## Technical Bulletin All 2 Subject: Battery Discharging 2706 Group All 2 Part Identifier 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.
- Battery service (general /new, stored and displayed vehicles).
- 3. Hints on vehicle delivery.
- 4. Replacement batteries.
- 5. Discharged batteries.
- Voltage and electrolyte density checking (correction values).
- Load testing.
- 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.

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 voltage service/battery is... Recharging intervals
Filled (not installed) 3 months

Dry Only after filling with acid

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### 5.

Complaint	Cause	Possible Faults, Corrections, Hints
Battery discharged within short period of time	High current draw	<ul> <li>Vehicle faults: Contact switches on doors, luggage compartment or engine compart- ment lid; lid bent or out of adjustment; relay sticking; ground connections. Current draw checking and fault diagnosis from central electric required.</li> </ul>
		<ul> <li>After market installation: Telephone, Radio Alarm, Vehicle Theft Locator.</li> </ul>
		<ul> <li>Operator errors: Ignition key is position X, parking light, interior lights.</li> </ul>
	Insufficient charging	<ul> <li>Insufficient charging because of short distance driving, stop and go, low RPM driving</li> </ul>
		<ul> <li>High power requirements. Consumers switched on at the same time: fans, rear w dow defogger, lights.</li> </ul>
		<ul> <li>Aftermarket equipment with high power consumption.</li> </ul>
		<ul> <li>Alternator defective: Charging control light voltage regulator.</li> </ul>
		<ul> <li>Battery depleted: High cyclic load because of discharging and charging frequently.</li> </ul>
		<ul> <li>Battery partially sulfated: Long parking/stage periods with low charged battery.</li> </ul>
		<ul> <li>Wiring connections loose or corroded.</li> </ul>
		<ul> <li>Demo or showroom vehicle.</li> </ul>
		<ul> <li>Dry battery: Not charged after filling.</li> </ul>
	Battery defect	<ul> <li>Production defect: Cells leaking /plates sho circuited.</li> </ul>
Battery discharges after a longer period of time	Insufficient charging	<ul> <li>Insufficient or wrong battery service (election lyte level, service charging).</li> </ul>
		Long vehicle parking /storage periods with

- out recharging.
- "Fair Weather" or "Weekend" vehicle.

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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  $A_{\rm h}$  - Porsche battery and the following preconditions:

- 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/mi	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℃	0
+20°C	-0.005
+13℃	-0.01
+ 6°C	-0.015
- 1ºC	-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 circults 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.
- 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:



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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℃	-0.005
+13℃	-0.01
+ 6℃	-0.015
- 1℃	-0.02
- 8°C	-0.025
-15 <b>℃</b>	-0.03
-22℃	-0.035
-29℃	-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

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## **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.

## Battery Check Sheet

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_	tery check sheet consists of three parts:					
	ire to be used when checking new and used		<b></b>		<b>1</b> 44	
	d to determine current draw requirements a laims are made for batteries, this three part					enta.
Dealer #	RO#		<del></del>	· —	1 1 1 1	
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Safety Procestic	Mac:	•	nty Department)		SIGNATURE	
Bettery acid is spilled on pair	s highly countic, explosive if gases are ig ated surfaces, ciothes, skin and/or eyes.	mited by operk	s, and require sp	ocial handling pr	recentions and neutra	lization if
<ul> <li>Always reat o</li> </ul>	ell caps when charging and provide ampi	le ventilation t	o prevent gascor	s fume bulidup.	Avoid sparks around	hettery to
Wear suitable	ble explosion. eye protection and locate emergency his	t location and :	eye week station	in dealership.		
Have chemics the recomment	i neutralization agent readily available a aded procedures as outlined by the neutr	ad apply imag	distely to any of	doots which hav	e acid spilled on thes	a following
EXX	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			to prevent dam		<del>-</del>
1) Clean tennin	als and outer battery housing if necessary.			Leaking or a		
Check houst	ng for cracks or leaks.	Go to Step 2	2	Replace bat	tery	
2) Check electro	dyte level	Level O.K. (	(Go to Step 3)		ill with distilled water	
		<del></del>			at 15-25 amps. Go to 5	
3) The ideal term	perature for checking battery electrolyte de	matty is between	n 70° and 80°F.	Determine the an	nbient temperature of t	he
pattery and c	compensate if necessary. Most bettery hydr	rometers are equ	Apped with tempe	sature compensa	tion scales.	
Hydronic	ter Test: Cell Reading 1 2_	а	. 4 5	6		
All cells are	above 1225 (at approx. 70°F) and	Yes	(Go to		No.	
variation be	tween cells is less than 50.		(Go to	Step 4)	No (Go t	o Paurt II)
	attery above 70°F). Apply 50% of the	Above 9.6V		Below	v 9.6√	
	ing performance rating for 15 seconds.	condition sa	-		Part II	
If the craniday	g performance rating is not available, load i	pattery at three	times the amp/ho	ur rating for 15 a	econds.	
		When the	idag betterles be	low 70°F. Befor	to Temperature/	
Voltage R	cadingVolts	Voltage Co	raparlaça Table e	t and of pheck a	Most.	
Pag II				-		
	lay a customer, install a new battery in the	vehicle After fi	ling per better:	udth and hatters	must be showed at 10	
to war or mon S	assing begins. To be certain the battery be	ing installed is i	n satisfactory con	dition, the new bi	attery and vehicle elect	rical
***	be checked as per part II and part III of the	•	sheet.			
1) Chause batter						
DO NOT EXC	y for approximately 10 hours or overnight a	t 4-6 emps. (No	ot for new/replace	ment batteries.]		
2) The ideal term	EED MAXIMUM INPUT VOLTAGE OF 14.5  Cerature for checking battery electrolyte de-	VOLTS	70 and 80 F F	leterroles the omi	blent temperature of th	e hattery
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2) The ideal tempand compense Highromore All cells are a variation bet  3) Load Test: (Be battery cranics)	perature for checking battery electrolyte detaile if necessary. Most hattery hydrometers (OF TCSE) Cell Reading 1 2 above 1225 (at approx. 70°F) and ween cells is less than 50.  attery above 70°F). Apply 50% of the	Above 9.6V Ba condition satisfactory at three 1	70° and 80° F. Eith temperature of 4	etermine the aminimpensation scale  6 No ep 3) Relow Go to	Part II	•
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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.



### 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 Volta
40° F	9.3 Volts
90° 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, alow charge the battery at 4-6 amps for approximately 10 hours and retest.

If battery was disconnected, perform system adaption where applicable.

## PORSCHE

## VEHICLE IN INVENTORY BATTERY MAINTENANCE LOG SHEET

## SEE REVERSE SIDE FOR INSTRUCTIONS

## Every seven days:

- Check and record battery electrolyte density, voltage and battery temperatures.
- Charge battery using a low charge (trickle) battery charger. A charger with a maximum charge rate of
  .05 amps (50 mA) and maximum voltage of 13.8 Volts is recommended. This type of battery charger
  should remain on the battery for ten hours.

### Every 30 days (monthly):

- The battery must be checked once per month using the procedure outlined in Part I and Part II of the battery check sheet, Part # PNA000132.

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This checklist must accompany warranty claims for battery replacement in vehicles in dealer inventory.

If battery was disconnected, perform system adaption where applicable.

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