Formula Hybrid Design Spec. Sheet 2018

Submit this sheet with your design report. This information will be reviewed by the design judges and may be referred to during the design event.

--Please do not modify the format of this sheet. Consistent formatting will help keep the judges happy!

Car No.	214
School	Rensselaer Polytechnic Institute
Team Name	Rensselaer Formula Hybrid

Dimensions	**Front**	**Rear**
Overall Length, Width, Height	115 x 55.4 x 42.5" (2.93 x 1.41 x 1.08m)	
Wheelbase	66.4"	
Track	49.4"	46.0"
Weight (empty)	126 kg	134 kg
Weight with 150lb driver	203 kg	207 kg

Suspension Parameters	**Front**	**Rear**
Suspension Type	Double wishbone/Pushrod	Double wishbone/Pushrod
Tire Size and Compound Type	20.5 x 7.0 x 13 - R25B	20.5 x 7.0 x 13 - R25B
Wheels	BBS E14-4 (Cast Magnesium/Aluminum)	BBS E14-4 (Cast Magnesium/Aluminum)
Design ride height (chassis to ground)	2.125"	2.125"
Center of Gravity Design Height	8"	
Suspension design travel	1" Compression, 1" Rebound	1" Compression, 1" Rebound
Static Toe and adjustment method	-0.51	0.35°/Adjustable Tie Rod
Static camber and adjustment method	4.00°/Adjustable upper a-arm	2.25°/Shims
Front Caster and adjustment method	3.43°/ N/A	
Static Akermann and adjustment method	88.64%/ N/A	
Anti dive / Anti Squat	NA	NA
Roll center position static	1.36" above ground	1.42" above ground
Steer location, Gear ratio, Steer Arm Length	Front-Steer, 1 rev per 4.75", 13.59"	

Mechanical Brake System / Hub & Axle	**Front**	**Rear**
Brake Rotors	9.55" 4130 Alloy Steel	8.60" 4130 Alloy Steel
Master Cylinder	Wilwood 260-12384	
Calipers	Wilwood GP200	Wilwood GP200
Hub Bearings	N/A	Timken 13889-13830 Tapered Roller
Upright Assembly	CNC Milled Aluminum 7075	CNC Milled Aluminum 6061
Axle type, size, and material	N/A	Steel Rzeppa CV Joints, Steel Drive-Shafts

Regenerative Braking	**Front**	**Rear**
Type	Electric	Electric

Ergonomics	
Driver Size Adjustments	Swappable seat Insert
Seat (materials, padding)	Nomex covered XPS foam
Driver Visibility (angle of side view, mirrors?)	230 deg

Frame	
Frame Construction	Spaceframe
Material	4130 Alloy Steel
Joining method and material	Welded
Bare frame weight with brackets and paint	39.2 kg
Crush zone material	Aluminum honeycomb
Crush zone length	9"
Crush zone energy capacity	Approx. 145000 lb ft.

I.C. Engine	
Fuel type	N/A, electric vehicle
Manufacturer / Model	N/A, electric vehicle
No. of Cylinders	N/A, electric vehicle
Bore	N/A, electric vehicle
Stroke	N/A, electric vehicle
Displacement	N/A, electric vehicle
Muffler	N/A, electric vehicle
Max. rated power (kW @ RPM)	N/A, electric vehicle
Max. rated torque (N·m @ RPM)	N/A, electric vehicle
Compression ratio	N/A, electric vehicle
Induction	N/A, electric vehicle
Throttle Body / Mechanism	N/A, electric vehicle
Fuel System (mfgr. and type)	N/A, electric vehicle
Other significant modifications	N/A, electric vehicle

Accumulator / Batteries	
Type	Lithium-ion
Manufacturer	Samsung
Model No.	INR18650-30Q
Capacity (Nameplate Rating)	3 Ah
Nominal Voltage & Operating Range	3.6V // 2.5V-4.2V
Quantity (Number of Cells)	440
Total battery voltage	79.2 VDC nom.
Total capacity (*Wh*)	3.8016 kWh
Protection / Fuses	200A Master // 100A to Each Motor
Protection / Relays	2x Kilovaq EV200 Contactors

Accumulator / Capacitors	
Type	N/A
Manufacturer	N/A
Type	N/A
Capacitance	N/A
Nominal Voltage & Operating Range	N/A
Rated Voltage	N/A
Quantity (Number of Cells)	N/A
Total capacitor voltage	N/A
Total capacity (*Wh*)	N/A
Protection / Fuses	N/A
Protection / Relays	N/A

Drive Motor(s)	
Manufacturer	NeuMotors
Type	Brushless DC Outrunner
Model Number	2x 8057-100 // 2x 8038-100
Max. rated power (kW @ RPM)	45 kW @4000 RPM // 30kW @ 4000 RPM
Max. rated torque (N·m @ RPM)	43 Nm @4000 RPM // 29Nm @ 4000 RPM
Maximum voltage	80V // 72V
Maximum current	562.5A // 375A
Estimated efficiency range	90%

Motor Controller(s)	
Manufacturer	Kelly
Model Number	KBL96201
Maximum voltage in	120 V
Maximum voltage out	120 V
Maximum current in	200A
Maximum current out	200A
Estimated efficiency range	99%

Drivetrain	
Type	Electric AWD
Architecture	Four-Wheel Independent, In-Line

Voltage Converter 1	
Type (DC/DC, Inverter, or rectifier; unidirectional or bidire	DC/DC Unidirectional, Isolated
Input source (bus, accumulator, generator, etc.)	HV Bus
Output load (bus, accumulator, generator, etc.)	GLV Bus
Maximum input voltage	154 V
Maximum output voltage	16.1 V
Maximum input current	5.2 A
Maximum output current	33.3 A
Estimated efficiency range	85% - 86.2%

Voltage Converter 2	
Type (DC/DC, Inverter, or rectifier; unidirectional or bidire	DC/DC Unidirectional, Isolated
Input source (bus, accumulator, generator, etc.)	HV Bus
Output load (bus, accumulator, generator, etc.)	TSAL
Maximum input voltage	176 V
Maximum output voltage	12 V
Maximum input current	55 mA
Maximum output current	665 mA
Estimated efficiency range	83% - 85%

On-board Charger (if applicable)	
Max. Voltage	N/A
Max Current	N/A

Instrumentation	
Driver displays	None
Telemetry	Wheel Speed, suspension positions, driver input, 6DOF IMU, GPS location, temperature
On-board computer	Proprietary telemetry and drive control computation system
Fuel level/consumption/efficiency/state of charge	State-of-Charge from AMS, Efficiency from Drive Control board

Aerodynamics (if applicable)	
Front Wing (lift/drag coef., material, weight)	L/D:7, carbon fiber skin and XPS and PVC foam core, 2lbs
Rear Wing (lift/drag coef., material, weight)	L/D:2.4, carbon fiber skin and XPS and PVC foam core, 5 lbs
Undertray (downforce/speed)	140 lbs at 60mph
Wing mounting	Front: aluminum brackets Rear: Aluminum tierods, Aluminum Brackets

Additional Information	
Body Work?	Carbon fiber nose cone and carbon fiber side panels
Special Bit A?	
Special Bit B?	