

Topic Battery Charger/ Design1

Designing rectifier transformer for battery charger 6Vdc, 40dc

Input parameters

Input	Voltage	120V, +-10%, 60Hz, sine wave
	Wire	Al, round, single insulated
Output	Nominal DC output voltage	6.3Vdc, via central tap, one phase rectifier with 2 diodes
	Nominal DC output current	40Adc, via central tap, one phase rectifier with 2 diodes
	Wire	Al, round, single insulated, wound bifilar
Core	Steel	M19, alternate stacking, not annealed
Bobbin	Type	Single section
Design	Insulation class	B, max. operating temperature 120C
	Criterion of design	16.6% regulation of the DC output voltage for battery charging between 2.45V/cell and 2.1V/cell
	Ambient temperature	40C

General rules

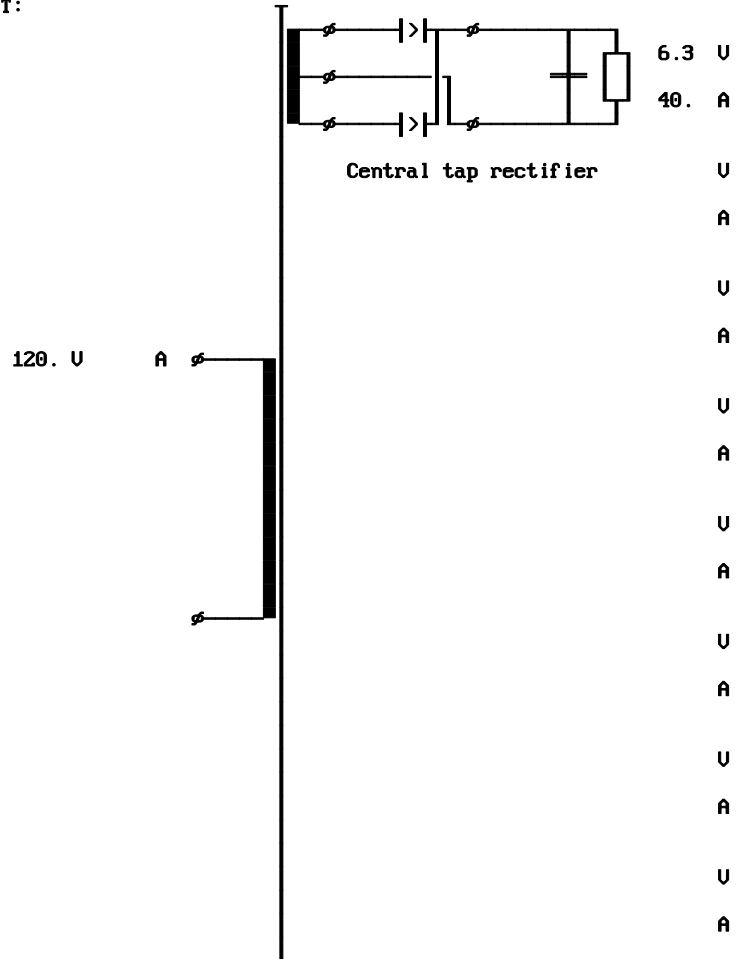
1. The cell voltage of an empty battery has amount of 2.1Vdc. If it is full then the voltage is between 2.35Vdc and 2.45Vdc per cell. The criterion of design has to be
Regulation:
 $Regulation = 100 \times (2.45 - 2.1) / 2.2 = 16.6\%$
2. Due to the fact that the allowed regulation is relatively low we have to use only single section bobbin.
3. The transformers with Al wires are bigger, cooler but cheaper.

#*0	DIAGNOSE	Page 0
Name	:1 X EI 150/(3_1/2) 8535-0	
Steel	-:M19 Gauge 24 / 0.0250"	
Number of Sections	-:1	
max.Cu-Fill Factor	%:83.1	
max. parallel Wires	:2	
Induction on Load	T:1.354	
Max. Induction	T:1.386	
Max.Cu-Temp.rise on load	°K:58.3	
Max.Cu-Temp.rise no-load	°K:18.6	
Regulation	%:5.9	
I [^] Inrush/I [^] nom-Factor	*:28.4	
Input Current No-Load	%:20.	

PRIMARY	U(U) I(A)	SECOND.	1---	2---	3---	4---	5---	6---	7---	8---
Circuit--:1	120.	Circuit--:23								
Overvlt*:1.00 .		Volta. U:6.3								
Wire :-0.0 .		Curre. A:40.								
I/L. mil:0. .		Wire :-0								
I/E. mil:10. .		I/L mil:0.0								
Formfac.:1.11 .		I/E mil:0.0								
Fre.Hz:60 .										
dI/Io :100 .										

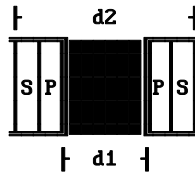
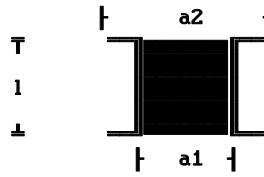
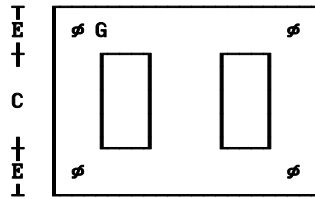
Regulat. %:-16.6	Steel --:22	Cooling *:1.00	Bobbin --:1
Udiode U:1.2	Induction T:1.35	Force ft/s:0.00	P/S-Order --:1
dUdiode U:.05	Remanence *:0.35	Bracket --:1	Rac/Rdc *:1.05
Ripple %:5.	W/kg *:1.00	Radiator --:0	Space *:0.90
Tmp. Amb. °C:40	UAr/kg *:1.00	Chassis --:1.00	Vertical --:1
Tmp.rise °K:75	Gap *:1.00	Channel in:0.00	Horizontal --:1
Time 1 Min:30.0	Annealed --:0	Cu-Surface*:1.00	Impregnat. --:2
Load 1 *:1.0	Stacking *:1.00	Rth-uarni.*:1.00	Spread %:0
Time 2 Min:30.0	Hole --:1	Rth-comp. *:1.00	Selection --:0
Load 2 *:1.0	Assembly --:1	Case --:0	Criterion --:0

CIRCUIT:



Name :1XEI 150/(3_1/2) 8535-0
 Steel :M19 Gauge 24 / 0.0250"

| F | B | A | B | F | | D |

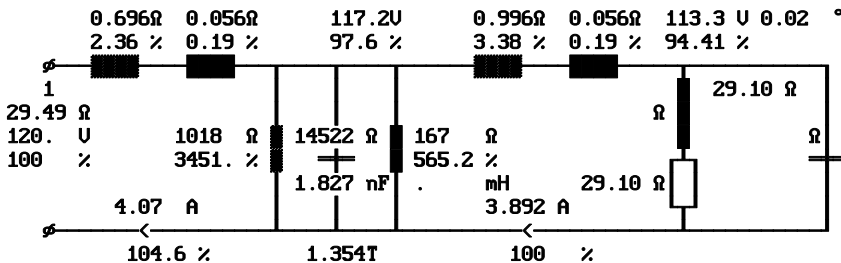


Weight /25.59
 lb:12.81
 Gap total in:0.000
 A-Limb in:1.50
 B-Width in:0.75
 C-Height in:2.25
 D-Stack in:3.50
 E-Yoke 1 in:0.75
 F-Yoke 2 in:0.75
 G-Hole in:0.233
 Radiator Fin :0
 Radiator Chan. :0
 a1 cm:1.64
 a2 cm:2.96
 d1 cm 3.63
 d2 cm 5.49
 l cm:2.12
 lp cm:
 ls cm:
 Margin cm:0.07

X- Length 1 in:
 Y- Width 1 in:
 Z- Height 1 in:
 x- Length 2 in:
 y- Width 2 in:
 z- Height 2 in:
 w- Thickness in:
 Material :
 Potted :

	Typ	Windun	MTI	DN	DN	Par	D/φ mil	B/φ mil	W/L	L	I/L mil	I/E mil	Weight lb	RWH %
1 2 3 4 5 6 7 8	1	99.	A00	15.5	15.5	1	53.9	53.9	36	2.7	.	10.	.241	27.
1 2 3 4 5 6 7 8	23	5.0 bifilar	A00	6.5	6.5	2	153.	153.	12	1.6	.	.	.456	54.
TOTAL													.698	83.

NOMINAL OPERATION at Temperature °C 98.1 and Overvoltage 1.00
 Output Power on Load W:252.5 Output Power of Transform. W:440.9
 Cu Losses W:26.63 Fe-Losses active W:13.49
 Short-Circuit-Volt. cold %:6.02 Regulation %:5.92
 Instantaneous pow. .5/958 W:1201. Efficiency of Transformer %:86.29
 dT Fe average Surface °K:47.9 dT primary °K:57.9
 dT Case aver. Surface °K:. dT secondary °K:58.4



DUTY CYCLE OPERATION at Amb. Temperature °C 40. and Overvoltage 1.00
 dT Fe average Surface °K:47.9 dT primary °K:57.9
 dT Gehäuse av. Surface °K:. dT secondary °K:58.3

NO LOAD OPERATION at Amb. Temperature °C 40. and Overvoltage 1.00
 Losses active W:13.05 Losses reactive UAr:96.77
 Current factor %:20. Induction T:1.386
 dT Fe average Surface °K:19.7 dT primary °K:18.6
 dT Gehäuse av. Surface °K:. Rezonance frequency kHz:5.6

SHORT-CIRCUIT OPERATION at Amb. Temperature °C 40. and Overvoltage 1.00
 Losses active W:8096. Losses reactive UAr:519.5
 Current factor cold %:1661. Induction T:956
 dT Fe average Surface °K:1110. dT primary °K:1527.
 dT Gehäuse av. Surface °K:. dT secondary °K:1543.

PRIMARY (Tap:1) 1---- 2---- 3---- 4---- 5---- 6---- 7---- 8----

Voltage Input/Output U:120.
 Out. Voltage no load U:
 Current Input/Output A:4.07
 Load on output Ω:
 Power factor of load :
 Current in segment A:4.07
 Current density A/in²:1783.
 Icc-Current cold A:67.61
 Io -Current A:0.814
 Inrush Current peak ^A:163.0
 Inrush Current rms A:70.63
 Cu-Losses W:11.5
 Resistance cold Ω:.5306
 Reactance Ω:.0561
 Eddy-Current Factor :1.

SECONDARY 1---- 2---- 3---- 4---- 5---- 6---- 7---- 8----

Output Voltage U:6.28
 Output Current A:40.23
 Out. Voltage no load U:7.34
 Sec. Voltage U:5.72
 Sec. Current A:77.06
 Current density A/in²:2090.
 Sec. Voltage cold U:5.8
 Load on output Ω:.073
 Power factor of load :1.000
 Icc cold A:1335.
 Cu-Losses warm W:15.09
 Resistance cold Ω:.0019
 Reactance Ω:.0001
 Eddy-Current Factor :1.01
 Capacitor mF:349.2