Test results:

Capacity test - 60896 – 11 clause 14

C_{10}

Type: 6 OPzS 300

Date	07.02.2017		
Batt.	1		
Temperature	T [°C]	23.1	Signed document
Discharge current	I [A]	32.0	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	320.0	Page 17
Measured capacity (20.0°C)	C [Ah]	**348.2**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**108.8**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_5

Type: 6 OPzS 300

Date	15.02.2017		
Batt.	1		
Temperature	T [°C]	22.8	Signed document
Discharge current	I [A]	56.3	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	281.5	Page 18
Measured capacity (20.0°C)	C [Ah]	**322.8**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**114.7**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_3

Type: 6 OPzS 300

Date	15.03.2017		
Batt.	1		
Temperature	T [°C]	23.8	Signed document
Discharge current	I [A]	82.7	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	248.1	Page 19
Measured capacity (20.0°C)	C [Ah]	**280.7**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**113.1**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

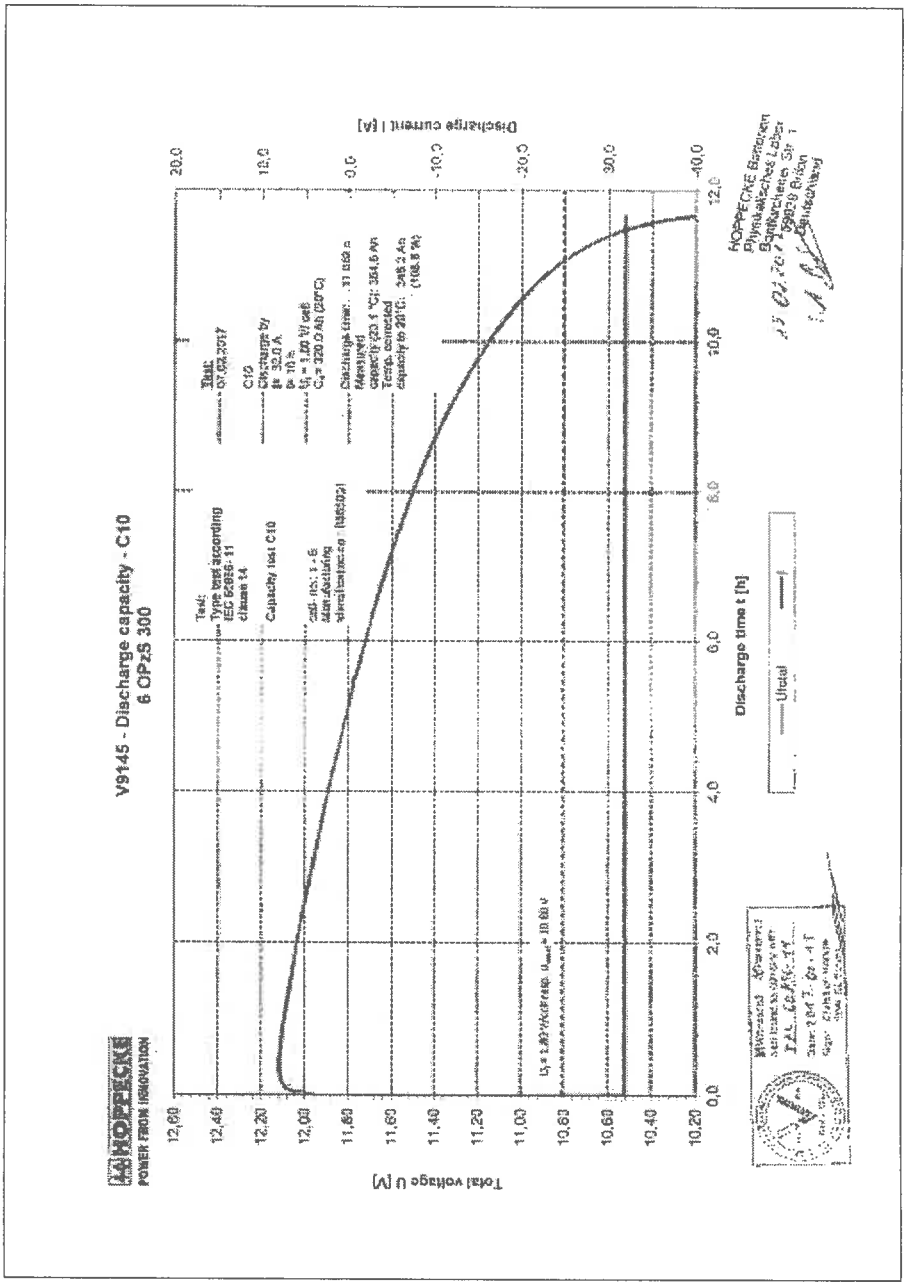
C_1

Type: 6 OPzS 300

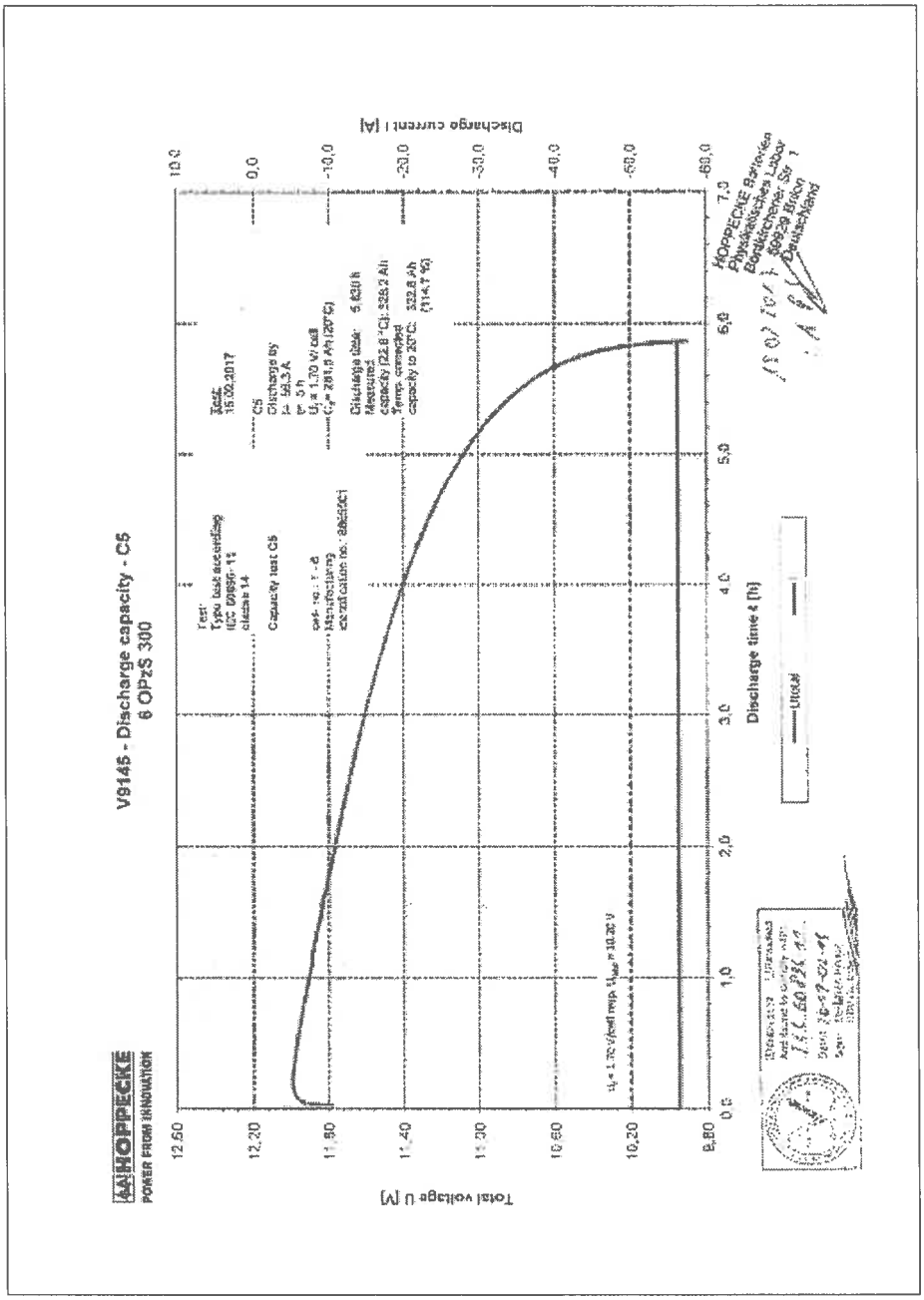
Date	07.04.2017		
Batt.	1		
Temperature	T [°C]	22.2	Signed document
Discharge current	I [A]	179.0	
Cut off voltage	U [V/cell]	1.60	
Nominal capacity (20°C)	C_{Nenn} [Ah]	179.0	Page 20
Measured capacity (20.0°C)	C [Ah]	**217.1**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**121.3**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

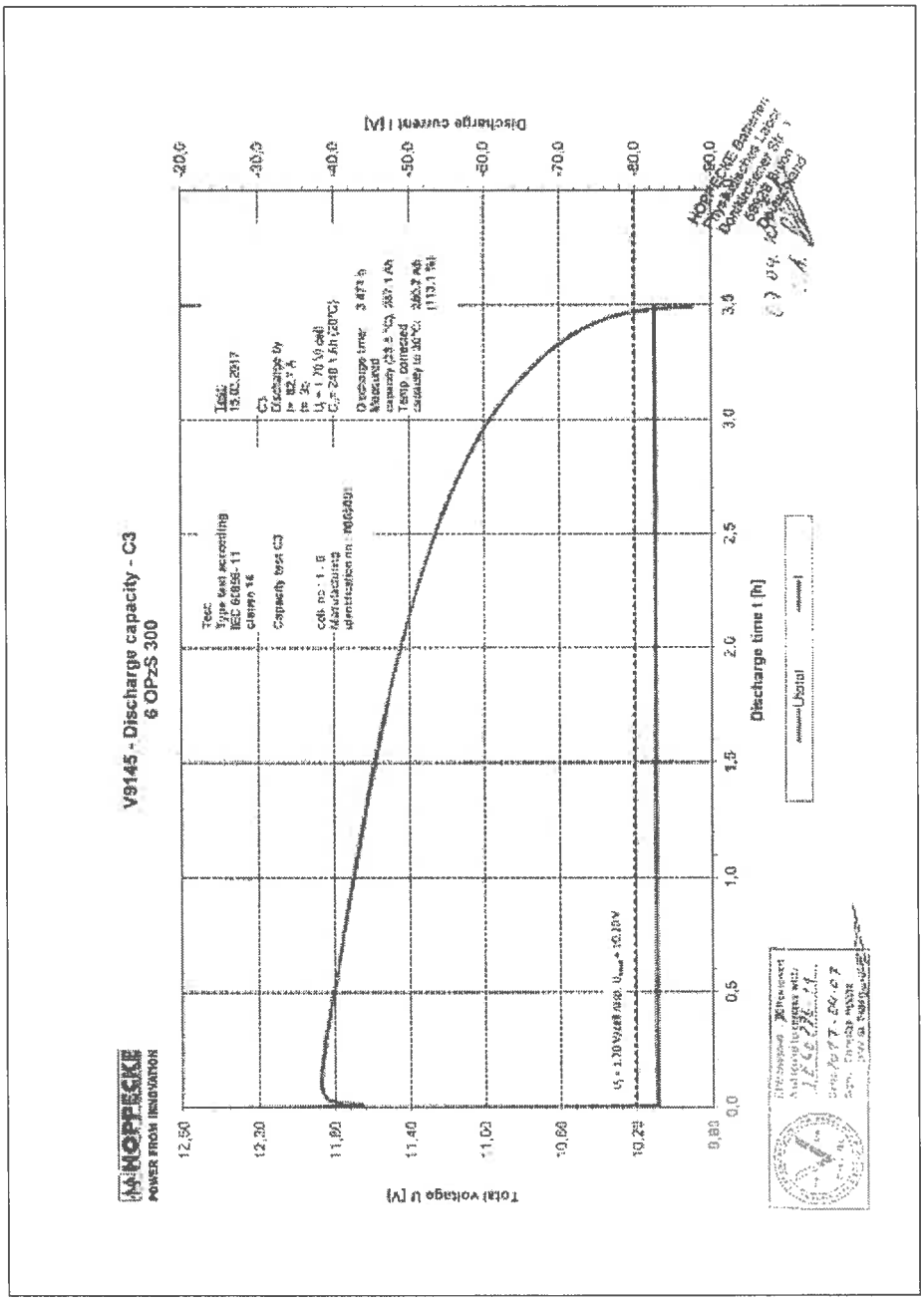
Test Report Physical Test Laboratory



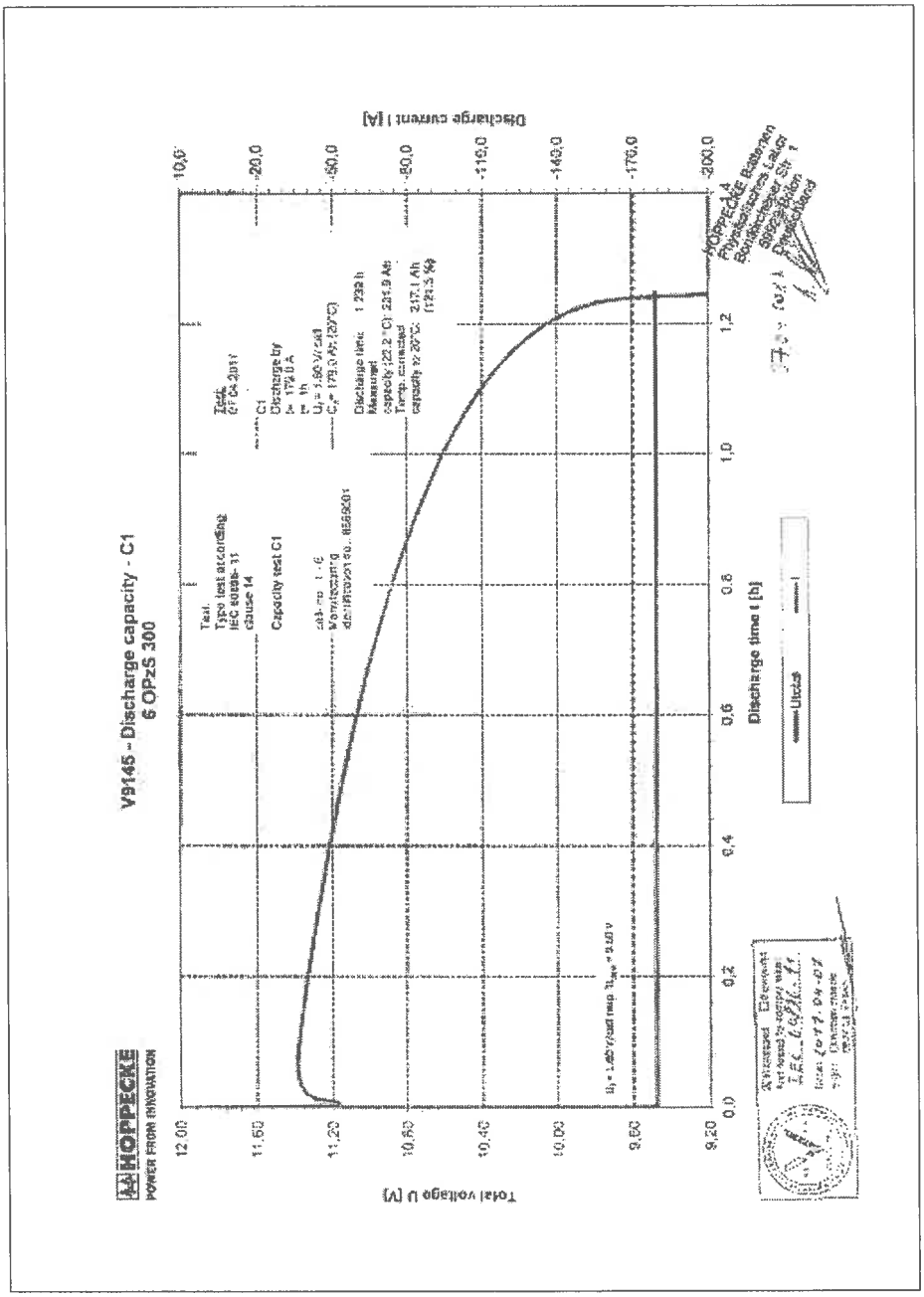
Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



C_{10}

Type: 7 OPzS 490

Date	15.02.2017		
Batt.	3		
Temperature	T [°C]	21.5	Signed document
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	Page 23
Measured capacity (20.0°C)	C [Ah]	**583.4**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**106.9**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_5

Type: 7 OPzS 490

Date	15.02.2017		
Batt.	5		
Temperature	T [°C]	23.1	Signed document
Discharge current	I [A]	99.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	495.0	Page 24
Measured capacity (20.0°C)	C [Ah]	**517.0**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**104.4**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_3

Type: 7 OPzS 490

Date	15.02.2017		Signed document Page 25
Batt.	6		
Temperature	T [°C]	22.4	
Discharge current	I [A]	146.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	438.0	
Measured capacity (20.0°C)	C [Ah]	**452.6**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**103.3**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

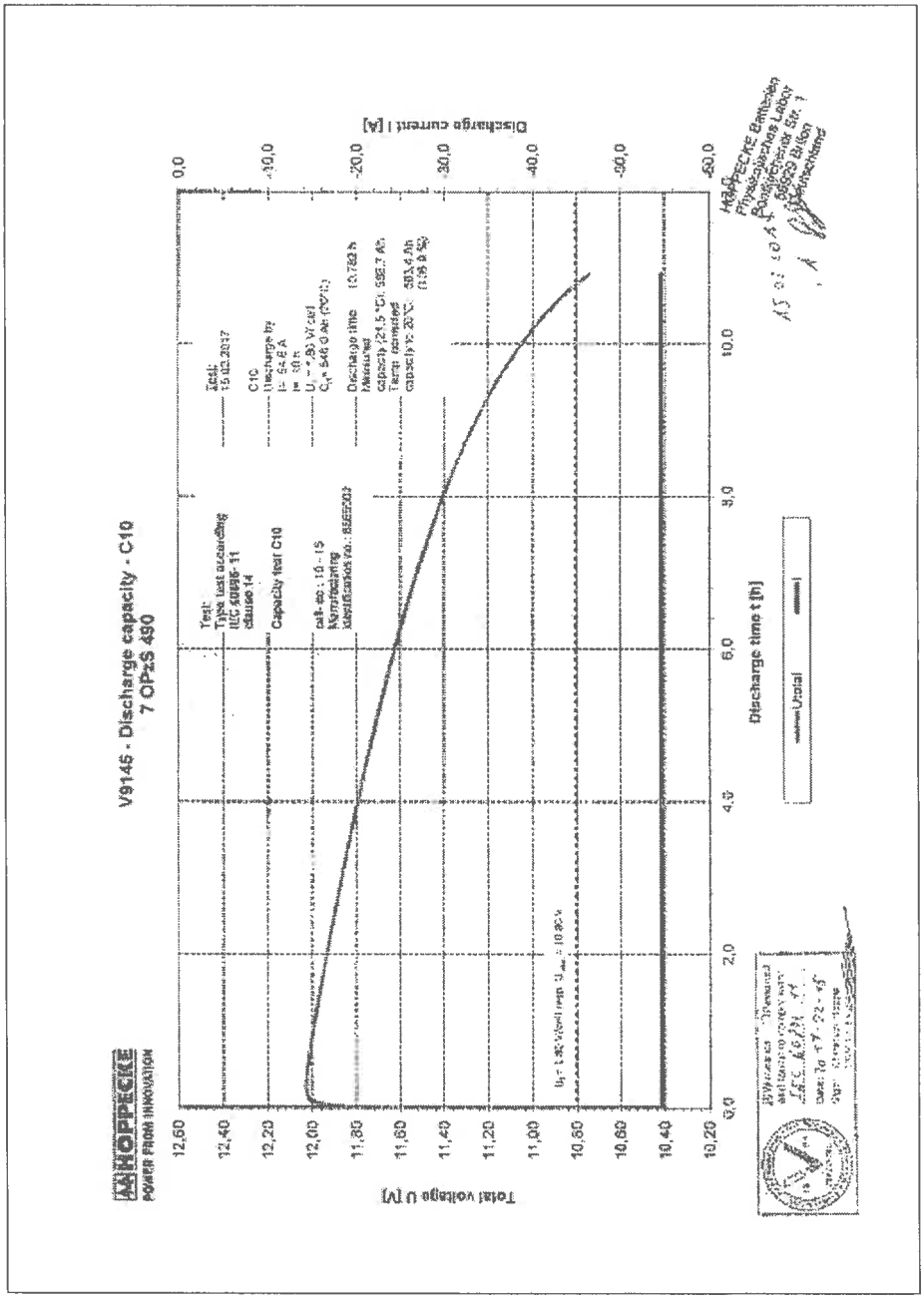
C_1

Type: 7 OPzS 490

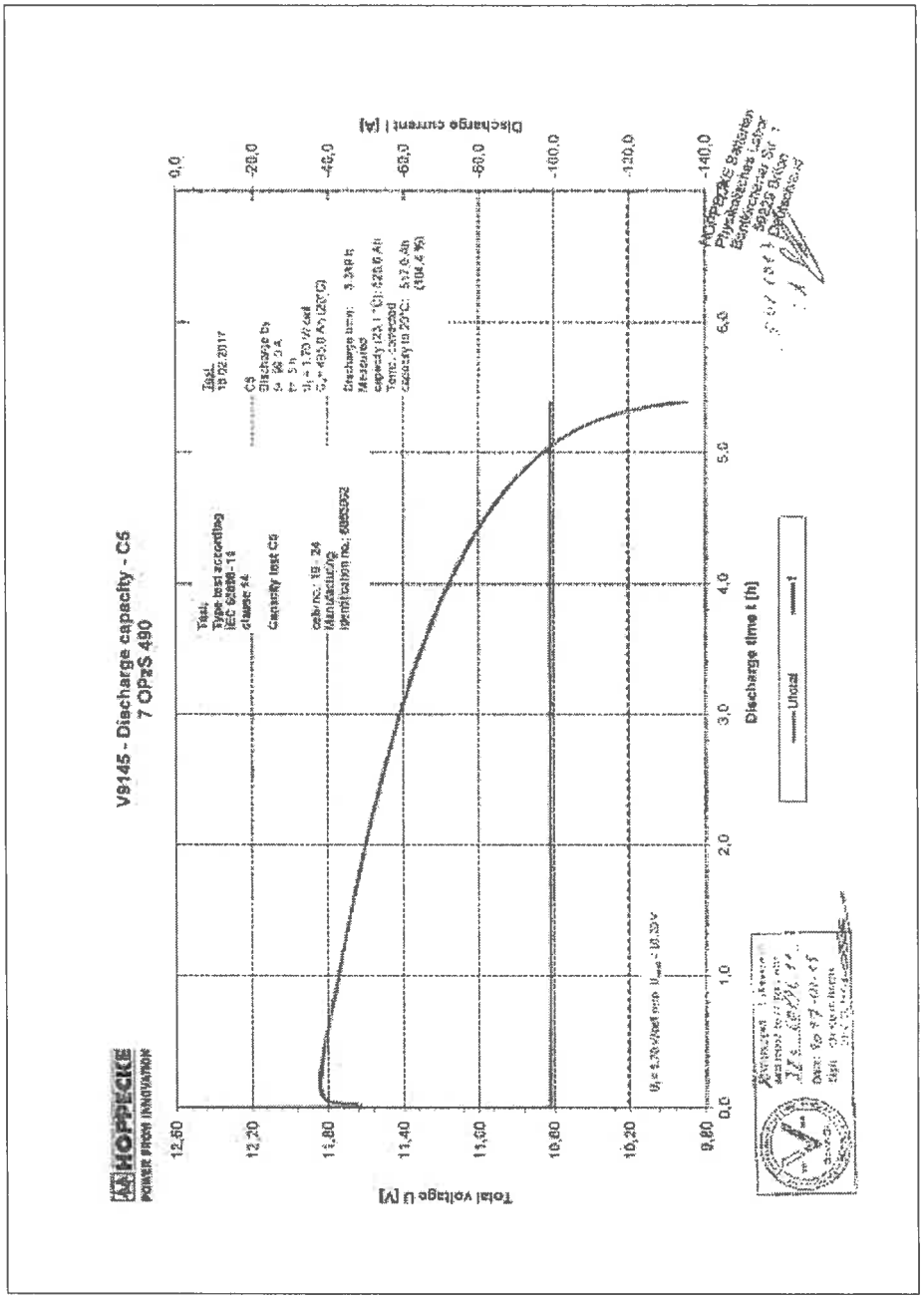
Date	15.02.2017		Signed document Page 26
Batt.	7		
Temperature	T [°C]	21.0	
Discharge current	I [A]	308.0	
Cut off voltage	U [V/cell]	1.60	
Nominal capacity (20°C)	C_{Nenn} [Ah]	308.0	
Measured capacity (20.0°C)	C [Ah]	**347.5**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**112.8**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

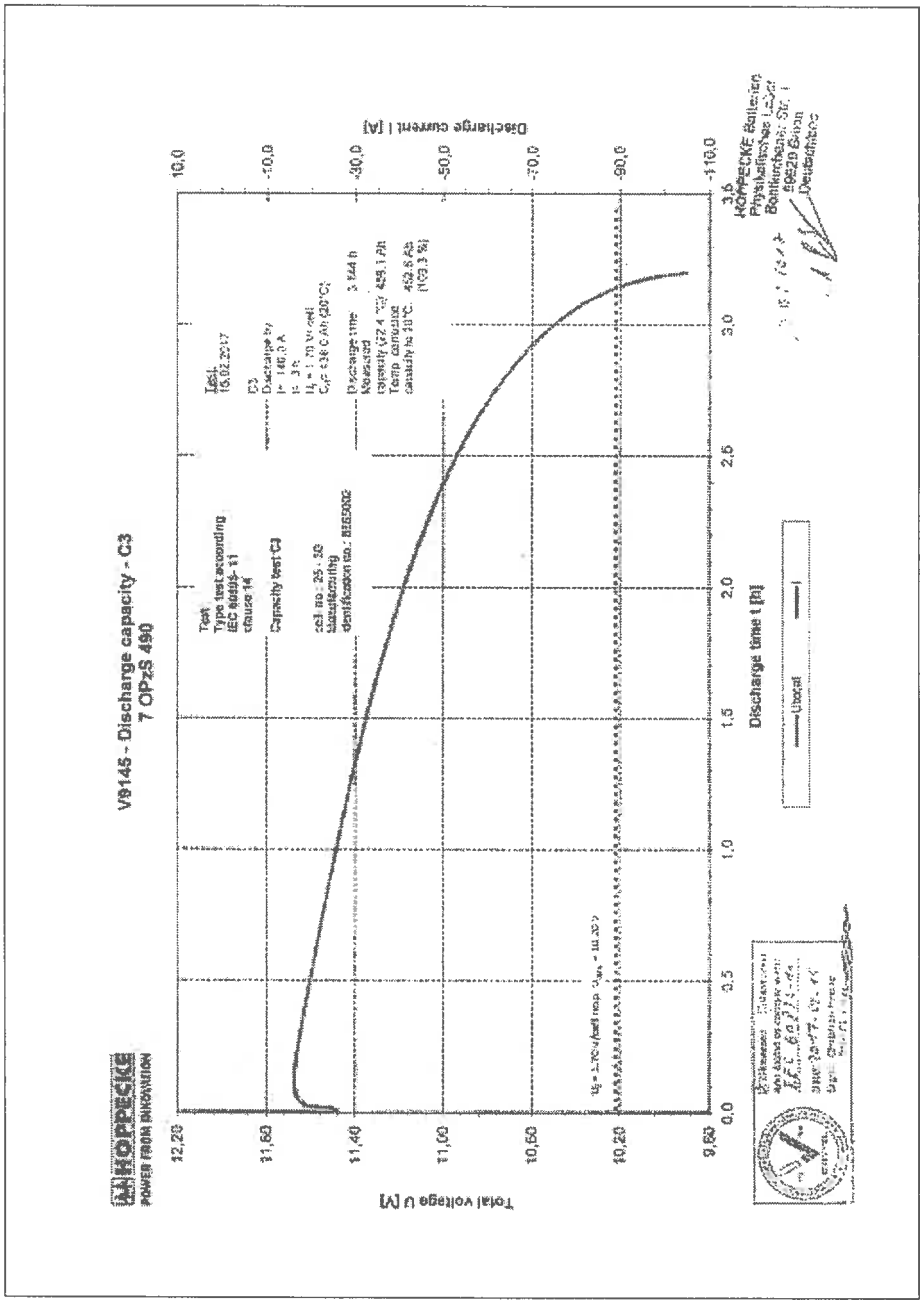
Test Report Physical Test Laboratory



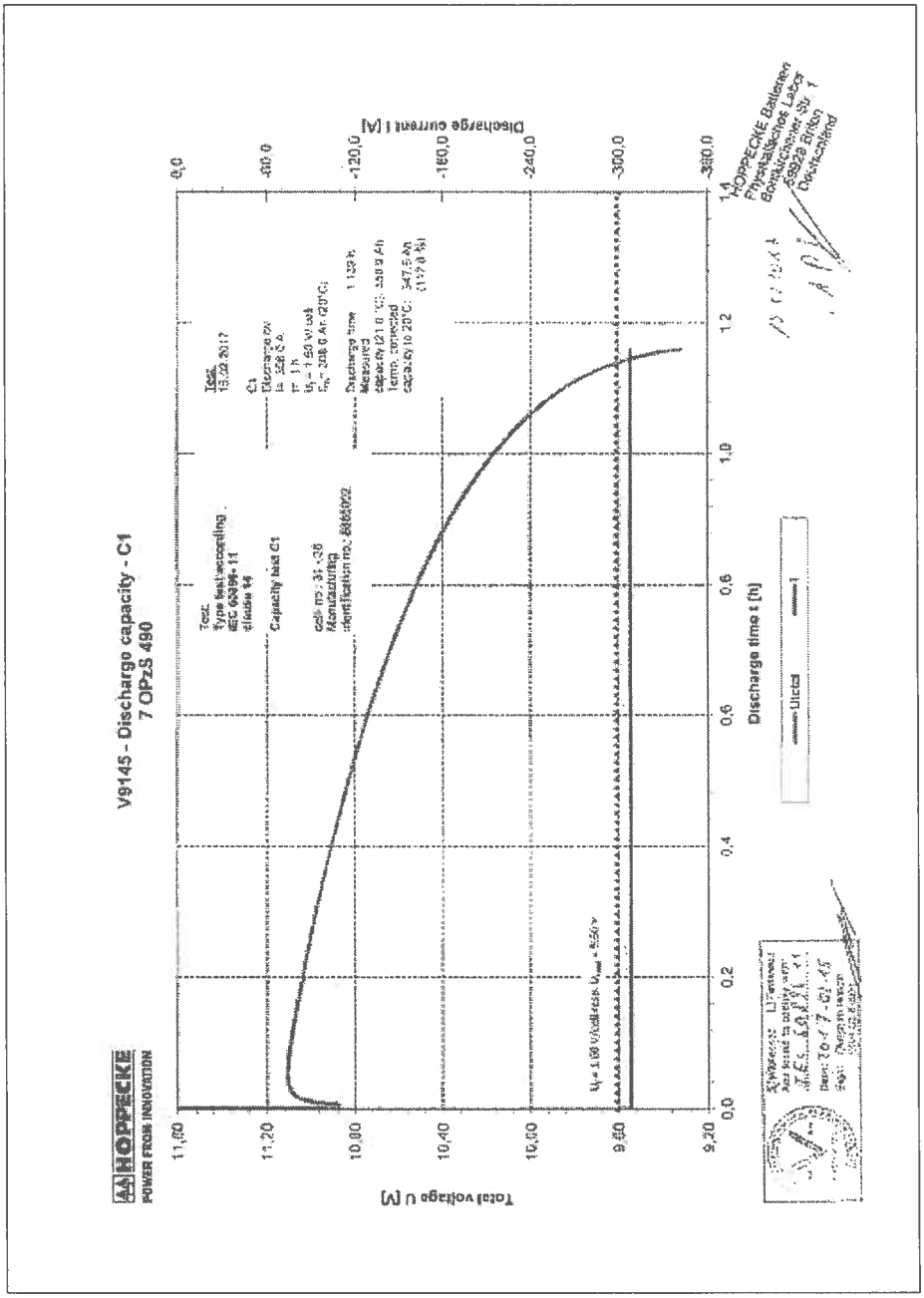
Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



C_{10}

Type: 6 OPzS 600

Date	07.02.2017		
Batt.	10		
Temperature	T [°C]	21.5	Signed document
Discharge current	I [A]	68.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	686.0	Page 29
Measured capacity (20.0°C)	C [Ah]	**726.2**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**105.9**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_5

Type: 6 OPzS 600

Date	15.02.2017		
Batt.	10		
Temperature	T [°C]	21.4	Signed document
Discharge current	I [A]	123.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	615.0	Page 30
Measured capacity (20.0°C)	C [Ah]	**666.0**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**108.3**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_3

Type: 6 OPzS 600

Date	07.03.2017		
Batt.	10		
Temperature	T [°C]	20.1	Signed document
Discharge current	I [A]	177.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	531.0	Page 31
Measured capacity (20.0°C)	C [Ah]	**583.5**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**109.9**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

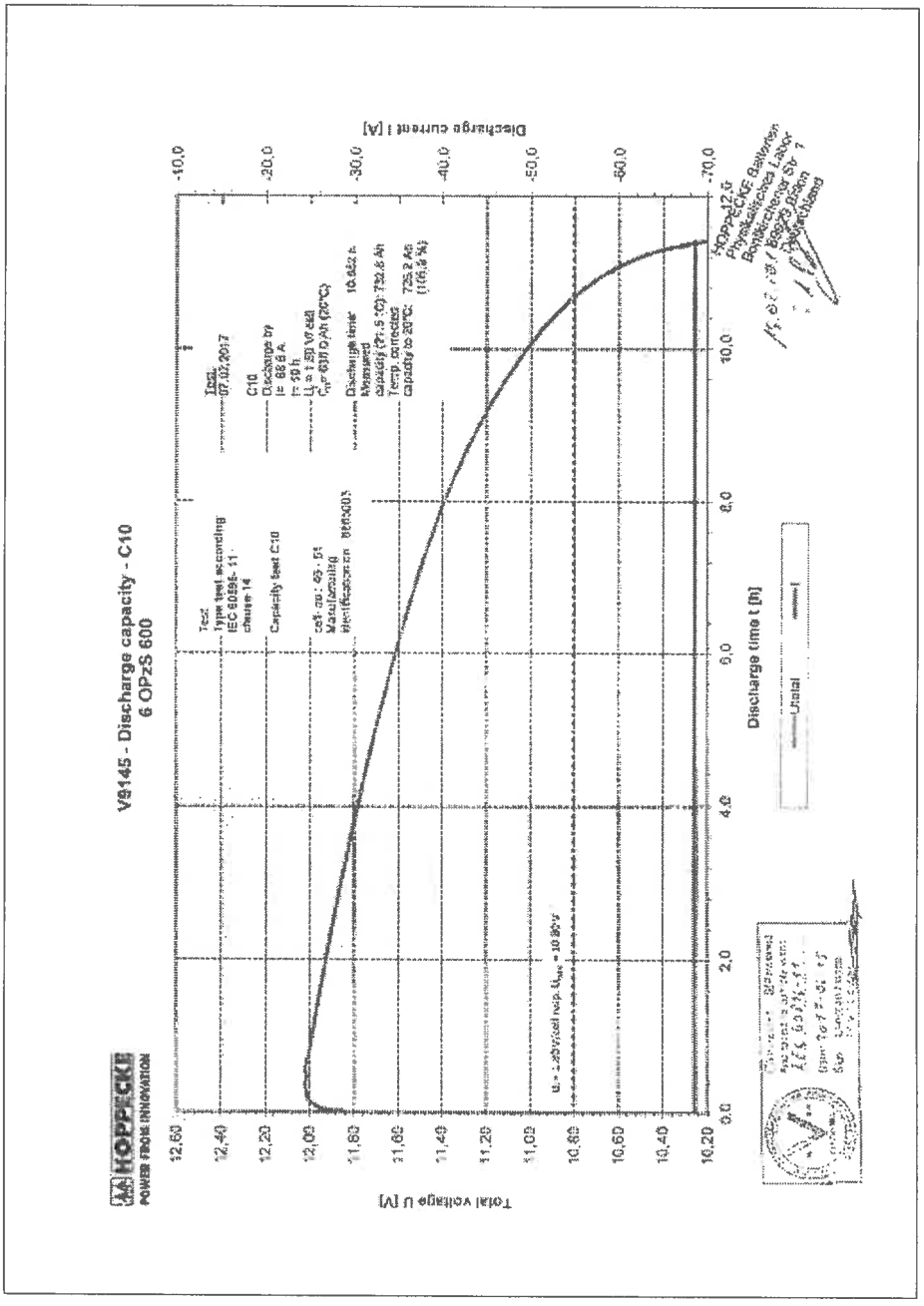
C_1

Type: 6 OPzS 600

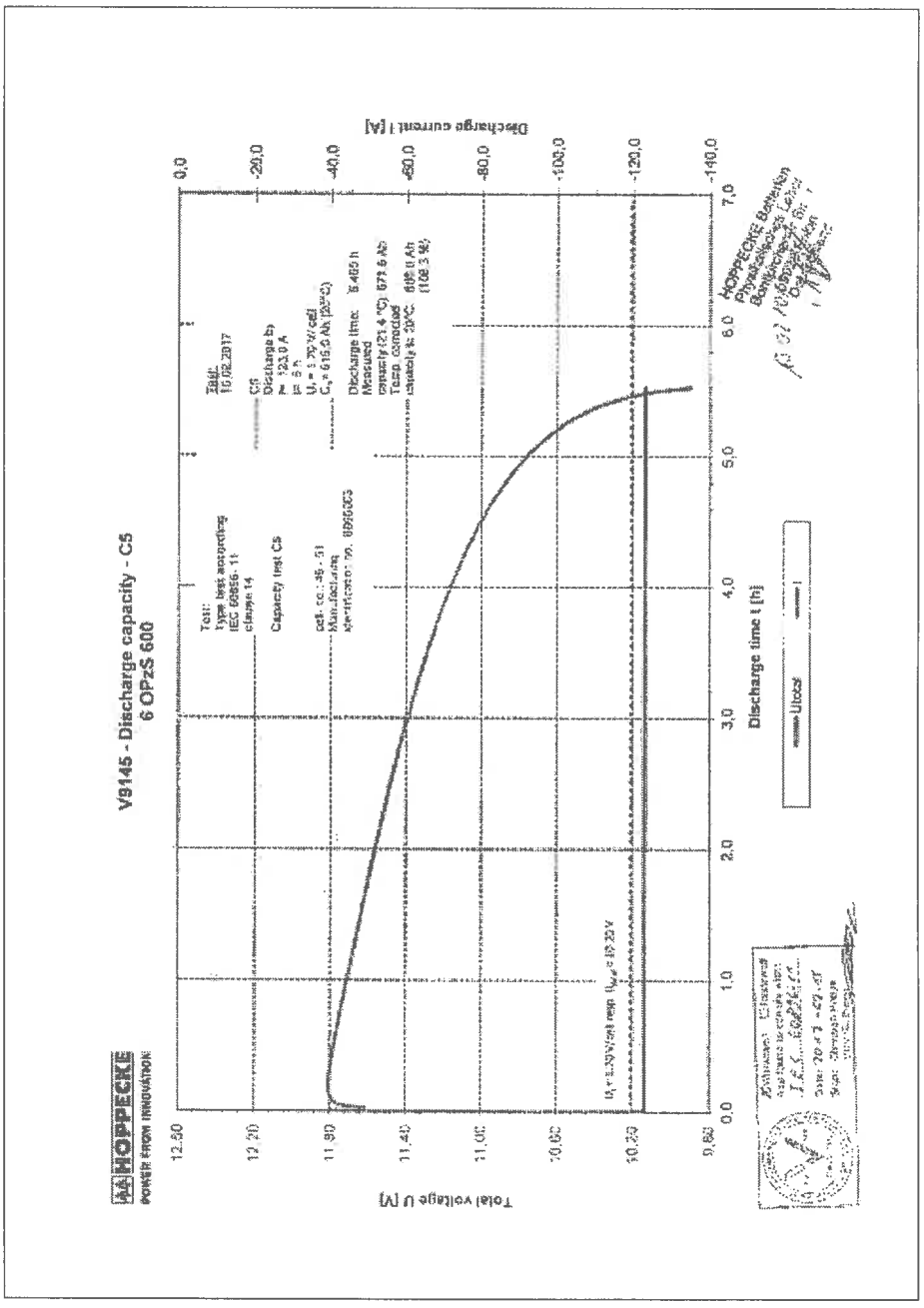
Date	07.04.2017		
Batt.	10		
Temperature	T [°C]	19.6	Signed document
Discharge current	I [A]	373.0	
Cut off voltage	U [V/cell]	1.60	
Nominal capacity (20°C)	C_{Nenn} [Ah]	373.0	Page 32
Measured capacity (20.0°C)	C [Ah]	**449.7**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**120.6**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



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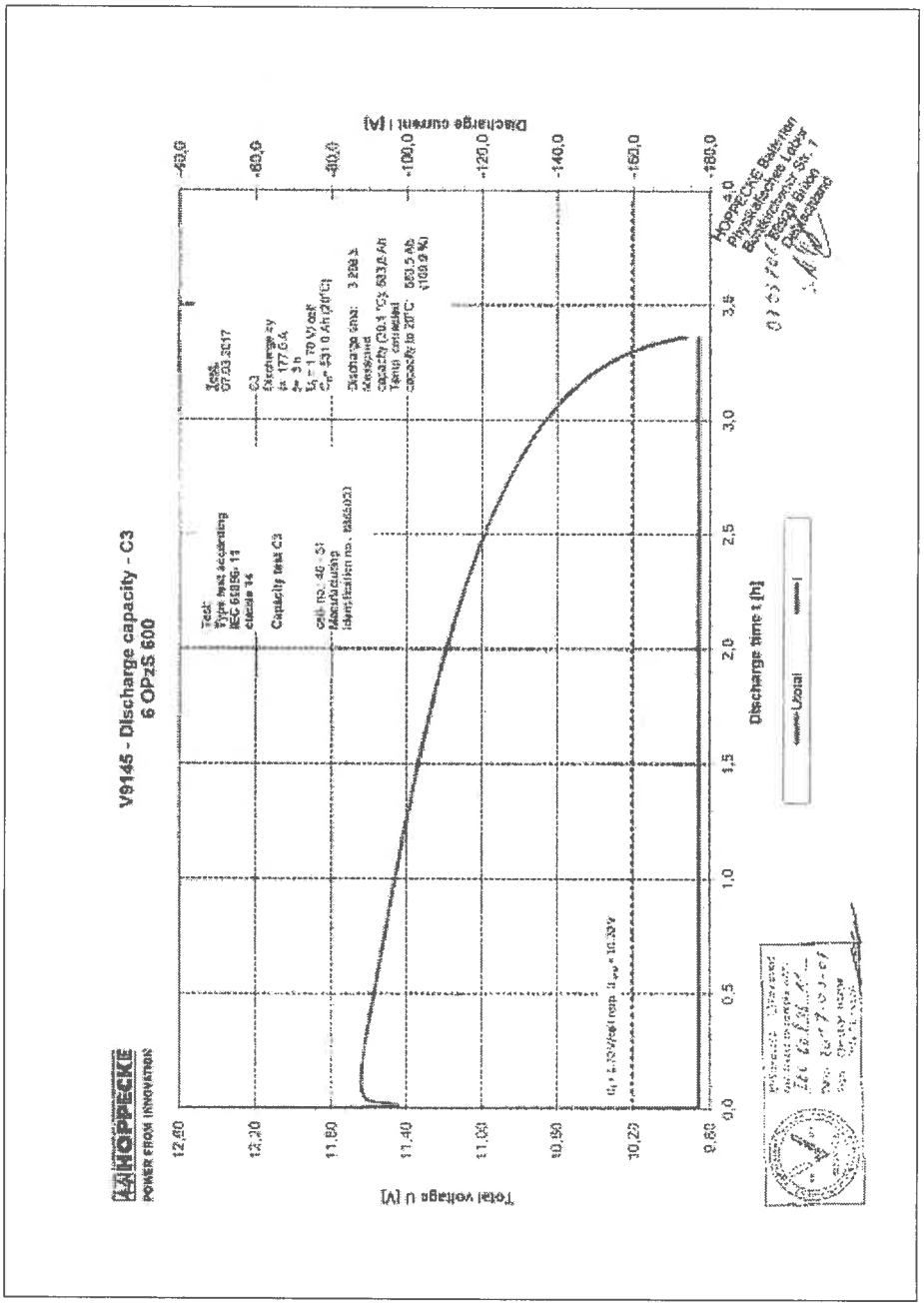
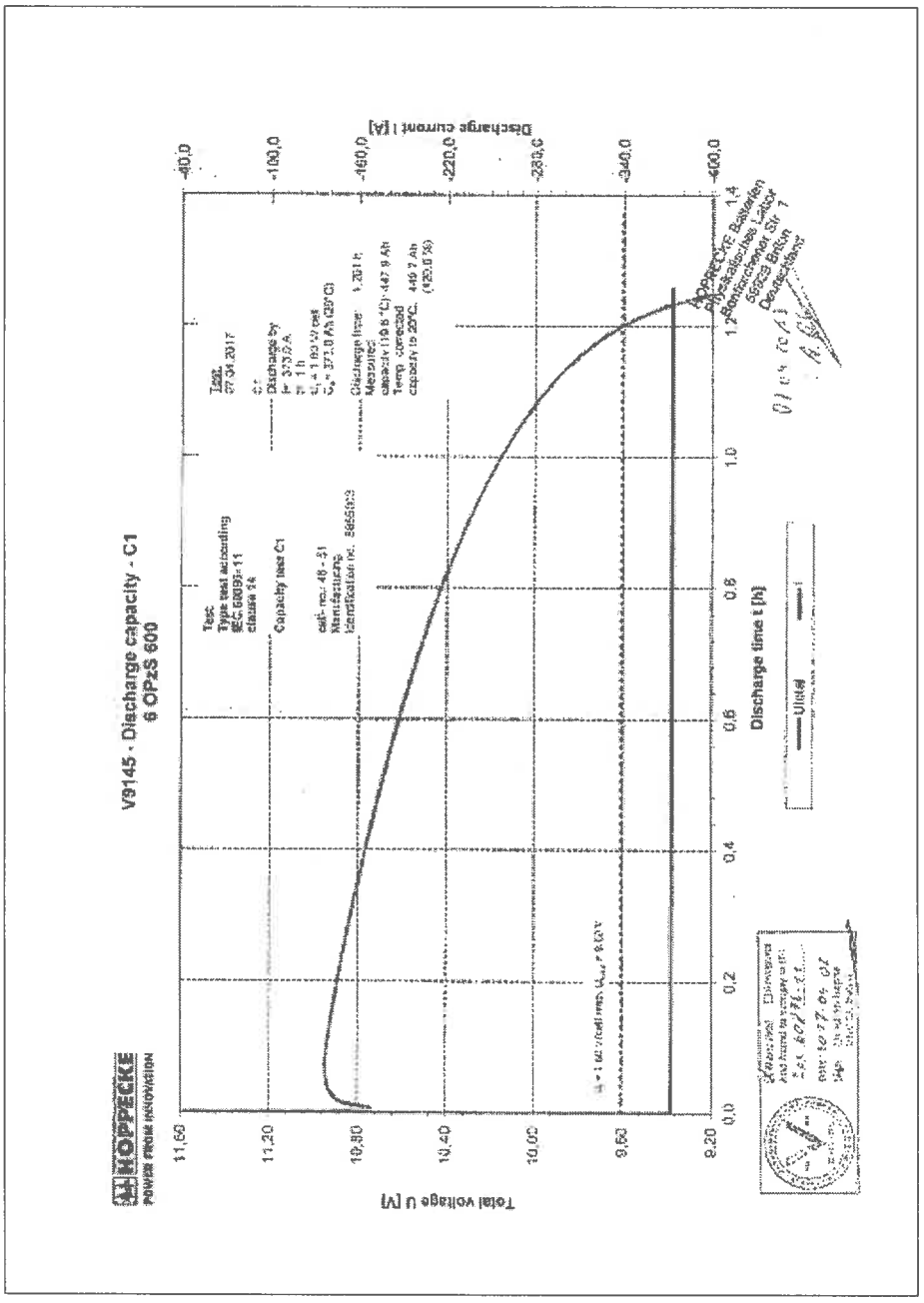


Test Report Physical Test Laboratory



Test Report Physical Test Laboratory

C_{10}

Type: 12 OPzS 1500

Date	22.02.2017		
Batt.	12		
Temperature	T [°C]	23.2	Signed document
Discharge current	I [A]	161.0	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	1610.0	Page 35
Measured capacity (20.0°C)	C [Ah]	**1803.3**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**112.0**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_5

Type: 12 OPzS 1500

Date	07.03.2017		
Batt.	12		
Temperature	T [°C]	20.5	Signed document
Discharge current	I [A]	297.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	1485.0	Page 36
Measured capacity (20.0°C)	C [Ah]	**1662.6**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**112.0**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

C_3

Type: 12 OPzS 1500

Date	27.03.2017		
Batt.	12		
Temperature	T [°C]	20.0	Signed document
Discharge current	I [A]	421.0	
Cut off voltage	U [V/cell]	1.70	
Nominal capacity (20°C)	C_{Nenn} [Ah]	1263.0	Page 37
Measured capacity (20.0°C)	C [Ah]	**1469.3**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**116.3**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

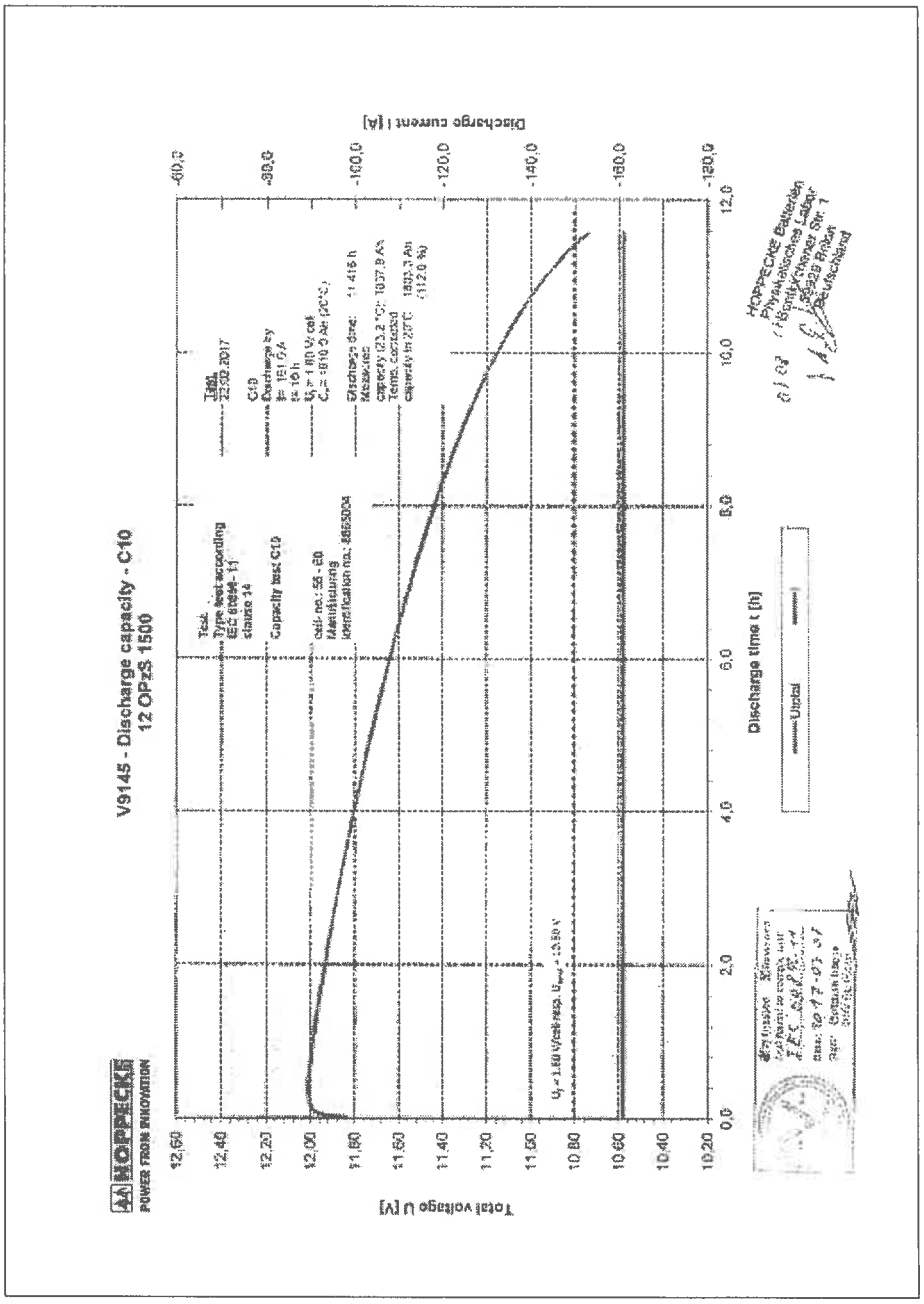
C_1

Type: 12 OPzS 1500

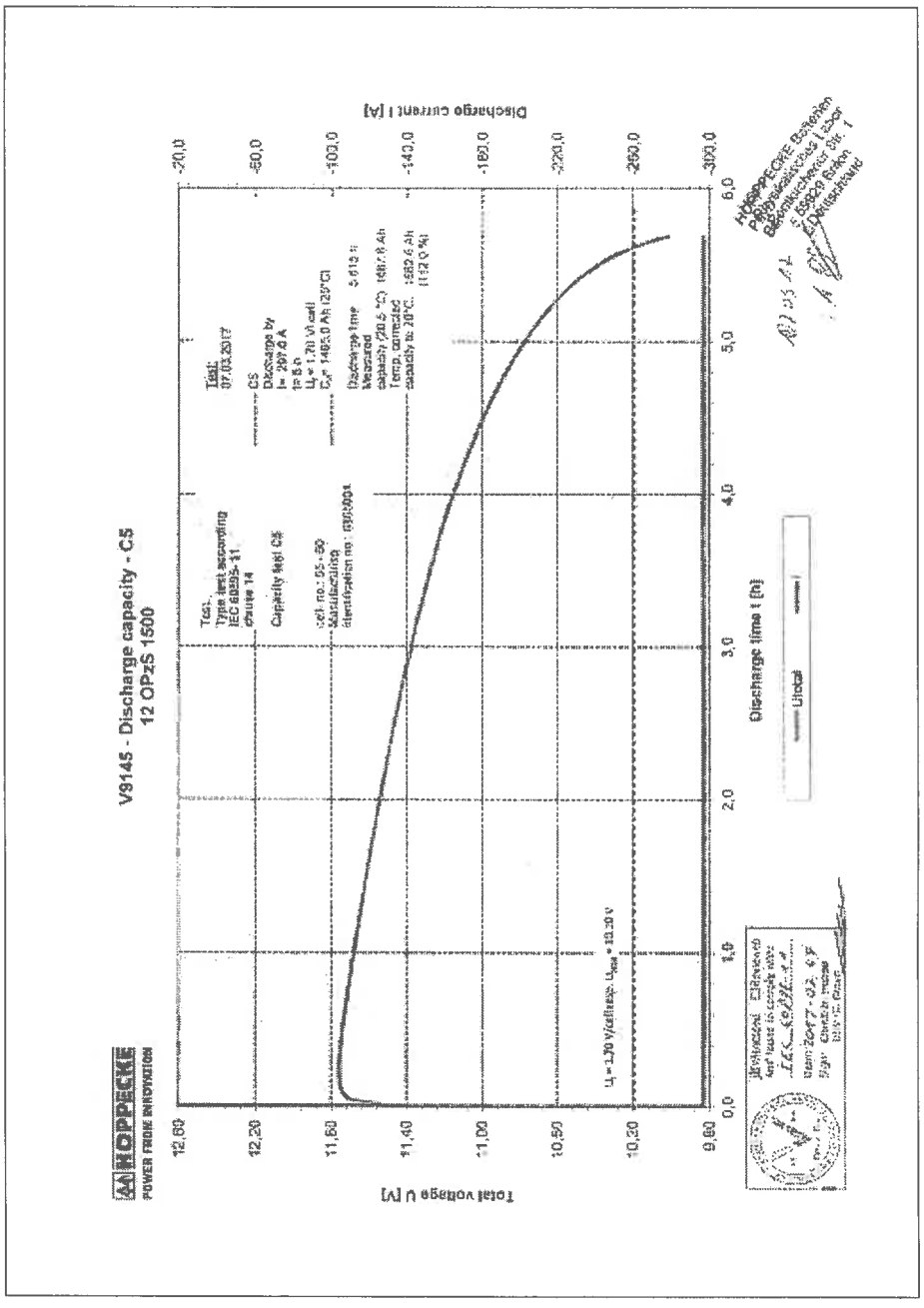
Date	07.04.2017		
Batt.	12		
Temperature	T [°C]	22.8	Signed document
Discharge current	I [A]	829.5	
Cut off voltage	U [V/cell]	1.60	
Nominal capacity (20°C)	C_{Nenn} [Ah]	829.5	Page 38
Measured capacity (20.0°C)	C [Ah]	**1137.5**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**137.1**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

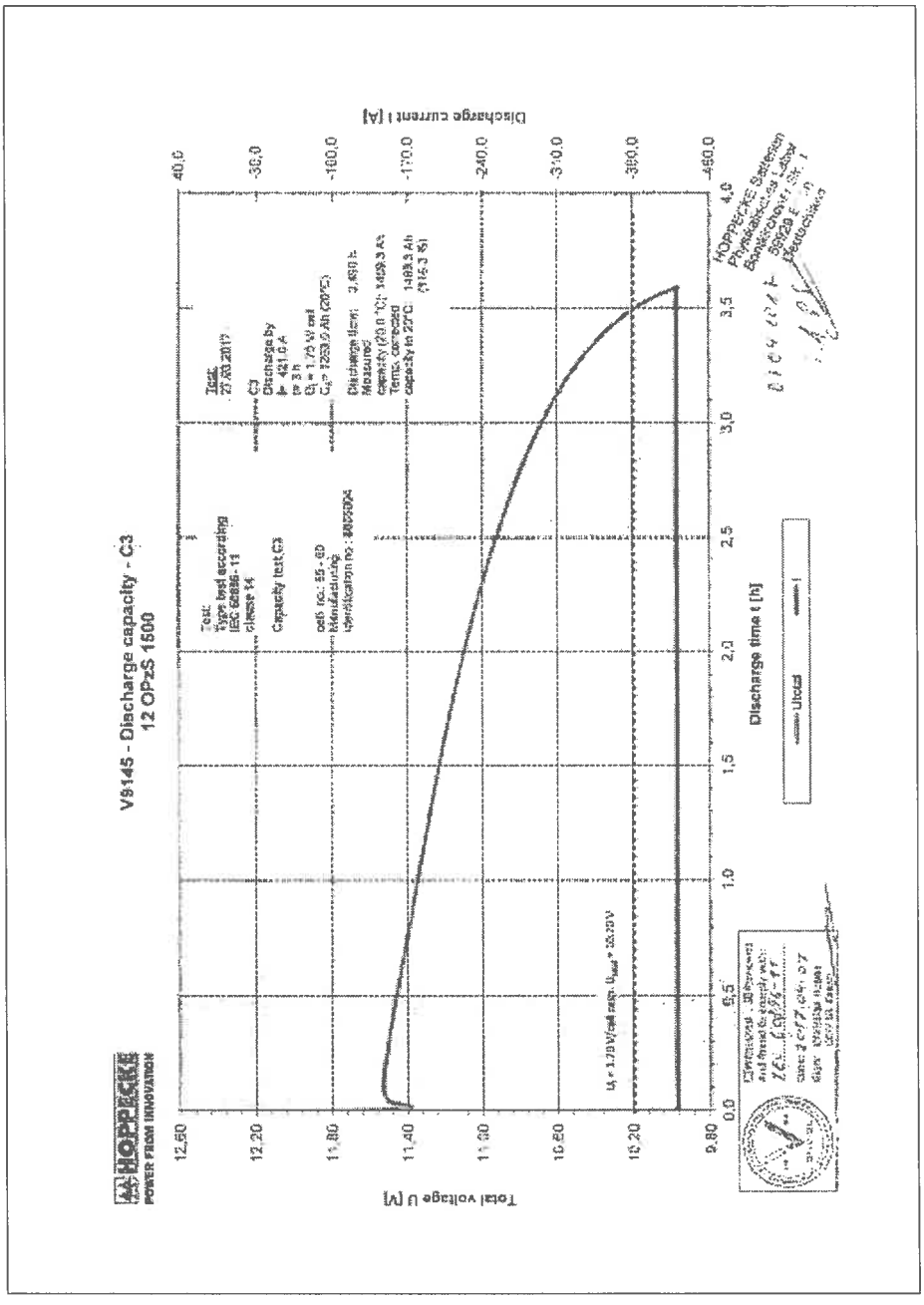
Test Report Physical Test Laboratory



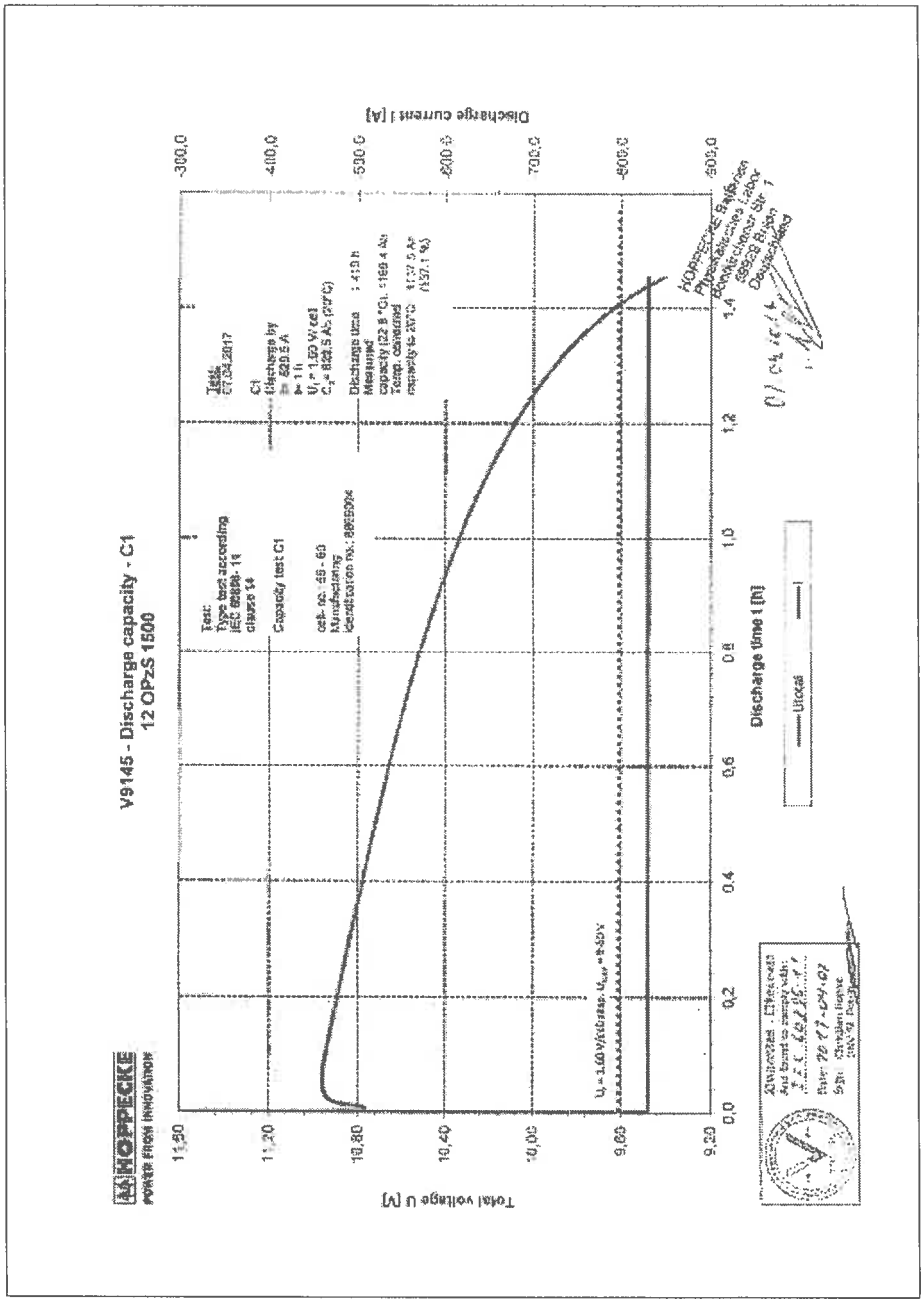
Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



Test of suitability for floating battery operation – 60896 – 11 clause 15

Capacity Test - C_{10} before float voltage

Date	22.02.2017		Signed document Page 42
Batt.	6		
Temperature	T [°C]	22.3	
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	
Measured capacity (20.0°C)	C [Ah]	**581.6**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**106.5**	
$C_{a25\_20.0°C}$ / C_{Nom}	[%]	**106.1**	
$C_{a26\_20.0°C}$ / C_{Nom}	[%]	**106.5**	
$C_{a27\_20.0°C}$ / C_{Nom}	[%]	**106.0**	
$C_{a28\_20.0°C}$ / C_{Nom}	[%]	**108.9**	
$C_{a29\_20.0°C}$ / C_{Nom}	[%]	**108.0**	
$C_{a30\_20.0°C}$ / C_{Nom}	[%]	**106.9**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory

Date of measurement	Cell-number	Temperature °C	Cell-voltage in V	Voltage-variation 2.23V	Electrolyte-density in g/cm³ (corr. to 20°C)	Density-variation 1.24g/cm³
07.03.2017	25	20.3	2.224	-0.006	1.244	+0.004
	26		2.227	-0.003	1.244	+0.004
	27		2.225	-0.005	1.244	+0.004
	28		2.233	+0.003	1.243	+0.003
	29		2.232	+0.002	1.242	+0.002
	30		2.227	-0.003	1.242	+0.002
After 3 months						
06.06.2017	25	20.9	2.224	-0.006	1.246	+0.006
	26		2.225	-0.005	1.246	+0.006
	27		2.226	-0.004	1.247	+0.007
	28		2.231	+0.001	1.245	+0.005
	29		2.231	+0.001	1.244	+0.004
	30		2.225	-0.005	1.244	+0.004
After 6 months						
04.09.2017	25	21.5	2.227	-0.003	1.247	+0.007
	26		2.228	-0.002	1.247	+0.007
	27		2.229	-0.001	1.248	+0.008
	28		2.232	+0.002	1.246	+0.006
	29		2.233	+0.003	1.245	+0.005
	30		2.226	-0.004	1.245	+0.005

Test was started with Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime) at 07.03.2017

Evaluation criterion: (for 3 and 6 months)
ΔU_{Cell} is within the range of -0.050 to +0.100 V
Δdensity is within the range of -0.010 to +0.010 g/cm³

Variation after 3 months:
ΔU_{Cell} = -0.006 to +0.001 V
Δdensity = 0.004 to +0.007 g/cm³

Variation after 6 months:
ΔU_{Cell} = -0.04 to +0.003 V
Δdensity = +0.005 to +0.008 g/cm³

The data meet the required criteria!

Water consumption in mm:

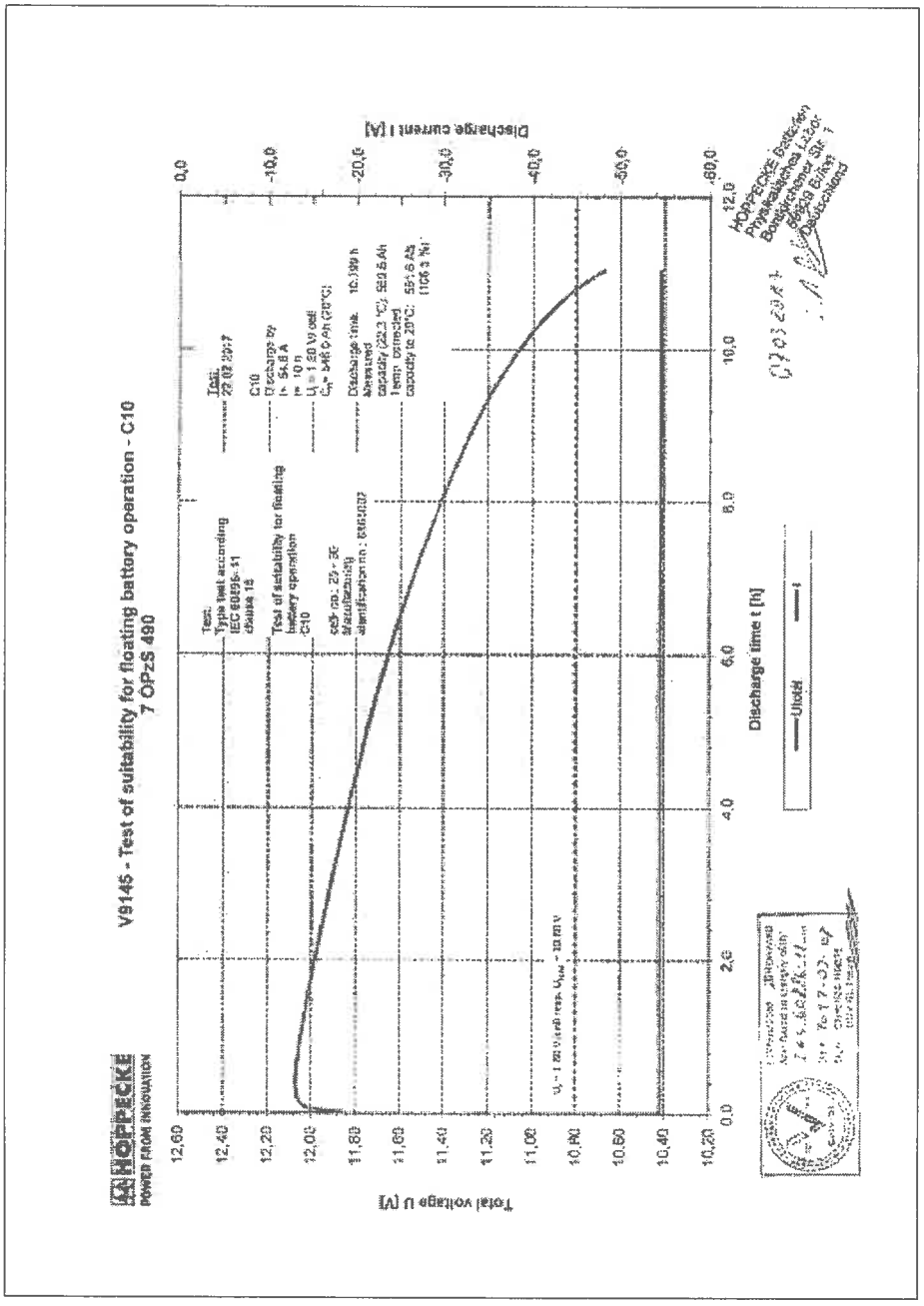
Cell	25	26	27	28	29	30
Test beginning	0	0	0	0	0	0
after 3 months	0	0	0	0	0	0
after 6 months	2	2	2	1	1	1

Capacity Test - C_{10} after float voltage

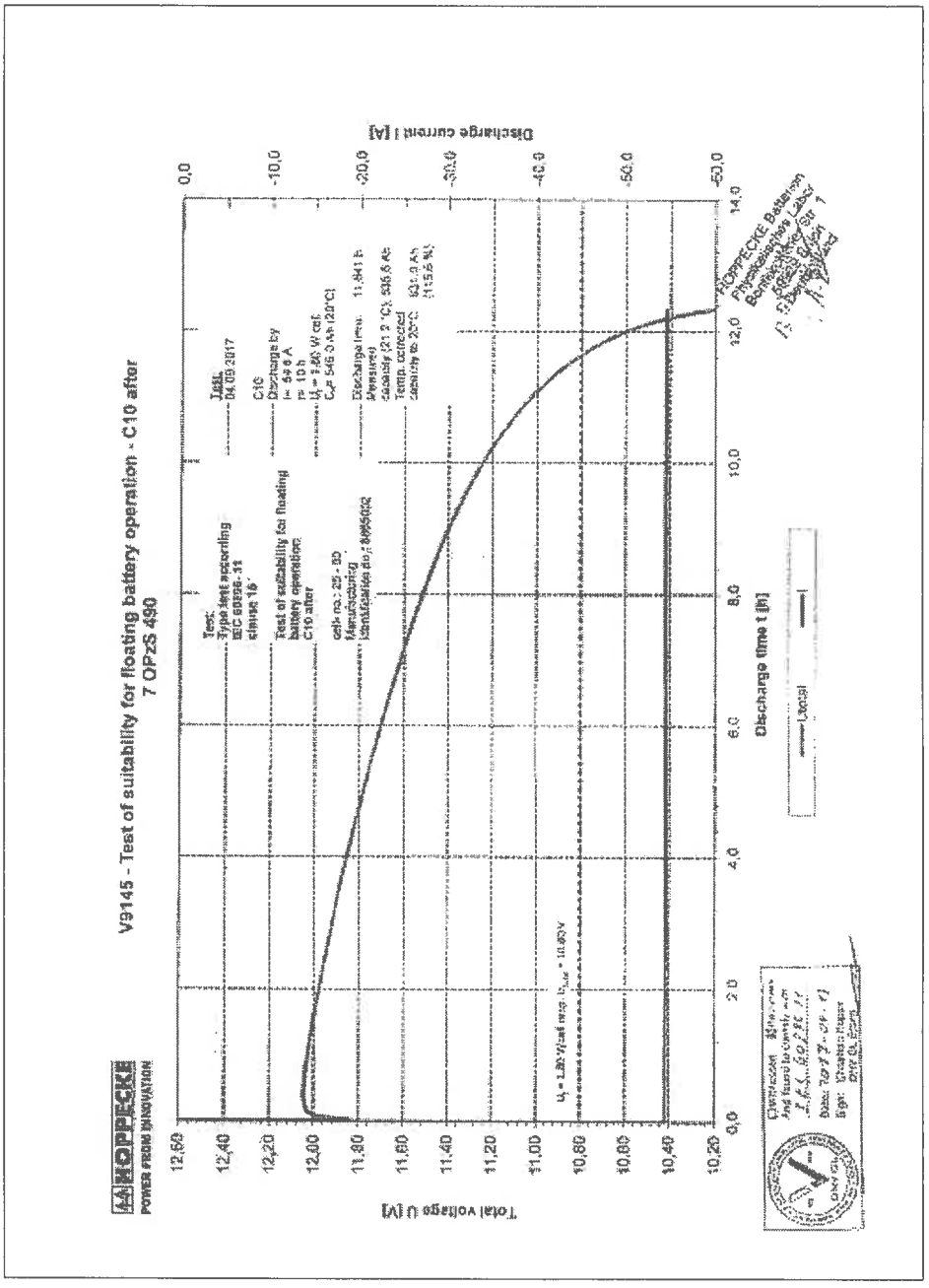
Date	04.09.2017		
Batt.	6		
Temperature	T [°C]	21.2	
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	
Measured capacity (20.0°C)	C [Ah]	**631.0**	Signed document
$C_{a20.0°C} / C_{Nom}$	[%]	**115.6**	
$C_{a25\_20.0°C} / C_{Nom}$	[%]	**115.7**	Page 43
$C_{a26\_20.0°C} / C_{Nom}$	[%]	**115.5**	
$C_{a27\_20.0°C} / C_{Nom}$	[%]	**115.8**	
$C_{a28\_20.0°C} / C_{Nom}$	[%]	**117.5**	
$C_{a29\_20.0°C} / C_{Nom}$	[%]	**116.5**	
$C_{a30\_20.0°C} / C_{Nom}$	[%]	**114.5**	

Test was revlewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory



Test Report Physical Test Laboratory



Endurance in discharge-charge cycles – 60896 - 11 clause 16

Capacity Test - C_{10} before discharge-charge cycles

Date	15.02.2017		
Batt.	3		
Temperature	T [°C]	21.5	Signed document
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	Page 45
Measured capacity (20.0°C)	C [Ah]	**583.4**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**106.9**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

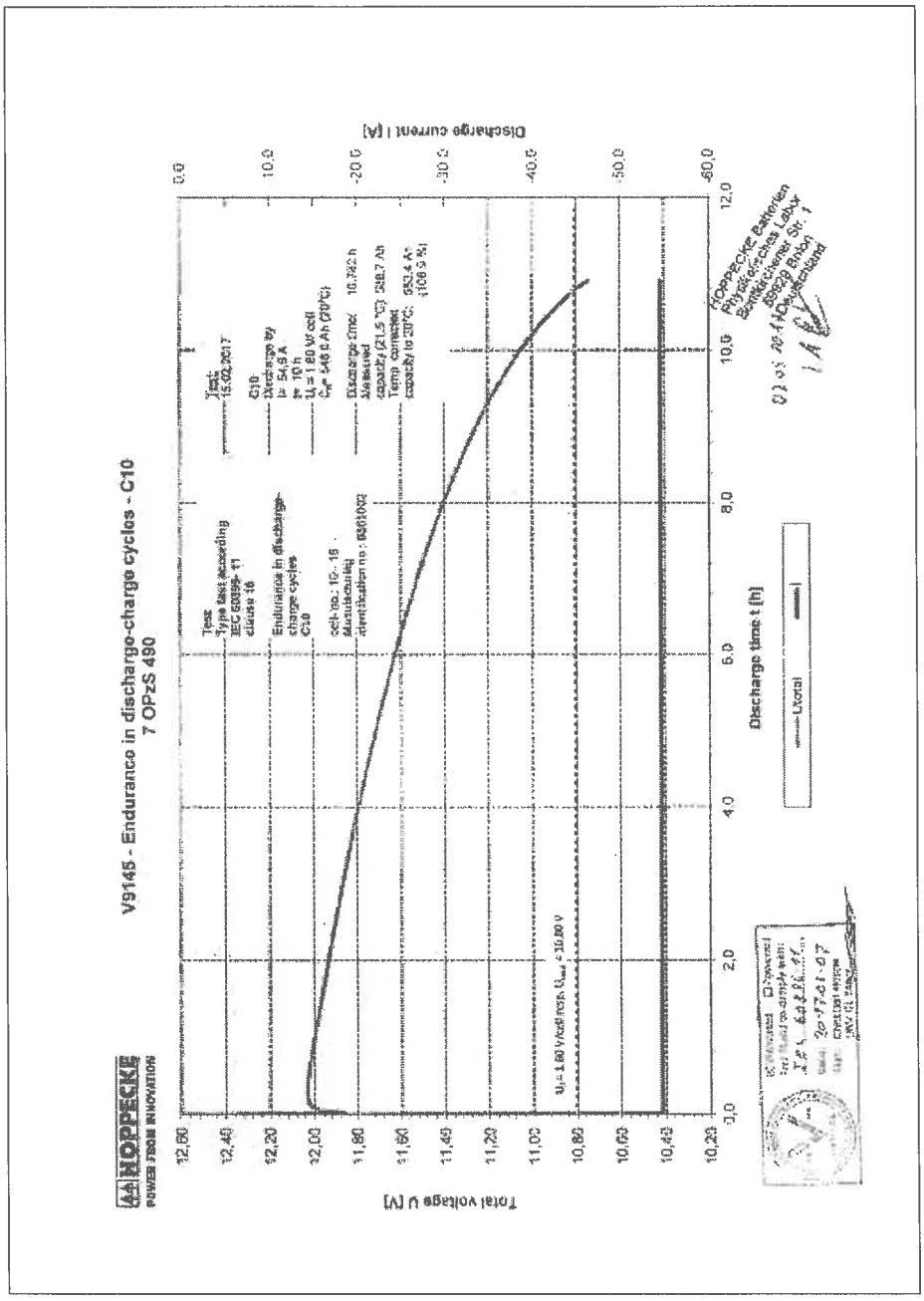
Test passed > 100 cycles

		Discharge capacity					cut of voltage of the measured 6 cells					
cycle no.	Date	Discharge Time t [h]	Measured capacity C [Ah]	Temp. T [°C]	Temp. corrected capacity to 20°C C [Ah]	Capacity [%]	U10 [V]	U11 [V]	U12 [V]	U13 [V]	U14 [V]	U15 [V]
0	15.02.2017	10,782	588,7	21,5	583,4	106,9	1,800	1,802	1,810	1,804	1,805	1,806
51	02.05.2017	10,691	583,7	24,0	570,0	104,4	1,803	1,807	1,812	1,803	1,803	1,802
102	27.06.2017	9,980	544,9	23,9	532,6	97,6	1,803	1,808	1,813	1,798	1,804	1,807
153	23.08.2017	9,766	533,2	22,8	524,4	96,0	1,799	1,808	1,810	1,806	1,804	1,808
204	16.10.2017	9,691	529,1	24,2	516,1	94,5	1,802	1,806	1,810	1,799	1,810	1,808
255	12.12.2017	9,016	492,3	19,2	494,6	90,6	1,796	1,808	1,816	1,813	1,798	1,803
306	06.02.2018	8,848	483,1	19,1	485,7	89,0	1,806	1,811	1,812	1,808	1,795	1,805
357	04.04.2018	9,349	510,5	22,3	503,5	92,2	1,801	1,801	1,807	1,802	1,814	1,807
408	12.06.2018	9,726	531,0	25,0	515,6	94,4	1,806	1,798	1,806	1,798	1,814	1,812
459	07.08.2018	9,374	511,8	21,0	508,8	93,2	1,797	1,794	1,805	1,808	1,816	1,818
510	02.10.2018	9,361	511,1	21,4	506,9	92,8	1,801	1,800	1,810	1,809	1,808	1,806
561	28.11.2018	9,118	497,9	22,3	491,1	89,9	1,812	1,802	1,816	1,802	1,805	1,802
612	24.01.2019	8,599	469,5	17,8	475,8	87,1	1,811	1,805	1,816	1,808	1,801	1,799
663	22.03.2019	9,108	497,3	23,3	487,6	89,3	1,804	1,803	1,814	1,803	1,805	1,807

Document Page 46

Test was started with Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime) at 07.03.2017

Test Report Physical Test Laboratory



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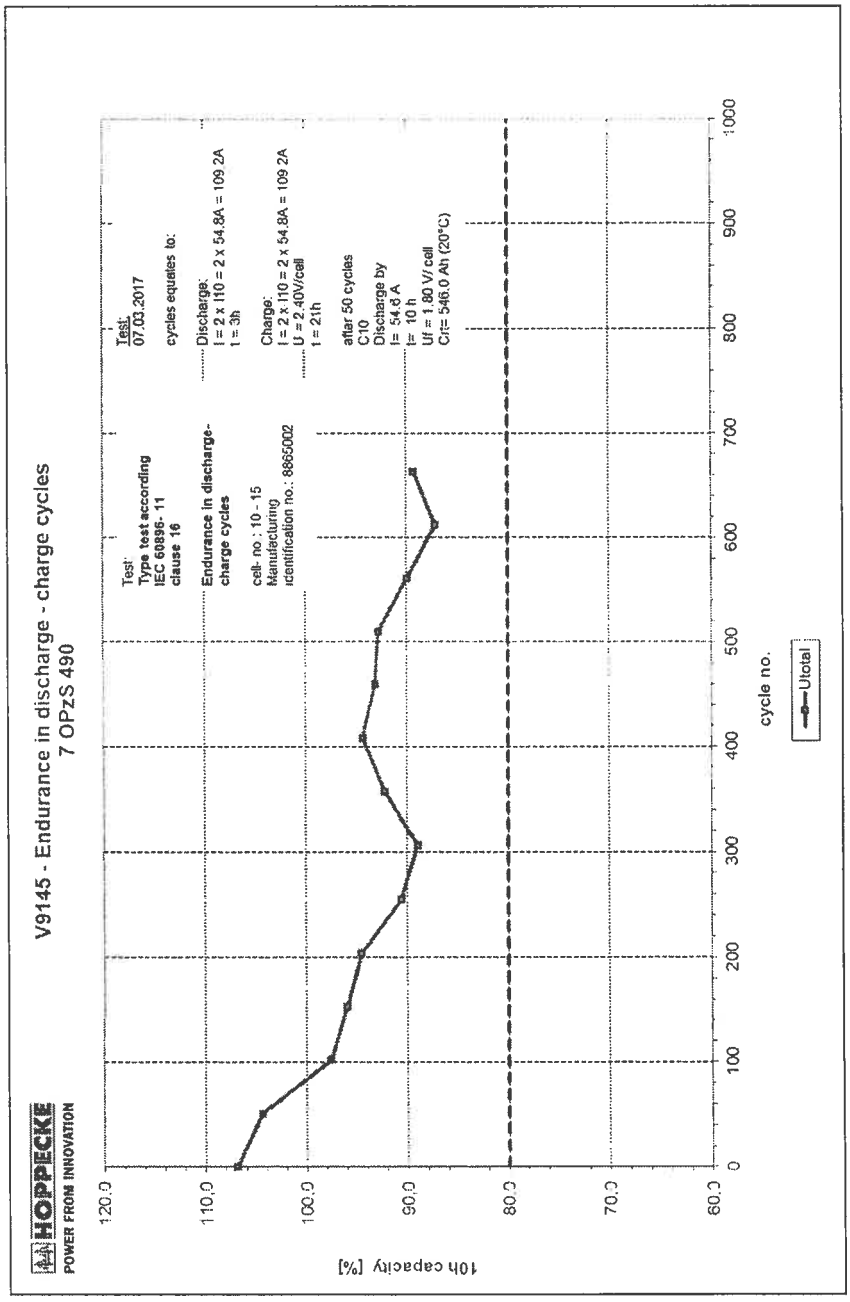

Endurance in overcharge – 60896 – 11 clause 17

Capacity Test - C_1 before Endurance in overcharge

Date	15.02.2017		Signed document Page 48
Batt.	7		
Temperature	T [°C]	21.0	
Discharge current	I [A]	308.0	
Cut off voltage	U [V/cell]	1.60	
Nominal capacity (20°C)	C_{Nenn} [Ah]	308.0	
Measured capacity (20.0°C)	C [Ah]	**347.5**	
$C_{a20.0°C}$ / C_{Nom}	[%]	**112.8**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

		Discharge capacity						cut of voltage of the measured 6 cells					
Test unit	Date	Discharge Time t [h]	Measured capacity C [Ah]	Temp. T [°C]	Temp. corrected capacity to 20°C C [Ah]	Capacity [%]	Ca/Crt	U31 [V]	U32 [V]	U33 [V]	U34 [V]	U35 [V]	U36 [V]
0	15.02.2017	1,139	350,9	21,0	347,5	112,8	1,128	1,573	1,635	1,650	1,582	1,581	1,659
1	10.04.2017	1,266	389,8	26,2	367,4	119,3	1,193	1,587	1,612	1,625	1,605	1,605	1,641
2	16.05.2017	1,260	388,1	25,5	367,8	119,4	1,194	1,605	1,604	1,620	1,599	1,607	1,640
3	20.06.2017	1,278	393,5	25,3	373,7	121,3	1,213	1,600	1,621	1,615	1,602	1,605	1,632
4	25.07.2017	1,278	393,6	25,7	372,4	120,9	1,209	1,610	1,620	1,623	1,604	1,600	1,631
5	29.08.2017	1,250	385,1	25,1	366,4	119,0	1,190	1,604	1,620	1,608	1,610	1,607	1,627
6	05.10.2017	1,224	377,1	24,2	361,9	117,5	1,175	1,614	1,618	1,611	1,612	1,611	1,625
7	07.11.2017	1,240	381,8	24,9	364,0	118,1	1,182	1,608	1,619	1,613	1,612	1,608	1,628
8	12.12.2017	1,224	377,4	24,9	359,8	116,8	1,168	1,600	1,608	1,593	1,599	1,598	1,618
9	17.01.2018	1,217	375,2	25,0	357,3	116,0	1,160	1,601	1,605	1,601	1,592	1,600	1,619
10	19.02.2018	1,224	377,1	25,3	358,1	116,3	1,163	1,584	1,606	1,598	1,597	1,604	1,629
11	27.03.2018	1,203	370,5	24,7	353,8	114,9	1,149	1,594	1,601	1,593	1,606	1,596	1,628
12	08.05.2018	1,176	362,1	25,0	344,8	112,0	1,120	1,593	1,574	1,581	1,623	1,612	1,635
13	12.06.2018	1,155	355,7	25,2	338,2	109,8	1,098	1,596	1,530	1,595	1,626	1,609	1,661
14	17.07.2018	1,072	330,2	25,0	314,5	102,1	1,021	1,619	1,432	1,638	1,639	1,604	1,689
15	20.08.2018	0,995	306,5	25,4	290,8	94,4	0,944	1,622	1,386	1,662	1,634	1,610	1,705
16	25.09.2018	0,846	260,7	24,2	250,2	81,2	0,812	1,628	1,474	1,704	1,618	1,537	1,727
17	30.10.2018	0,778	239,7	25,0	228,3	74,1	0,741	1,607	1,421	1,699	1,599	1,565	1,730
18	04.12.2018	0,695	214,1	24,7	204,5	66,4	0,664	1,604	1,476	1,709	1,600	1,564	1,724

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Test was started with Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime) at 07.03.2017

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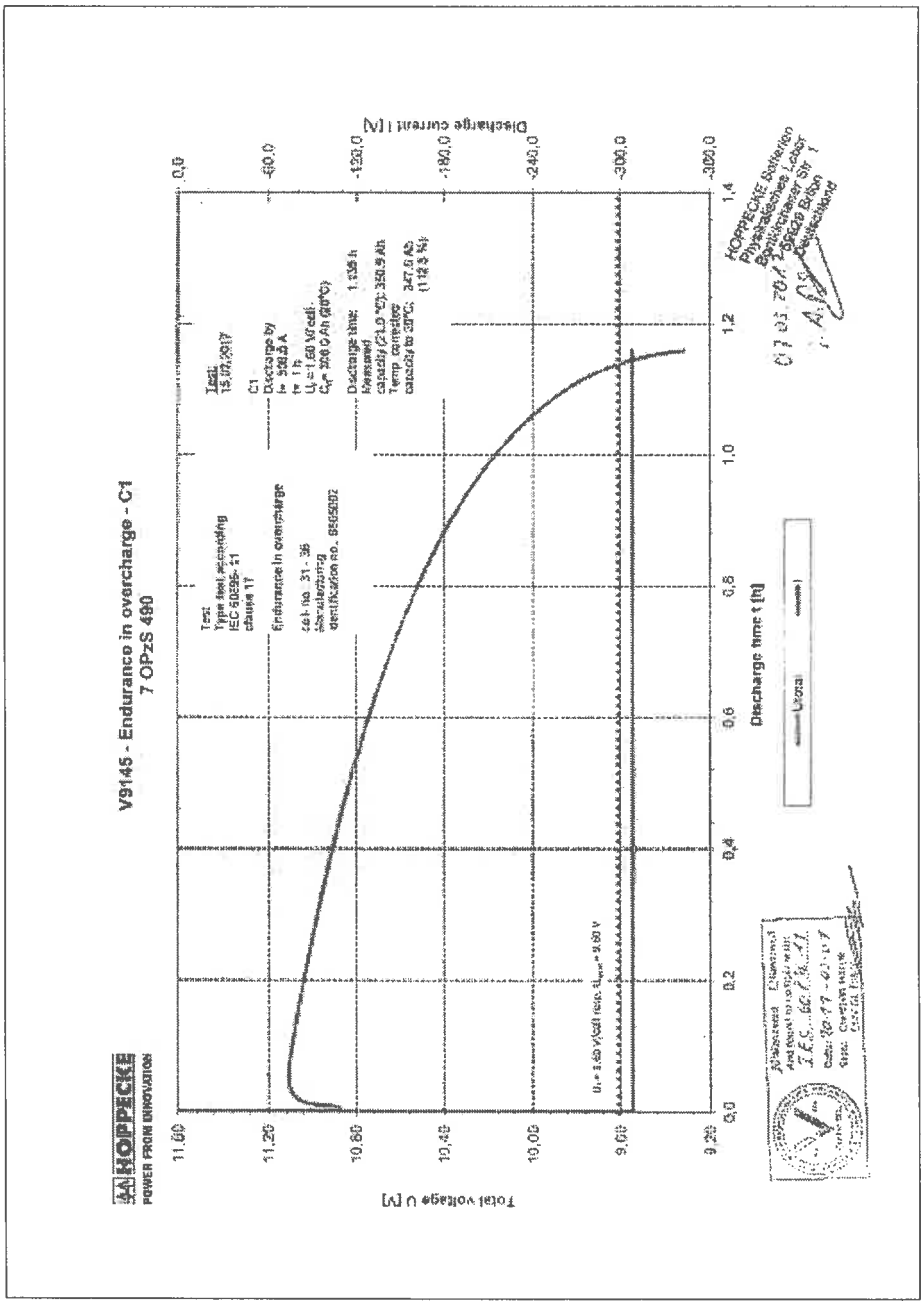

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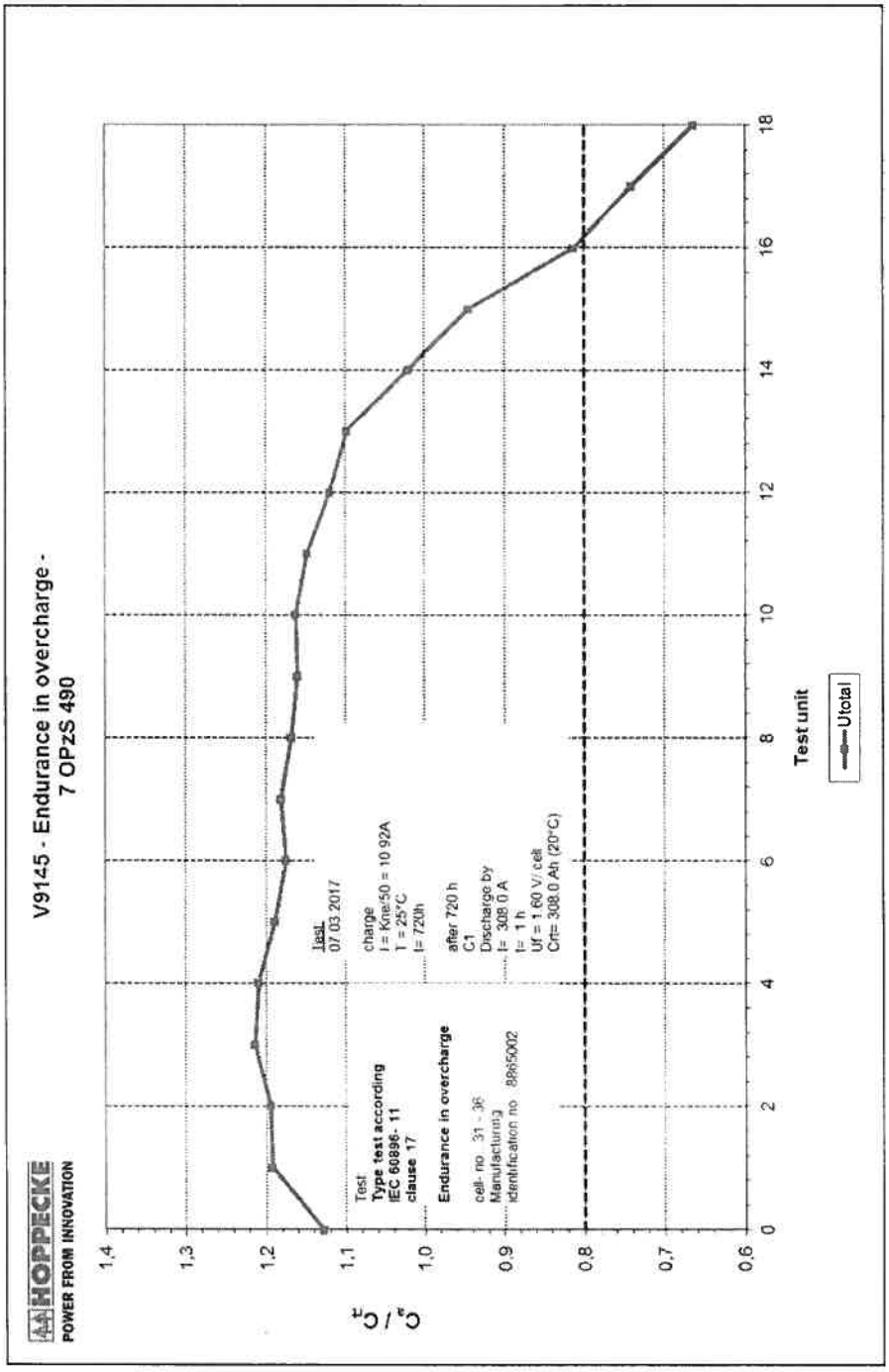


Charge retention test – 60896 - 11 clause 18

Capacity Test - C_{10} before Charge retention test

Date	07.03.2017		Signed document Page 52 + 53
Batt.	5		
Temperature	T [°C]	21.1	
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	
Measured capacity (20.0°C)	C [Ah]	**588.5**	
$C_{a20.0°C} / C_{Nom}$	[%]	**107.8**	
$C_{a19\_20.0°C} / C_{Nom}$	[%]	**107.9**	
$C_{a20\_20.0°C} / C_{Nom}$	[%]	**107.3**	
$C_{a21\_20.0°C} / C_{Nom}$	[%]	**108.3**	
$C_{a22\_20.0°C} / C_{Nom}$	[%]	**108.9**	
$C_{a23\_20.0°C} / C_{Nom}$	[%]	**109.1**	
$C_{a24\_20.0°C} / C_{Nom}$	[%]	**108.6**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Capacity Test - C_{10} after Charge retention test

Date	08.06.2017		Signed document Page 54 + 55
Batt.	5		
Temperature	T [°C]	20.7	
Discharge current	I [A]	54.6	
Cut off voltage	U [V/cell]	1.80	
Nominal capacity (20°C)	C_{Nenn} [Ah]	546.0	
Measured capacity (20.0°C)	C [Ah]	**569.9**	
$C_{a'20.0°C} / C_{Nom}$	[%]	**104.4**	
$C_{a'19\_20.0°C} / C_{Nom}$	[%]	**104.0**	
$C_{a'20\_20.0°C} / C_{Nom}$	[%]	**104.9**	
$C_{a'21\_20.0°C} / C_{Nom}$	[%]	**104.8**	
$C_{a'22\_20.0°C} / C_{Nom}$	[%]	**104.1**	
$C_{a'23\_20.0°C} / C_{Nom}$	[%]	**104.3**	
$C_{a'24\_20.0°C} / C_{Nom}$	[%]	**105.5**	

Test was reviewed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Capacity loss: $C_R = \frac{C_a'}{C_a} \bullet 100\,\%$

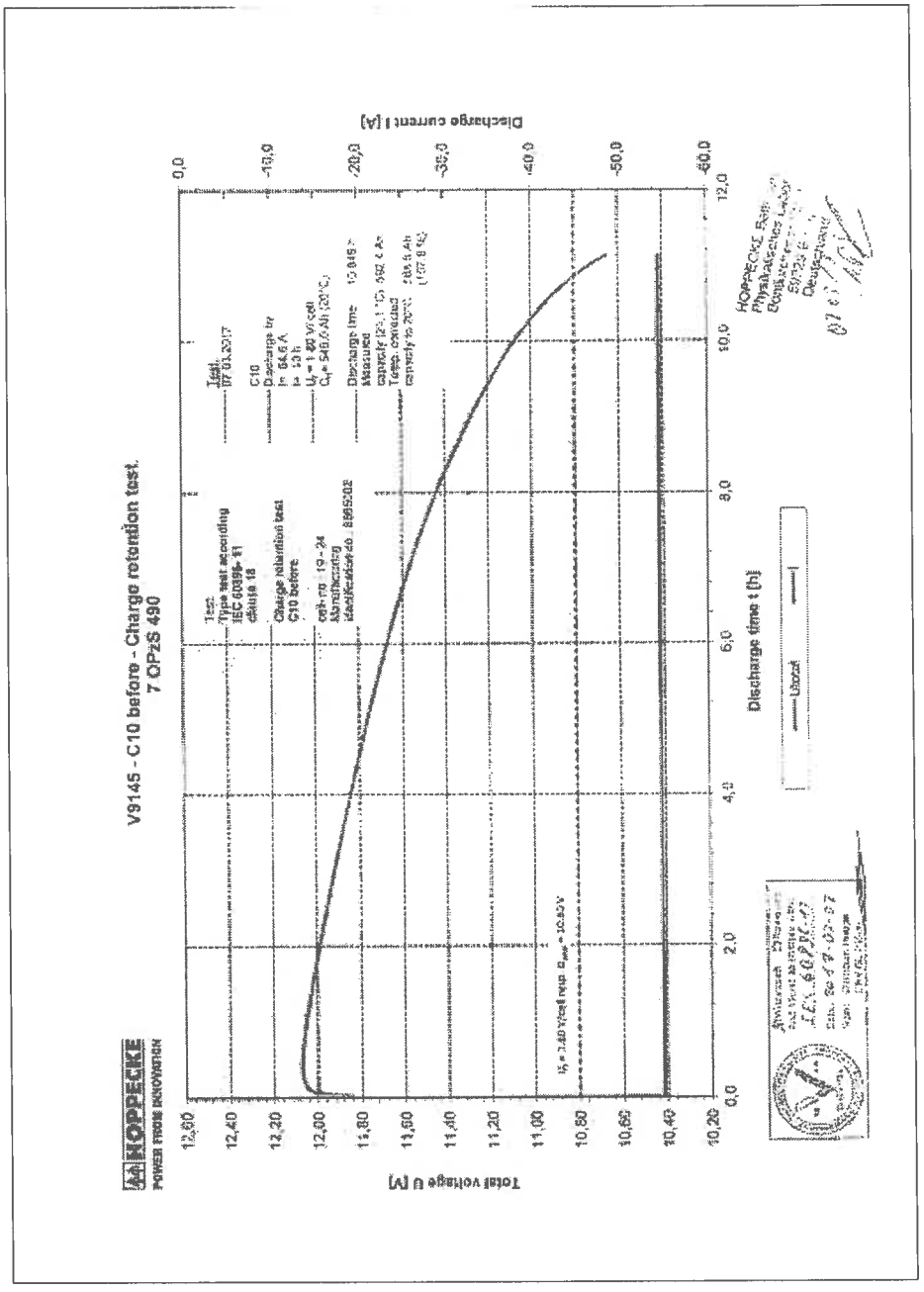
with C_a : 10 hour Initial capacity

with C_a': 10 hour capacity after 90 days self discharge

		U19	U20	U21	U22	U23	U24
C_a	[%]	107,9	107,3	108,3	108,9	109,1	108,6
$C_{a'}$	[%]	104,0	104,9	104,8	104,1	104,3	105,5
C_R	[%]	96,4	97,8	96,8	95,5	95,6	97,1

Thus results in an average capacity decrease of 1.2% per month.

Test Report Physical Test Laboratory



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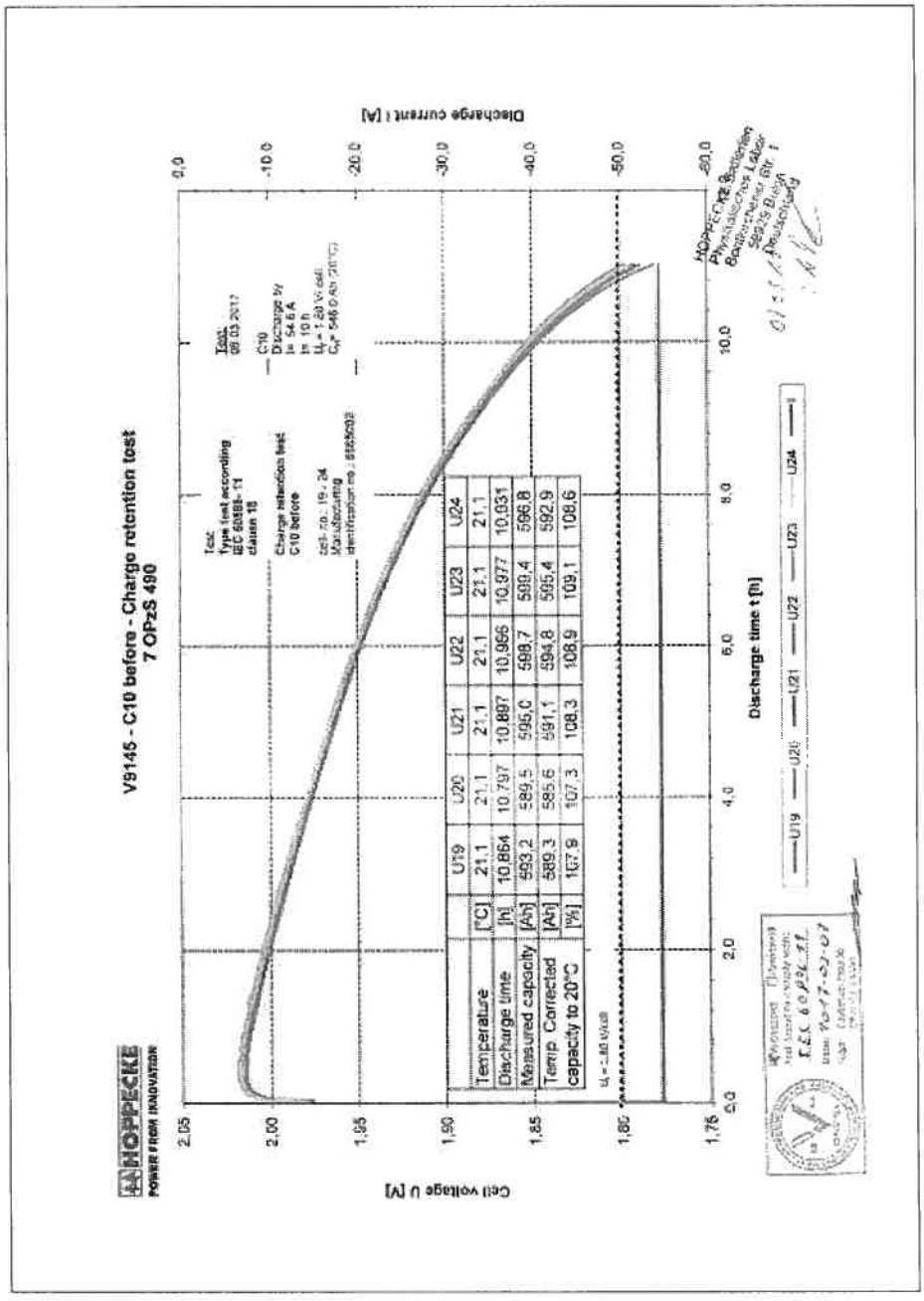

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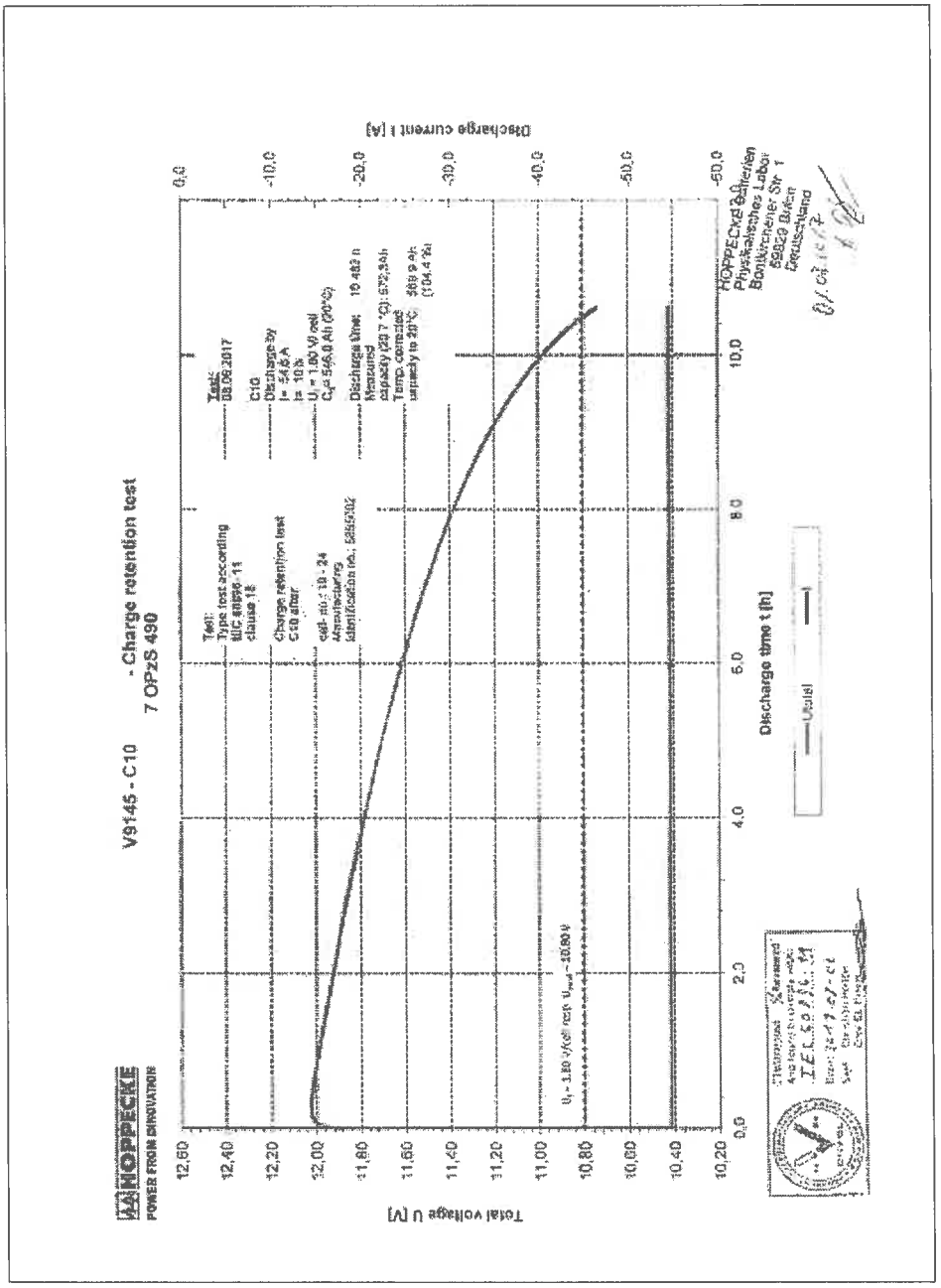

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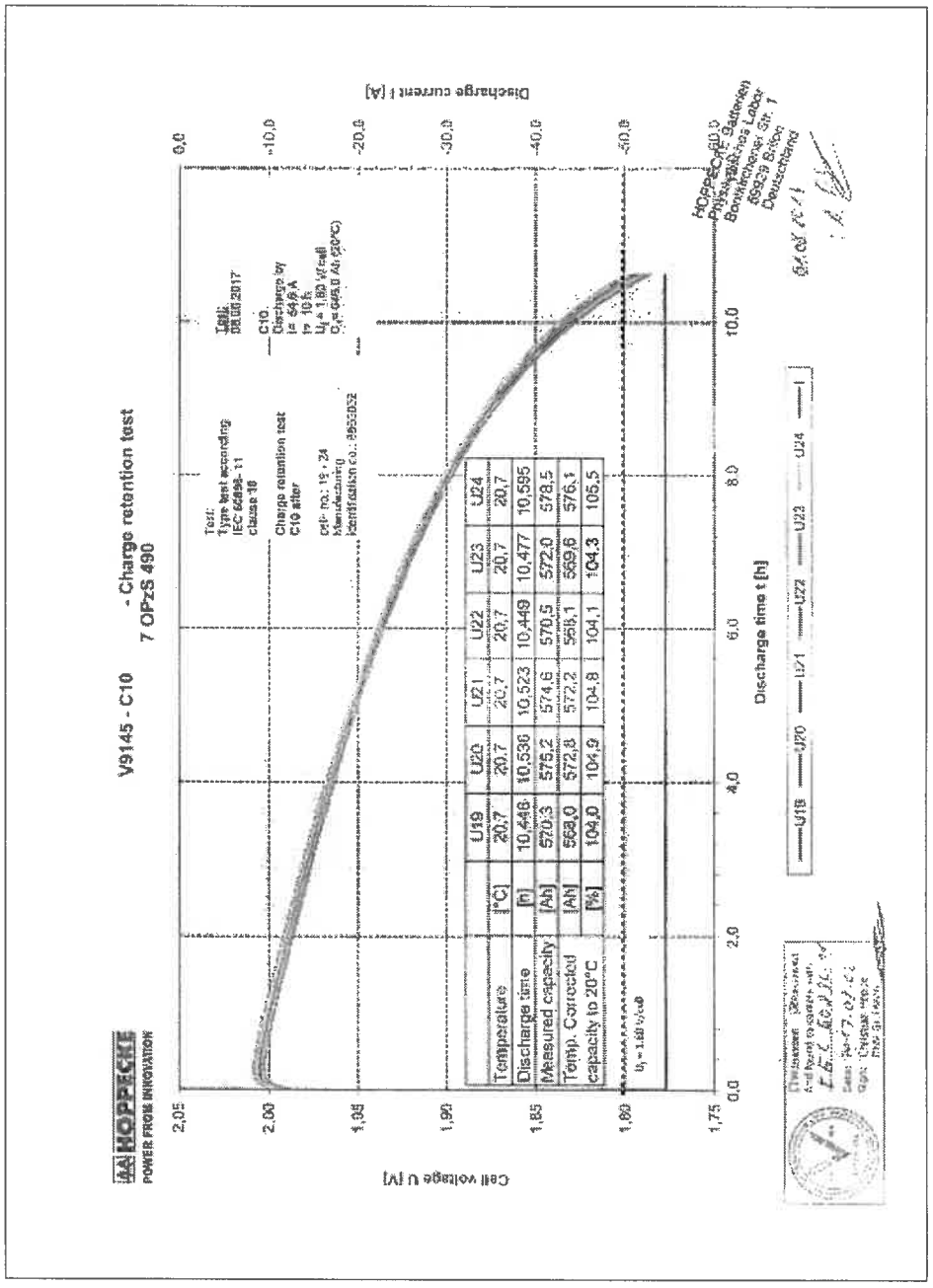


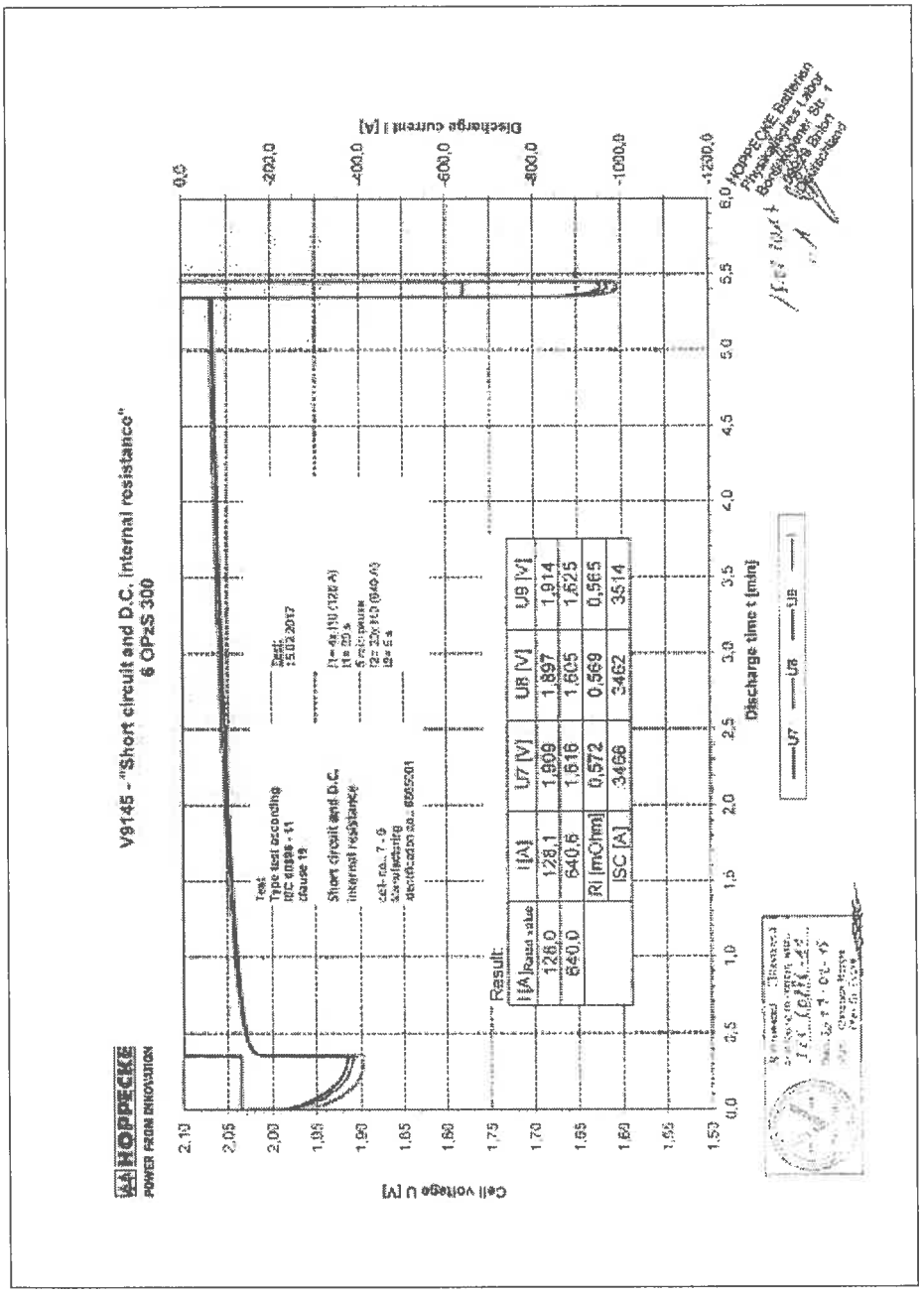
Short circuit and D.C. internal resistance – 60896 – 11 clause 19

Type: 6 OPzS 300

Short circuit current [I_{SC}] and internal resistance test [R_i]		
Date	15.02.2017	Signed document Page 57
Batt.	2	
Temperature [°C]	22.3	
Discharge current [A]	I_1= 4x I10 (128A) t_1= 20 s 5 min pause I_2= 20x I10 (640A) t_2= 5 s	
Ri [mOhm] ISC [A]	**0.569** **3480**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory



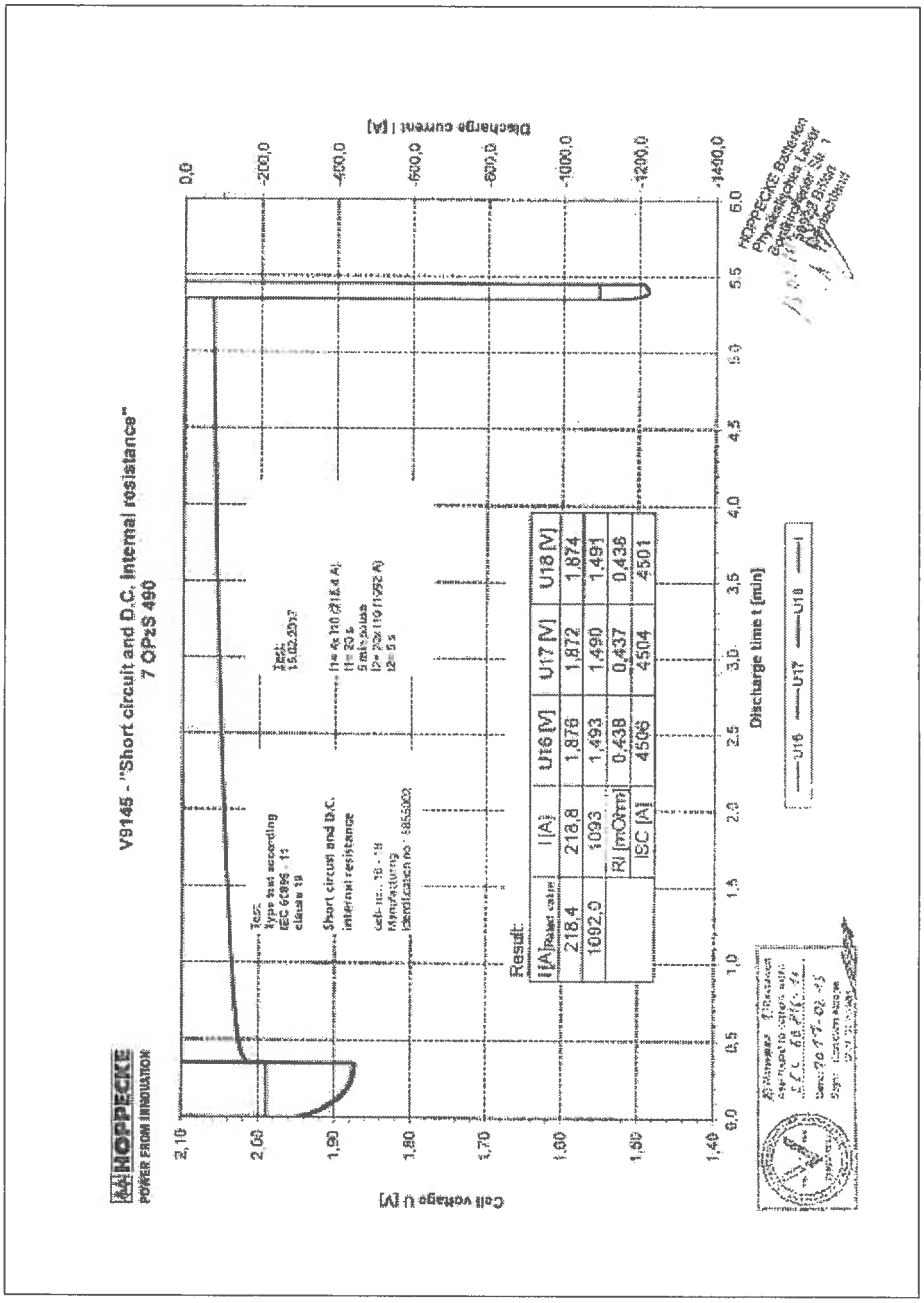
Test Report Physical Test Laboratory

Type: 7 OPzS 490

Short circuit current [I_{SC}] and internal resistance test [R_i]		Signed document Page 59
Date	15.02.2017	
Batt.	4	
Temperature [°C]	22.2	
Discharge current [A]	I_1= 4x I10 (218.4 A) t_1= 20 s 5 min pause I_2= 20x I10 (1092 A) t_2= 5 s	
Ri [mOhm]	**0.437**	
ISC [A]	**4504**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory



[A] Power cable	I [A]	U16 [V]	U17 [V]	U18 [V]
218,4	218,8	1,876	1,872	1,874
1092,0	1093	1,493	1,490	1,491
	Ri [mOhm]	0,438	0,437	0,438
	ISC [A]	4566	4504	4501

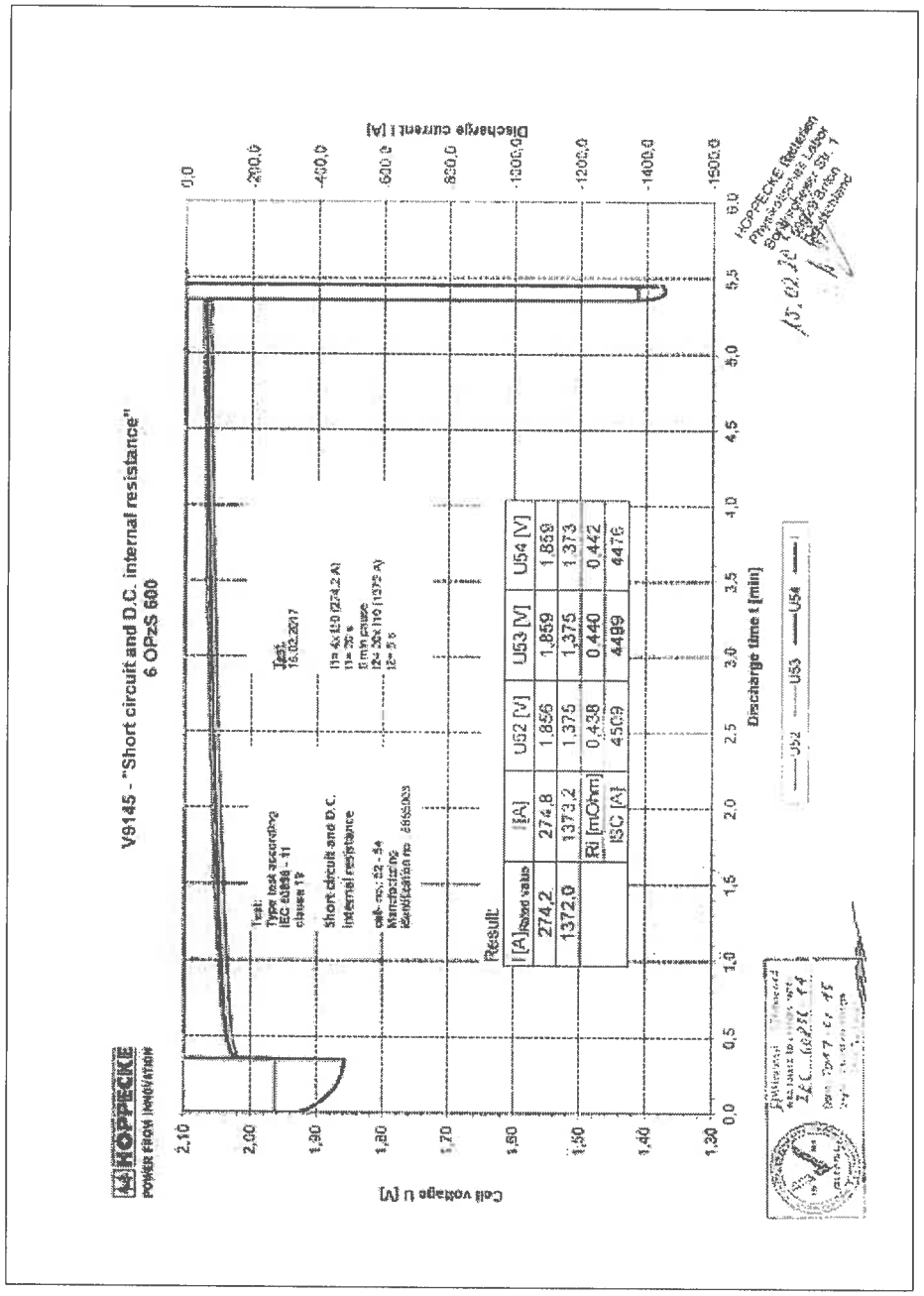
Test Report Physical Test Laboratory

Type: 6 OPzS 600

Short circuit current [I_{SC}] and internal resistance test [R_i]		
Date	15.02.2017	Signed document Page 61
Batt.	11	
Temperature [°C]	22.4	
Discharge current [A]	I_1= 4x I10 (274.2 A) t_1= 20 s 5 min pause I_2= 20x I10 (1372 A) t_2= 5 s	
Ri [mOhm]	**0.440**	
ISC [A]	**4495**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory



I [A] Rated value	I [A]	U2 [V]	U3 [V]	U4 [V]
274,2	274,8	1,856	1,859	1,859
1372,0	1373,2	1,375	1,375	1,373
	Ri [mOhm]	0,438	0,440	0,442
	ISC [A]	4509	4489	4476

Test Report Physical Test Laboratory

Type: 12 OPzS 1500

Short circuit current [I_{SC}] and internal resistance test [R_i]		Signed document Page 63
Date	07.04.2017	
Batt.	13	
Temperature [°C]	19.6	
Discharge current [A]	I_1= 4x I10 (644 A) t_1= 20 s 5 min pause I_2= 20x I10 (3220 A) t_2= 5 s	
Ri [mOhm]	**0.218**	
ISC [A]	**9072**	

Test was witnessed by Mr. C. Hoppe (Surveyor, Essen Operation, DNV GL Maritime)

Test Report Physical Test Laboratory