

## Senior Capstone Design

Project: **Hyster-Yale Battery Cooling**

Primary Author: **Beau Nuxoll**

Team: **Cool Charge**

Date: **12/5/2018**

### Design Validation Plan & Results (DVP&R)

Requirement	Tests	Test Subject	Target Date	Result	Recommendation
Remove 875 Watts of heat From each Battery Module under full load (5% heat generation)	Measure actual air velocity	Physical Prototype	2/4/19		
	Calculate total surface area exposed to air flow	Solidworks model	11/16/18		
	Calculate total heat loss from each battery with heat tranfer equations	Physical Prototype	12/4/18		
Cooling system must maintain a battery temperature of 55 degrees Celcius or below	Provide heat transfer calculations to client	Computational fluid dynamics Model	2/5/19		
Total width needs to be less than 651 mm	Dimension cooling system at maximum width	SolidWorks assembly with all parts mated in correct locations	3/29/19		
Total height needs to be less than 502 mm	Dimension cooling system from at maximum height	SolidWorks assembly with all parts mated in correct locations	3/29/19		
Total depth needs to be less than 272 mm	Dimension cooling system from mounting point to furthest point from battery	SolidWorks assembly with all parts mated in correct locations	3/29/19		
Create Computer aided drafting model of final design	present SolidWorks model of final design to client	SolidWorks model	12/7/18		
Create computational fluid dynamics model of final design	present CFD model to client	SolidWorks model or other CFD software model	3/29/19		
Build proof of concept prototype	Present prototype to client	Physical Prototype	3/29/19		
cooling system must run on a 12 Volts DC power supply	Provide cooling system secifications showing operating voltage of 12 Volts DC	Physical Prototype	3/29/19		
The system must draw no more than 15 amps	Provide cooling system secifications and a calculation for maximum current draw	Physical Prototype	3/29/19		

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The system must use no more than 180 watts	Provide cooling system secifications and a calculation for maximum operating wattage	Physical Prototype	3/29/19		