Electrical Team

Power Management Systems Team

Precharge Circuit - Power Resistor

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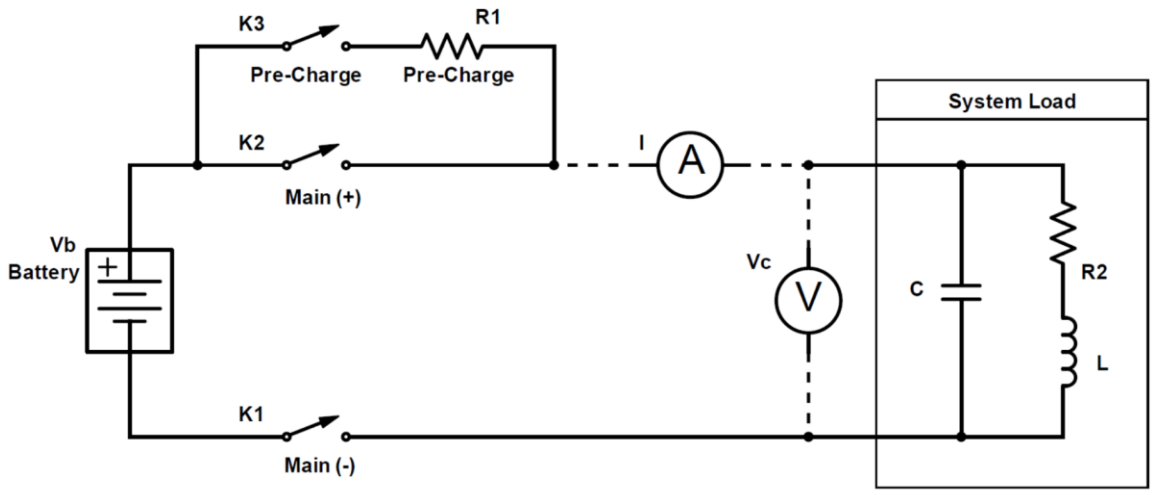


Figure 1: The above shows a simple diagram of the precharge circuit

Importance:

The motor controller which can be shown as the "system load" in Figure one stores capacitance after the car is turned off. It will internally discharge the capacitance, however, this will take a long time. We need to create an external discharge circuit to quickly discharge the capacitance in the motor controller once we turn the car off.

The purpose of the precharge circuit is to ensure we don't weld the contactors together when turning on the power.

Key Properties:

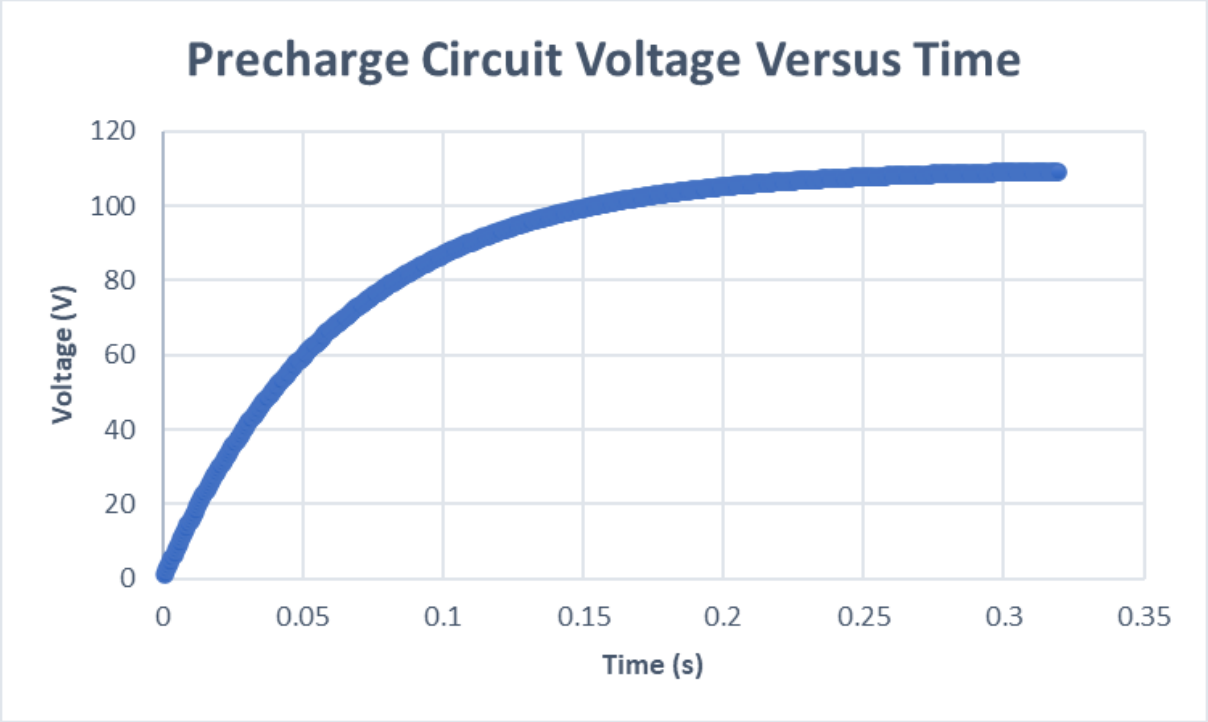
Mitsuba motor controller has a capacitance of: **3200 uF**

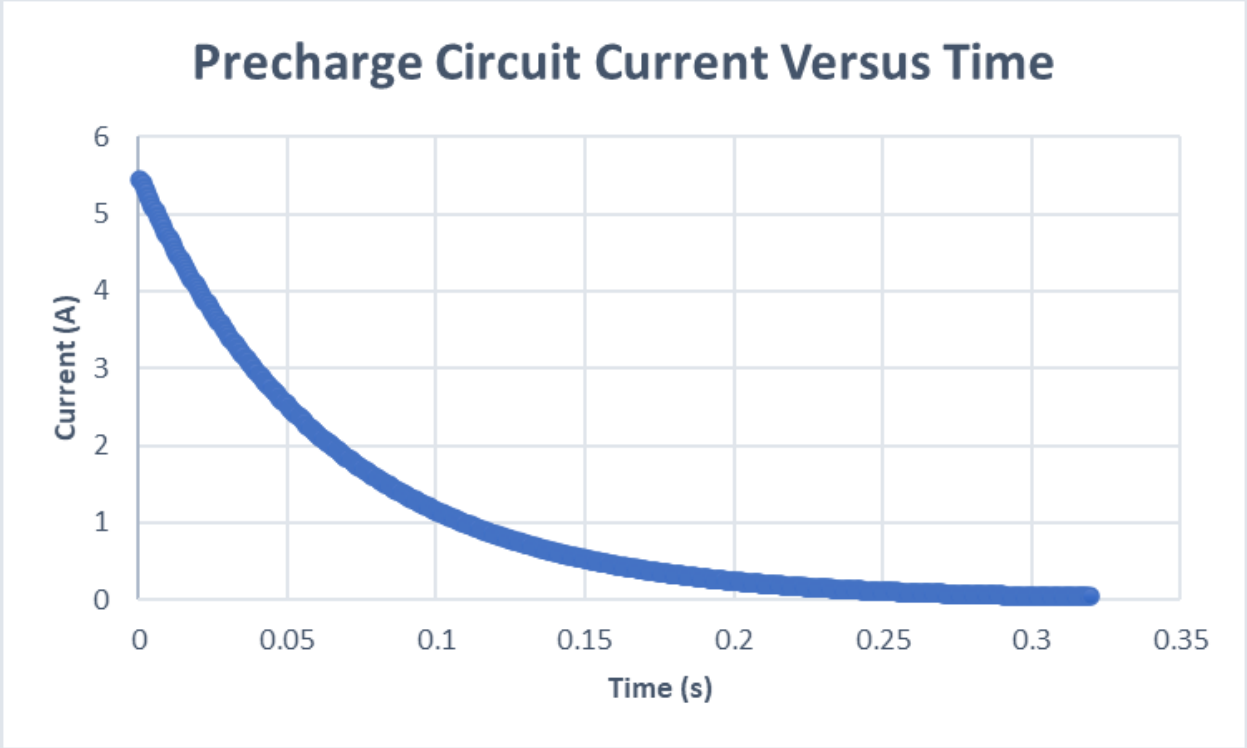
Time to reach full voltage is: **0.32 s**

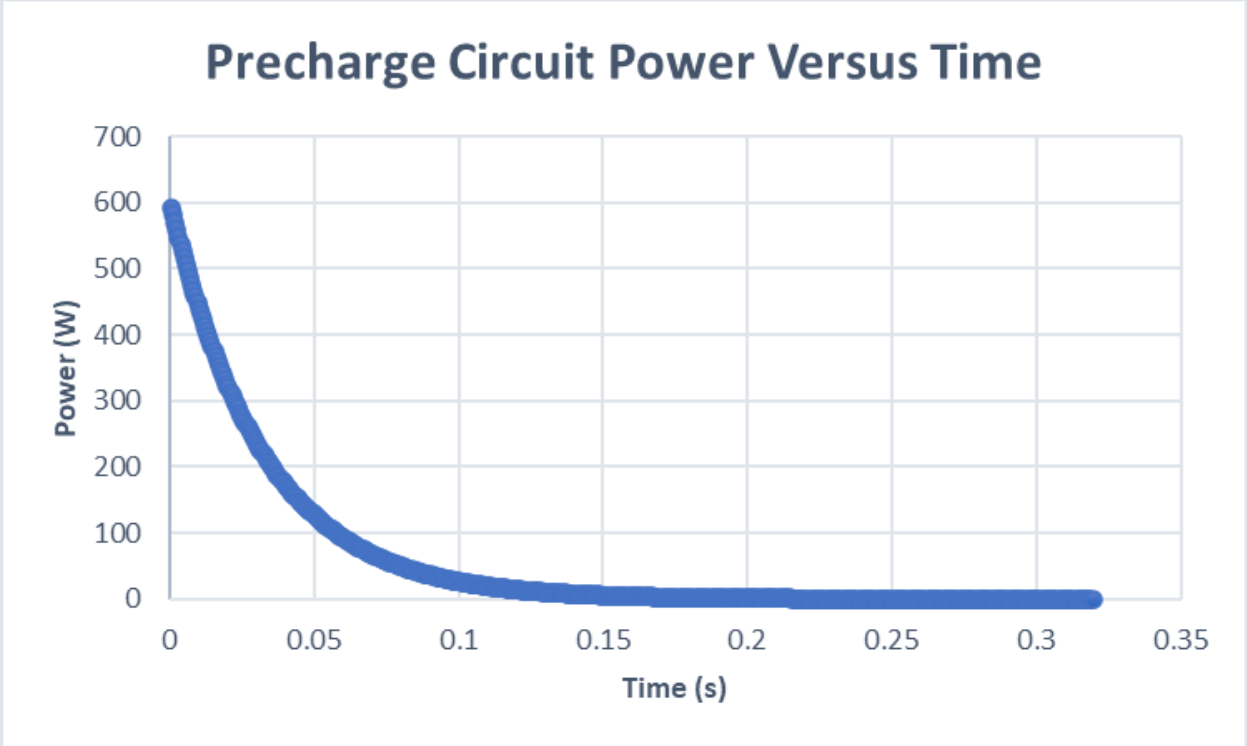
Battery Voltage: **110V**

Results

Resistance	20Ω
Time Constant	0.064 sec
Actual Pre-charge time	0.32 sec
Pre-Charge inrush current	5.500A
Energy Dissipated by Pre-Charge Resistor	19.359J
Average Power	60.494W
Peak Power	604.970W
Voltage Delta Remaining after Pre-Charge	0.741V




Precharge Circuit Current Versus Time
Current (A)
0
1
2
3
4
5
6
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Time (s)


Precharge Circuit Power Versus Time
Power (W)
0
100
200
300
400
500
600
700
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Time (s)

Chosen Resistor:

ARF600 20R J

Digi-Key Part Number	ARF60020RJ-ND
Manufacturer	**Ohmite**
Manufacturer Product Number	ARF600 20R J
Description	RES CHAS MNT 20 OHM 5% 600W
Manufacturer Standard Lead Time	45 Weeks
Detailed Description	20 Ohms ±5% 600W Wirewound Chassis Mount Resistor

References

https://www.sensata.com/calculator/precharge