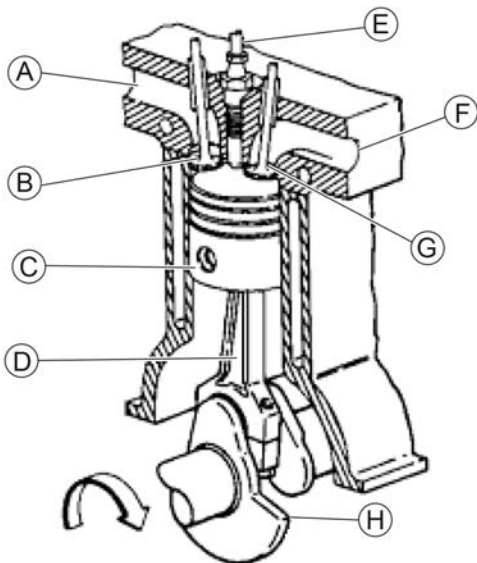


Figure 6-1. Components

A. Exhaust port	E. Injector
B. Exhaust valve	F. Intake port
C. Piston	G. Intake valve
D. Connecting rod	H. Crankshaft

4-stroke diesel engines have the same strokes or cycles as 4-stroke gas engines, however the differences are as follows:

1. **Intake Stroke**—the intake valve opens, the exhaust valve is closed and the piston is in its downward stroke due to the centrifugal force of the crankshaft. The engine draws cool fresh air into the cylinder.

2. **Compression Stroke**—the intake valve and exhaust valve are closed and the piston is in its upward stroke due to the centrifugal force of the crankshaft. The piston will compress the air at ratios from 14.5:1 to 23:1. The air gets very hot and dense as it is compressed. An air temperature of 350–625 °F (177–329 °C) at high pressure is needed to start combustion of diesel fuel.
3. **Fuel Injection and Power Stroke**—a few degrees before the piston reaches top dead center (TDC), the diesel injector will inject fuel into the cylinder (injection pressure can be between 2900–4400 psi). As the piston continues its stroke, the fuel will ignite and the resulting expanding gas will force the piston delivering power to the load.
4. **Exhaust Stroke**—as the engine continues to rotate, and the piston reaches the bottom of its stroke, the exhaust valve will open and the piston will force the exhaust gas out of the cylinder.

Typical engine rotation is counter clockwise from the flywheel end. Typical exhaust temperatures can be 900–1200 °F (482–649 °C).

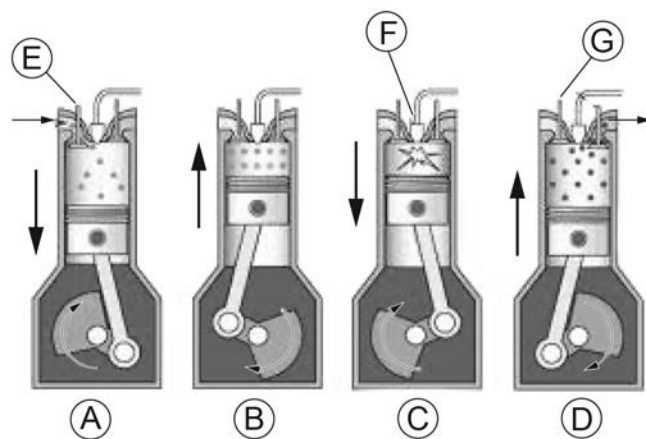


Figure 6-2.

A. Intake	E. Intake valve
B. Compression	F. Fuel injector
C. Power	G. Exhaust valve
D. Exhaust	

Combustion Chamber and Design

There are 2 types of diesel combustion chamber designs:

- Direct injected
- Indirect injected (pre-chamber)

Direct Injected

Diesel fuel is injected directly into the combustion chamber located on top of the piston, usually 14–18:1 compression ratio.

Indirect Injection or Pre-Chamber

Fuel is injected into a pre-chamber where combustion begins. Combustion then spreads to the chamber located on top of the piston, usually at a 20–23:1 compression ratio.

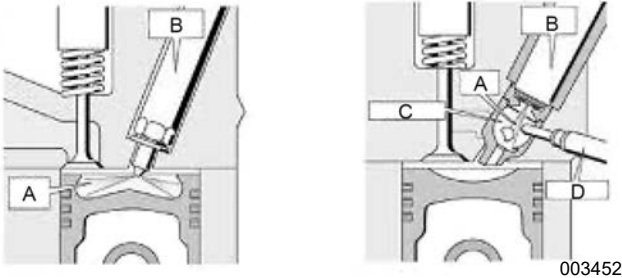


Figure 6-3. Combustion Chambers

A. Fuel spray	C. Pre-chamber
B. Fuel injector	D. Glow plug

Glow Plugs and Intake Air Heaters (Pre-Heaters)

Pre-heaters heat the air coming into the combustion chamber or the air in the combustion chamber as in the case of the pre-chamber engines. The heaters will be activated at a certain temperature. This is done before the engine starter is engaged to pre-heat the air. This cold starting aid is used to assist starting and limit white smoke.

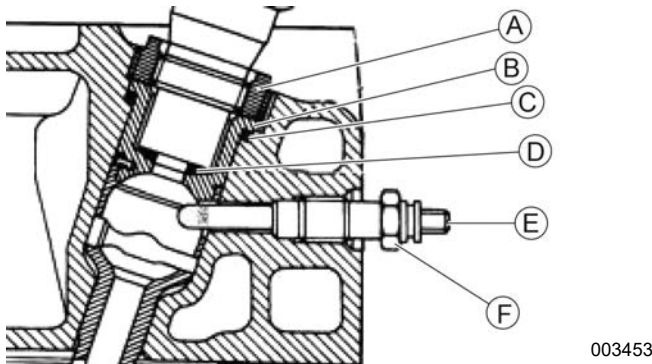


Figure 6-4. Glow Plug

A. Pre-chamber collar	D. Injector nozzle heat shield
B. Pre-chamber	E. Threaded glow plug power hole
C. Pre-chamber seal ring	F. Glow plug

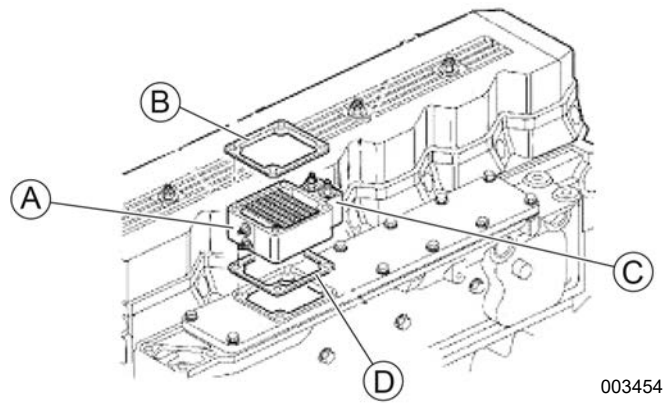


Figure 6-5. Air Heater

A. Block	C. Air heater elements
B. Upper gasket	D. Lower gasket

Injector, Injection Pump, and Fuel Storage (Fuel System)

Diesel fuel from the fuel tank is supplied to the fuel injection pump. The typical injection pump has an internal pump, but some units may require an external lift pump. The fuel within the injection pump is pressurized then distributed through high pressure tubing to the injectors, which injects fuel into the combustion chamber. Injection pressure can be between 2900–4400 psi (19,995–30,337 kPa). Unused fuel from the injectors and pump is returned to the fuel tank. This unused fuel or excess fuel is used to cool and lubricate the injection pump and injectors.

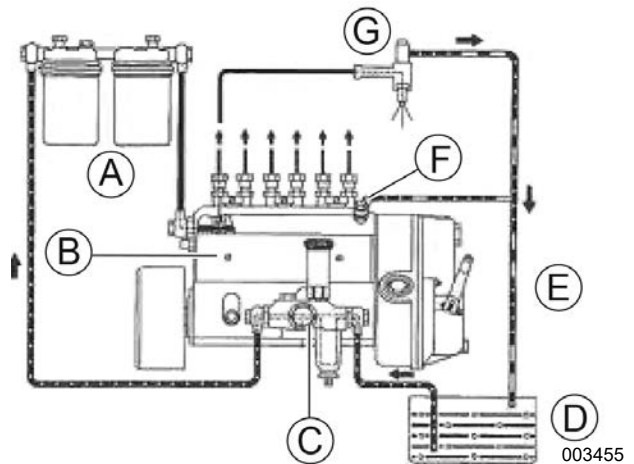
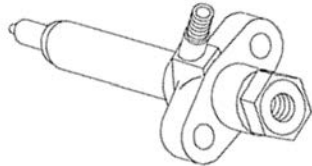


Figure 6-6. Fuel System

A. Fuel filter	E. Overflow line
B. Fuel injection pump	F. Overflow valve
C. Fuel supply pump	G. Injection nozzle
D. Fuel tank	

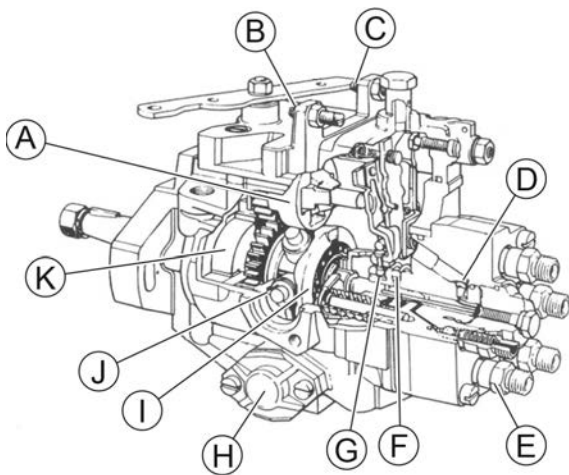
Fuel is injected with the help of a nozzle that is opened and closed with a needle valve. The needle valve is controlled by fuel pressure supplied by the fuel injection pump. The temperature of the fuel being supplied to the pump will have an effect on the pump and the engines performance. Fuel issues begin to arise at temperatures of 90 °F (32 °C) and up. Diesel fuel becomes less dense at 90 °F (32 °C), and suffers a reduction of delivered BTU content. The fuel can become even thinner at 100–110 °F (38–43 °C), and will greatly affect the performance output of the engine. The fuel tank will act like a heat sink, dissipating the heat from the fuel. Under extreme conditions a fuel cooler maybe needed.



003457

Figure 6-7. Injection Nozzle

Rotary injection pumps such as the VE style pump supply the needed pressure and volume of fuel for the injector to inject fuel into the combustion chamber. Rotary pumps will also control the advance of the injection timing. At no load or light load the pump will inject fuel close to top dead center. The pump will inject more fuel to maintain the units speed or frequency as load is applied. As more fuel is injected into the engines combustion chamber the pump will advance the injection timing to inject fuel before top dead center to allow time for the fuel to fully combust.



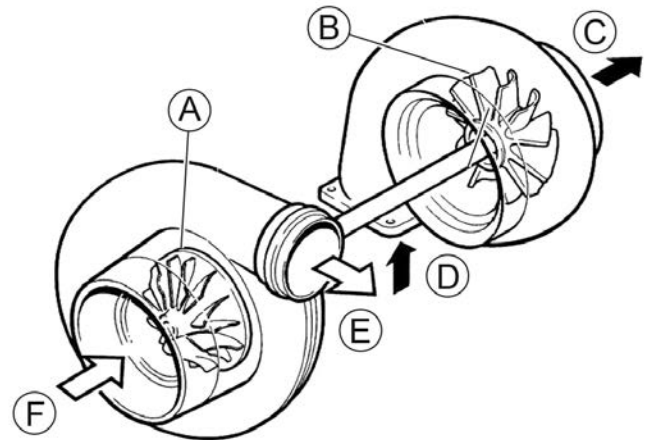
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Figure 6-8.

A. Centrifugal plunger	G. Metering sleeve
B. Maximum speed adjustment	H. Cover for injection timing
C. Idle speed adjustment	I. Cam plate
D. Fuel intake port	J. Roller
E. Fuel delivery valve	K.
F. Distributor plunger	Vane pump

Turbo Charging and Charged Air Cooling

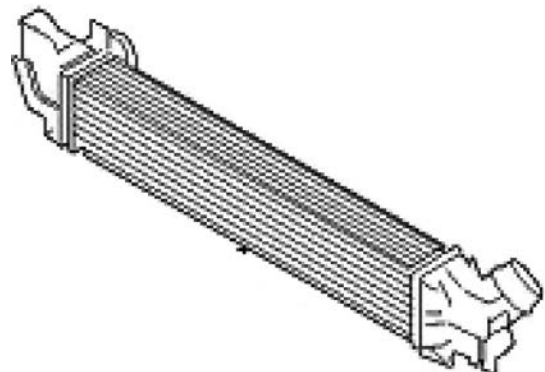
A turbocharger is a small radial fan pump driven by the energy of the exhaust gases of an engine. A turbocharger consists of a turbine and a compressor on a shared shaft. The turbine section of a turbocharger is a heat engine in itself. It converts the heat energy from the exhaust to power, which then drives the compressor, compressing ambient air and delivering it to the air intake manifold of the engine at higher pressure, resulting in a greater mass of air entering each cylinder. Compressed air is routed through a charge air cooler before introduction to the intake manifold.



003459

Figure 6-9. Turbo Charger

A. Compressor wheel	D. Exhaust gas inlet
B. Turbine wheel	E. Compressed air discharge
C. Exhaust gas outlet	F. Ambient air inlet (from engine air filter)



003460

Figure 6-10. Charge Air Cooler

Diesel Fuel Information

Use fuel that has a Cetane value of 40-50. Cetane value is the ease of diesel fuel ignition. The higher the value the easier the fuel can ignite.

- Ignition quality—The ability to vaporize and ignite easily.
- Fuel—Ultra low sulfur diesel fuel (Less than 15 parts per million of sulfur, also so known as ULSD).
- Cloud Point—Diesel fuel contains paraffin wax. The temperature at which it crystallizes D2 at approximately 10 °F (-12 °C).
- Pour Point—The minimum temperature at which fuel can flow, which is approximately 5° above the level at which the fuel becomes solid or refuses to flow. Approximately 10° lower than cloud point.
- Stored diesel fuel should be tested for longevity every 90 days.
- Diesel fuel inlet temperature should not exceed 90 °F (32 °C). Maximum diesel fuel temperature is 104 °F (40 °C).

Prime Fuel System

Loosen the air bleed screw and work priming pump until bubbles are observed. Place a shop rag near the air bleed screw to catch any leaking fuel.

When all bubbles are purged and replaced by a solid stream of fuel, depress pump handle and tighten the air bleed screw.

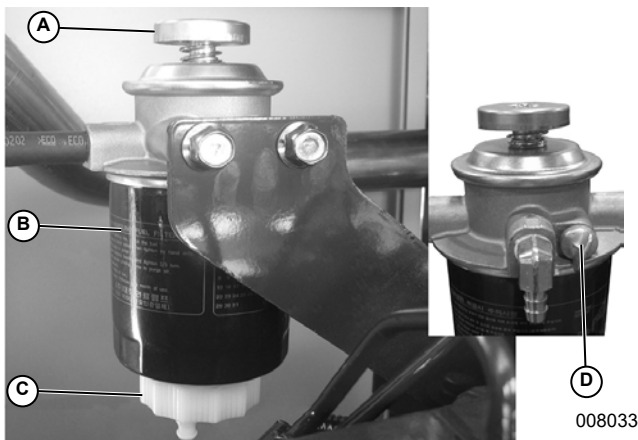


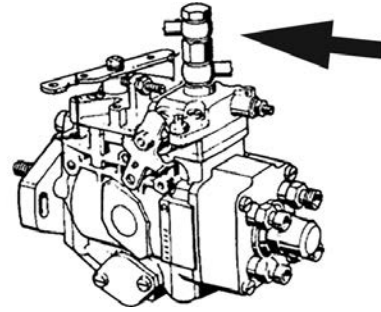
Figure 6-11. Priming Components

A. Priming Pump	C. Water Drain Plug
B. Fuel Filter	D. Air Bleed Screw

Total Fuel System Prime

1. Loosen the air bleed screw and work priming pump until bubbles are observed. Place a shop rag near the air bleed screw to catch any loss of fuel. When all bubbles are purged and replaced by a solid stream of fuel, depress pump handle and tighten the air bleed screw.

2. Loosen injection pump bleed screw. The bleed screw is normally located on the injection pump fuel return line.



003431

Figure 6-12. Air Bleed Screw

3. Work priming pump until bubbles are observed. Tighten the bleed screw when all bubbles are purged.
4. Locate the highest injection line on the back of the injection pump. This line will usually coincide with the number 1 injector.
5. Loosen the corresponding injector line, at the injector.
6. Place unit in MANUAL. As the unit cranks, a foamy bubbly fuel spray should bleed from the loosened injection line. Once the foam has been replaced with a steady stream of fuel, place unit in OFF and tighten the injection line.

NOTE: Unit may attempt to run while performing step 6.

NOTE: In extreme cases of an “air bound” injection system it may be necessary to loosen all the injection lines at the injectors to purge the air from the system.

Sight Glass Test

A diesel fuel sight glass test is extremely important for diesel fuel systems. More than any other test, it can tell you if the diesel fuel inlet system is sealed or has a restricted inlet. The test should be performed anytime you are experiencing engine performance problems. A bad fuel supply can cause hard starting in cold weather, loss of power, rough running, shaking, and excessive white exhaust smoke.

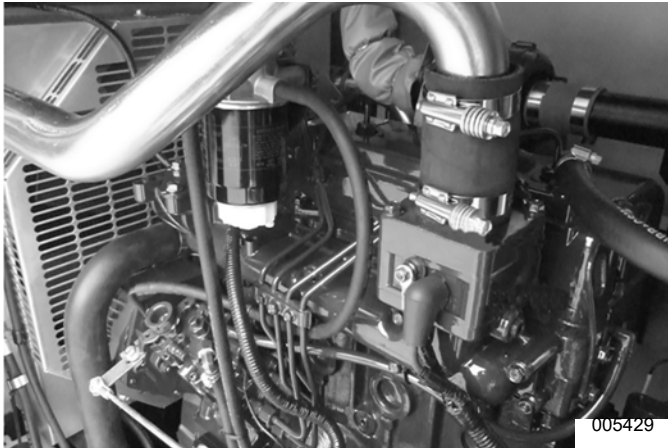
When a diesel engine begins to exhibit performance issues, one of the first things to check is the fuel inlet system. If the fuel filter is clogged, it can be an easy repair. However, if the fuel system is sucking air, the repair may be more difficult.

Required Parts

- A fuel filter restriction gauge or vacuum gauge
- Two each of 5/16 inch ID, 12 inch long, thick walled clear vinyl or tygon tubing
- A 5/16 inch barbed tee
- Steel hose type clamps or similar
- Shop towels and spill containers

Procedure

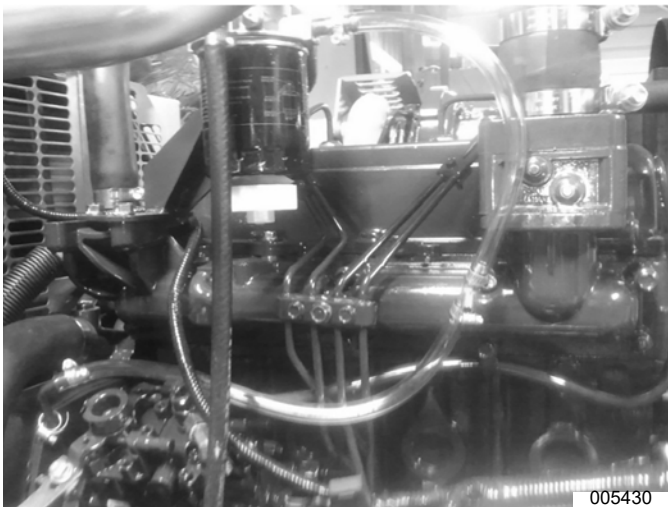
1. Identify and remove the fuel supply line from the fuel filter to the inlet of the injection pump.

**Figure 6-13. Fuel Supply Line**

2. Assemble a fuel line test tube by placing the two 12 inch sections on the in-line ends of the tee fitting. Use the clamps to prevent air leaks.

**Figure 6-14. Fuel Line Test Tube**

3. Install the fuel line test tube from the fuel filter to the inlet of the injection pump. Use the clamps to prevent air leaks.

**Figure 6-15. Install Fuel Line Test Tube**

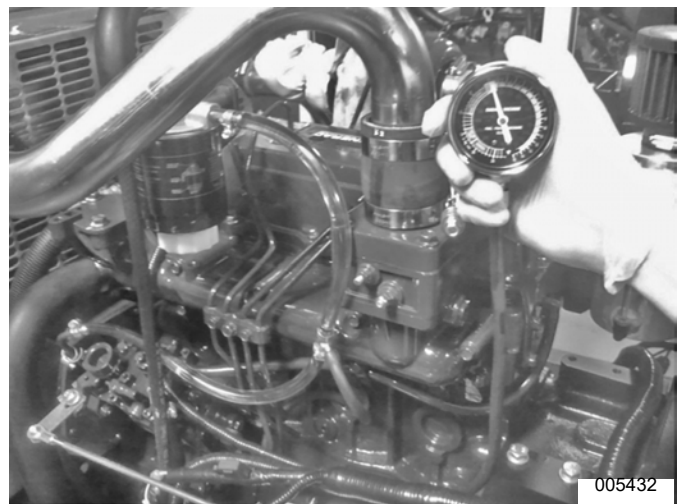
4. Install the fuel filter restriction gauge on the open barb that is perpendicular to the two in-line barbs. Use the clamps to prevent air leaks.



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Figure 6-16. Fuel Filter Restriction Gauge

5. Hold the restriction gauge above the filter, and follow the fuel priming procedure as outlined in the owner's manual. While priming, NO fuel should be allowed into the gauge.



005432

Figure 6-17. Fuel Filter Restriction Gauge

6. Start and run unit. It may be necessary to let the unit run for a short time to remove all air from lines. It may also be necessary to "roll out the bubble" in the line.
7. With the engine running and all air purged from the line, a new clean filter should read approximately -2 to -4 inches of mercury restriction. The restriction should be tested at a no load and in a fully loaded condition.
8. If the gauge reads -10 inches of mercury restriction, replace fuel filter.

Record reading here: _____

NOTE: When installing a new fuel filter, always install the filter dry. This ensures no debris enters the fuel system post-filter.



Figure 6-18. Fuel Filter Restriction Gauge

9. While performing the test, visually inspect the fuel flow from the filter to the pump. If more than an occasional bubble can be seen, or if there is foam in the line, air is getting into the fuel system. Inspect and repair or replace fuel system components until the leak is found and/or repaired.

What does the visual inspection look like?

Injector Drop Out Test

With the engine running, place shop towels around the fuel fitting on the injector connection. Then crack open the injection line to each cylinder one at a time.

NOTE: Diesel fuel will spray out of the cracked injector fuel fitting, use shop towel to capture escaping fuel.

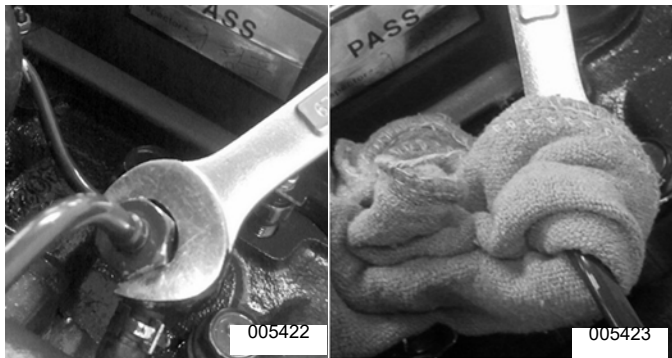


Figure 6-19. Opening Injection Line

If the engine drops speed or the sound changes, that cylinder is functioning properly.

If cracking open the line for the cylinder does not make a difference, or the white or black exhaust smoke clears, then that cylinder is not running well.

This test can also help to identify an engine knock problem.

If the noise goes away when the injection line is loosened, there could be a problem with the injector or the injection pump.

NOTE: The injection timing to the cylinder could be incorrect and causing the knock.

If the noise changes but does not fully go away, there could be a problem with a wrist pin or possibly a scored piston.

NOTE: With a scored piston, the sound may not go away but will usually change.

If the noise does not change or go away, then the problem is a hard mechanical problem.

Cylinder Leak-down Test

A cylinder leak-down test is a more accurate test for compression. When performing a cylinder leak-down test, the cylinder being tested is placed at TDC on the compression stroke. A leak down tester is used to put a controlled amount of air into the cylinder and the gauge will indicate how much air is leaking.

Read the gauge to see if the air loss is at an acceptable level. If there is excessive air leakage, the test will also show where the problem is.

- If air leaking from the intake manifold can be heard, then a leaking intake valve is likely.
- Air leaking from the output of the exhaust system indicates a leaking exhaust valve.
- Air bubbling in the radiator or around the cylinder head indicates a cracked head or a faulty head gasket.

NOTE: There will always be air leaking from the crankcase. If the gauge shows excessive leakage and the only place air can be heard is coming from the crankcase, then the piston rings can be suspected.

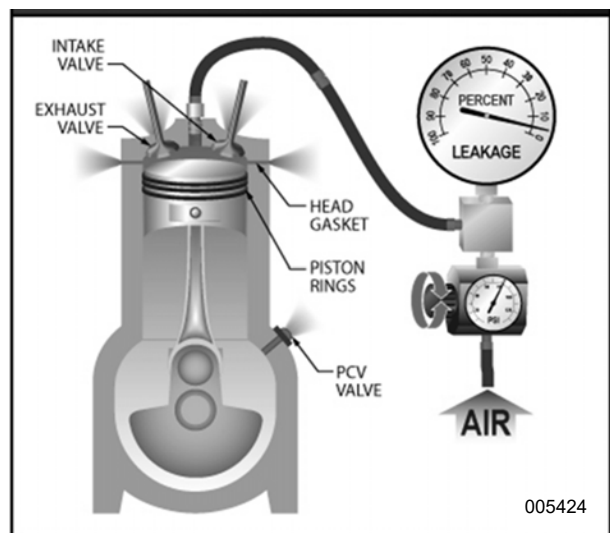


Figure 6-20. Leak Down Test

To Perform the Cylinder Leak-Down Test

1. Remove the glow plug or injector from the suspected cylinder and install the correct adapter.
2. Remove the valve cover. This is done to identify when the engine is at or near TDC.
3. Rotate the engine until both valves on the cylinder to be tested are loose and the timing indicator shows that the suspected cylinder is at TDC.
4. Follow the manufactures directions for the cylinder-leak down tester.
5. Connect the cylinder leak-down test tool.
6. Check the reading on the gauge.

If excessive leakage is shown, check the air filter and the exhaust for an indication of the area of the leak.

Turbo Charger Boost Pressure Test

If a unit will not pull full load, or emits excessive black smoke, a boost pressure test can determine if the turbo charger, engine air inlet piping or charge air cooler are leaking or not performing.

1. With the engine not running, locate the test port on the intake manifold (this will be an NPT pipe plug).
2. Remove the plug and insert a pressure gauge (follow the directions of the test gauge being used).
3. Start the engine. Run unit at no load and load the unit to full load, or run the maximum load that can be achieved if full load can not be attained.
4. Record the boost pressure at 25%, 50%, 75% and full load.
 - If boost pressure is within acceptable parameters and black smoke still persists, then an injector may be the issue.
 - If boost pressure is low, check for a pressure leak in the air piping system or charge air cooler (if equipped).

Charge Air Cooler Leak Test

NOTE: To prevent debris from entering the engine, cover the turbocharger exhaust and intake piping while the charge air cooler is disconnected.

NOTE: Before performing the leakage test, visually inspect the core, tanks, and welds for cracks and holes. If the cooler fails this visual inspection, REPLACE the charge air cooler.

NOTE: It is not necessary to remove the charge air cooler from the vehicle to perform this test.

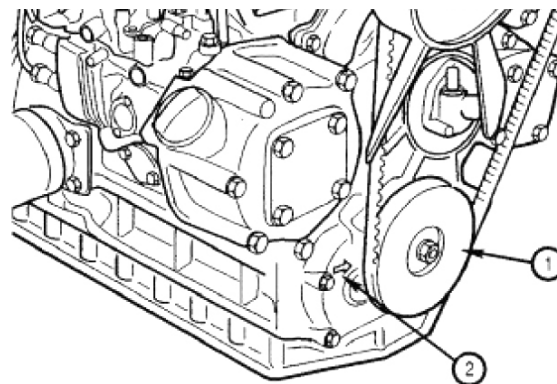
1. Disconnect turbocharger piping from the charge air cooler.
2. Follow the charge air cooler tester directions to install the tester on the charge air cooler.

3. Connect a filtered air supply to the air valve on the gauge/regulator assembly.
4. Open the air valve slightly, then SLOWLY increase air pressure until the gauge reads 30 psi (206.8 kPa). If necessary, adjust the air regulator until the gauge reads 30 psi (206.8 kPa).
5. Close the air valve and monitor the gauge with a stopwatch for 15 seconds. Note any decrease in air pressure.
6. If the pressure drop is 5 psi (34.5 kPa) or less in 15 seconds, the charge air cooler passes. If the pressure drop is more than 5 psi (34.5 kPa) in 15 seconds, the charge air cooler fails.
7. Check for air leaks by using a soapy solution to the charge air cooler, hose connections, and test equipment. No bubbles should appear.

Valve Clearance Adjustment

1. See **Figure 6-21**. Place wrench on crankshaft pulley nut (1), and while watching for movement of the intake and exhaust rocker arms on cylinder #1, rotate crankshaft in the direction of engine rotation (CCW as viewed from the flywheel end) until arrow (2) cast on injection pump housing points to the slash between numbers "1" and "4" stamped on the edge of the crankshaft pulley.

NOTE: If any movement of the rocker arms is observed, the piston of cylinder #1 is at TDC of the exhaust stroke.



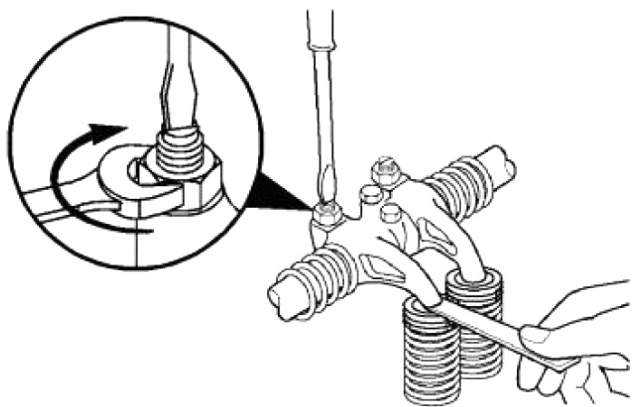
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Figure 6-21. Crankshaft Pulley

2. Rotate crankshaft in the direction of engine rotation 360° until arrow again points to the line between numbers "1" and "4" on the crankshaft pulley.
3. See Figure 183. Insert feeler gauge between lever and valve stem.
4. Rotate adjustment screw to obtain the proper clearance.

Valve Clearance	
Intake Valve	Exhaust Valve
0.011 in (0.30 mm)	0.011 in (0.30 mm)

NOTE: Perform valve clearance adjustment when ambient temperatures are below 108 °F (42 °C) with the engine cool.



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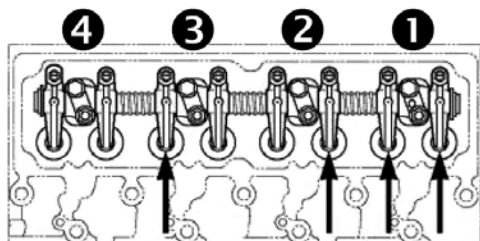
Figure 6-22. Feeler Gauge

5. Tighten jam nut to 20 ft-lbs (27 Nm).
6. Proceed to the next valve as described below.

NOTE: Refer to specific engine manual for information on valve clearance and other engine specific data.

Adjustment Order

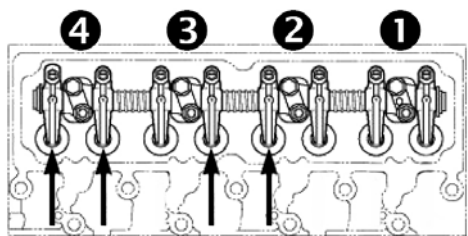
1. Adjust intake valves of cylinders 1 and 2.
2. Adjust exhaust valves of cylinders 1 and 3.
3. Rotate crankshaft 360° in the direction of engine rotation.



005427

Figure 6-23. Adjustment Order

4. Adjust intake valves of cylinders 3 and 4.
5. Adjust exhaust valves of cylinders 2 and 4.



005428

Figure 6-24. Adjustment Order

Compression Check

Loss of compression in a diesel engine is a sign that there is an internal mechanical issue(s). Low compression can cause hard starting in cold weather, loss of power, rough running, shaking, excessive exhaust smoke, and poor fuel economy.

If the compression loss is constant over all cylinders, a common internal component(s) within the engine may be at fault. Compression loss over just one or two cylinders may only require valve lash adjustment.

Before performing a compression test, rule out the following:

- mis-adjusted valves
- clogged fuel filter
- clogged air filter
- the fuel system “sucking air”
- a mis-performing turbo charger system

Once the condition of the external components has been verified, a compression check should be performed to rule out the possibility of an internal engine problem.

Always perform a valve adjustment on diesel engines before doing a compression test. Failing to do this can give false readings.

Verify the unit’s battery or batteries are fully charged. An external maintenance charger can help keep the batteries charged during the test.

WARNING

Personal injury. Do not add oil to cylinder. High compression in cylinder could cause serious injury or equipment damage.

(000330)

NOTE: In the case of an engine still under warranty, the engine may be replaced instead of a field rebuild. This is verified by the technical service department.

Procedure

1. Identify the correct adapter for the compression tester.
2. Disconnect the run solenoid on the injection pump. On Protector diesels, follow the wires coming out of the fuel injection pump.
3. Remove the in-line fuse that sits between the run circuit and the Injection Pump (IP).



Figure 6-25. Remove In-line Fuse

4. Use a compression tester and identify the correct adapter.
5. Remove all injectors, or if using glow plug adapters, remove the glow plugs. Refer to the units specific engine manual.
6. Install the adapter into the cylinder head.
7. Attach the compression tester to the installed adapter in the cylinder head.



Figure 6-26. Compression Tester and Adapters

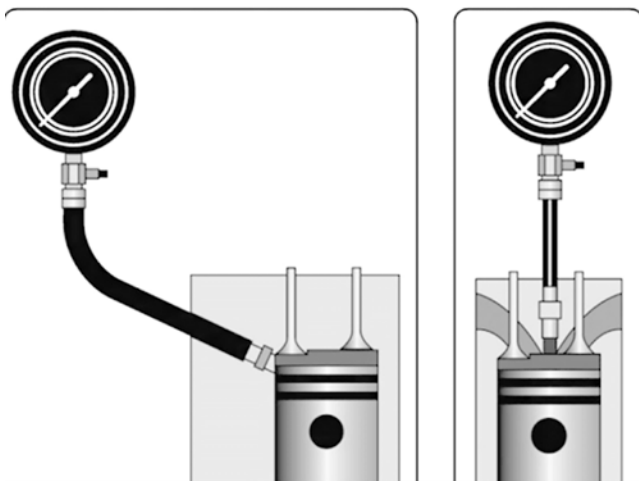


Figure 6-27. Compression Tester Installed In Glow Plug and Injector Port.

⚠ WARNING

Personal injury. Do not use an automotive compression tester. Use only a compatible compression tester. Failure to do so could result in personal injury or equipment damage.

(000329)

8. Remove Wire 16 from the starter motor solenoid.

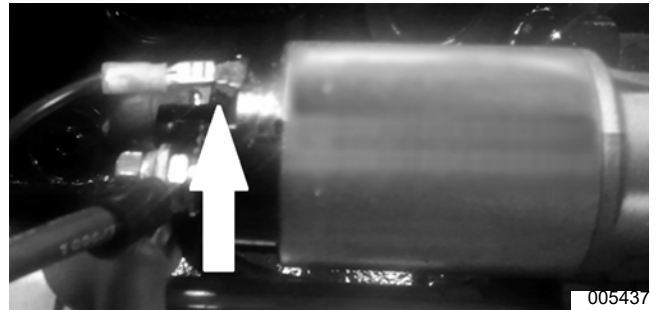


Figure 6-28. Starter Motor Solenoid

9. Using a starter motor test switch on the starter motor solenoid (connect one connection of the remote switch to the terminal where wire 16 was removed from the starter contactor and the other connection of the remote switch to the battery positive (+) terminal) crank the engine for 6–8 engine compression cycles “puffs” (approximately 12–16 crankshaft revolutions).



Figure 6-29. Starter Motor Test Switch

10. Observe how far and how fast the compression tester needle moves. Record the values below.



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Figure 6-30. Compression Tester Needle

11. Move to the other cylinders and write down the values to compare later.

Slightly low readings are acceptable within specifications—as long as the compression is consistent across all of the cylinders of the engine. High altitude will also cause lower compression test readings.

If the readings fall within specifications and are consistent across all the cylinders, the problem may lay within the fuel system or air intake / turbo charger.

The maximum allowable difference between the highest and lowest readings is 10–15%.

Record Compression Values:

Cylinder #1 _____

Cylinder #2 _____

Cylinder #3 _____

Cylinder #4 _____

Cylinder #5 _____

Cylinder #6 _____

Electrical Formulas

To Find	Known Values	1-phase	3-phase
Kilowatts (kW)	Volts, Current, Power Factor	$\frac{E \times I}{1000}$	$\frac{E \times I \times 1.73 \times PF}{1000}$
KVA	Volts, Current	$\frac{E \times I}{1000}$	$\frac{E \times I \times 1.73}{1000}$
Amperes	kW, Volts, Power Factor	$\frac{kW \times 1000}{E}$	$\frac{kW \times 1000}{E \times 1.73 \times PF}$
Watts	Volts, Amps, Power Factor	Volts x Amps	$E \times I \times 1.73 \times PF$
No. of Rotor Poles	Frequency, RPM	$\frac{2 \times 60 \times \text{Frequency}}{\text{RPM}}$	$\frac{2 \times 60 \times \text{Frequency}}{\text{RPM}}$
Frequency	RPM, No. of Rotor Poles	$\frac{\text{RPM} \times \text{Poles}}{2 \times 60}$	$\frac{\text{RPM} \times \text{Poles}}{2 \times 60}$
RPM	Frequency, No. of Rotor Poles	$\frac{2 \times 60 \times \text{Frequency}}{\text{Rotor Poles}}$	$\frac{2 \times 60 \times \text{Frequency}}{\text{Rotor Poles}}$
kW (required for Motor)	Motor Horsepower, Efficiency	$\frac{HP \times 0.746}{\text{Efficiency}}$	$\frac{HP \times 0.746}{\text{Efficiency}}$
Resistance	Volts, Amperes	$\frac{E}{I}$	$\frac{E}{I}$
Volts	Ohm, Amperes	$I \times R$	$I \times R$
Amperes	Ohms, Volts	$\frac{E}{R}$	$\frac{E}{R}$

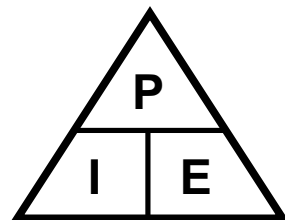
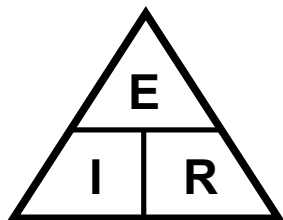
E = Volts

I = Amperes

R = Resistance (Ohms)

PF = Power Factor

Term	Symbol	Measurement
Current	I	Amps
Wattage	P	Watts
Voltage	E	Volts
Resistance	R	Ohms



003003

Constant	Shift		Result	
Voltage E	Resistance Increase	↑	Current Decrease	↓
Voltage E	Resistance Decrease	↓	Current Increase	↑
Resistance R	Voltage Decrease	↓	Current Decrease	↓
Resistance R	Voltage Increase	↑	Current Increase	↑
Current I	Resistance Decrease	↓	Voltage Decrease	↓
Current I	Resistance Increase	↑	Voltage Increase	↑
Power P	Voltage Increase	↑	Power Increase	↑
Power P	Voltage Decrease	↓	Power Decrease	↓
Power P	Current Increase	↑	Power Increase	↑
Power P	Current Decrease	↓	Power Decrease	↓

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