FORMULA STUDENT GERMANY
INTERNATIONAL DESIGN COMPETITION

Design Spec Sheet

The DSS can only be edited by the event captains.

DSS has not been transmitted to the judges, yet.

Dimensions	Front	Rear
Overall Length [mm]	2930	
Overall Width [mm]	1425	
Overall Height [mm]	1160	
Wheelbase [mm]	1535	
Track [mm]	1200	1150
Weight with 68kg driver [kg]	123	145

Suspension Parameters	Front	Rear
Suspension type	Unequal Double wishbone, Push-rod, decoupled vehicle modes	Unequal Double wishbone, Push-rod, decoupled vehicle modes
Design ride height (chassis to ground) [mm]	50	50
Center of gravity design height [mm]	265	
Suspension design travel - jounce [mm]	30	30
Suspension design travel - rebound [mm]	30	30
Wheel rate (chassis to wheel center) [N/mm]	37	37.01
Roll rate (chassis to wheel center) [degrees/g]	27.09	
Jounce damping (chassis to wheel center) [Ns/mm]	Adjustable	Adjustable
Rebound damping (chassis to wheel center) [Ns/mm]	Adjustable	Adjustable
Sprung mass (incl. 68 kg driver) natural frequency [Hz]	2	2.56
Motion type	linear	linear
Motion ratio (spring travel/wheel center travel) [mm/mm]	0.9482	1.0752
Camber coefficient in bump [deg/mm]	0.342	0.0274
Camber coefficient in roll [deg/deg]	0.645	0.725
Static toe [degrees]	0.65 degrees toe out	0.725 degrees toe in
Static toe adjustment method	adjustable steering rod ends	adjustable steering rod ends
Static camber [degrees]	-2 deg	-1.5 deg
Static camber adjustment method	1mm shims on upright	1mm shims on upright
Front caster angle [degrees]	4.5 deg	
Front caster angle adjustment method	Non-adjustable	
Front kingpin inclination [degrees]	9.48	
Front kingpin inclination adjustment method	Non-adjustable	
Kingpin offset [mm]	53.42	
Kingpin trail [mm]	18.38	
Static ackermann [%]	86.79%	
Static ackermann adjustment method	Non-adjustable	
Anti dive / Anti lift [%]	32.8% / 7.2%	24.2% / 1.6%
Roll center position static (above ground) [mm]	30.64	42.25
Roll center position at 1g lateral acceleration [mm]	30.37mm above ground, 12.38 mm toward unladen side	40.6mm above ground, 117.06mm toward unladen side
Other significant suspension parts	Linear motion sensor	Linear motion sensor

Tyres and Wheels	Front	Rear
Wheels	7x13, 25.4mm offset, 2 pc Al Rim	7x13, 25.4mm offset, 2 pc Al Rim
Tyres - dry, make	Continental	
Tyres - dry, size	205/470 R13	205/470 R13
Tyres - dry, compound	C17 slick compound	
Tyres - rain, make	Continental	
Tyres - rain, size	205/470 R13	205/470 R13
Tyres - rain, compound	C17 wet compound	

Steering system	Front	Rear
Steering location	116 mm above ground plane	no rear wheel steer
Steering ratio (steering wheel / outer wheel) [deg/deg]	4.12	n/a
Steering arm length [mm]	56.2	n/a

Brake System / Hub & Axle	Front	Rear
Rotors (incl. outer and inner diameter [mm] of friction surface)	Hub mounted titanium alloy rotors, 190mm diameter	Hub mounted titanium alloy rotors, 190mm diameter
Master cylinders (incl. diameters [mm])	Tilton racing - 78 series - 5/8" bore size - driver adjustable balance bar	
Calipers (incl. diameters [mm])	AP Racing - CP4227-2S0 - aluminium - 25.4 mm piston diameter - 4 pistons	AP Racing - CP4226-2S0 - aluminium - 25.4 mm piston diameter - 2 pistons
Hub bearings	Angular contact ball bearings in O config 80x100x10	Angular contact ball bearings in O config 80x100x10
Upright assembly	5 axis milled 7075 aluminium	5 axis milled 7075 aluminium
Axle type, size, and material	n/a	n/a
ABS	n/a	

Ergonomics	
Driver size Adjustments	Adjustable head restraint height, adjustable seat inclination
Seat (materials, padding)	prepreg carbon layup with 5mm aluminum honeycomb core
Driver visibility (angle of side view, mirrors?)	210 degree side visibility, no side mirrors
Shift actuator (type, location)	N/A
Clutch actuator (type, location)	N/A
Instrumentation	4.3 inch Oled screen + LED Feedback

Frame	
Frame construction	Sandwich laminate single piece monocoque
Material	Pre impregnated uni- and bidirectional carbon fiber, Al & Nomex honeycomb, balsa
Joining method and material	Single piece, Mainhoop is bolted
Targets (Torsional stiffness or other)	4000 Nm/deg between supension mount points
Torsional stiffness [Nm/deg]	4000
Torsional stiffness validation method	FEA
Bare frame weight with brackets and paint [kg]	23
Crush zone material	Rohacell 71kg/m^3
Crush zone length [mm]	250
Crush zone energy capacity [Joules]	8000
Additional safety features	N/A

Tractive System	Front	Rear
Motors Manufacturer / Model	AMK/DD5-14-10-POW/18600-B5	AMK/DD5-14-10-POW/18600-B5
No. of motors	2	2
Motor Driven Wheels	independently trough torque vectoring	independently trough torque vectoring
Type of motors	Permanent magnet synchronous motors	Permanent magnet synchronous motors
Max RPM [1/min]	20000	20000
Max Torque [Nm]	21	21
Max Torque until RPM [1/min]	16000	16000
Max power [kW]	36 kW @16000 rpm	36 kW @16000 rpm

Significant motor modifications	N/A	N/A
Type of motor controller(s)	KW26-S5-FSE-4Q	KW26-S5-FSE-4Q
Motor Speed Sensors	AMK 108072 type P	AMK 108072 type P
Nominal Motor Voltage	350V	350V
Coolant System and Radiator location	2 side pod radiators. 2 times 1Drive in series with 2 motors,which are parallel	
Accumulator Cell Manufacturer and Type	Melasta - SLPB8742126HF	
Nominal Cell Voltage [V]	4.2	
Nominal Cell Capacity mAh	5200	
Accumulator Cell Technology	Polymer Li-Ion	
Accumulator Cell Configuration	144s2p	
Accumulator Voltage when fully charged [V]	600	
Combined Accumulator Capacity [kWh]	5.5	

Drivetrain	
Drive type	Inwheel motors with direct connection from motor to wheels through 1,5 step plan
Differential type	Electronic differential (torque vectoring)
Final drive ratio	15.12
1st gear [km/h]	117
2nd gear [km/h]	N/A
3rd gear [km/h]	N/A
4th gear [km/h]	N/A
5th gear [km/h]	N/A
6th gear [km/h]	N/A
Half shaft size and material	N/A
Joint type	N/A

Electronics	
Driver aids	Torque vectoring, traction control, push to talk, launch control
Data logging	custom built datalogger & telemetry, GPS assisted, CAN bus
Telemetry system	bidirectional stream via zigbee
electric auxilliaries (fan, fuelpump, waterpump)	Electric waterpump, 2 radiatior fans, 3 battery fans
CAN bus	Highspeed CAN 2.0 B, Baudrate: 1 Mbit/s
Battery	N/A (DC/DC)
Control System Voltage [V]	24
Other significant electronic parts	Dashboard with 4.3 inch display and push to talk (RF-module)

Aerodynamics (if applicable)	**Front**	**Rear**
Wing (lift/drag coef., material, weight)	prepreg carbon layup with balsa and aluminum core	prepreg carbon layup with balsa core
Undertray (downforce/speed)	11kg @ 60km/h, center of pressure 60mm after vehicle COG	
Wing mounting	swanneck to mainhoop (rear) and bracktes to monocoque (front)	

Design Top5	
Top 1	LV-Electronics
Top 1 Comment	self built ECU, datalogging and telemetry with a large focus on data visualisation
Top 2	Peripherals (Intake, Exhaust, Cooling, Fuel)
Top 2 Comment	Cooling jacket and - plate designed by artificial intelligence, produced with 3D printing.
Top 3	Mechanical Design (Suspension components)
Top 3 Comment	The suspension features a decoupled pitch and roll control utilizing only two dampers per axle.
Top 4 (optional)	Structural Design (Primary structure)
Top 4 Comment	optimized single piece monocoque built with bi - and unidirectional carbon fibre
Top 5 (optional)	Driver Interface
Top 5 Comment	Driver interface optimized using user centered design processes

Optional Information
Body work?
Special bit A?
Special bit B?

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