Charging System

Refer to Wiring Diagrams Section 414-02 for schematic and connector information.

General Equipment

Midtronics EXP-1050 battery tester
Midtronics GRX-3590 battery diagnostic station
Ford diagnostic equipment

Inspection and Verification

WARNING: Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Accessory drive belt – Generator	– Fuse(s) – Wiring harness – Electrical connector(s) – Charging system warning indicator – Generator – Battery – Battery cables – Battery monitoring sensor – Engine junction box (EJB) – Central junction box (CJB) – Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Check the operation of the charging system warning indicator lamp, located in the instrument cluster. Normal

operation is as follows:

Normal Charging System Voltages

Ignition Switch Position	I Circuit	Generator B+ Circuit	Battery	Engine to battery ground	Charging System Warning Indicator Operation
Position 0	0V	10-12V	10-12V	0V	OFF
Position II	0V	10-12V	10-12V	0V	Illuminated
Position II with the engine running	13-15V	13-15V	13-15V	0V	OFF

5. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• The charging system warning indicator is on with the engine running (The charging system voltage does not increase)	• Accessory drive belt.	• CHECK the accessory drive belt condition, REFER to: Accessory Drive (303-05 Accessory Drive - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing), Accessory Drive (303-05 Accessory Drive - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
	• Circuit. • Generator. • Voltage regulator.	• CARRY OUT the generator tests, REFER to the Generator On-Vehicle Tests in Component Tests in this section.
• The charging system warning indicator is off with the ignition switch in the RUN position and the engine off	• Bulb/LED.	• REFER to: Instrument Panel Cluster (IPC) (413-01) .
	• Ignition switch.	• CHECK the ignition switch.
	• Circuit. • Generator.	• CARRY OUT the generator tests, REFER to the Generator On-Vehicle Tests in Component Tests in this section.
• Radio interference	• Circuit. • Generator.	• REFER to the Ford diagnostic equipment
• The generator is noisy	• Accessory drive belt.	• REFER to: Accessory Drive (303-05 Accessory Drive - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing), Accessory Drive (303-05 Accessory Drive - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
	• Loose generator	• TIGHTEN the generator mounting bolts.

	mounting bolts. • Generator.	• INSTALL a new generator. REFER to: (414-02) Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02) , Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02) , Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02) .
• Vehicle electrical systems inoperative	• Battery.	• CARRY OUT the battery tests, REFER to the Battery Tests in Component Tests in this section.
• The engine cranks slowly	• Battery. • Battery cable (s). • Starter motor.	• CARRY OUT the battery tests, REFER to the Battery Tests in Component Tests in this section. • REFER to: Starting System (303-06 Starting System - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing), Starting System (303-06B) .

Component Tests

Generator On-Vehicle Tests - No-Load Test

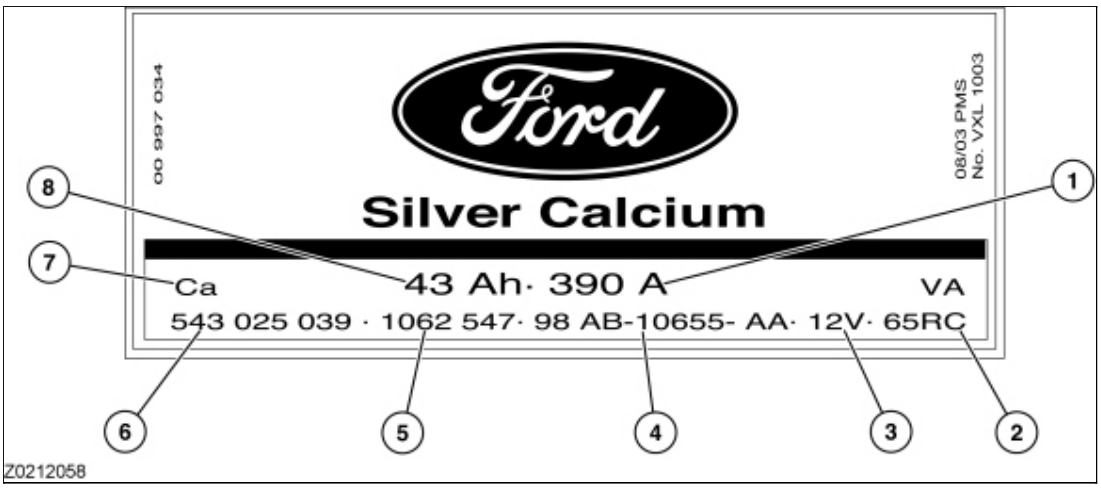
1. Turn off all electrical loads and the ignition switch.
2. Switch the multimeter to the voltage function.
3. Connect the leads of the multimeter across the battery terminals.
4. Read the voltage (base voltage).
5. Start the engine.
6. Run the engine at 1500 rpm with no electrical load.
7. Read the voltage. The voltage should be in the range of 14.1 volts to 15.1 volts. If the voltage increase is less than 2.5 volts above the base voltage, carry out the Load Test. If the voltage increase is greater than 2.5 volts, REFER to the Ford diagnostic equipment.

Generator On-Vehicle Tests - Load Test

1. With the engine running, turn on the air conditioning (if equipped), turn the blower motor to high speed and the headlamps to high beam.
2. Increase the engine speed to 2000 rpm. The voltage should increase a minimum of 0.5 volts above the base voltage. If the voltage does not increase as specified, REFER to the Ford diagnostic equipment. If the voltage increases as specified, the charging system is charging correctly.

Battery Tests

Battery Identification



Item	Part Number	Description
1	—	Cold crank amp (CCA) rating
2	—	Reserve capacity (RC) rating (minutes)
3	—	Battery voltage
4	—	Ford Part number
5	—	FINIS code
6	—	EN number (European Norm)
7	—	Battery type: Ca = Silver/Calcium; Sb = Lead/Antimony
8	—	Amp hour rating

Item	Part Number	Description
1	—	Battery performance data
2	—	Motorcraft internal labelling
3	—	DIN labelling

Battery Performance Data

NOTE: *The data only applies to a new fully-charged battery.*

- The first group of digits (12V) indicates the battery voltage (12 volts).
- The second group of digits (590A) indicates that the battery delivers a current of 590 amps at -18°C without the terminal voltage falling below 7.2 volts.
- The third group of digits (90RC) indicates the time in minutes in which the battery voltage falls to 10.5 volts in the case of a 25 amp load and an ambient temperature of 22°C.

DIN Labelling

- The first group of letters (WF) indicates that the battery is maintenance-free.
- The first digit (5) indicates that the battery is 12 volts.
- The second and third digits (58) indicates the battery capacity is 58 Ah, which means it could power a 58 amp load for 1 hour.
- The last two digits (11) is a sequential serial number.

Midtronics EXP-1050 Battery Tester

The Midtronics EXP-1050 battery tester is the only battery tester recommended by Ford to test latest technology batteries including Absorbent Glass Mat (AGM) and Enhanced Flooded Battery (EFB), previously known as Improved Flooded Battery (IFB) used on Ford Start-Stop vehicles.

Main specifications of the Midtronics EXP-1050 battery tester

- Tests 6/12V batteries
- Tests discharged batteries down to 1V both in and out of the vehicle
- Ratings in battery tester: CCA, JIS, EN, DIN, IEC, SAE
- CCA range: By Ford battery type 100-1700 A SAE / EN / CCA 100-1000 A DIN / IEC All current JIS codes
- Large LCD display with adjustable backlight
- Detects short-circuited cells
- Surface charge removal procedure
- Dynamic Response procedure for refined decisiveness on battery diagnostics
- Upgradeable by SD card
- Export data feature to send data to infra red printer
- Voltmeter function
- Date and time indication with every test
- 23 languages included within the battery tester

Using the Midtronics EXP-1050 Battery Tester

- Disconnect the battery ground cable at the battery negative (-) post. Note: if using this battery tester on models where the ground cable is not accessible, the battery does not have to be removed from the vehicle and may be tested using the vehicle's 'jump start post' if the battery tester is set to the correct mode. In this case, the battery must be disconnected at the positive (+) post before testing.
- Connect the positive red clamp of the Midtronics EXP-1050 battery tester to the battery positive (+) post.
- Connect the negative black clamp of the Midtronics EXP-1050 battery tester to the battery negative (-) post or jump start post as appropriate.

A poor connection will prevent testing and the battery tester will display the message CHECK CONNECTION. If this message appears after you have correctly reconnected the clamps, clean the terminals and reconnect.

It is recommended that batteries are always tested using both battery posts. However, if used in 'jump start post' mode, the Midtronics EXP-1050 battery tester will compensate for the extra resistance of the additional cable.

1. Select BATTERY TEST or START-STOP BATTERY TEST.
   - Press the NEXT key to continue.
2. Select the BATTERY LOCATION
   - UNDER HOOD
   - UNDER SEAT
   - OUT OF VEHICLE
   - Press the NEXT key to continue.
3. Select the negative POST TYPE (IN-VEHICLE ONLY)
   - BATTERY POST
   - JUMP START POST
   - JUMP START POST (Battery Monitoring Sensor)
   - Press the NEXT key to continue.
4. Select the BATTERY RATING from the drop down list.
   - Press the NEXT key to test the battery.
5. If the battery under test is not listed in the drop down list, it can still be selected with the MANUAL ENTRY mode. This is item 11 of 11 in the list.

The Midtronics EXP-1050 battery tester will display the word TESTING while it evaluates the battery.

Battery Tester Results and Required Actions

Battery Tester Reading	Action
GOOD BATTERY	Return the battery to service
GOOD - RECHARGE	Fully recharge the battery and return it to service

CHARGE & RETEST	Fully charge the battery and retest (failure to fully charge the battery before retesting may cause false readings)
REPLACE BATTERY or BAD CELL BATTERY	**WARNING: Do not recharge the battery.** Make sure that the surface charge was removed. A "REPLACE BATTERY" result could also mean a poor connection between the battery cables and the battery. Check the connections are OK and retest. If the result remains the same, INSTALL a NEW battery
In addition it is advisable to check the vehicle electrical system. Check that the generator is functioning correctly and the vehicle does not have an excessive key-off load (in general this should be under 20mA after 40 minutes of key off).	

Midtronics EXP-1050 Battery Tester Test Code

At the end of the test, use the arrow keys to scroll down the screens to see additional information. One of these is the TEST CODE.

The TEST CODE has 11 digits, for example: 0021U-B88WKX.

Midtronics GRX-3590 Battery Diagnostic Station

Using the Midtronics GRX-3590

Item	Description
1	GRX-3590 stand-alone version with integrated keypad and display
2	GRX-3590 docking station

The Midtronics GRX-3590 is both a battery charger and battery tester and automatically removes the surface charge as part of the normal operating procedure.

The Midtronics GRX-3590 can be used on a battery in-vehicle or out-of-vehicle.

- Disconnect the battery ground cable.
- Connect the positive red clamp from the Midtronics GRX-3590 to the battery positive terminal.
- Connect the negative black clamp from the Midtronics GRX-3590 to the battery negative terminal.
- Connect the AC power cable to the mains outlet and switch ON.
- Follow the instructions supplied with the Midtronics GRX-3590 to charge the battery.
- To disconnect the Midtronics GRX-3590, reverse the connection procedure.

The Midtronics GRX-3590 will automatically carry out a charge cycle before giving the resulting test code. The TEST CODE has 13 digits, for example: Y74NH-58R36-ESV. It will bring the battery into a serviceable condition and if required can proceed to fully charge the battery.