



# TEST REPORT

N° 3456-BAT

**DELIVERED TO** : **BATTERIE PLUS** (Represented by Mr. Coste)  
ZA du Meyrol  
BP 266  
26206 MONTELIMAR cedex  
France

**OBJET** : Electric tests performed on a type of traction battery , according to a specific program , set up in conformity with articles 4.3 ad 5.2 of the CEI 60254-1 (2005) standard.

**Test dates** : June 10<sup>th</sup> , July 6<sup>th</sup> and August 2<sup>nd</sup> , 2005

**Test conducted by** : Laurent CHAPUS / Jacques LORQUIN

**Testing location** : **BATTERIE PLUS**  
ZA du Meyrol  
BP 266  
26206 MONTELIMAR cedex - France

**Tested product** : Battery HAWKER OLDHAM Type 12DYA3, 330Ah, 24V

This document includes 7 pages.

Voiron, September 15<sup>th</sup>, 2005

Technical manager,

Laurent CHAPUS

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### 1. - PURPOSE OF TESTS

The purpose of these tests is to check the BRT 20 equipment ability to regenerate traction batteries, by the meaning of a measure of the battery electric performances (actual capacity) before and after a regeneration cycle .

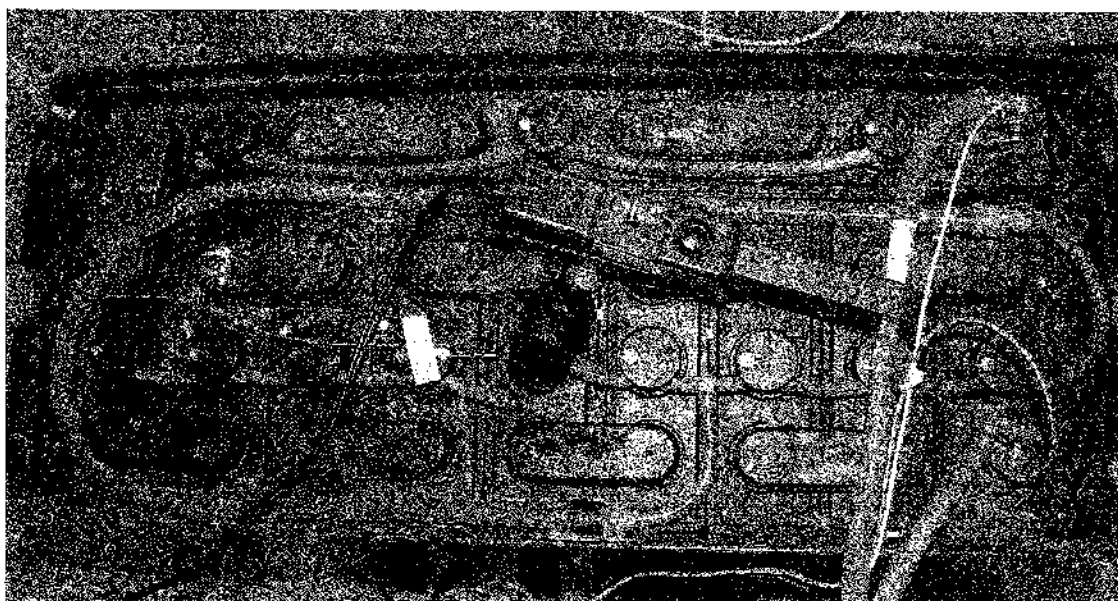
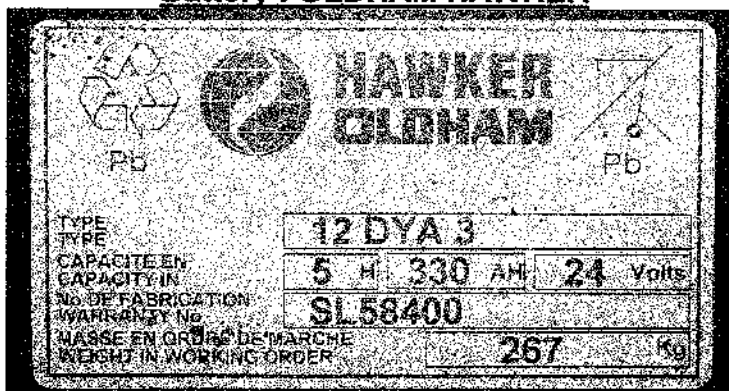
### 2. - TESTED PRODUCT

The device subjected to test was the following:

Chart n°1 : Tested battery

Battery	N°	Nominal voltage	Nominal capacity (C5)	Number of elements	Warranty number
OLDHAM HAWKER		24 V	330 Ah	12	SL58400
Date of first use	1999, January				
Date of last use	2004, December				

**Battery : OLDHAM HAWKER**





### **3- TESTING PROGRAM**

The tests were conducted according to a specific program following testing recommendations of article 4.3 (battery charging) and article 5.2 (capacity test) of IEC 60254-1 standards (2005-04).

Capacity tests according to article 5.2 are intended to check the initial productive capacity  $C_n$  (declared on the battery).

For a brand new battery or a newly built battery, actual measured capacity must be equal to 100%  $C_n$ .

The testing program is reported on Chart 2.

The purpose of these trials is to check BRT-20 ability for battery regeneration.

Measurements will be conducted on a second hand battery, with poor productive capacity, which will be first measured.

The same battery will be then tested for renewed capacity after a partial 3 cycles regeneration, and again after a 5 cycles regeneration (11 hours).

**Chart n° 2 : Testing program**

SAMPLE	TEST	Paragraph
HAWKER OLDHAM, 330Ah, 24V (Type 12DYA3)	Initial battery charging	---
	Initial capacity test	§ 5.2
	Regeneration BRT 20-1 (3 cycles) + charge	
	Capacity test	§ 5.2
	Regeneration BRT 20-1 (5 cycles) + charge	
	Capacity test	§ 5.2

### **4 – TEST DATE AND LOCATION**

The tests were conducted on June 10<sup>th</sup>, July 6<sup>th</sup> and August 2<sup>nd</sup>, 2005 in the Battery Plus main offices in Montélimar.

### **5 – PROCEDURE AND TEST RESULTS**

#### **5.1 – Preliminary checking**

These measurements were conducted on a second hand battery as delivered by the client. Battery charging and regeneration was performed by the client.



## 5.2 – General testing procedure

### 5.2.1 – Spot check up of battery productive capacity

#### 5.2.1.1 – Procedure for charging

The battery being charged by the client , a spot check is conducted before testing.

#### 5.2.1.2 - Procedure for discharge

The battery is charged according to testing procedure from paragraph 5.2 of IEC 60254-1 standard.  
Discharge is conducted under constant current  $I_d = I_n \pm 1\%$  until voltage reaches the final point of 1.7 V per element , i.e 20.4V for this battery.

Discharge is started within 1 to 24h , after charging.

Definition of nominal current:

$$I_N = C_N / 5$$

Where  $C_N$  = nominal capacity in Ah (with final voltage  $U_f=20.4V$ )

$$I_N = 66A$$

Notice :  $C_N$  is the nominal value reported on the battery (330Ah), although this value indicates the productive capacity for a brand new item .

## 5.3 – Test results

### 5.3.1 – Capacity test

Chart n° 3 : Initial capacity measurements test results (discharge n°1)

Battery	Test n°	Discharge			
		Duration (h)	Discharge capacity $C_D$ (Ah)	Ratio $C_D / C_N$ (%)	Date of discharge
HAWKER OLDHAM, 330Ah, 24V (Type 12DYA3)	1	1.453	95.90	29.06	06/10/2005

The discharge curve is on Graph n° 1.



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**Chart n° 4 : Capacity measurements test results (discharge n°2 after 3 regeneration cycles)**

Battery	Test n°	Discharge			
		Duration (h)	Discharge capacity $C_D$ (Ah)	Ratio $C_D / C_N$ (%)	Date of discharge
HAWKER OLDHAM, 330Ah, 24V (Type 12DYA3)	2	3.050	201.30	61.00	07/06/2005

The discharge curve is on Graph n° 2.

**Chart n° 5 : Capacity measurements test results (discharge n°3 after 3 regeneration cycles)**

Battery	Test n°	Discharge			
		Duration (h)	Discharge capacity $C_D$ (Ah)	Ratio $C_D / C_N$ (%)	Date of discharge
HAWKER OLDHAM, 330Ah, 24V (Type 12DYA3)	3	3h41min	242.88	73.6	08/02/2005

The discharge curve is on Graph n° 3.

## 6 – CONCLUSIONS

The different measurements reported give the following results

- Initial productive capacity before regeneration : **95.9 Ah**
- Final productive capacity after regeneration : **242.88 Ah**

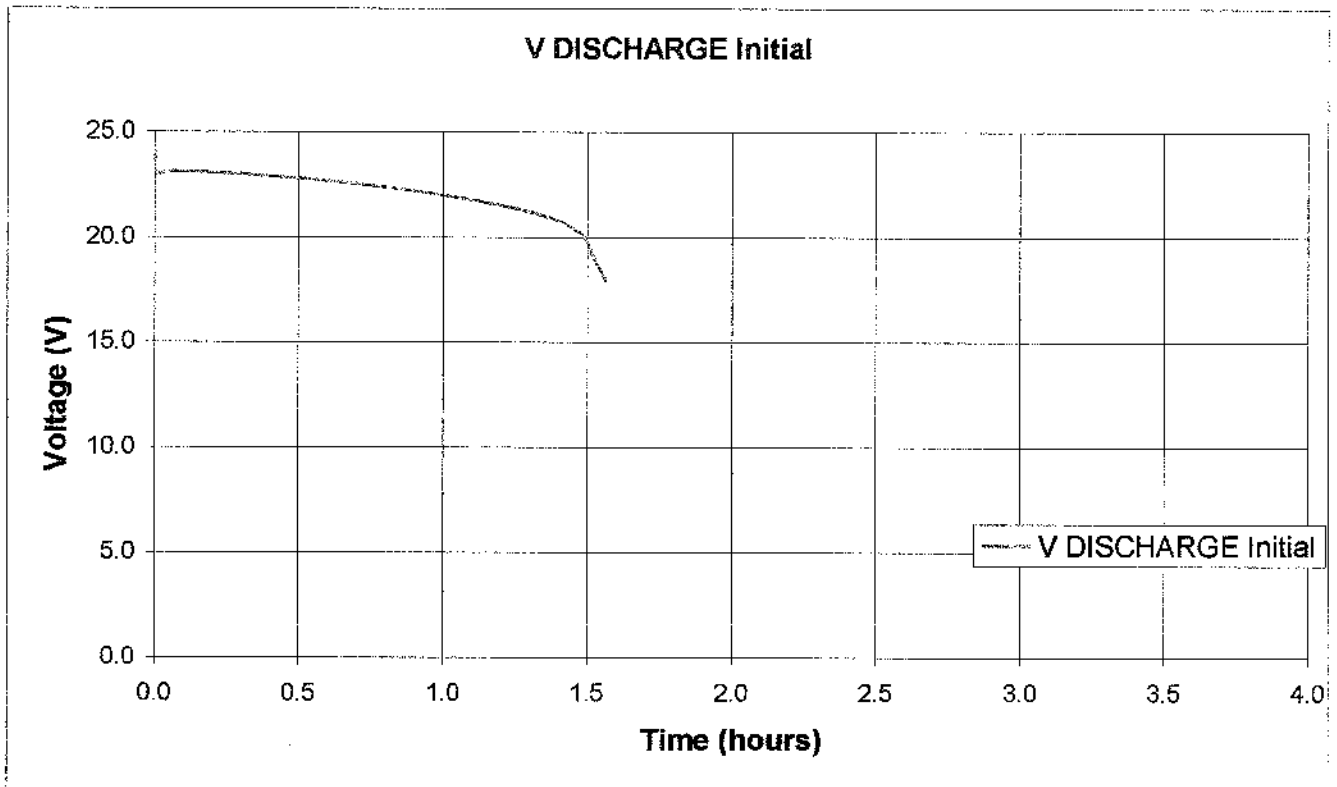
That translates into a capacity increase of **153.%** after a 5 cycles regeneration .



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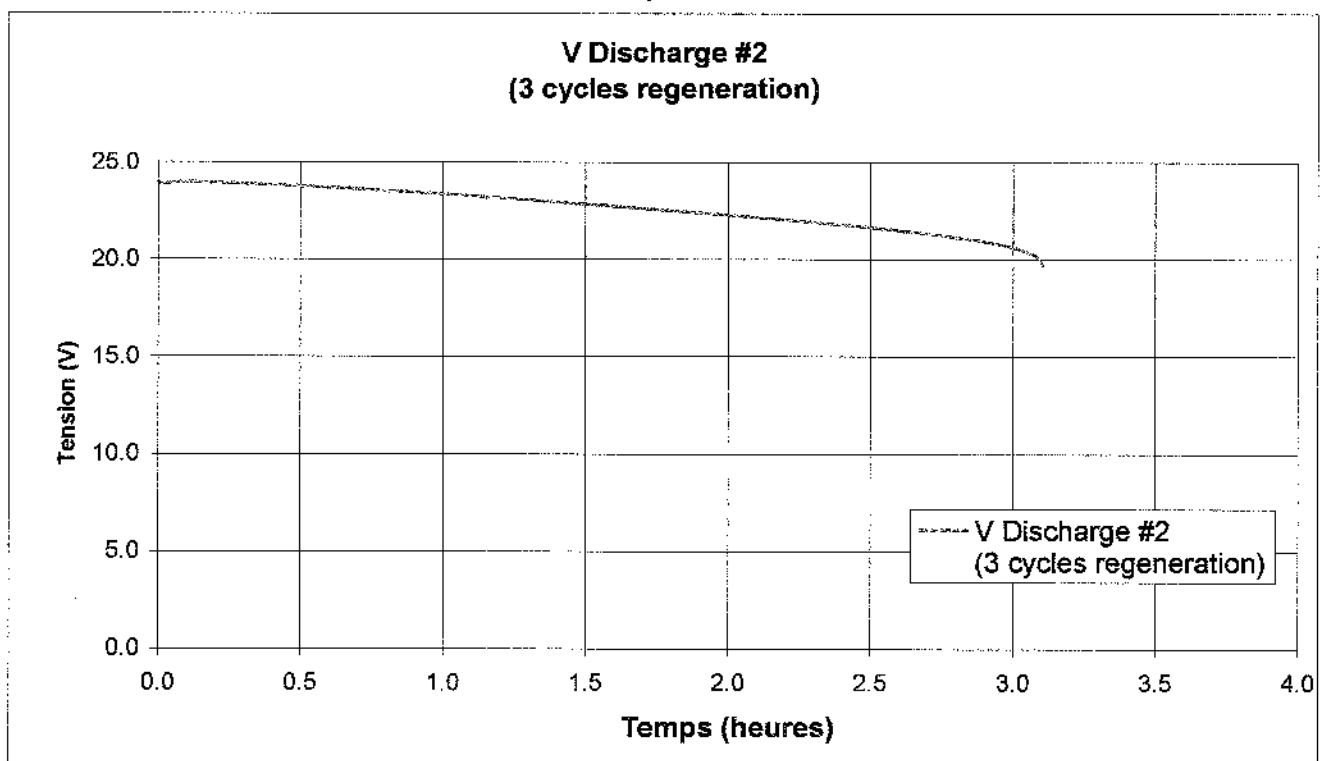
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Graph n° 1



Battery voltage with a discharge constant current of 66A  
 $66A = 100\%$  of new battery  $C_n / 5 h$

Graph n°2



Battery voltage with a discharge constant current of 66A  
 $66A = 100\%$  of new battery  $C_n / 5 h$

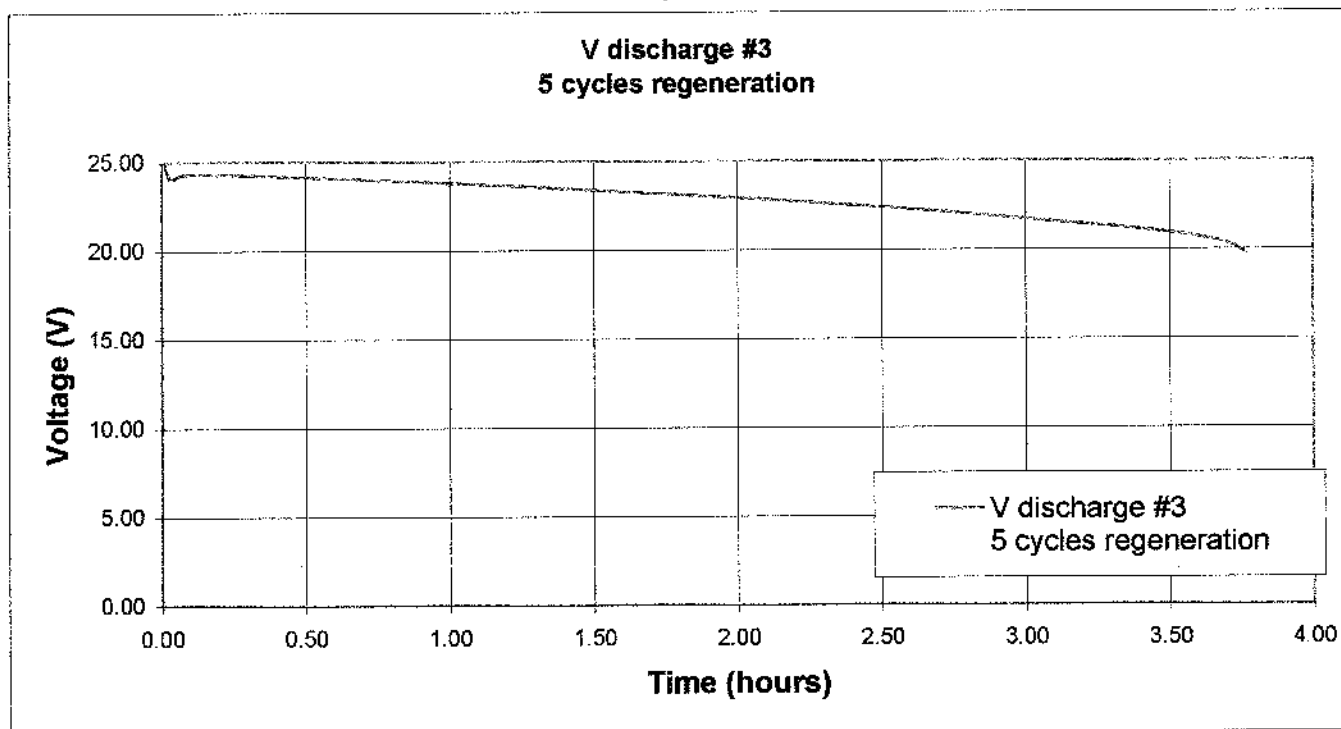


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Graph n°3



Battery voltage with a discharge constant current of 66A  
66A = 100% of new battery Cn / 5 h