Countries:	BAHAMAS, BOLIVIA, BELIZE, CANADA, CHILE, TAIWAN, COLOMBIA, COSTA RICA, DOMINICAN REPUBLIC, ECUADOR, EL SALVADOR, TRINIDAD AND TOBAGO, UNITED STATES, URUGUAY, VENEZUELA, ARUBA, NICARAGUA, PERU, Curaçao, GUAM, GUATEMALA, GUYANA, HAITI, HONDURAS, JAMAICA, KOREA, SOUTH KOREA, PANAMA	**Document ID:**	IK0800403
Availability:	ISIS	**Revision:**	15
Major System:	ELECTRICAL SYSTEM	**Created:**	11/1/2012
Current Language:	English	**Last Modified:**	8/11/2015
Other Languages:	Français, Español,	**Author:**	David Smith
Viewed:	7668		

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Title: Alternator Troubleshooting and Diagnostics

Applies To: All

CHANGE LOG

08/11/2015 - Added alternator terminal identification charts.
04/10/2015 - Changed warranty authorization code to charge code, adjusted note under description. Added Charge Code Location picture as appendix E
04/02/2015 - Added information on how to find Alternator WAC on MidTronics
03/30/2015 - Added additional question to Step 5, and added Midtronics WAC requirement on all Alternator replacements. Added another condition

DESCRIPTION

This document details the procedure that must be followed to assure proper Alternator troubleshooting and diagnostics.

The procedure requires the use of the **Midtronics EXP Tester**, and **Alternator Diagnostic Worksheet.**

NOTE: Midtronics Warranty Authorization Codes, and Charging System Charge Codes are now required on every Navistar Warranty Alternator replacement (excluding 55 over the counter parts).

FAULT CODES/SYMPTOMS

Overcharging
Undercharging
Fluctuating Battery Gauge
red battery warning light

Customer Concern:

Low battery system voltage
Red battery warning light
Batteries aren't Charging
Battery gauge reading too high
Battery gauge reading too low
Battery gauge fluctuating

SPECIAL TOOLS or SOFTWARE

Tool Description	Tool Number	Comments
Midtronics EXP Tester	EXP1000HD	
Digital Multimeter		

DIAGNOSTICS

Step	Action	Decision
1	Feature code confirmation : Power Pack 3 Alternator Does this vehicle have a Power Pack 3 alternator--DuraStar or WorkStar with feature code 60AJN, 60AJP,60AAC, or 60AAE? For further information on this feature click here	Yes: Go to Power Pack 3 Diagnostics linked Here No: Go to Step 2

Step	Action	Decision
2	Inspect accessory drive belt for the following : - Excessive cracking - Missing/torn ribs - Excessive edge wear - Contamination Note: belts may not be covered under warranty--verify warranty policy. Is the accessory drive belt usable?	Yes: Go to Step 3 No: Replace Belt, and retest

Step	Action	Decision
3	Check accessory drive belt auto tensioner for the following: - Does the auto tensioner pulley spin freely? - Does the tensioner arm move smotthily through its entire range of motion? - Is there spring tension through the entire range of motion? - Is the tensioner, at a mid-point, within its range of travel? - Inspect for loose Alternator Pulley Was "yes" the answer to **ALL** of the previous questions?	Yes: Go to Step 4 No: Replace accessory drive belt auto tensioner and retest

Step	Action	Decision
4	Inspect alternator cables and connections for the following : - Loose crimps - Corrosion - Damage - Proper routing Are all alternator cables and connections free of issues?	Yes: Go to Step 5 No: Repair/Replace any defective Alternator Cables and Connections and retest

Step	Action	Decision
5	If the Alternator has an ignition (IGN) terminal, there must be power present at all times. Use a volt meter to measure voltage at the terminal. Is the voltage reading 12.4V or greater?	Yes or not present, Go to Step 6 No: Find Circuit issue and repair. Then Retest.

Step	Action	Decision
6	If the Alternator has a battery voltage sensing feature. • Verify that the sense wire is securely connected to the "S" (Sense) Terminal • Visually inspect circuit to the batteries, to verify the circuit is not damaged. **See Appendix D for illustration describing the issue** Note : If voltage sense is not equipped on the alternator go to Step 7. The voltage sense wire should NOT be connected to the "L" (Lamp) Terminal Note : For further terminal information see Appendix F. Is Voltage Sensing Wire hooked up correctly, and not damaged?	Yes: Go to Step 7 No: Reinstall/repair Voltage Sensing Wire to appropriate terminal and then retest

Step	Action	Decision
7	Battery Pack Breakdown Test 1. Do the "Test Preparation" as described in Section 4 of the Midtronics EXP Instruction Manual. 2. Select "System Test" and follow procedure for testing battery individual battery, as described in Section 5 of the Midtronics EXP Instruction Manual Note : Do not test as a pack. Test batteries individually. Note : Use Midtronics battery stud adaptors on each battery tested. Failure to do so will yield inaccurate results. Note : Keep all generated warranty codes during testing to later be submitted on Warranty Claim (If warranty applies) What were the individual test results for each Battery?	Good Battery(s) : Go to Step 8 Replace/Bad Cell : Replace bad batteries and re-perform Step 7 Charge and Retest : Charge batteries and reperform Step 7

Step	Action	Decision
8	Starter and Alternator System Test Continue with Midtronics System Test, Section 5, for Starter and Alternator : 1. Connect positive (+), and negative (-) test leads to batteries 2. Following Midtronics prompts, conduct "Starter System Test" and "Charging System Test" 3. When prompted choose 'Amp Clamp Available' option if available **Note : Record Midtronics Charge Code generated for warranty submission (See Appendix E for Charge Code Location).** **Note : Midtronics Charge Code can be found by using the down arrow on the key pad after Charging System portion of the test is completed.** Was a problem with the alternator detected?	Yes: Replace alternator and retest for condition. No: Go to Step 9

Step	Action	Decision
9	Circuit Test (If Midtronics Cable Drop Test Leads) are available : **Note : If Midtronics Cable Drop Test Leads are not available go to Step 10** 1. Connect the Midtronics Cable Drop Test Leads 2. Perform the Cable Drop Test as described in Section 7 of the Midtronics Manual 3. Record indicated Voltage drops from each cable on the Midtronics tool, into the Alternator Diagnostic Worksheet. Is the sum of cable drop between both cables greater than 0.5V (+/- 0.25V)?	Yes: Repair Charging System Cable(s) as needed, and Retest. No: Go to Step 10

Step	Action	Decision
10	Feature Code Confirmation : Leece Neville Alternator 1. Does this vehicle have a Leece Neville Alternator with feature code 08GXD, 08GXE, 08GXC, or 08GXB? 2. Was this vehicle also built between 08/2013 - 03/2014? Does the vehicle have this feature code, **and** fall in this build date range?	Yes: Go to Step 11 No: Go to Step 12, if cable drop wasn't possible at Step 9 No : If cable drop was possible in Step 9, restore truck to operating condition and contact your supervisor.

Step	Action	Decision
11	Leece Neville Symptom Verification • Alternator voltage is intermittently high (above the normal running range of 13.8-14.8V).	Yes: Replace Alternator and Retest(See Appendix C for replacement guidelines) No: Go to Step 12, if Step 9 was unable to be performed.

	• Voltage as seen on the volt gauge spikes above 15V temporarily, and then drops to normal range. • Voltage gauge fluctuates abnormally. Is the Vehicle experiencing any of the issues above?	No : If cable drop has already been performed. Restore truck to operating condition, and contact your supervisor

Step	Action	Decision
12	Positive Cable Circuit Test if Midtronics Cable Drop Test Leads (DMM Test Leads) are not available **(Illustration in Appendix A)** 1. Connect Ammeter to positive alternator Cable 2. Make sure Ammeter is atleast 6 inches away from alternator to eliminate the possibility of faulty readings. 3. Connect Voltemeter's negative lead to the positive terminal of the alternator 4. Connect the voltmeter's positive lead to the positive terminal of the battery. 5. Start engine and set engine 1500 RPM's 6. Turn on vehicle loads until 75% of alternators rated output is acheieved on ammeter display 7. If necessary, use a carbon pile tester to apply load on alternator 8. Record Measured voltage to checklist 9. Turn off engine **Note : Record measured voltage drops into the Alternator Diagnostic Worksheet** Was the reading greater than .25 Volts (+/- 0.10V)?	Yes: Correct voltage drop, and re-test before proceeding No: Go to Step 13

Step	Action	Decision
13	Negative Cable Circuit Test if Midtronics Cable Drop Test Leads (DMM Test Leads) are not available **(Illustration Shown in Appendix B)** 1. Connect Ammeter to positive alternator Cable 2. Make sure Ammeter is atleast 6 inches away from alternator to eliminate the possibility of faulty readings. 3. Connect Voltemeter's negative lead to the negative terminal of the Battery 4. Connect the voltmeter's positive lead to the negative output terminal on the alternator. 5. Start engine and set engine 1500 RPM's 6. Turn on vehicle loads until 75% of alternators rated output is acheieved on ammeter display 7. If necessary, use a carbon pile tester to apply load on alternator 8. Record Measured voltage to checklist 9. Turn off engine **Note : Record measured voltage drops into the Alternator Diagnostic Worksheet** **Note : Clean and tighten connections, or replace wiring as needed** **Note : Refer to the table, "Charging System Decision" in the Midtronics Instruction Manual. Follow instructions for further inspections and re-tests** Was the reading greater than .25V (+/- 0.10V) Volts?	Yes: Correct voltage drop,and re-test before proceeding No: Restore truck to operating condition and contact supervisor

WARRANTY INFORMATION

When troubleshooting a replacing an alternator, technicians must utilize the **Midtronics EXP Tester**, and submit a **Alternator Diagnostic Worksheet**. Critical diagnostic testing values are to be recorded on the worksheet, and submitted with the claims on iClaim.

Exception: Worksheet is not required for over-the-counter parts warranty when no vehicle is present to perform diagnostics.

NOTE : A Midtronics Alternator 9 Digit Charge Code is now required on all alternator replacements. Only exception being 55 Over the Counter Parts Warranty replacement.

Warranty Return Information

Due to the high rate of damaged alternators, any and all alternators sent back via warranty/service contract/service part must be undamaged and testable.

Unwarrantable Damage includes :

Stripped pulley/terminal threads
Missing/damaged terminals
Foreign object damage
Missing parts that render unit untestable
Cracked Housing
Alternators returned in disassembled condition

Warranty Claim Coding:

Group:	08000 - Generating System
Noun:	018 - Alternator Assy

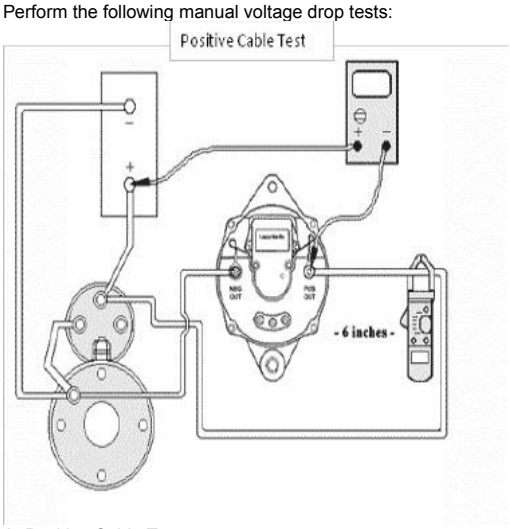
Standard Repair Times:

Description	SRT Link or Code	Hours
Alternator Diagnostics	Select model	0.5
Positive Cable Test	Select model	0.1
Negative Cable Test	Select model	0.1
Replace Alternator	Select model	Select model

APPENDIX

Appendix A :

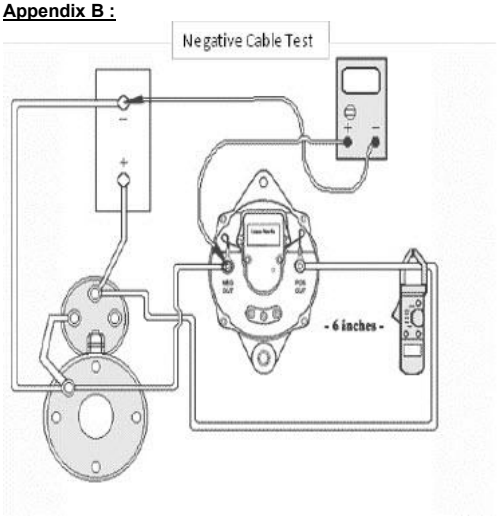
Perform the following manual voltage drop tests:



A. Positive Cable Test
1. Connect ammeter to positive alternator cable.
2. Make sure ammeter is at least 6 inches (15 cm) away from alternator, to eliminate possibility of faulty readings.
3. Connect voltmeter's negative lead to positive terminal of alternator.
4. Connect voltmeter's positive lead to positive terminal on battery.
5. Start engine and set engine 1500 RPMs.
6. Turn on vehicle loads until 75% of alternator's rated output is achieved on ammeter display.
7. If necessary, use a carbon pile tester to apply load on alternator.

8. Record measured voltage to checklist.
9. Turn off engine.

Appendix B :



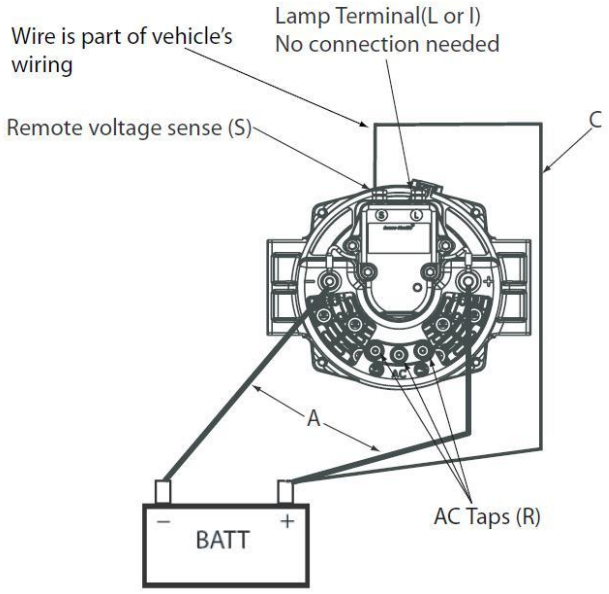
B. Negative Cable Test
1. Connect ammeter to positive alternator cable.
2. Verify the ammeter is at least 6 inches (15 cm) away from alternator, to eliminate possibility of faulty readings.
3. Connect voltmeter's negative lead to negative terminal of battery.
4. Connect voltmeter's positive lead to negative output terminal on alternator.
5. Start engine and set engine 1500 RPMs.
6. Turn on vehicle loads until 75% of alternator's rated output is achieved on ammeter display.
7. If necessary, use a carbon pile tester to apply load on alternator.
8. Record measured voltage to checklist.
9. Turn off engine.

Appendix C :

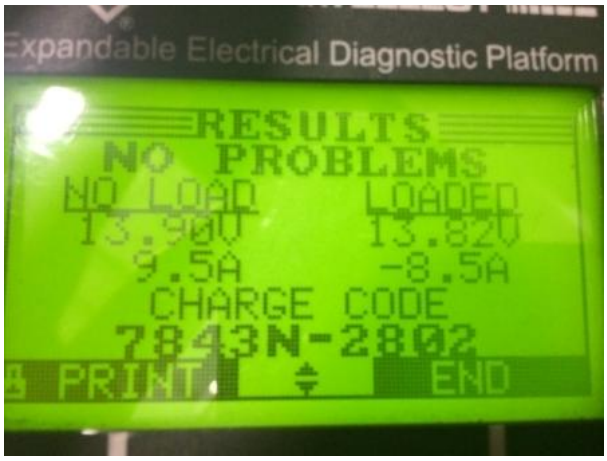
Action	Corrections and Warranty Determination
1. Record alternator date code	Part label must be intact. If label is missing or destroyed, a justifiable reason must be presented and accepted by a representative before a claim process is initiated. A missing or intentionally destroyed label may void the warranty. If date code is newer than vehicle manufacture or in-service date, this is a replacement part. The date code must coincide with the date of invoice when the part was purchased, or be validated by an "install date".
2. Inspect for excessive dirt, grease, or oil	Excessive dirt, grease, or oil soaked/saturated condition: Oil and grease on surface and/or interior of alternator will prevent unit from cooling properly, causing premature failure. This may also create a low voltage condition on the vehicle. Check and correct any sources of excessive oil, grease, and dirt. Check for missing shields, leaking hoses, or fraying belts.
3. Inspect for rust and corrosion.	Alternators can become rusted or corroded such that they cannot function, or function intermittently. Examples are positive side rectifiers shorted to case by a "corrosive bridge", the rotor rusted and seized to the stator, or electrical connections open due to corrosion.
4. Inspect for damaged shaft, mounting bosses, housing	Bent, broken, cracked or elongated mounting holes, impact marks or cracked housings render all products unacceptable for warranty.
5. Inspect for signs of arcing or shorts to housing or connection points.	Signs of arcing or direct shorts to housing or connection points, including hardware dropped or loose inside of alternator housing, improperly connected or modified electrical connectors, or cut/severed wires will void warranty.
6. Inspect mounting brackets	Make sure charging system components are securely mounted to their applicable brackets. Brackets, in turn, must be bolted securely to the engine. Poorly mounted charging system components lead to vibration damage and diminished drive belt performance.

Appendix D :

Fig. 1



Appendix E :



Appendix F :

Leece Neville Terminal ID Chart :

Terminal Name(s)	Connection	Description
B+, (+)	Positive Battery Connection	
B-, (-)	Negative Battery Connection	
L	Lamp	Provides ground when fault or unit not operating
IGN	Ignition switched B+ (only on when ignition is on)	Power supplied to this terminal by ignition
D+	Trio	Provides voltage when operating to power regulator or signal relay
S	Remote Sense	Voltage supplied to this terminal provides reference voltage to regulate to
AC,W, R	Stator terminal	Phase tap from stator
F+	Field connecton (positive)	Field resistance can be measured between F+ and F-
F-	Field connecton (negative)	Field resistance can be measured between F+ and F-

Delco Remy Terminal ID Chart :

Terminal	Function

Battery Positive (B+) and Ground Terminals : all case grounded alternators	Alternator output terminals
Battery Positive (B+) and Battery Negative (B-) : all case insulated alternators	Alternator output terminals
Relay (R) Terminal or Phase (P) Terminal	Alternating speed signal at 1/2 system voltage (Half wave rectified. A terminal is provided to monitor the voltage of one phase. The maximum current loading is 4 amps, and may be used for tachometers, hour meters etc...
Indicator (I) Terminal	Constant current source or sink to reduce turn-on speed or indicate fault (1 amp max). This terminal carries full system voltage
Lamp (L) Terminal	Constant 1 amp current sink only to indicate charging system condition. The L terminal will function as a fault indicator by pulling the applied voltage low, and hence terminal L is capable of sinking a current of up to 1 Amp indefinitely when the alternator is not working
Sense (S) Terminal	Connection point for remote voltage sensing. Battery voltage may be sensed using an external sense. In the event the sense wire becomes disconnected, or is not in use, the battery voltage sense circuit will automatically revert to internal sensing on most models
Field (FM) Terminal	Available on only certain products. The FM terminal is used to monitor the pulse width modulated (PWM)field voltage. With the alternator field referenced to ground, the FM terminal is connected to the high side of the field using a 10,000 ohm resistor. When the field switch is turned on, essentially battery voltage appears at the FM terminal, nad thus the average voltage a Terminal FM is directly proportional to field strength. When the ECU recognizes a full filed condtion, it can activate fast idle to maintain required loads

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