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Abbreviations

AIR – Accumulator Insulation Relay
BMS- Battery Management System
GLV – Grounded Low Voltage
HV – High Voltage
RTDS – Ready to Drive Sound
TS – Tractive System
TSAL – Tractive System Active Light

1 System Overview

Complete the information in the table below.

Maximum Tractive System Voltage:	54.6V
Nominal Tractive System Voltage:	48V
Grounded Low Voltage System Voltage:	12V
Number of Accumulator Containers:	1
Total Accumulator Capacity:	110Ah
Motor Type:	BLDC
Number of Motors:	1
Maximum Combined Motor Power:	4.5kW

Table 1-1 - High Level Specifications

Insert a system overview block diagram showing major electrical components and system interactions

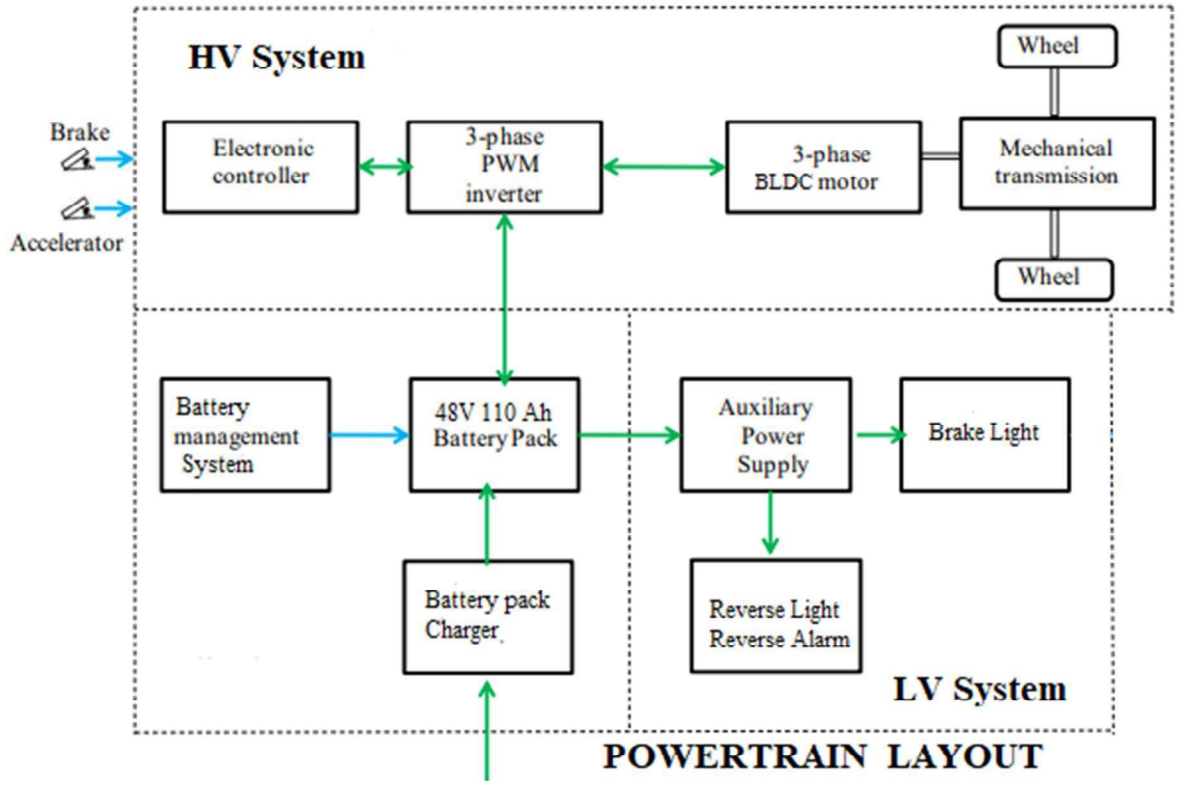

Figure 1-1 - System Block Diagram

2 Tractive System Schematics

2.1 Tractive System Schematic (Power Electronics ONLY)

Provide any CAD drawing with Colour Code. Mark the parts in the drawing, if necessary.

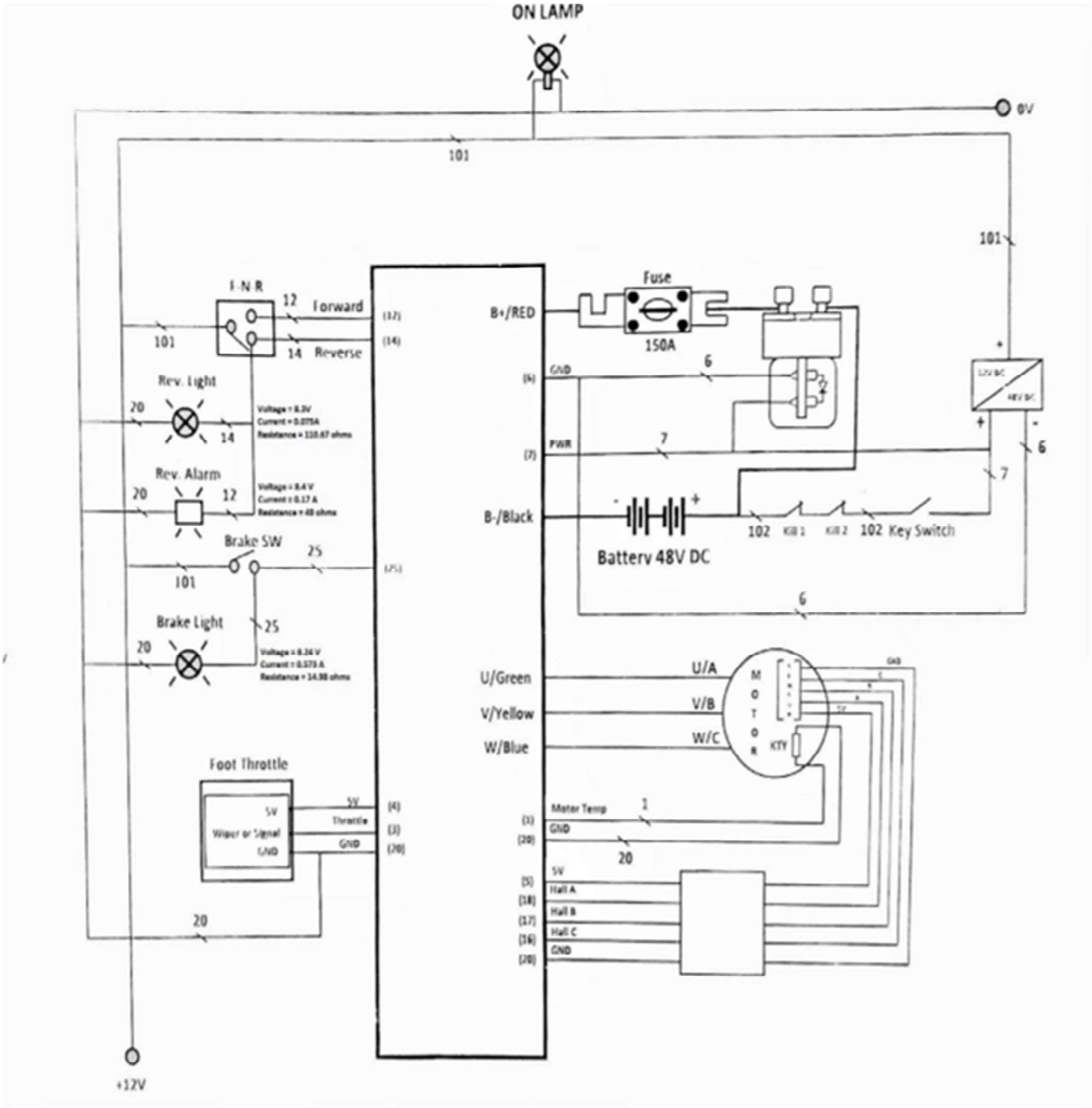

Figure 2-1 - HV System Schematic

3 Accumulator

3.1 Cells

Complete the information in the table below.

Cell Make / Model / Style:	Panasonic NCR-18650B
Cell nominal capacity:	2600mAh
Maximum Voltage:	4.2V
Nominal Voltage:	3.7V
Minimum Voltage:	2.5V
Maximum output current:	8.25A
Maximum continuous output current:	2.75A
Maximum charging current:	1625mA
Maximum Cell Temperature (discharging)	60^0C
Maximum Cell Temperature (charging)	45^0C
Cell chemistry:	Li-ion NMC

Table 3-1 - Cell Specifications

3.2 BMS

Complete the information in the table below.

	Detail	**Spec**
Discharge	Maximal Continuous Discharging Current	60A
	Peak Discharging Current	180A
	Over Current Protection Current	180A
Charge	Charging Voltage	55V
	Charging Current	24A
Over charge protection	Over Charge Detection Voltage	4.25±0.025V
	Over Charge Detection Delay Time	0.5S
	Over Charger Release Voltage	4.19±0.05V
	Cell balancing Detection Voltage	4.18V
	Cell balancing Release Voltage	4.18V
Cell balancing	Cell balancing Current	35±5mA
	Over Discharge Detection Voltage	2.8±0.05V
Over discharge protection	Over Discharge Detection Delay Time	0.5S
	Over Discharge Release Voltage	3.0±0.05V
	Over Current Detection Voltage	260mV
Over current protection	Over Current Detection Delay Time	9MS
	Over Current Protection Condition	Disconnect the load

	Detection Condition	Exterior Short Circuit
Short Protection	Detection Delay Time	250µS
	Release Condition	Disconnect the load
Temperature Protection		65°C to 75°C

Table 3-2 – BMS Specification

3.3 Accumulator

Complete the information in the table below.

Maximum Voltage	54.6V
Nominal Voltage	48V
Nominal Capacity	110Ah
Nominal Current	60A
Accumulator Configuration	13x42
Approximate Weight	32.032 Kg
Size	450mm X 290mm X 180mm
Max Continuous Discharge Current	150A
Max Instantaneous Discharge Current	150A
Charge Voltage	54.6V
Operating Temperature range	> 45^0C
Battery Cooling Type	Passive natural cooling

Table 3-3 – Accumulator Specification

3.3.1 Accumulator Location

Provide CAD-rendering(s) showing the Battery Pack inside the vehicle. Mark the parts in the renderings, if necessary.

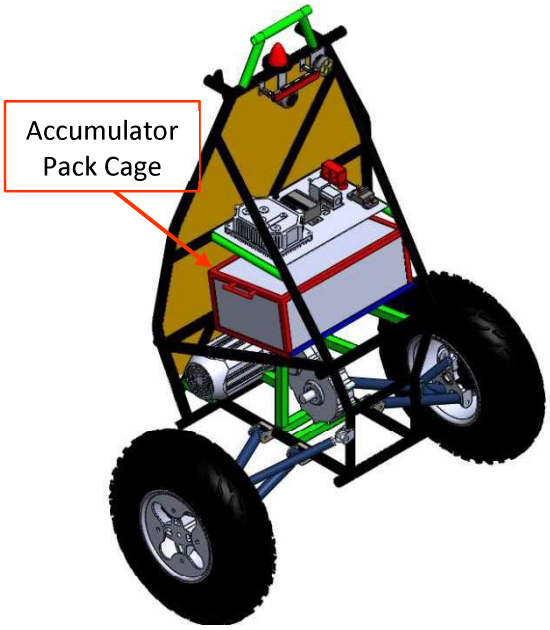

Figure 3-1 – Battery Pack Location

3.4 Charger

Complete the information in the table below.

Make / Model:	Quantum 48V/1200W
Power:	1.2kW
Output Voltage:	54.6V
Output Current:	24A
Input Voltage:	230V
Input Current:	22A
Time taken for full charge:	5 hours
Range of Vehicle on one full charge:	19km

Table 3-4 - Charger Specifications

3.4.1 Charger Location

Provide CAD-rendering(s) showing the charger (if placed) inside the vehicle. Mark the parts in the renderings, if necessary.

NA

Figure 3-2 – Charger Location

4 Motor and Motor Controller

4.1 Motor

Complete the information in the table below.

Make:	BLDC
Operating Voltage	48V
Rated Power	4.5kW
Peak Power	5.45kW
Rated Current	94A
Maximum Current	200A
Rated Speed	4500Rpm
Maximum Speed	4500Rpm
Rated Torque	10.7Nm
Maximum Torque	35Nm
Cooling Type	Passive natural cooling

Table 4-1 – Motor Specification

4.1.1 Motor Location

Provide CAD-rendering(s) showing the Motor inside the vehicle. Mark the parts in the renderings, if necessary.

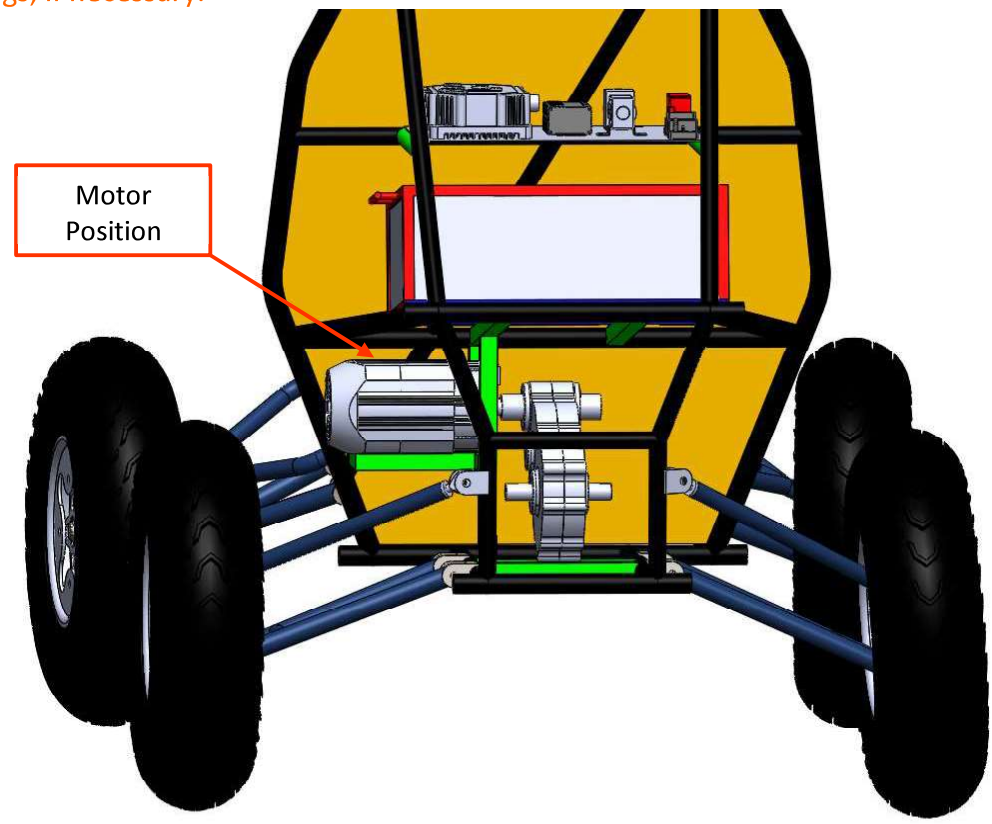

Figure 4-1 – Motor Location

4.2 Motor Controller

Complete the information in the table below.

Make/Model:	Kelly KLS-H Series Brushless Controller, KLS6030H
Available Battery Voltage	24-72V
Available Motor Power	4.5kW
Phase Peak Current	180A (for 30 seconds)
Rated Current	120A
Communication Protocol	CAN
Throttle Input Voltage	0-5V
Operating Temperature Range	-40 C to 100 C

Table 4-2 – Motor Controller Specification

4.2.1 Motor Controller Location

Provide CAD-rendering(s) showing the Motor Controller inside the vehicle. Mark the parts in the renderings, if necessary.

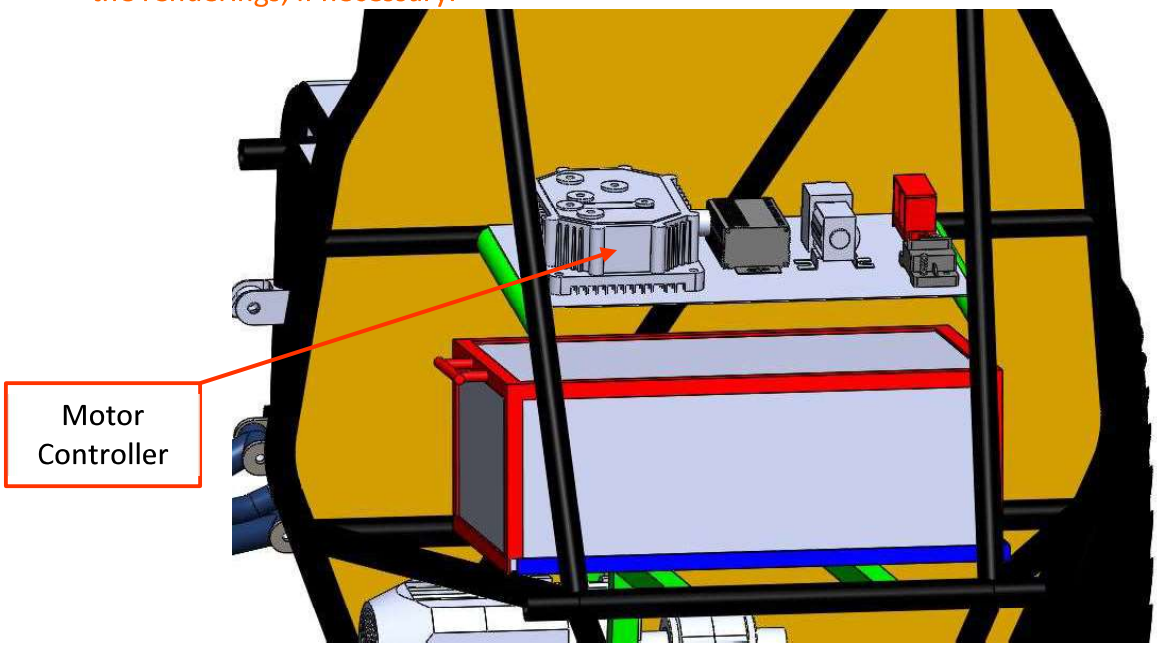

Figure 4-2 – Motor Controller Location

5 Safety Systems

5.1 TSAL

5.1.1 TSAL Specifications

Complete the information in the table below.

Make/Model:	Royal Enfield
Color:	Red
Flash Rate:	3.4Hz
Operating Voltage:	12V

Table 5-1 - TSAL Specifications

5.1.2 TSAL Location

Provide CAD-rendering(s) showing the TSAL. Mark the parts in the renderings, if necessary.

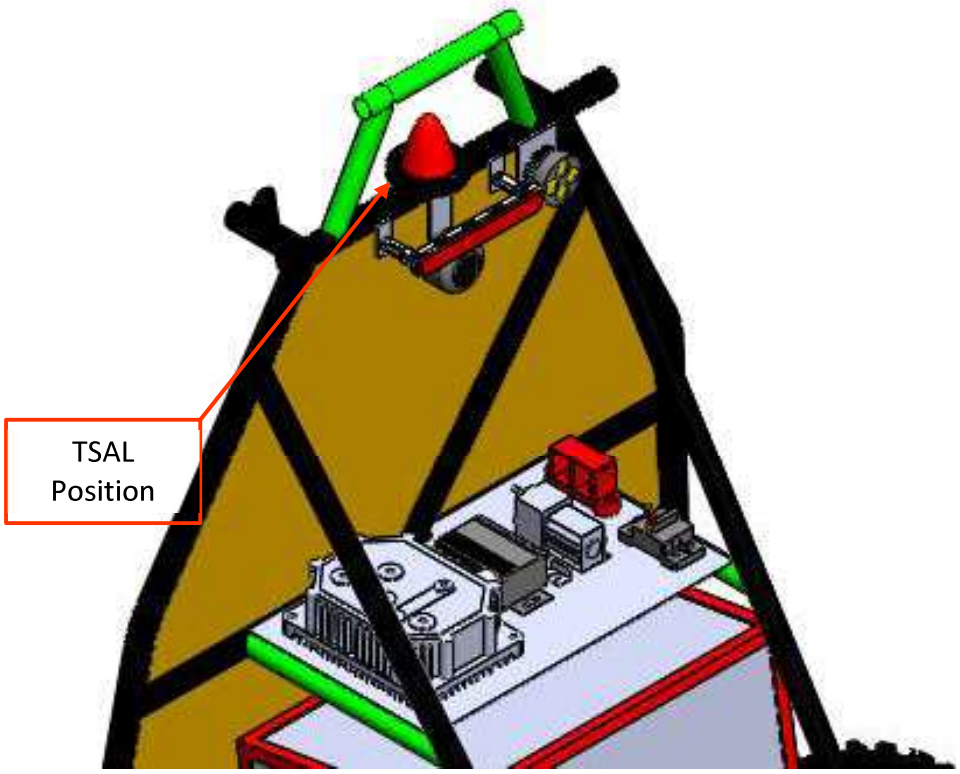

Figure 5-1 - TSAL Component Locations

5.1.3 TSAL Schematic

Provide any CAD drawing of circuit with Color Code. Mark the parts in the renderings, if necessary.

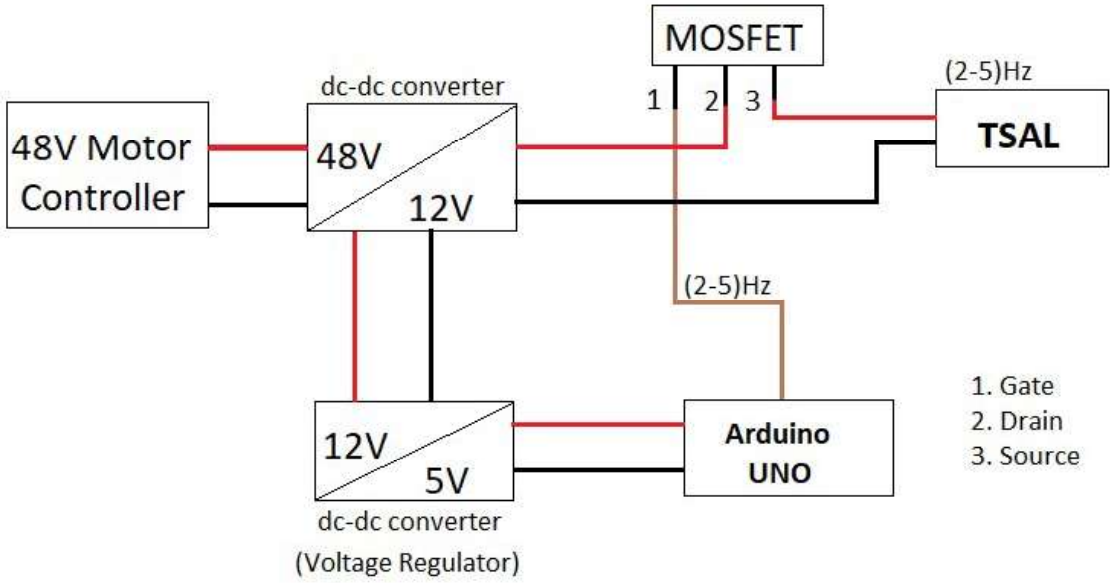

Figure 5-2 - TSAL Circuit Diagram

5.2 Ready to Drive Sound

Complete the information in the table below.

Make / Model:	Generic buzzer
Control Voltage:	12V
Sound intensity at 3m:	70dB

Table 5-2 - RTDS Specifications

5.2.1 RTDS Image & Location

Provide CAD-rendering(s) showing the RTDS. Mark the parts in the renderings, if necessary.

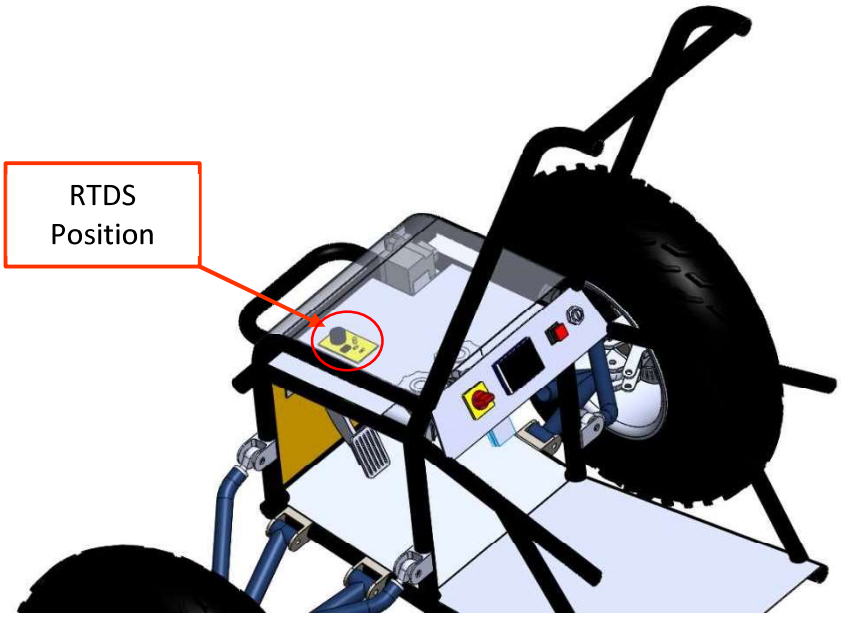

Figure 5-3 - RTDS Image & Location

5.3 Fuse

Complete the information in the table below.

Fuse Location/Purpose	Current Rating	Voltage Rating
Motor controller/Overcurrent	150A	60V
After Battery/AIR	200A	60V
DC-DC Converter	15A	48V

Table 5-3 - Fuse Specifications

5.3.1 Fuse Image & Location

Provide CAD-rendering(s) showing the Main Fuse. Mark the parts in the renderings, if necessary.

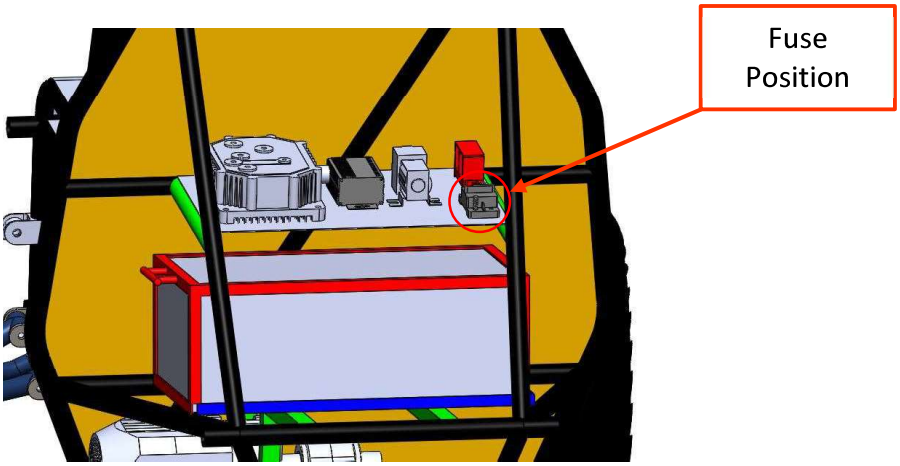

Figure 5-4 – Fuse Image & Location

5.4 AIR

Complete the information in the table below.

Make / Model:	ZJW
Contact Current:	200A
Contact Voltage:	48V

Table 5-4 - AIR Specifications

5.4.1 AIR Image & Location

Provide CAD-rendering(s) showing the AIR. Mark the parts in the renderings, if necessary.

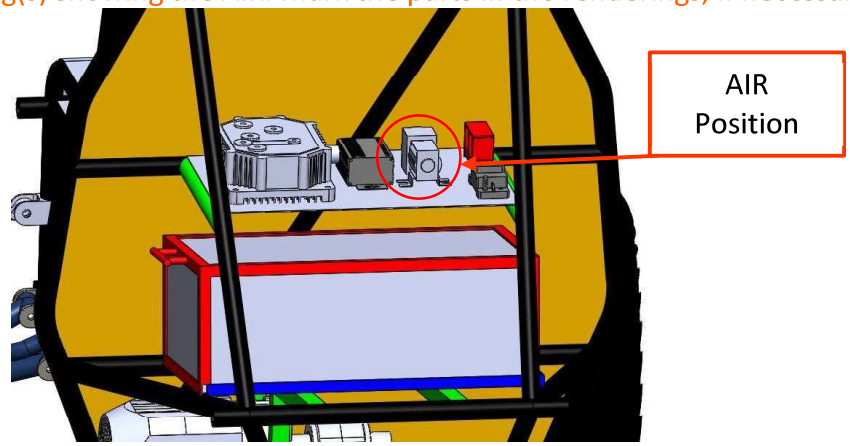

Figure 5-5 – AIR Image & Location

5.5 Firewall

Complete the information in the table below.

Insulating layer thickness:	0.5 mm
Insulating Material Make / Model:	Al 7606 Sheet

Table 5-5 - Firewall Specifications

6 Other Parts

6.1 DC-DC Convertor

Complete the information in the table below.

Input rated voltage	48V
Input voltage range	40V-100V
Efficiency	88%
Output voltage	DC 13.5V under 70℃ or DC 12.2V above 70℃
Output current	10A
Output rated power	275W
Output peak power	400W
Voltage regulation	77.33%
Load regulation	7.5%
Ripple (full load test)	≤1%
No-load current	≤5mA
Working Temperature	-20℃ to 90℃
Waterproof rating	IP66
Protections	IP66 protection

Table 6-1 – DC-DC Convertor Specification

6.2 Lights

Complete the information in the table below.

Name of Light	Brake Light
Make/OEM	Generic
Colour	Red
Name of Light	Reverse Light
Make/OEM	Generic
Colour	White
Name of Light	TSAL
Make/OEM	Royal Enfield
Purpose	To show that system is active

Table 6-2 – Lights Specification

7 Full Schematic (Wiring) include HV system and GLV system.

Provide any CAD drawing with Colour Code. Mark the parts in the drawing, if necessary.

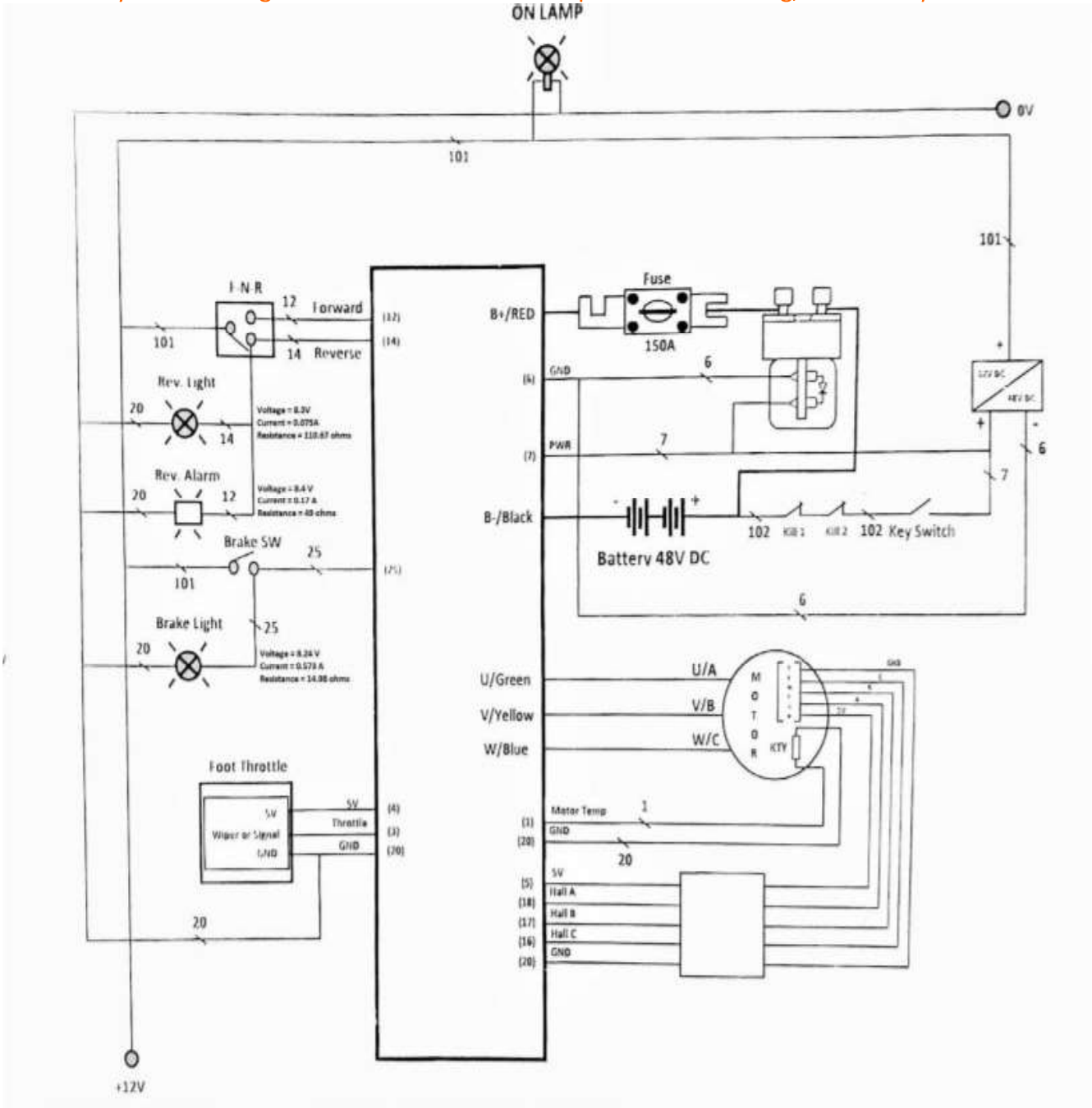

Figure 7-1 – System Diagram

8 Driver Display

Mention the details of the information displayed.

Provide any CAD drawing. Mark the parts in the drawing, if necessary.

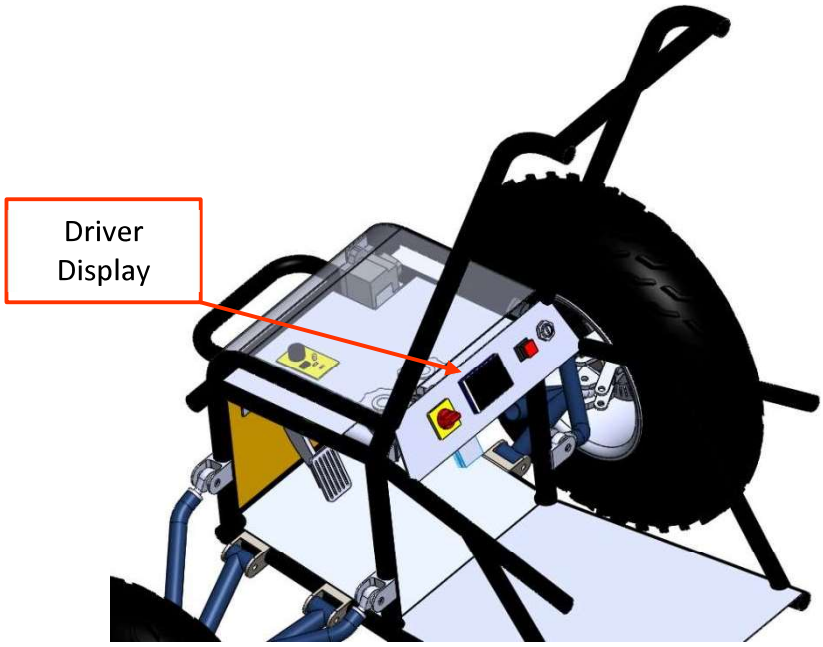

Figure 8-1 – Circuit Diagram

9 Electrical Circuit/Part made at own facility. (If Applicable)

Provide any CAD drawing with Colour Code. Mark the parts in the drawing, if necessary.

NA

Figure 9-1 – Circuit Diagram

10 Appendix

Attach datasheets of Battery, Motor, Motor controller, Charger, AIR, Firewall Insulating Material and Main Fuse.

1) Battery:
   https://drive.google.com/open?id=1kajzbd6IqiQw7JcDyKM_tI1mpftgbGKE

2) Motor:
   https://drive.google.com/open?id=1DmwUuSxik6KNcUyivBtgI31KXbbAWFFd

3) Motor controller:
   https://drive.google.com/open?id=1eQ8KZKQCH3MHKzoGkGEESt0roAYPGC7v

4) Charger:
   https://drive.google.com/open?id=1FfP0p4czjjYtVl1rJFOoAX6pFfmB01Ss

5) AIR:
   https://drive.google.com/open?id=1lzAuAxKdbJ_j2l1Cc9uZVDCWKf77hfOT

6) Main fuse:
   https://drive.google.com/open?id=12FdQS1tcasKeTS-6m5Dj9yN3iX1YRnPh