



ACCREDITED TEST LABORATORY "STARBAT"

ANNEX NO. 5.10-OP-01-01-00-06



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TEST PROTOCOL

NO 0127 / 25.08.2017

1. **Product type, model:** *Valve regulated lead-acid battery UP-FTS-PL*
2. **Applicant for the test:** *Masterbattery*
3. **Name & Number of the standardizing documents:** *IEC 60896 – 21/22*
cl.6.16 Impact of a stress temperature of 55 °C
cl.6.8 Valve operation
4. **Date of receipt of samples at the laboratory:** *29.07.2016*
5. **Number of test samples:** *3pcs. UP-FTS-PL*
code 381 code 382 code 383
6. **Date of test:** *29.07.2016 – 24.08.2017*

Accredited Test Laboratory Head:

/Lyubenov/
/ Family name, Signature, Stamp/

ACCREDITED TEST LABORATORY "STARBAT"

7. Table of test results:

PROTOCOL NO. 0127 / 25.08.2017

No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
1	Discharge capacity	Ah	IEC 60896 – 21/22 cl. 6.11.	No. 381	$C_a = 153.7 \pm 0.6$ Ah	$C_a \geq 153$ Ah	Rated capacity C_3 is 153.0 Ah – declared by the manufacturer. $I_3 = 51.0$ A, at temperature 25°C. Final voltage $U_f = 10.2$ V.
				No. 382	$C_a = 153.6 \pm 0.6$ Ah	$C_a \geq 153$ Ah	
				No. 383	$C_a = 153.5 \pm 0.6$ Ah	$C_a \geq 153$ Ah	

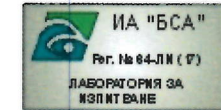
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PROTOCOL NO. 0127 / 25.08.2017

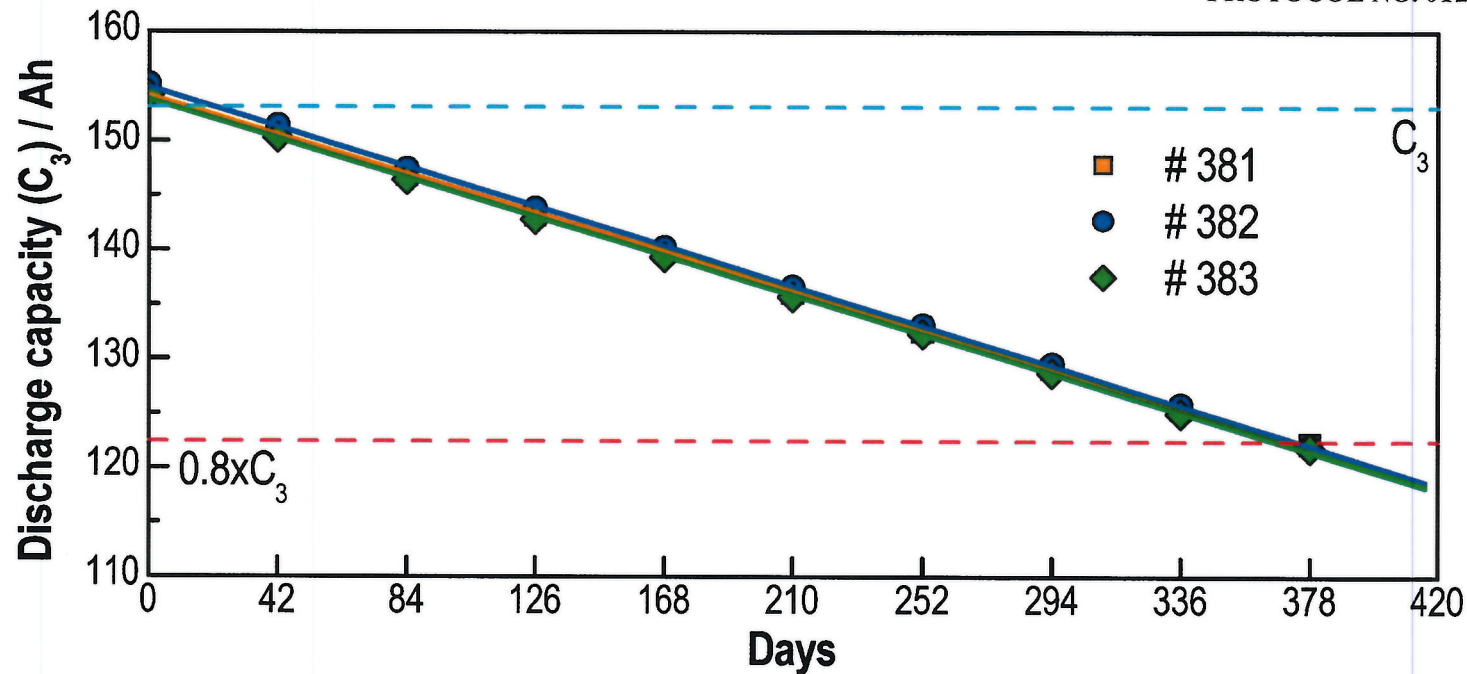
No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
2	Impact of a stress temperature of 55°C with 3h rate discharge test	number of days	IEC 60896 – 21/22 cl. 6.16.	No. 381	370 days $C_a = 118.7 \text{ Ah}$	$C_a \leq 122.4 \text{ Ah}$ to end the test. 150 days for brief duration exposure time; 250 days for medium duration exposure time; 350 days for long duration exposure time; 500 days for very long duration exposure time.	Float charge the units at 55°C. Every 42 days perform a test to determine the actual capacity for 3 h rate. The test is terminated when the actual capacity is less than 0.8 C_3 .
				No. 382	370 days $C_a = 117.9 \text{ Ah}$		
				No. 383	370 days $C_a = 117.1 \text{ Ah}$		
4	Valve operation	-	IEC 60896 – 21/22 cl.6.8	No. 381	Gas release detected before and after stress temperature impact test.	Gas release detected before and after stress temperature impact test.	Overcharge the test samples and test the valve opening before and at the end of the stress temperature impact test at 55°C according to cl.6.8.2 and 6.8.3.
				No. 382	Gas release detected before and after stress temperature impact test		
				No. 383	Gas release detected before and after stress temperature impact test		



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PROTOCOL NO. 0127 / 25.08.2017



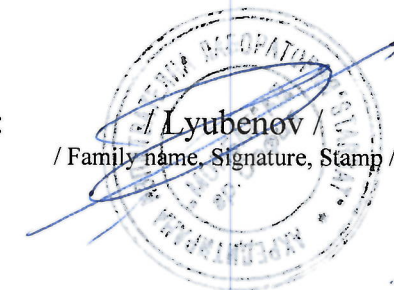
NOTE: The test results refer to the test samples only. Extracts of the test protocol shall not be copied without the written consent of the Accredited Test Laboratory.

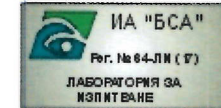
Test carried out by:

/Georgiev /
/ Family name, Signature /

Accredited Test Laboratory Head:

/ Lyubenov /
/ Family name, Signature, Stamp /





ACCREDITED TEST LABORATORY "STARBAT"

TEST PROTOCOL

NO 0086 / 16.05.2017

- 1. Product type, model:** *Valve regulated lead-acid battery UP-FTS-PL*
- 2. Applicant for the test:** *Masterbattery*
- 3. Name & Number of the standardizing documents:** *IEC 60896 – 21/22 cl.6.15 Service life at an operating temperature of 40 °C*
- 4. Date of receipt of samples at the laboratory:** *13.07.2017*
- 5. Number of test samples:** *3 pcs. UP-FTS-PL*
452 # 453 # 454
- 6. Date of test:** *14.07.2013 – 15.05.2017*

Accredited Test Laboratory Head:

Lyubenov /
/ Family name, Signature, Stamp



ACCREDITED TEST LABORATORY "STARBAT"

7. Table of test results:

PROTOCOL NO. 0086 / 16.05.2017

No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
1	Discharge capacity	Ah	IEC 60896 – 21/22 cl. 6.11.	No. 452	$C_a = 153.8 \pm (<0.1\%)$	$C_a \geq 153.0 \text{ Ah}$	Rated capacity C_3 is 153.0 Ah – declared by the manufacturer. $I_3 = 51.0 \text{ A}$, at temperature 25°C . Final voltage $U_f = 10.2 \text{ V}$.
				No. 453	$C_a = 153.4 \pm (<0.1\%)$		
				No. 454	$C_a = 153.6 \pm (<0.1\%)$		

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PROTOCOL NO. 0086 / 16.05.2017

No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
2	Service life at an operating temperature of 40°C	number of days, Ah	IEC 60896 – 21/22 cl. 6.15.	№ 452	118 days $C_{a118} = 152.6 \pm (<0.1\%)$ 236 days $C_{a236} = 150.4 \pm (<0.1\%)$ 354 days $C_{a354} = 149.7 \pm (<0.1\%)$ 472 days $C_{a472} = 147.3 \pm (<0.1\%)$ 590 days $C_{a590} = 144.6 \pm (<0.1\%)$ 708 days $C_{a708} = 143.1 \pm (<0.1\%)$ 826 days $C_{a826} = 140.3 \pm (<0.1\%)$ 944 days $C_{a944} = 138.7 \pm (<0.1\%)$ 1062 days $C_{a1062} = 136.5 \pm (<0.1\%)$ 1180 days $C_{a1180} = 128.6 \pm (<0.1\%)$ 1298 days $C_{a1298} = 118.4 \pm (<0.1\%)$	$C_a \leq 122.4$ Ah to end the test. 500 days for brief duration exposure time; 750 days for medium duration exposure time; 1100 days for long duration exposure time; 1700 days for very long duration exposure time.	Float charge the units at 40°C. Every 118 days perform a test to determine the 3 hour rated actual capacity. The test is terminated when the actual capacity is less than 0.8 C ₃ .

No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
3	Service life at an operating temperature of 40°C	number of days, Ah	IEC 60896 – 21/22 cl. 6.15.	№ 453	118 days $C_{a118} = 151.8 \pm (<0.1\%)$ 236 days $C_{a236} = 149.5 \pm (<0.1\%)$ 354 days $C_{a354} = 149.0 \pm (<0.1\%)$ 472 days $C_{a472} = 146.7 \pm (<0.1\%)$ 590 days $C_{a590} = 143.9 \pm (<0.1\%)$ 708 days $C_{a708} = 142.7 \pm (<0.1\%)$ 826 days $C_{a826} = 139.9 \pm (<0.1\%)$ 944 days $C_{a944} = 138.5 \pm (<0.1\%)$ 1062 days $C_{a1062} = 134.7 \pm (<0.1\%)$ 1180 days $C_{a1180} = 129.6 \pm (<0.1\%)$ 1298 days $C_{a1298} = 115.4 \pm (<0.1\%)$	$C_a \leq 122.4\text{Ah}$ to end the test. 500 days for brief duration exposure time; 750 days for medium duration exposure time; 1100 days for long duration exposure time; 1700 days for very long duration exposure time.	Float charge the units at 40°C. Every 118 days perform a test to determine the 3 hour rated actual capacity. The test is terminated when the actual capacity is less than 0.8 C ₃ .

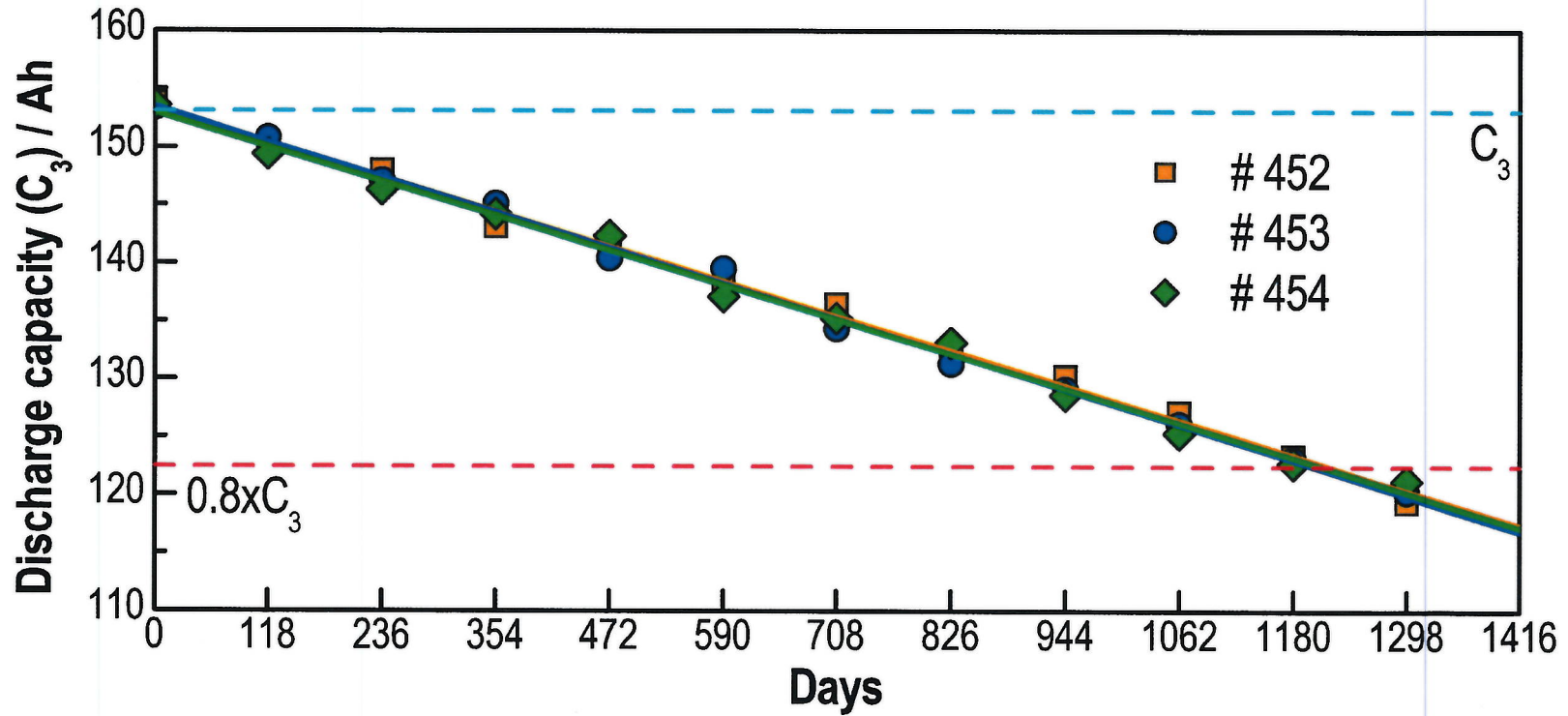


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PROTOCOL NO. 0086 / 16.05.2017

No.	Test /characteristics/	Measuring Unit	Standards/ Verified Test Methods	Sample No. as per Ref. Log	Test Results (value, uncertainty)	Test Parameter Value & Tolerance	Test Conditions
1	2	3	4	5	6	7	8
4	Service life at an operating temperature of 40°C	number of days, Ah	IEC 60896 – 21/22 cl. 6.15.	№ 454	118 days $C_{a118} = 152.2 \pm (<0.1\%)$ 236 days $C_{a236} = 150.0 \pm (<0.1\%)$ 354 days $C_{a354} = 149.1 \pm (<0.1\%)$ 472 days $C_{a472} = 146.1 \pm (<0.1\%)$ 590 days $C_{a590} = 143.6 \pm (<0.1\%)$ 708 days $C_{a708} = 142.0 \pm (<0.1\%)$ 826 days $C_{a826} = 139.2 \pm (<0.1\%)$ 944 days $C_{a944} = 138.8 \pm (<0.1\%)$ 1062 days $C_{a1062} = 136.3 \pm (<0.1\%)$ 1180 days $C_{a1180} = 127.2 \pm (<0.1\%)$ 1298 days $C_{a1298} = 116.5 \pm (<0.1\%)$	$C_a \leq 122.4$ Ah to end the test. 500 days for brief duration exposure time; 750 days for medium duration exposure time; 1100 days for long duration exposure time; 1700 days for very long duration exposure time.	Float charge the units at 40°C. Every 118 days perform a test to determine the 3 hour rated actual capacity. The test is terminated when the actual capacity is less than 0.8 C ₃ .



NOTE: The test results refer to the test samples only. Extracts of the test protocol shall not be copied without the written consent of the Accredited Test Laboratory.

Test carried out by:

[Signature]
 /Georgiev /
 / Family name, Signature /

Accredited Test Laboratory Head:

[Signature]
 /Lyubenov /
 / Family name, Signature, Stamp /

