

Technical Bulletin

Model
All

Group
2

Subject: Battery Discharging

Part Identifier
2706

Number
9204

ATTENTION: Service Manager/Service Technician

Models Affected: All

Concern: Servicing Batteries:
Battery testing and constant current draw checking procedures.

Bulletin Contents: Our experience and information from dealers show very different methods and opinions about battery service and testing. To address this subject in detail, additional information, recommendations and suggestions are given in the following text.

The following subjects are addressed in this technical bulletin.

1. General information.
2. Battery service (general /new, stored and displayed vehicles).
3. Hints on vehicle delivery.
4. Replacement batteries.
5. Discharged batteries.
6. Voltage and electrolyte density checking (correction values).
7. Load testing.
8. Current draw checking.
9. Summary.

1. General Information:

The condition of a battery can be determined by measuring battery voltage (or electrolyte density) and battery load testing.

Battery voltage or electrolyte density gives information about the charging condition. (Energy stored through electro-chemical transformation.) 100% charging condition with all cells OK corresponds to 12.7 volts or 1.28 g/ml, acid density.

Starting capability of a battery is the characteristic to release stored energy under load. This capability decreases with discharge, eventually sulfating with age.

Battery wear is very high when discharging and charging often (high cyclic load), for instance short distance driving, demonstrator vehicle service or at high ambient temperatures.

General assumption: New Battery = Full Battery. In storage, a battery discharges through self-discharge (up to 1% of A_h capacity per day). If the battery is installed in a vehicle, current draw and temperature are additional influences.

Long transportation, handling and parking times of the vehicle are also influencing factors. Measures are taken on all vehicles at the factory to reduce current draw during transportation.

Other influencing conditions are traffic density, speed limits and personal driving habits.

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1. General Information (cont.):

Recharging by the alternator is not always assured with low RPM driving. This can lead to insufficient charging results because of high current draw from vehicle electronics and low charging voltage with short distance driving and stop and go traffic.

A new battery is only a new and full battery if voltage and starting capability is checked. Batteries must be recharged, if necessary, and tested to factory specs before putting in service.

Service and testing of a battery therefore starts when the product is first put into use.

If you do not proceed in a similar manner, we recommend the following procedures, examples and hints.

These measures will ensure that you and your customer have assurance of the condition of the battery. Please use every service department visit for a battery test to ensure top battery performance.

If the battery was disconnected, perform system adaption where applicable.

2. Battery Service/General:

Battery service includes the following general work procedures.

- Check electrolyte level; correct, if necessary.
- Check tightness of battery terminals and cable /post cleanliness.
- Battery cleanliness. Thoroughly clean all electrolyte traces from between cells and terminals.
- Check battery voltage (or hydrometer test).
- Check current draw.
- Load test (starting capability).
- Recharging.

2.1 Battery Service on New Vehicles, Vehicles In Storage and Showroom Vehicles:

Please check battery voltage or electrolyte density when receiving the vehicle and, if necessary, charge battery to be certain about its condition. While the vehicle is in storage or on showroom display, the battery **must** be serviced regularly and measured values **must** be documented.

Service Steps (example)

A Battery Maintenance Log Sheet (see enclosed sample) should be kept with the vehicle to record battery service intervals. Service intervals are different for connected and removed batteries. Accordingly, the next battery check date must be noted.

During servicing, battery voltage or electrolyte density must be checked. At the same time, the approximate battery temperature must be recorded.



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2.1 Battery Service on New Vehicles, Vehicles in Storage and Showroom Vehicles (cont.):

This is important because temperature influences battery voltage and electrolyte density which will influence measured values. The measured value must be temperature compensated (refer to 6.1 and 6.3 for compensation values).

Comparing measured values recorded on the log sheet makes it easier to judge the battery.

If battery is...

Battery voltage service/ Recharging intervals

Connected	1 month
Disconnected or removed	3 months
In showroom display vehicle	7 days

3. Vehicle Delivery Hints (see Delivery Check Sheet):

Before delivering a new or pre-owned car, battery voltage (refer to 6) and starting capability (refer to 7) must be checked. This should be done in time to permit, if necessary, recharging or replacing the battery.

4. Replacement Battery (filled or dry):

Only Porsche approved batteries may be used for replacement. Filled batteries should also be serviced according to the battery check sheet (see enclosed sample). Maximum storage time for dry batteries is 24 months. **(Dry batteries are service free and do not require checking until filled with electrolyte.)**

To fill a battery, diluted sulfuric acid with a density of 1.28-1.29 g/ml must be used. When filling, make sure acid penetrates battery cells completely.

Lightly shake battery to release air bubbles. After a period of time, recheck acid level and fill to "max" if necessary.

After filling with acid, the battery must initially be charged at 10 amps for 15 minutes or until gassing begins. Afterwards, the same condition applies for filled batteries.

Before installation in a vehicle, battery voltage (refer to 6) and starting capability (refer to 7), must be checked.

New /pre-damaged or defective batteries can be recognized before installation with these measures.

If replacement battery is...

Battery voltage service/ Recharging intervals

Filled (not installed)	3 months
Dry	Only after filling with acid



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5. Discharged Battery:

Complaint

Battery discharged within short period of time

Cause

High current draw

Possible Faults, Corrections, Hints

- Vehicle faults: Contact switches on doors, luggage compartment or engine compartment lid; lid bent or out of adjustment; relay sticking; ground connections. Current draw checking and fault diagnosis from central electric required.
- After market installation: Telephone, Radio, Alarm, Vehicle Theft Locator.
- Operator errors: Ignition key is position X, parking light, interior lights.
- Insufficient charging because of short distance driving, stop and go, low RPM driving.
- High power requirements. Consumers switched on at the same time: fans, rear window defogger, lights.
- Aftermarket equipment with high power consumption.
- Alternator defective: Charging control light, voltage regulator.
- Battery depleted: High cyclic load because of discharging and charging frequently.
- Battery partially sulfated: Long parking /storage periods with low charged battery.
- Wiring connections loose or corroded.
- Demo or showroom vehicle.
- Dry battery: Not charged after filling.
- Production defect: Cells leaking /plates short circuited.
- Insufficient or wrong battery service (electrolyte level, service charging).
- Long vehicle parking /storage periods without recharging.
- "Fair Weather" or "Weekend" vehicle.

Insufficient charging

Battery defect

Battery discharges after a longer period of time

Insufficient charging

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5. Discharged Battery (cont.):

Complaint

Cause

Possible Faults, Corrections, Hints

Battery defective

- Service faults: No or wrong service. No charging to reduce sulfation, contaminated acid or dirty battery.
- Wear, short circuited cells, sulfating.
- Production defect: Cells leaking /plates short circuited.

If the battery was replaced or recharged a short time ago, the reason for discharging must be clarified. Ask the customer about his driving habits and under what circumstances the battery failed. The battery must be recharged and reused if not damaged or defective. **Do not fast charge the battery under any circumstances.** If the vehicle is a "Fair Weather" vehicle, we recommend you explain to the customer that long parking/storage periods do discharge the battery. Ask your customer to obtain a simple charging device for maintenance/supplemental charging. Instruct the customer in proper use of the charger.

5.1 Preservation Charging:

To prevent gassing, a simple charging device with maximum 0.05A and voltage limit 13.8V is sufficient for preservation/maintenance charging.

Preservation charging can be performed with battery connected at the following points:

- Jump start connection (928 only)
- Cigarette lighter
- Battery post

5.2 Discharged and Sulfated Batteries:

A discharged battery can be recognized by low electrolyte density (one or more cells) and no starting capability. Sometimes the battery can be saved. Because of the high internal resistance for regeneration, a higher charging voltage with a current limit of maximum 2 amps is necessary.

5.3 Reference Values for Battery Discharge/Parking Time:

Referring to a 75 A_h - Porsche battery and the following pre-conditions:

- Battery capacity at least 80% (12.6V or 1.24 g/ml).
- Constant current draw less than 25 m A.
- Temperature above 0° Celsius (32° F).
- Normal self-discharge (battery technically OK).

A parking/storage time of 5 weeks with sufficient starting capability is obtainable. With temperatures below 0° C (32° F) parking time of 3 weeks with sufficient starting capability is obtainable.

The parking time is shorter for short distance vehicles and older pre-damaged (sulfated) batteries.



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5.3 Reference Values for Battery Discharge/ Parking Time (cont.):

Prior to a longer planned parking /storage period, a battery service should be performed (charge, electrolyte density, battery voltage.)

6. Battery Voltage Checking:

Battery voltage is checked with a voltmeter between battery plus and minus pole. The following points should be observed before measuring to receive definite and valid measuring values:

- Minimum resting times must be observed after load testing or charging to obtain the actual battery voltage. The measured value will not correspond to the actual charging condition if resting times are not observed.

Resting Times: 2 hours after battery charging (minimum)
(8 hours even better)

1 hour after loading (engine start, load testing)

- The battery must be disconnected when measuring. If necessary, voltage can be checked at the cigarette lighter plug. However, accuracy is not very high because of the constant current draw influences.
- Determine approximate battery temperature. The battery temperature equals ambient temperature if the battery was stored for at least 12 hours in an area with approximate constant ambient temperatures. (See evaluation table below.)

Battery Voltage	Electrolyte Density g/ml	Charging Condition	Evaluation
12.9 - 12.5V	1.28 - 1.24	100% - 80%	Battery OK
12.5 - 12.1V	1.24 - 1.17	80% - 50%	Recharge battery
12.1 - 11.6V	1.17 - 1.10	50% - 10%	Determine cause: Cells, electrolyte density constant current draw, parking /storage periods, battery age. Recharge if battery is OK.
Below 11.6V	Below 1.10	Below 10%	Determine cause: Cells, constant current draw, battery age. If necessary, replace battery and dispose of defective battery properly.

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6.1 Battery Voltage Correction Values:

If the Battery temperature is below 0°C (32°F) a correction value applies.

Measured value correction is only necessary if battery temperature is below 0°C (32°F). The value correction is 0.10V and has to be added to the measured value. No correction is necessary at battery temperatures above 0° C (32°F).

Example: Battery temperature approximately -3°C (27°F) measured value 12.4V.

Correction value = 0.10V

Corrected measured value: 12.4 + 0.10 = 12.5V.
(charging condition approximately 80%)

6.2 Checking Electrolyte Density:

Electrolyte density can be measured instead of measuring battery voltage. No pre-conditions apply. However, measured electrolyte density values must be corrected according to battery temperature. **To judge the charging condition, the lowest electrolyte density value is decisive.** The electrolyte density difference between cells is maximum 0.04. Otherwise a cell defect is present.

6.3 Correction Values for Electrolyte Density:

The relation charging condition /electrolyte density refers to a battery temperature of 27°C (80°F). When checking electrolyte density at a different temperature, a compensation value applies.

Example: Temperature approximately + 8°C (44°F) lowest measured value 1.26.

Correction value: 0.015

Corrected measured value: 1.26 - 0.015 = 1.245.
(charging condition approximately 80%)

Battery temperature	Electrolyte density correction value
+41°C	+0.01
+34°C	+0.005
+27°C	0
+20°C	-0.005
+13°C	-0.01
+ 6°C	-0.015
- 1°C	-0.02
- 8°C	-0.025
-15°C	-0.03
-22°C	-0.035
-29°C	-0.04

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7. Starting Capability (Load Test):

Use an appropriate test device to determine starting capability. We recommend battery condition tester BZS 10 from Motometer or equivalent.

Caution: Danger of explosion when connecting or disconnecting battery terminals. Observe safety precautions.

8. Checking Constant Current Draw (All Vehicle Types):

Check constant current draw with an ammeter in series between battery minus pole and car body ground point. Adherence to the work procedure steps is important to avoid false measurements.

Procedures:

- Open engine lid (4 cylinder) luggage compartment lid (6 cylinder) rear hatch (8 cylinder). Set contact switch for the interior lights to "off" position.

On 928 models leave rear hatch open. Disconnect two pin alarm wiring on rear hatch lock behind the tool plate (brown - brown/white wires).

- Switch off all consumers and lock doors.
- On 911 and 968 models from M.Y. 1992, the switch for the lights and alarm contact is located in the front lower latch. When checking constant current draw, close the latch using a screwdriver or suitable tool.

Caution: Remember to release the latch prior to closing the hood to prevent damage to the latch.

- Set ammeter to 10 amp range and connect leads in series between battery minus and body ground point **before** disconnecting battery minus pole. The ammeter is used for current flow without interruption. Disconnect battery minus cable at battery and observe ammeter. If no display, switch ammeter to mA range without disconnecting leads. **Measuring current draw in this manner will prevent possible sticking relays or other circuits from opening.**

Waiting times:

911 Carrera 2/4 from 1989 (K) and 911 Turbo from 1991 (M):
20 minutes (climate control)

928 S4, GT, GTS: 45 minutes (cooling fan control, instrument cluster, power window/sunroof control unit)

- **Maximum current draw for all models: 30 mA.** If constant current draw is above 30 mA, the cause must be determined. Pull fuses and relays one at a time from the central electric board with the ammeter connected. Observe the ammeter for current drop.



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8. Checking Constant Current Draw (All Vehicle Types) (cont.):

Locate consumer with high current draw. Check for the presence of aftermarket electrical equipment and disconnect as necessary. If current draw is within specifications and additional current draw from aftermarket equipment results in higher than specified values, the customer/owner must be notified in writing on the Repair Order of the potential for increased battery discharge caused by said equipment. Battery discharge caused by aftermarket equipment is not a warranty matter.

Important:

Carrera 2/4 and 928 S4/GT

The current draw is higher (maximum 1 amp) for a short while after connecting or switching the ammeter.

This is caused by the instrument cluster and fan control unit on 928 vehicles and the climate control unit on 911 Carrera 2/4 vehicles. Use a testing device with a fused range up to 4 amps. It should be possible to switch the tester to a 40 mA range without current interruption.

— When assuming a sticky relay may be the problem, proceed as follows: To avoid opening of the relay, connect ammeter to battery minus and body ground point **before** disconnecting battery minus pole. The ammeter is used for current flow without interruption. Disconnect battery cable and observe ammeter.

9. Summary:

- Check battery voltage or electrolyte density when receiving new vehicles.
- Before vehicle delivery, check battery voltage or electrolyte density and starting capability. Same applies to new batteries before installation.
- Vehicles in storage and filled spare batteries:
Check battery voltage or electrolyte density periodically. Recharge if necessary. This does not apply to dry batteries until filled with electrolyte. Observe dry battery shelf life (24 month).
- Demo and showroom vehicles: Periodical preservation charging.
- Perform a battery service prior to a long parking/storage period (charging, electrolyte level, voltage test).
Periodical preservation/maintenance charging.
- Before checking battery voltage observe battery rest times. Do not load the battery prior to checking voltage.
- Recharge discharged batteries immediately. Do not fast charge batteries. Determine cause for discharge.
- Use only Porsche approved batteries.



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9. Summary (cont.):

- Use digital measuring devices to check voltage and current draw. (Display accuracy.)
- Measured device for current draw should have a fused 4A range.
- When checking battery voltage, compensate for battery temperature (correction values for voltage and electrolyte density).
- Danger of explosion when connecting or disconnecting battery cables.

Battery Service/Testing Intervals:

Battery is:	Date received (example)	Test cycle
Connected	05-10-91	1 month 06/91 - 7/91 - 8/91 etc.
Disconnected or removed	07-02-91	3 months 10/91 - 01/92 etc.
Vehicle in showroom	04-16-91	7 days 04/23 - 04/30 etc.
Filled	06-10-91	3 months 09/91 - 12/91 etc.
Dry	04-02-91	No, only after filling

Battery Voltage	Electrolyte Density	Charging Condition	Evaluation
12.7 - 12.5V	1.28 - 1.24	100 - 80%	Battery OK.
12.5 - 12.1V	1.24 - 1.17	80 - 50%	Recharge battery.
12.1 - 11.6V	1.17 - 1.10	50 - 10%	Determine cause. Recharge if battery OK.
Below 11.6V	Below 1.10	Below 10%	Determine cause. If necessary, replace battery.



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9. Summary (cont.):

Battery Temperature	Electrolyte Density Correction Value
+41°C	+0.01
+34°C	+0.005
+27°C	0
+20°C	-0.005
+13°C	-0.01
+ 6°C	-0.015
- 1°C	-0.02
- 8°C	-0.025
-15°C	-0.03
-22°C	-0.035
-29°C	-0.04

Battery Temperature	Battery Voltage Correction Value
Above 0°C (32°F)	No correction necessary
Below 0°C (32°F)	Add 0.10V to measured value



Battery Maintenance Log Sheet

Correct battery maintenance ensures maximum battery life. Vehicles in dealer inventory must undergo regular battery service. Please check battery voltage and electrolyte density when receiving the vehicle and, if necessary, charge the battery to be certain about its condition. The first service date recorded on this log sheet should correspond with the date the vehicle is received.

While the vehicle is in storage or on showroom display, the battery must be serviced regularly and measured values must be documented.

A Battery Maintenance Log Sheet (see reverse side) should be placed in the vehicle to record battery service intervals. On service dates, battery voltage, electrolyte density and approximate battery temperature must be recorded. This is important because temperature influences battery voltage and electrolyte density and, therefore, influences measured values.

The following battery check sheet consists of three parts:

Part I and II are to be used when checking new and used batteries.

Part III is used to determine current draw requirements and **must** be performed when servicing the vehicle battery.

When warranty claims are made for batteries, this three part form must be filled out completely and submitted with the claim documents.

Dealer # RO # Repair Date

VIN Delivery Date

Tested By

Mileage

Verified by Porsche Cars North America's DSM _____
(If requested by Warranty Department) SIGNATURE

Safety Precautions:

- Battery acid is highly caustic, explosive if gases are ignited by sparks, and require special handling precautions and neutralization if spilled on painted surfaces, clothes, skin and/or eyes.
- Always vent cell caps when charging and provide ample ventilation to prevent gaseous fume buildup. Avoid sparks around battery to prevent possible explosion.
- Wear suitable eye protection and locate emergency kit location and eye wash station in dealership.
- Have chemical neutralization agent readily available and apply immediately to any objects which have acid spilled on them following the recommended procedures as outlined by the neutralization agent's manufacturer to prevent damage.

Part I

- | | | |
|---|------------------------------------|--|
| 1) Clean terminals and outer battery housing if necessary. Check housing for cracks or leaks. | No leaks or cracks
Go to Step 2 | Leaking or cracked
Replace battery |
| 2) Check electrolyte level | Level O.K. (Go to Step 3) | Level low. Fill with distilled water and charge for 15 min. at 15-25 amps. Go to Step 3. |

3) The ideal temperature for checking battery electrolyte density is between 70° and 80° F. Determine the ambient temperature of the battery and compensate if necessary. Most battery hydrometers are equipped with temperature compensation scales.

Hydrometer Test: Cell Reading 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____
All cells are above 1.225 (at approx. 70° F) and variation between cells is less than 50. **Yes** _____ (Go to Step 4) **No** _____ (Go to Part II)

- | | | |
|---|---|-----------------------------|
| 4) Load Test: (Battery above 70° F). Apply 50% of the battery cranking performance rating for 15 seconds. | Above 9.6V Battery condition satisfactory | Below 9.6V
Go to Part II |
|---|---|-----------------------------|

If the cranking performance rating is not available, load battery at three times the amp/hour rating for 15 seconds.

Voltage Reading: _____ Volts

When checking batteries below 70° F. Refer to Temperature/Voltage Comparison Table at end of check sheet.

Part II

In order not to delay a customer, install a new battery in the vehicle. After filling new battery with acid, battery must be charged at 10 amps. for 15 min. or until gassing begins. To be certain the battery being installed is in satisfactory condition, the new battery and vehicle electrical system must also be checked as per part II and part III of the battery check sheet.

- | |
|---|
| 1) Charge battery for approximately 10 hours or overnight at 4-6 amps. (Not for new/replacement batteries.)
DO NOT EXCEED MAXIMUM INPUT VOLTAGE OF 14.5 VOLTS |
|---|

2) The ideal temperature for checking battery electrolyte density is between 70° and 80° F. Determine the ambient temperature of the battery and compensate if necessary. Most battery hydrometers are equipped with temperature compensation scales.

Hydrometer Test: Cell Reading 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____
All cells are above 1.225 (at approx. 70° F) and variation between cells is less than 50. **Yes** _____ (Go to Step 3) **No** _____ (Replace Battery)

- | | | |
|---|---|-----------------------------|
| 3) Load Test: (Battery above 70° F). Apply 50% of the battery cranking performance rating for 15 seconds. | Above 9.6V Battery condition satisfactory | Below 9.6V
Go to Part II |
|---|---|-----------------------------|

If the cranking performance rating is not available, load battery at three times the amp/hour rating for 15 seconds.

Voltage Reading: _____ Volts

When checking batteries below 70° F. Refer to Temperature/Voltage Comparison Table at end of check sheet.

- Notes:**
- During battery charging, reduce charging rate if cells begin gassing strongly. Slight gassing is normal.
 - Temperature of electrolyte must not exceed 125° F during charging.
 - For vehicles in stock, batteries must be recharged. Refer to Battery Maintenance Log Sheet.
 - Do not charge or store batteries on cement floors.

Part III

Current Draw checking:

Check constant current draw with an ammeter in series between battery minus pole and car body ground point. Adherence to the work procedure steps is important to avoid false measurements.

Procedures

- Open engine lid (4 cyl.) luggage compartment lid (6 cyl.) rear hatch (8 cyl.). Set contact switch for the interior lights to "off" position.
- On 928 models leave rear hatch open. Disconnect two pin alarm wiring on rear hatch lock behind the tool plate (brown - brown/white wires).
- Switch off all consumers and lock doors.
- Set ammeter to 10 amp range and connect leads between battery minus and body ground point before disconnecting battery minus pole. The ammeter is used for current flow without interruption. Disconnect battery minus cable at battery and observe ammeter. If no display, switch ammeter to mA range without disconnecting leads. Record current draw in space provided below. Measuring current draw in this manner will prevent possible sticking relays or other circuits from opening.

Total Current Draw _____ mA
minus _____ mA

Actual Vehicle System Draw _____ mA
(without aftermarket consumers)

Aftermarket Current Draws	
Alarm	_____ mA
Phone	_____ mA
Stereo	_____ mA
Vehicle Theft Locator	_____ mA
Other	_____ mA
Other	_____ mA
Total Aftermarket Draw _____ mA	



On 911 and 968 from M.Y. 1992, the switch for the lights and alarm contact is located in the front lower latch. When checking constant current draw, close the latch with a screwdriver or suitable tool.
CAUTION: Remember to release latch prior to closing hood.

Waiting Times:

911 Carrera 2/4 from 1989 (K) and 911 Turbo from 1991 (M): 20 minutes (climate control)

928 S4, GT, GTS: 45 minutes (cooling fan control, instrument cluster, power seat/sunroof control).

- **Maximum current draw for all models: 30 mA.** If constant current draw is above 30 mA, the cause must be determined to localize the consumer. Pull fuses and relays one at a time from the central electric board with the ammeter connected. Observe the ammeter for current drop. Locate consumer with high current draw. Check for the presence of aftermarket electrical equipment and disconnect as necessary.

If current draw is within specifications and additional current draw from aftermarket equipment results in higher than specified values, the customer/owner must be notified in writing on the Repair Order of the potential for increased battery discharge caused by said equipment. Battery discharge caused by aftermarket equipment is not a warranty matter.

Part III cont.

IMPORTANT:

Carrera 2/4 and 928 S4/GT:

The current draw is higher (max. 1A) for a short while after connecting or switching the ammeter.

This is caused by the instrument cluster and fan control unit on 928 vehicles and the climate control unit on 911 Carrera 2/4 vehicles. Use a testing device with a fused range up to 4A. It should be possible to switch the tester to a 40 mA range without current interruption.

Certain waiting times must be observed when checking current flow without interruption. Some control units are still powered after removing the ignition key and a higher current draw is displayed.

BATTERY LOADING

Temperature/Voltage Comparison Table

Ambient Temperature	(15 Sec. test) Voltage Reading
70° F	9.6 Volts
60° F	9.5 Volts
50° F	9.4 Volts
40° F	9.3 Volts
30° F	9.1 Volts
20° F	8.9 Volts
10° F	8.7 Volts
0° F	8.5 Volts

Allow battery to stabilize after load testing for 10 minutes, at which time, the battery voltage must be 12.4 volts or above. If battery voltage is below 12.4 volts, slow charge the battery at 4-6 amps for approximately 10 hours and retest.

If battery was disconnected, perform system adaption where applicable.