

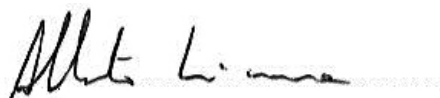
Technical report

59898

Comparative test carried on batteries

<i>Client / test place</i> : SACE S.r.l. Via Matteotti, 116 20099 Sesto S. Giovanni (MI)	<i>Start testing date</i> 3 rd march 2006
<i>Data documento</i> : 2006-05-12	<i>End testing date</i> 10 th may 2006

Operator: Alberto Lumina



Verified: Paolo Barbieri



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1 - SCOPE

The object of this work is a comparative test, base on same test condition, between three different couple of 12V Pb consumer grade vehicular batteries.

The tests are performed in order evaluate the performance of a device, called Battery Brain, which was linked on one battery for each couple. The performed test were chosen on manufacturer proposal and they were performed according a manufacturer agreed procedure.

We want to underline that this technical relation regards only the aspects of the interaction of a device (Battery Brain) versus the discharge/ ageing process of batteries. Other interactions (such as effects of Battery Brain versus vehicle) are not on the scope of this technical relation.

2 – OVERVIEW

This technical relation will be structured as follows:

- technical procedure used (proposed by the Client)
- description of test setup (Test instrument used and test setup diagram)
- execution of the test
- Test result

3 – EQUIPMENT UNDER TEST

Model:	Battery Brain
Manufacturer:	Sace Srl
Ratings:	Vnom 12Vdc V set: 12,3V
Other:	Reaction time: 30 sec

4 – TEST PROCEDURE

Here is reported the used test procedure.



Srl v.le Matteotti, 116 - 20099 SESTO S. G. (MI) - tel 02 26262885 - fax 02 2401053

BATTERY BRAIN(tm) Effectiveness Test Procedure

Revision N. 02	Feb. 23, 2006
Released by	M. Bizzaro
Approved by	P. Bighinatti

The following procedure has been used to verify the usefulness and effectiveness of the product named BATTERY BRAIN to protect batteries from deep discharge and consequently from performance degradation.

The test has been carried out on three different brands of battery manufacturers covering three nominal capacity ratings (see Test Parameters page for details).

The scope of the test has been to verify the residual Battery Capacity after ageing due to discharge cycling. Two discharge mode have been applied:

- ❖ Low current discharge (normal use)
- ❖ High current discharge (typical engine start)

Two batteries of each brand have been submitted to the ageing cycles; only one battery has been equipped with the BATTERY BRAIN, the other has been allowed to deep discharge to 6V. An equal number of discharge cycles have been run on them.

Note: C identifies the nominal Battery Capacity in Ah

Test Step

- 1) **Definition** of the Nominal Capacity of the two batteries at a discharge rate of around 1.8C (high current) till the battery voltage reach 10.5V
- 2) **Simulation of ageing** by means of 10 charge/discharge cycles at around 0.15C rate.

Time to BATTERY BRAIN intervention (for the battery equipped with the BATTERY BRAIN) and time to reach a voltage of 6V (for the battery allowed to deep discharge) have been recorded to monitor the simulation trend.

A time interval of 16h has been left between simulation cycles.

- 3) **Verification after ageing** of the Nominal Capacity of the two batteries at a discharge rate of around 1.8C (high current) till the battery voltage reach 10.5V
- 4) **Comparison/analysis** between data recorded during step 1 and data recorded after ageing in step 2,3

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Test parameters for low and high current discharge

44Ah battery (brand: BOSCH)

Load current for low current discharge
during ageing simulation : $6.67\text{A @ }12\text{V} = 0.15\text{ C (80W)}$

Load current for high current discharge : $78\text{A @ }12\text{V} = 1.77\text{ C (935W)}$

- test ends at: 10.5V
- measured parameter: discharge curve

55Ah battery (brand: AUCHAN)

Load current for low current discharge
during ageing simulation : $7.5\text{A @ }12\text{V} = 0.14\text{ C (90W)}$

Load current for high current discharge : $106\text{A @ }12\text{V} = 1.93\text{ C (1275W)}$

- test ends at: 10.3V
- measured parameter: discharge curve

80Ah battery (brand: URSUS)

Load current for low current discharge
during ageing simulation : $11.3\text{A @ }12\text{V} = 0.14\text{ C (135W)}$

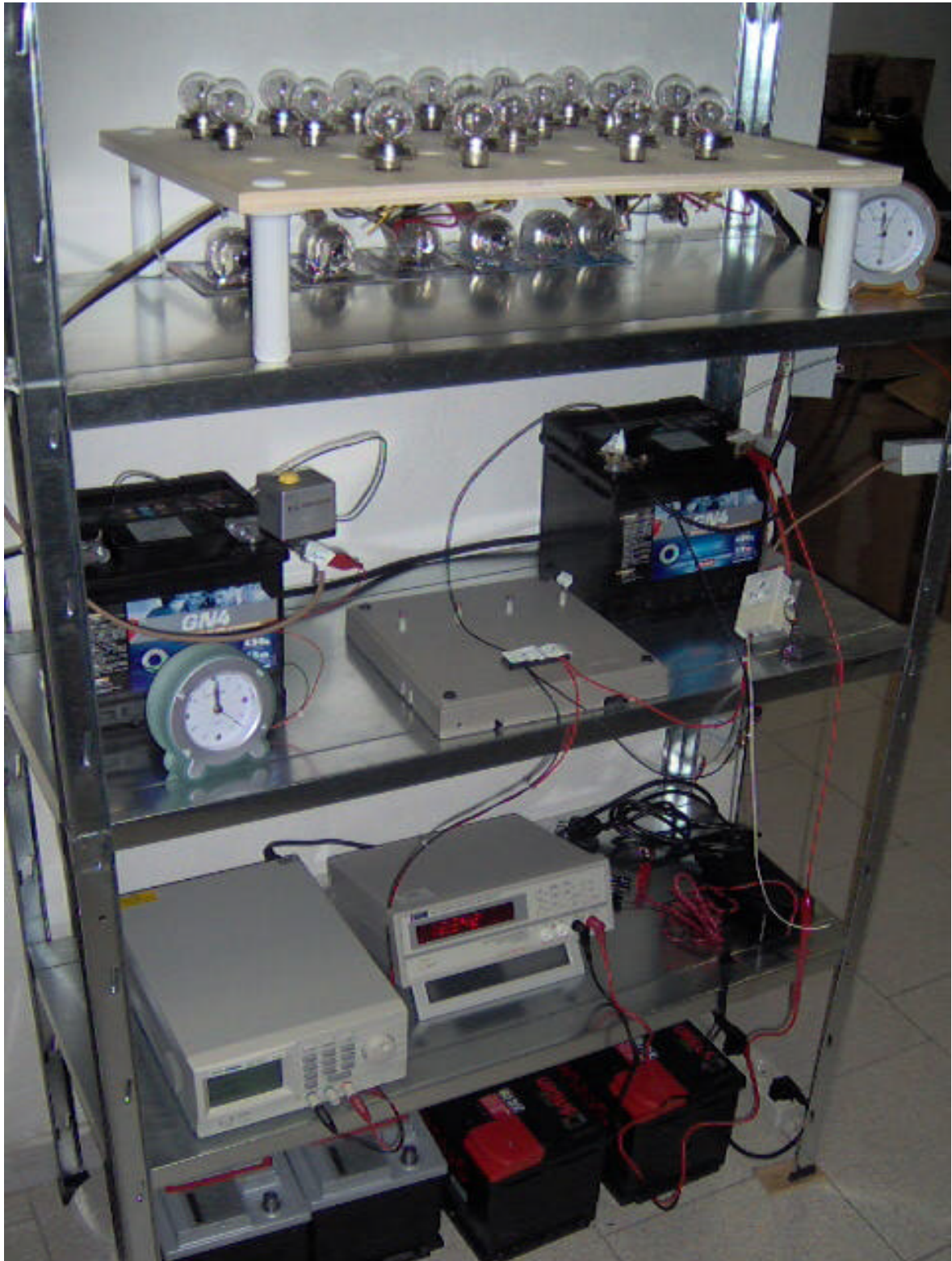
Load current for high current discharge : $142\text{A @ }12\text{V} = 1.77\text{ C (1700W)}$

- test ends at: 10.5V
- measured parameter: discharge curve

5 – LIST OF INSTRUMENT USED

<i>Instrument description</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial number</i>
44Ah consumer grade battery	Bosh	4CN	--
55Ah consumer grade battery	Auchan	GN4	--
80Ah consumer grade battery	Ursus	DX80	--
Battery charger	Mascot	2040	BC03
Programmable Switching DC power supply	Iso-Tech	PSP-series	505D171G1
Volt meter	Protech	MIT-4000	234367
Timer	Lsxibook	AL118	--

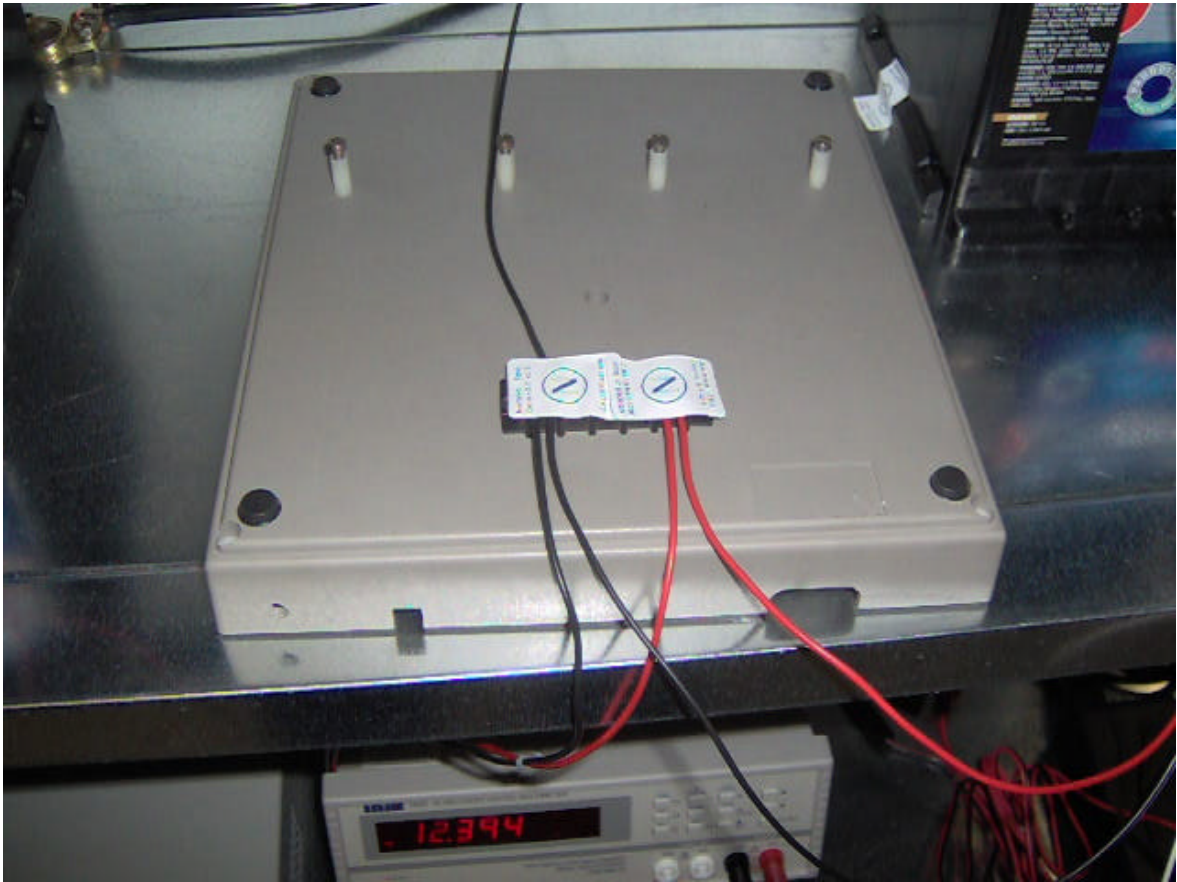
6 – TEST SETUP PHOTOGRAPHS



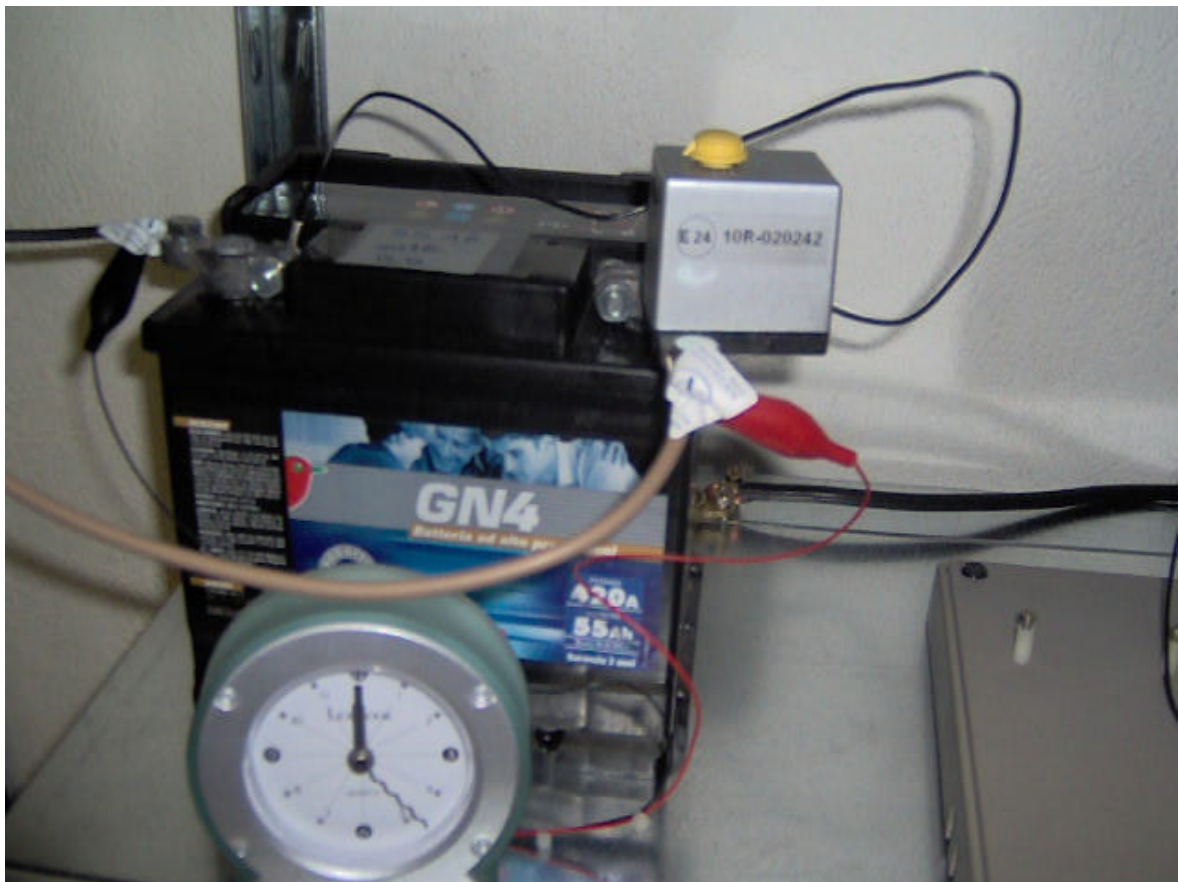
Set Up overview



Load



Connections



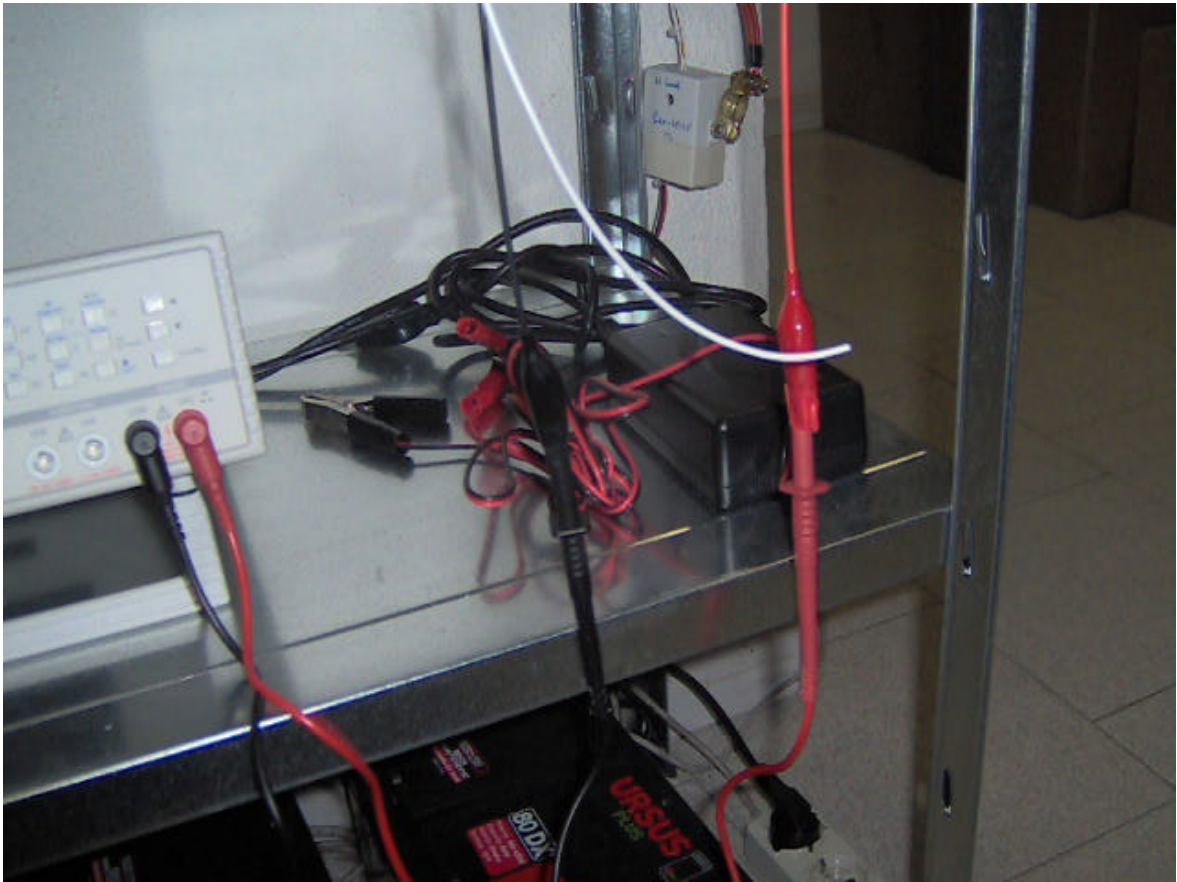
Set Up for battery with Battery Brain



Set Up for battery without Battery brain



Measuring instrument



Battery charger

7 – TEST CONDITIONS

Test Locations

SACE S.r.l.
Via Matteotti 116
I-Sesto S. Giovanni (MI)

Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 18-27 ° C

Humidity: 30-60 %

Atmospheric pressure: 860-1060 hPa

8 – TEST RESULT

Hereafter test result are reported

TEST ON BATTERY WITH 55 Ah CAPACITY

SACE Srl - Battery Life Test -

Date: 6/3/06 - 17/3/06

Battery : AUCHAN GN4 - 55 Ah -

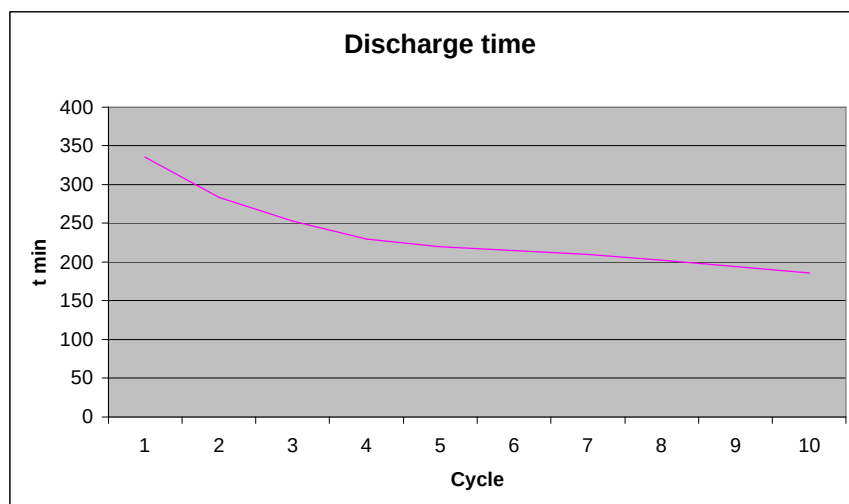
Item : WITHOUT BB

Type of test: Slow (0,14C)

Load: 90 W (2 lamps 45 W + 45 W)

Cut off voltage : 6 V

Date	Test N	Time mm
6-Mar	1	335
7-Mar	2	283
8-Mar	3	253
9-Mar	4	230
10-Mar	5	220
13-Mar	6	215
14-Mar	7	210
15-Mar	8	202
16-Mar	9	194
17-Mar	10	186



SACE Srl - Battery Life Test -

Date: 6/3/06 - 17/3/06

Battery : AUCHAN GN4 - 55 Ah -

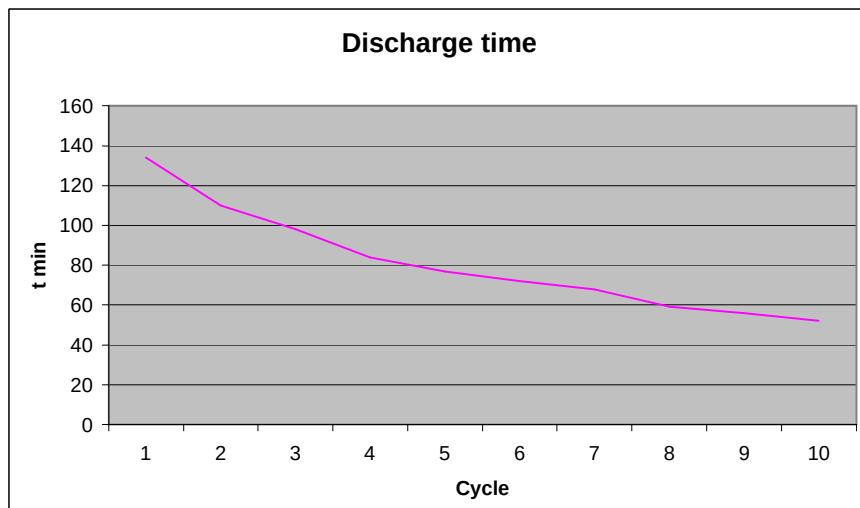
Item : WITH BB

Type of test: Slow (0,14C)

Load: 90 W (2 lamps 45 W + 45 W)

Cut off voltage : 12 V

Date	Cycle N	Time mm
6-Mar	1	134
7-Mar	2	110
8-Mar	3	98
9-Mar	4	84
10-Mar	5	77
13-Mar	6	72
14-Mar	7	68
15-Mar	8	59
16-Mar	9	56
17-Mar	10	52



TEST ON 55Ah BATTERY

SACE Srl - Battery Life Test

Date: From 22/3/06 - to 4/4/06

Battery : BOSH 4CN - 44 Ah -

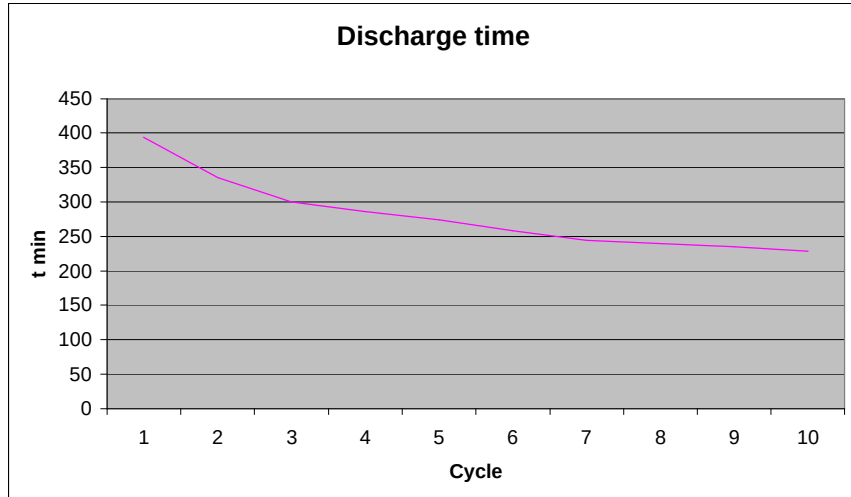
Item : *WITHOUT BB*

Type of test: Slow (0,14C)

Load: 80 W (2 lamps 40 W + 40 W)

Cut off voltage BB: 6 V

Date	Cycle N	Time mm
22-Mar	1	394
23-Mar	2	335
24-Mar	3	300
27-Mar	4	286
28-Mar	5	274
29-Mar	6	258
30-Mar	7	244
31-Mar	8	240
3-Apr	9	235
4-Apr	10	229



SACE Srl - Battery Life Test

Date: From 22/3/06 - to 4/4/06

Battery : BOSH 4CN - 44 Ah -

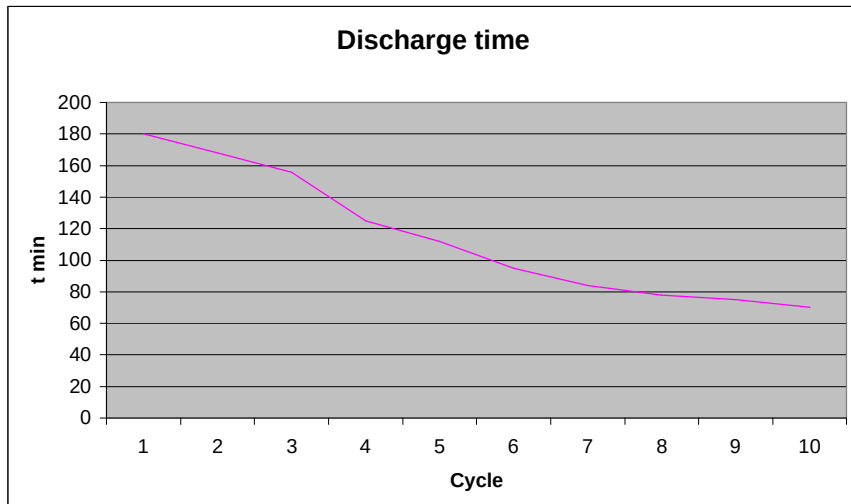
Item : *WITH BB*

Type of test: Slow (0,14C)

Load: 80 W (2 lamps 40 W + 40 W)

Cut off voltage BB: 12V

Date	Cycle N	Time mm
22-Mar	1	180
23-Mar	2	168
24-Mar	3	156
27-Mar	4	125
28-Mar	5	112
29-Mar	6	95
30-Mar	7	84
31-Mar	8	78
3-Apr	9	75
4-Apr	10	70



SACE Srl - Battery Life Test -

Date : 21/3 - 11/4 h : 16,05 and 16,35

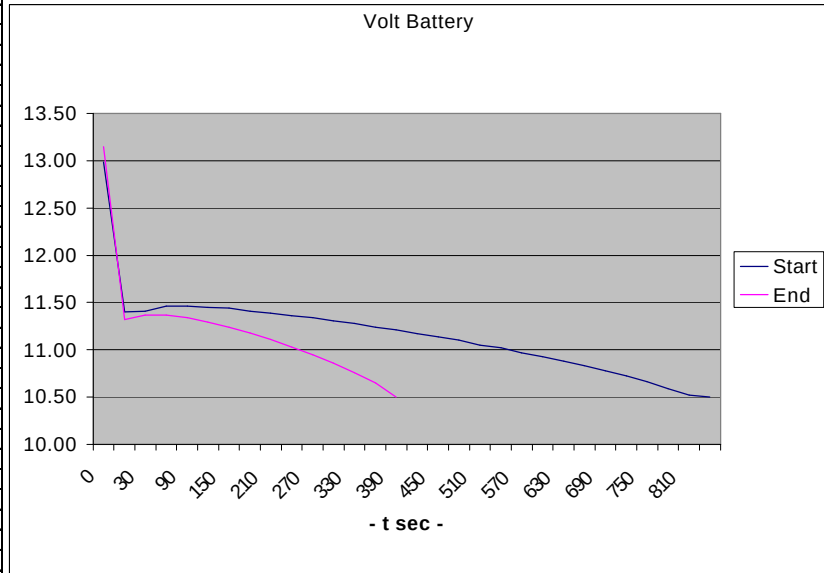
Battery : BOSH 4CN - 44 Ah -

Item : *WITHOUT BB*

Type of test: Fast (2C)

load: 935 W (11 lamps 40 W + 45 W)

time		Volt	Volt	Note
N	sec	Start	End	
1	0	12.99	13.15	No load
2	0	11.40	11.32	Start point
3	30	11.41	11.37	
4	60	11.46	11.37	
5	90	11.46	11.34	
6	120	11.45	11.29	
7	150	11.44	11.24	
8	180	11.41	11.18	
9	210	11.39	11.11	
10	240	11.36	11.03	
11	270	11.34	10.95	
12	300	11.31	10.86	
13	330	11.28	10.76	
14	360	11.24	10.65	
15	390	11.21	10.50	
16	420	11.17		
17	450	11.14		
18	480	11.10		
19	510	11.05		
20	540	11.02		
21	570	10.97		
22	600	10.93		
23	630	10.88		
24	660	10.83		
25	690	10.78		
26	720	10.72		
27	750	10.66		
28	780	10.59		
29	810	10.52		
30	820	10.50		



SACE Srl - Battery Life Test -

Date : 21/3 - 11/4 h : 15,45 and 16,45

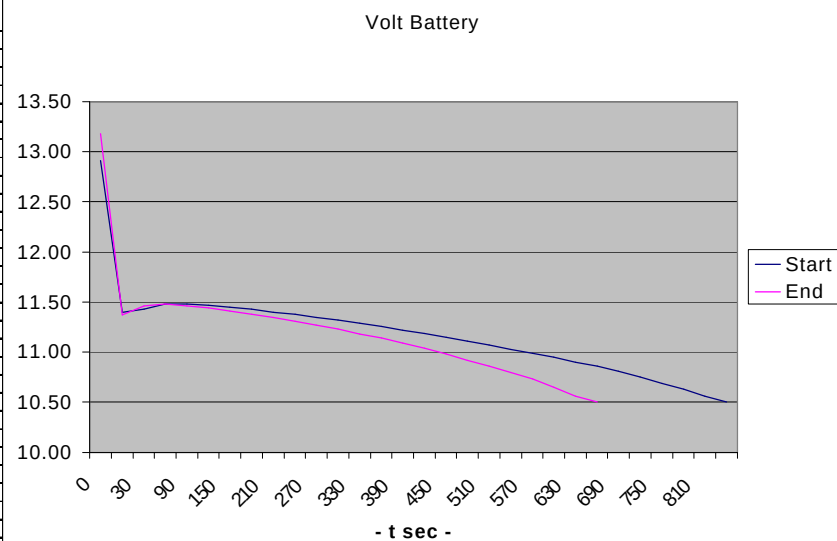
Battery : BOSH 4CN - 44 Ah -

Item : *WITH BB*

Type of test: Fast (2C)

load: 935 W (11 lamps 40 W + 45 W)

time		Volt	Volt	Note
N	sec	Start	End	
1	0	12.91	13.18	No load
2	0	11.40	11.37	Start point
3	30	11.43	11.46	
4	60	11.48	11.48	
5	90	11.48	11.46	
6	120	11.47	11.44	
7	150	11.45	11.41	
8	180	11.43	11.38	
9	210	11.40	11.35	
10	240	11.38	11.31	
11	270	11.35	11.27	
12	300	11.32	11.23	
13	330	11.29	11.18	
14	360	11.26	11.14	
15	390	11.22	11.09	
16	420	11.19	11.04	
17	450	11.15	10.98	
18	480	11.11	10.92	
19	510	11.07	10.86	
20	540	11.03	10.80	
21	570	10.99	10.73	
22	600	10.95	10.65	
23	630	10.90	10.56	
24	660	10.86	10.50	
25	690	10.81		
26	720	10.75		
27	750	10.69		
28	780	10.63		
29	810	10.56		
30	840	10.50		



TEST ON 80Ah BATTERY

SACE Srl - Battery Life Test

Date: from 12/4/06 to 28/4/06

Battery : URSUS 80DX - 80 Ah -

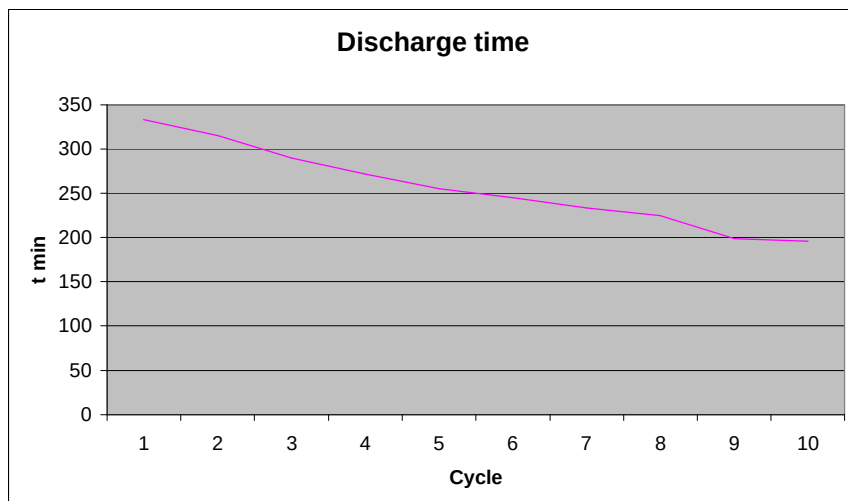
Item : WITHBB

Type of test: Slow (0,14C)

Load: 135 W (3 lamps 45 W + 45 W + 45 W)

Cutt off V BB: 6 V

Date	Cycle N	Time mm
12-Apr	1	333
13-Apr	2	315
18-Apr	3	290
19-Apr	4	272
20-Apr	5	255
21-Apr	6	245
23-Apr	7	233
24-Apr	8	225
26-Apr	9	199
27-Apr	10	196
28-Apr	11	192



SACE Srl - Battery Life Test

Date: from 12/4/06 to 28/4/06

Battery : URSUS 80DX - 80 Ah -

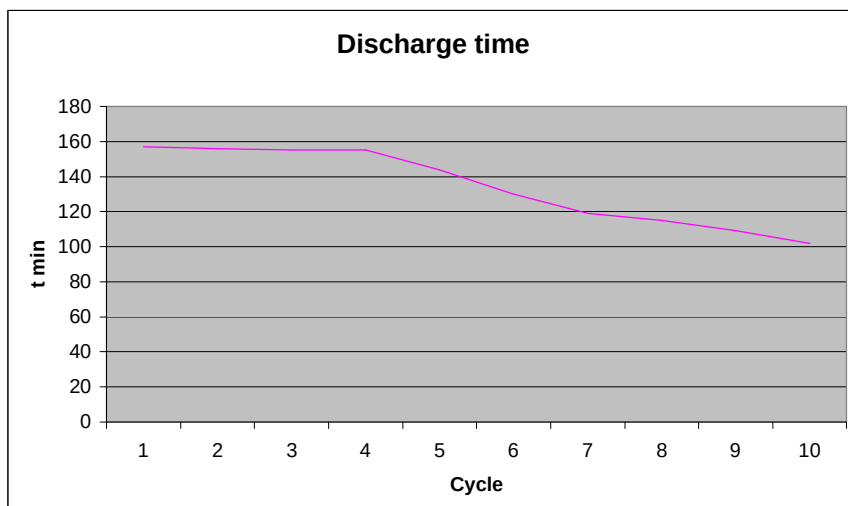
Item : WITHOUT BB

Type of test: Slow (0,14C)

Load: 135 W (3 lamps 45 W + 45 W + 45 W)

Cutt off V BB: 12 V

Date	Cycle N	Time mm
12-Apr	1	157
13-Apr	2	156
18-Apr	3	155
19-Apr	4	155
20-Apr	5	144
21-Apr	6	130
23-Apr	7	119
25-Apr	8	115
26-Apr	9	109
27-Apr	10	102
28-Apr	11	96



SACE Srl - Battery Life Test -

Date : 11 Aprile / 8 Maggio

h : 17,15 / 9,00

Battery : URSUS 80DX - 80 Ah -

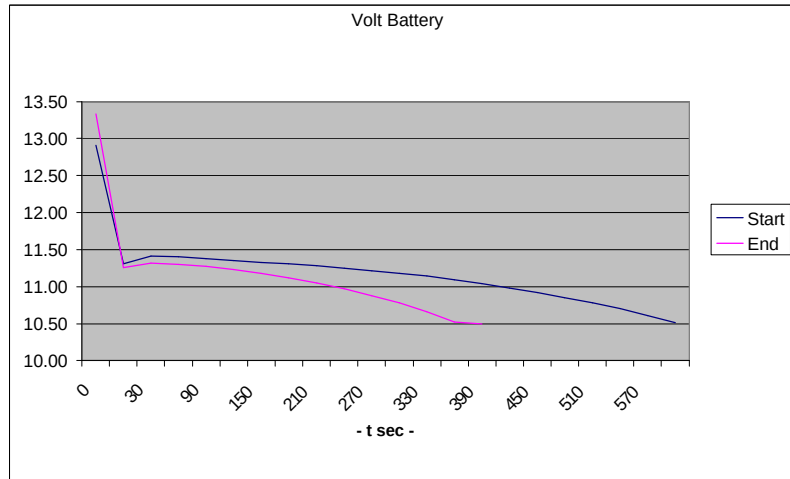
Item : *WITHOUT BB*

Discharge test: Fast (1,8C)

Load: 1.700 W (20 lamps 40 W + 45 W)

Cut off V BB: 10,5 V

time		Volt Start	Volt End	Note
N	sec			
1	0	12.91	13.33	No load
2	0	11.31	11.26	Start point
3	30	11.41	11.32	
4	60	11.40	11.30	
5	90	11.38	11.27	
6	120	11.35	11.23	
7	150	11.33	11.18	
8	180	11.31	11.12	
9	210	11.28	11.05	
10	240	11.25	10.97	
11	270	11.21	10.88	
12	300	11.18	10.78	
13	330	11.14	10.66	
14	360	11.09	10.52	
15	390	11.04	10.50	
16	420	10.98		
17	450	10.92		
18	480	10.85		
19	510	10.78		
20	540	10.70		
21	570	10.61		
22	600	10.51		



SACE Srl - Battery Life Test -

Date : 11 Aprile / 8 Maggio

h : 17,05 / 16,30

Battery : URSUS 80DX - 80 Ah -

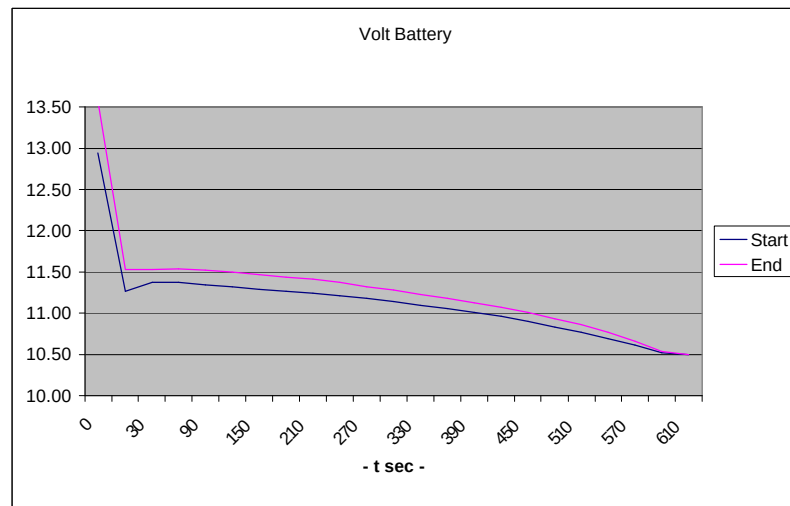
Item : *WITH BB*

Discharge test: Fast (1,8C)

Load: 1.700 W (20 lamps 40 W + 45 W)

Cut off V BB: 10,5 V

time		Volt Start	Volt End	Note
N	sec			
1	0	12.94	13.58	No load
2	0	11.27	11.53	Start point
3	30	11.37	11.53	
4	60	11.37	11.54	
5	90	11.34	11.52	
6	120	11.32	11.50	
7	150	11.29	11.47	
8	180	11.27	11.44	
9	210	11.24	11.41	
10	240	11.21	11.37	
11	270	11.18	11.32	
12	300	11.14	11.28	
13	330	11.10	11.23	
14	360	11.06	11.18	
15	390	11.01	11.13	
16	420	10.96	11.07	
17	450	10.90	11.01	
18	480	10.83	10.93	
19	510	10.77	10.86	
20	540	10.69	10.77	
21	570	10.61	10.66	
22	600	10.52	10.54	
23	610	10.50	10.50	



TESTS COMPARISON

44Ah	With BB	Without BB	diffrence%
Tin	840	820	0.98
Tfin	660	390	0.59
reduction	0.79	0.48	--
slow time red	0.39	0.59	--

55Ah	With BB	Without BB	diffrence%
Tin	540	480	0.89
Tfin	450	270	0.60
reduction	0.83	0.56	--
slow time red	0.39	0.56	--

80Ah	With BB	Without BB	diffrence%
Tin	608	600	0.99
Tfin	608	390	0.64
reduction	1.00	0.65	--
slow time red	0.61	0.58	--

