

2022 FORMULA SAE-A TECHNICAL INSPECTION SHEET

AV AUTONOMOUS VEHICLE CLASS

UNIVERSITY:	CAR NUMBER:
NUMBER OF DRIVERS:	TALLEST DRIVER'S HEIGHT:
TS VOLTAGE:	GLVS VOLTAGE:
TEMPERATURE MONITORING: <input type="checkbox"/> THERMAL STRIP <input type="checkbox"/> IBUTTON (SERIAL: _____)	ANTI-LOCK BRAKES: <input type="checkbox"/> YES <input type="checkbox"/> NO

VEHICLE MUST HAVE HVD DISCONNECTED AND TSMS KEY REMOVED AND LOCK IN PLACE UNTIL INSTRUCTED BY SCRUTINEERS

Present the vehicle for inspection as follows:	(Inspector Use Only)			
1. Electrical Technical Inspection (PART 1) – Visual Inspection.	Initials:	Day	Time In:	Time Out:
2. Mechanical Technical Inspection.	Initials:	Day:	Time In:	Time Out:
3. Weighing.	Initials:	Day:	Time In:	Time Out:
4. Tilt Table Test.	Initials:	Day:	Time In:	Time Out:
5. (Driver Egress). Not required for Demonstration - 2022	Initials:	Day:	Time In:	Time Out:
6. Electrical Technical Inspection (PART 2) – Functional Demonstration.	Initials:	Day:	Time In:	Time Out:
7. Autonomous Systems Technical Inspection	Initials:	Day:	Time In:	Time Out:
8. Rain Test.	Initials:	Day:	Time In:	Time Out:
9. Emergency Brake System Test.	Initials:	Day:	Time in:	Time Out:

IMPORTANT INFORMATION FOR TEAMS

- Please refer to the checklist provided overleaf before Registering at the event. Reference: LOCAL ADDENDUM AD ADMINISTRATION Rule AD 4.4
- Teams will not be permitted to commence Technical Inspection without presenting the necessary documentation and test samples as requested or reminded of at Registration.
- Teams must weigh their cars preferably after passing Mechanical Technical Inspection but before the Tilt Table Inspection. Vehicles are to be complete and ready to run, i.e., with any liquids, lubricants and brake fluid. Electric vehicles must have the accumulator installed.
- If there is a conflict between this document and the rules, the rules prevail.

AV PRE- REGISTRATION and TECHNICAL INSPECTION CHECK LIST						
TECHNICAL INSPECTION SHEETS (SELF INSPECTION) COMPLETED?	<input type="checkbox"/> YES	<input type="checkbox"/> NO		HARDCOPY PRESENTED at TI?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
COPY OF THE EGRESS TIMES LIST with Names of all Drivers and Times they achieved	<input type="checkbox"/> YES	<input type="checkbox"/> NO		HARDCOPY PRESENTED at TI?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
TESTED SAMPLE OF IMPACT ATTENUATOR (IA), OR PHOTO'S INCLUDING STANDARD IA IF REQUIRED DUE TO BULKHEAD CONFIGURATION (F.8.4 and F.8.7))	<input type="checkbox"/> YES	<input type="checkbox"/> NO		SAMPLE PRESENTED at TI?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
COPY of DECLARATION of FINAL HAZARDOUS MATERIALS and MSDS Deadline	<input type="checkbox"/> YES	<input type="checkbox"/> NO				
SAMPLE OF TWO PIECE FIREWALL TO CHECK THICKNESS AND ADEQUACY OF THE INSULATING LAYER (T.1.9) (if required)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	<input type="checkbox"/> N/A	SAMPLE PRESENTED at TI?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
SAMPLE OF ACCUMULATOR CONTAINER FLOOR AND TOP/SIDE WALLS IF NOT MADE FROM METAL (F.10.2.2) (if required) Ask to see SES.	<input type="checkbox"/> YES	<input type="checkbox"/> NO	<input type="checkbox"/> N/A	SAMPLE PRESENTED at TI?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
ALL DRIVERS MAY BE REQUIRED TO BE PRESENT AFTER TECHNICAL INSPECTION FOR DRIVER EGRESS TIMING?	<input type="checkbox"/> YES	<input type="checkbox"/> NO				
TALLEST DRIVER TO BE SUITED UP AND READY TO BE SEATED IN VEHICLE AT START OF MECHANICAL TECHNICAL INSPECTION.						

AV TECHNICAL INSPECTION VEHICLE PANEL

Autonomous Vehicle Inspection panel provided at registration.

FORMULA SAE AUSTRALASIA **FORMULA SAE-A** **SAE AUSTRALASIA**
[event dates] [event location]

AUTONOMOUS ELECTRIC VEHICLE **WEIGH-IN** **MINIMUM WEIGHT** kg
FRONT % WITH DRIVER % **OFFICIAL USE ONLY**

EV TECH INSPECTION **TECH INSPECTION** **TLT TABLE** **BRAKE TEST** **RAIN TEST** **AS Inspection** **EBS Test**



The bottom 1/3 is comprised of 7 event stage stickers.
Each applied after completing the respective task.



Save this space on nose cone for Vehicle Inspection panel.

AV ELECTRICAL TECHNICAL INSPECTION (PART 1) – VISUAL INSPECTION

Lead Scrutineer:

Start Date/Time:

PERSONNEL, DOCUMENTATION AND SAFETY EQUIPMENT

Teams are expected to have appropriate safety equipment to allow them to work on their vehicle All safety equipment should be in good condition

Identify Electrical Systems Officer (ESO)	The Electrical Systems Officer is the first point of contact	Ask for ESO	
Disable HV systems	Check HVD is removed and TSMS lock is in place	Visual Check	
Basic set of HV-proof tools	Insulated cable shear	Visual Check	
	Insulated screw drivers	Visual Check	
	Multi-meter with protected probe tips (CATIII or better)	Visual Check	
	Insulated spanners or insulated socket set if screwed connections are used in the tractive system	Visual Check	
	Other insulated tools if required for tractive system maintenance	Visual Check	
	Face shield	Visual Check	
Protective equipment	Safety glasses, HV isolating gloves, and HV isolating blanket (at least 1 square meter)	Visual Check	
Push bar	A pair of HV insulating gloves, a multimeter and fire extinguisher must be attached	Visual Check	
	If a tool is needed to open the HVD this must also be attached to the push bar	Visual Check	

GENERAL

Separation of TS and GLVS on self-developed PCBs	Check on self-developed PCBs that TS and GLVS are clearly separated. Check spare PCBs or photographs, if available. Otherwise check built-in PCBs, if easily accessible	Visual Check	
Tractive system measuring points	Two tractive system voltage measuring points and a GLVS ground point must be installed next to the master switches, right side of the vehicle, at shoulder height of the driver	Visual Check	
	The measuring points must be protected by a non-conductive housing which can be opened without tools	Visual Check	
	The measuring points must be protected from being touched with the bare hand/fingers once the housing is opened. 4mm shrouded banana jacks rated to an appropriate voltage must be used	Visual Check	
	The TSMPs must be marked with HV+ and HV-	Visual Check	
GND measuring point	Must be positioned next to the TSMPs and must be marked with GND	Visual Check	
GLVS voltage	Measure GLVS voltage between GLVS battery positive or DC/DC converter plus and chassis	Equal to or less than 60Vdc	
TS voltage	Measure TS voltage at measurement points	Equal to or less than 60Vdc	
Dis-charge circuit and body protection resistors	The discharge circuit has to be wired in a way that it is always active whenever the shutdown circuit is open. If a discharge circuit is used a low resistance can be measured between HV+ and HV- whenever the tractive system is de-activated	Measure resistance between HV+ and HV- with multi-meter. Must be 2*BPR+ Dis- Charge Resistor (GLVS must be off)	
HV wiring	All visible HV wiring and their cable channels must be orange	Visual Check	
	All tractive system wiring outside electrical enclosures must be enclosed in separate orange nonconductive conduit or use an orange shielded cable	Visual Check	

GENERAL (CONT)			
HV wiring	The conduit or shielded cable must be securely anchored (at least) at each end so that it can withstand a force of 200 N without straining the cable and crimp, and must be located out of the way of possible snagging or damage	Visual/Physical Check. Pull on conduit with reasonable force	
	Tractive system wiring must be shielded against damage by rotating and/or moving parts	Visual Check	
	No wires are allowed to run lower than the chassis	Visual Check	
	TS wires and GLVS wires are clearly separated/do not run directly next to each other/bounded together by cable rods or in the same cable channel (ALLOWED ONLY FOR PILOT CONTACTS OR INTERLOCK SIGNALS)	Visual Check	
	Wires must be marked with gauge, temperature rating and voltage rating, serial number or norm is also sufficient, if the team shows the datasheet in printed form	Visual Check	
	Wire temperature rating must be suitable for position of the wire in the car	Visual Check	
HV wiring/connections	Using only insulating tape or rubber-like paint for insulation is prohibited	Visual Check	
HV warning stickers	Each housing/enclosure containing HV parts (except motor housings) must be labelled with a HV-sticker	Visual Check	
Tractive system protection	It must not be possible to touch any tractive system connections with a 100mm long, 6mm diameter insulated test probe when the tractive system enclosures are in place	Check with Probe	
	Tractive System components and containers must be protected from moisture in the form of rain or puddles	Visual Check	
High voltage disconnect	The HV Disconnect has to be clearly marked with "HVD"	Visual Check	
	It must be possible to disconnect the HVD without removing any bodywork	Visual Check	
	In ready to race condition it must be possible to disconnect the HVD within 10 seconds	The team must demonstrate how to operate the HVD within 10s	
	If opening the HVD is possible without the use of tools, a pilot contact/interlock line has to be implemented which breaks the current through the AIRs whenever the connector is removed	Visual Check	
Outboard wheel motors	Outboard wheel motors are allowed if an interlock is added such that the Shutdown Circuit is opened if the wheel assembly is damaged or knocked off the car	Visual Check	
Energy meter wiring	All energy from accumulator containers must flow through a single point, the Energy Meter connection point for energy measurement	Visual Check	
Tractive system active light	Tractive system active light (TSAL) must be mounted under the highest point of the main roll hoop and no lower than 150mm below the highest point of the roll hoop	Visual Check	
	The TSAL must be visible by a person standing up to 3m away from the TSAL. The person's minimum eye height is 1.6m	Visual Check	
Shutdown buttons	One shutdown button, push-pull or push-rotate-pull on each side behind the drivers compartment (height approx. driver's head), one in the cockpit and easily accessible by the driver in any steering wheel position	Visual Check	
	Minimum diameter of shutdown buttons on the side is 40mm. Minimum diameter of shutdown button in the cockpit is 24mm	Visual Check	
	The shutdown buttons are not allowed to be easily removable, e.g. mounted onto a removable body work	Visual Check	
Cockpit shutdown button	The international electrical symbol consisting of a red spark on a white-edged blue triangle must be affixed in close proximity to this switch	Visual Check	
Brake over travel switch	Brake over travel switch must be positioned behind the brake pedal	Visual Check	

TS and GLVS master switches	TS and GLVS master switch on the right side of the vehicle. At the height of the drivers' shoulders, The ON position must be in horizontal position	Visual Check	
	Clearly marked with HV and LV respectively and indicated "ON" position	Visual Check	
	Both switches must be a rotary type with a removable key/handle	Visual Check	
TS master switch	TSMS must be fitted with a "lockout/tag out" capability to prevent accidental activation of the tractive system	Visual Check	
TS Activation or Reset	The driver must be able to activate or reset the Tractive System from within the cockpit without external assistance.	Physical Check	
Inertia switch	The device must be mechanically attached to the vehicle, however it must be possible to demount the device so that its functionality can be tested by shaking it.	Visual/Physical Check	
Torque encoder	Torque Encoder must return to original position, if not actuated	Visual/Physical Check	
	At least two sensors must be fitted as torque encoder not sharing supply or signal lines	Visual Check	
	The foot pedal must have a positive stop to prevent sensors from being mechanically overstressed	Visual/Physical Check	
	Two springs must be used to return the throttle pedal to the off position and each spring must work with the other disconnected	Visual/Physical Check	
Brake system encoder	A brake pedal position sensor or brake pressure switch must be fitted to check for plausibility	Visual Check	
Brake system master cylinder	The brake system master cylinder must be actuated directly or by a mechanical connection. Use of Bowden cables or push-pull Bowden cables is not allowed. The first 90% of the brake pedal travel may be used to regenerate brake energy without actuating the hydraulic brake system. The remaining brake pedal travel must directly actuate the hydraulic brake system, but brake energy regeneration may remain active.	Visual Check	
Accumulators	HV Accumulator(s) must be enclosed in container(s). The bottom must be steel, min 1.25mm or Al, min 3.2mm. Walls (internal and external) and cover/top, must be Steel, min 0.9mm or Al min 2.3mm. If alternative material used, they should present proof of equivalency (per SES or other) with a sample. If containers are monocoque, they must be mounted with Steel backing plates of at least 2mm thickness. The Accumulator Container must also have a minimum number of attachment points, dependent on weight and use minimum Grade 8.8 metric 8mm bolt at each (20 kg = 4 attachments; 20-30 kg = 6 attachments; 30-40 kg = 8 attachments; >40 kg = 10 attachments) Ensure 25mm clearance from any Side Impact Structure. Ask to see SES. If Rear mounted: At least 25mm clearance from Rear Impact Structure or any non-crushable items. Ensure 25mm clearance of surface from Firewall. Non-crushable items behind impact Structure cannot pass through the structure. Rear Impact Protection extends to or passed the upper height of the SIS and is supported to the SIS. F.11.2.1, 2, 3, 4	Visual/Physical Check	
	The poles of the accumulator stack(s) and/or cells must be insulated against the inner wall of the accumulator container, if the container is made of electrically conductive material.	Visual Check (photographs may be acceptable)	
Internals - cell connection	Contacting / interconnecting the single cells by soldering in the high current path is prohibited. Soldering wires to cells for the voltage monitoring input of the BMS is allowed	Visual Check (photographs may be acceptable)	
Internals - AIR/fuse	Every accumulator container must contain at least one fuse and at least two accumulator insulation relays	Visual Check (photographs may be acceptable)	
Internals - maintenance plugs	Maintenance plugs or similar measures have to be taken to allow separating the internal cell stacks in a way, that the separated cell stacks carry a voltage of less than 120VDC and a maximum energy of 12MJ. The separation has to affect both poles of the stack	Visual Check (photographs may be acceptable)	
Internals – cell stack barriers	Each stack has to be electrically insulated by the use of suitable material towards other stacks in the container and on top of the stack. Air is not considered to be a suitable	Visual Check (photographs may be acceptable)	
Indicator light/voltmeter	Each container must have an indicator light or an analogue voltmeter showing that voltages greater than 60V DC are present outside of the container	Visual Check	
Accumulator container connectors	If HV-connectors of the accumulator containers can be removed without the use of tools, a pilot contact/interlock line has to be implemented which breaks the current through the AIRs whenever the connector is removed	Visual Check	

ACCUMULATOR CONTAINER(S) (CONT)			
Openings in container	Breakthroughs or holes in the container are allowed for the wiring-harness, holes or slots are also allowed for ventilation, cooling or fasteners. Any holes must also be considered for the sealing against water and around 10mm or less in diameter. 2022 vehicles must have circular holes only – no slots.	Visual Check	
Equalising valve	If the container is completely sealed, it must have an equalizing valve	Visual Check	
Spare accumulator(s)	Must have the same size, weight and type. Only applicable if spare accumulators are used	Weigh, visual check and mark	
Temperature monitoring equipment	Teams may use an iButton or irreversible thermal strip (Range A: 37°C to 65°C). Serial number of iButton (where relevant) must be recorded on the front page of this document	Visual check of location and functional check	

GROUNDING

All electrically conductive parts of the vehicle (e.g. parts made of steel, (anodized) aluminium, any other metal parts, etc.) which are within 100mm of any tractive system or GLV component, and any driver harness mounting points, seat mounting points and driver controls must have a resistance below 300 mΩ (measured with a current of 1A) to GLV system ground. All parts of the vehicle which may become electrically conductive (e.g. completely coated metal parts, carbon fibre parts, etc.) which are within 100mm of any tractive system or GLV component, must have a resistance below 5Ω to GLV system ground.

Part (only if applicable)	Conductive (max 300 mΩ)	May become conductive / is coated (max 5Ω)	Measurement
Frame monocoque (measure in several locations)	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Firewalls	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Accumulator container	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Seat mounting points	X		(mΩ)
Driver harness mounting points	X		(mΩ)
Conductive housings with TS parts inside	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Motor inverter housings	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Steering wheel surface	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Pedal box	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Main roll hoop	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Forward roll hoop	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension front left upper	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension front left lower	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension front right upper	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension front right lower	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension front left upper	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension rear left lower	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension rear right upper	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Suspension rear right lower	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Driver controls/switches	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Exposed heatsinks/radiators	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Carbon fibre parts touched when moving car with TS disabled	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)
Additional parts:	<input type="checkbox"/>	<input type="checkbox"/>	(mΩ)

FIREWALLS

Vehicle must be reassembled and firewalls checked in place

Firewall(s)	A firewall must separate the driver compartment from all components of high voltage system (including HV wiring)	Visual Check	
	The firewall must be made from or coated with an electrically insulating material or there must be an electrically insulating barrier between all the tractive system components and the firewall	Visual Check	
	The firewall must be fire resistant according to UL94-V0, FAR25 or equivalent.	Visual Check/Review MSDS	
	The firewall must be puncture and scratch resistant	Visual/Physical Check	
	The firewall must not be thicker than 1 mm for the Al layer	Visual/Physical Check of two piece firewall sample	

NON COMPLIANCES / COMMENTS:**AV ELECTRICAL TECHNICAL INSPECTION (PART 1) COMPLETE**

Approved by:

Date/Time:

ONCE ALL ITEMS ARE PASSED, THE TEAM MAY PROCEED TO MECHANICAL TECHNICAL INSPECTION. NOTE: THE "EV TECH INSPECTION" STICKER IS NOT AWARDED UNTIL BOTH EV TECHNICAL INSPECTION PART 1 AND PART 2 HAVE BEEN COMPLETED.

AV MECHANICAL TECHNICAL INSPECTION

Lead Scrutineer:

Start Date/Time:

WHEELS & TYRES

V.4 – WHEELS and TYRES

Dry tyres	Make: _____ Size: _____ Compound:-----	Visual Check	
Rain tyres	Make: _____ Size: _____ Compound: -----	Visual Check. Rain tyres must have 3/32 in. minimum tread depth moulded by tyre manufacturer	
Wheels	Four wheels not in a line, 20.32cm (8.0 in) minimum diameter. Wheels with single wheel nut must have positive retainer	Visual Check	

DRIVERS' EQUIPMENT

VE.3

Helmets	Snell SA2010, SAH2010, SA2015; SA2020, AS1698. BS 6658-85 Type A/FR (not Types A or B). ECE 22. SFI 31.1, 31.1A, 31.2A, SFI 24.1, FIA 8860-2018, 8860-2010, 8859-2015, 15. Closed Face ONLY, must have integrated shield (no dirt bike helmets). No camera mounts	Visual Check	
Frontal Head Restraint	FIA 8858-2010 with or without Hologram, FIA 8858-2002	Visual Check	
Drivers' suits	Single piece - FIA 8856-2018 with Hologram, FIA 8856-2000 Hologram only after manufactured date 01/01/2016, FIA 1986.	Visual Check	
Underwear	Not compulsory – recommended, FIA 8856-2018 with Hologram.	Visual Check	
Balaclava – Hair cover	FIA 8856-2018 with Hologram, FIA 8856-2000 Hologram only after manufactured date 01/01/2016	Visual Check	
Shoes	FIA 8856-2018 with Hologram, FIA 8856-2000 Hologram only after manufactured date 01/01/2016 Shoes with leather uppers with or without Elasticised ankle regions acceptable.	Visual Check	
Socks	FIA 8856-2018, FIA 8856-2000 Hologram not compulsory.	Visual Check	
Gloves	FIA 8856-2018 with Hologram, FIA 8856-2000 Hologram only after manufactured date 01/01/2016	Visual Check	
Arm restraints	Min SFI Spec 3.3 Installed so the driver can release them and exit unassisted regardless of vehicle's position	Visual Check	

EXTERIOR GENERAL

VE - VEHICLE ID and EQUIPMENT

Fire extinguishers	Two (2) hand-held, 0.9 kg (2lb) minimum. Dry chemical/dry powder, AFFF extinguishers; Must see BOTH at Tech Inspection. On-board fire system encouraged as alternative to hand-held that moves with car	Visual/Physical Check	
Push bar	With car, detachable, push & pull for 2 people standing behind the car. EVs: HV Disconnect tool, if used. See VE.2.2	Visual Check	
Jacking point	Must have an exposed tube at the rear perpendicular to the longitudinal axis approx. 30cm long by 2.5-2.9cm (1.0-1.125") O.D. Painted orange. Visible to person standing 1 meter behind car. Rear tyres must come off the ground using Quick-Jack (200mm lift) See VE.2.1	Visual/Physical Check	
Body & styling	Open wheeled, open cockpit, formula style body. Vertical keep out zones 75mm in front & behind tyres (no aero exceptions,) tyres unobstructed from sides.	Visual/Physical Check	
Car numbers	Number must appear on the front and both sides of vehicle. Min height: 150mm. Spacing at least 25mm from the edge of the background. Helvetica Bold, Colour: Day glo yellow on a black background. Round, Oval, Square or Rectangle. Numbers must not be obscured by any parts of the car.	Visual Check	
School Name and Other decals	School Name, or recognized initials. Min height: 50mm on both sides in Roman letters. See VE.1.2 Logo's displayed on the Nose cone symmetrically. See VE.1.3	Visual Check	


EXTERIOR GENERAL (CONT)			
Wings	Securely mounted, should not wiggle when gently touched, especially side to side. If in question, call organisers for formal test. IN.8.2.2 rear wings/aerodynamic devices.	See: Affix inspection sticker to front and/or	Visual/Physical Check
Wing edges	Horizontal leading edges minimum 5mm radius; vertical forward-facing edges minimum 3mm radius. See		Visual/Physical Check
Event sponsor decals	Event sponsor decals displayed on front of car. Minimum dimensions: 500mm x 210mm		Visual/Physical Check
Inspection sticker space	250mm x 200mm on centreline of upper front nose of car		Visual/Physical Check
Bodywork	Minimum 38mm radius on nose. No large openings in bodywork into driver compartment in front of or alongside driver (except cockpit opening). 75mm clearance Front and Back tyres viewed from above. See V.1.1		Visual/Physical Check
Wheelbase	Minimum 1525mm (60 in)		Physical Check
Aerodynamics	ALL aero devices, wings, under trays, splitters, maximum 70cm forward of front tyres, maximum 250mm rearward of rear tyres. Front wings no wider than outside of front tyres. REAR WINGS no wider than INSIDE of rear tyres. Under trays no wider than line between front and rear tyres. No power ground effects. See T.7.3 – 5		Visual/Physical Check
Aero vertical height	Rear wing max 1200mm above ground (incl. end plates); Front wing max 250mm above ground. No bodywork or aero higher than 500mm between axles (except centre 800mm of car, i.e., cockpit panels.) See T.7.5		Visual/Physical Check
Cameras	If >0.25 kg, must be secured by two points, No cameras mounted to helmet. See VE.2.5		Visual/Physical Check
PRIMARY STRUCTURE F - CHASSIS and STRUCTURAL			
Alternative frame	If alternative tube size/material, approved Structural Equivalency Sheet (SES) required. If using Alternative Frame Rules, See F.3.2.1 and F.3.5 No titanium or magnesium in primary structure.		Visual/Physical Check
Inspection holes	Tech may use ultrasound to measure wall thickness and/or ask 4.5mm holes be drilled. See F.5.3		Visual/Physical Check
Main hoop	MUST BE STEEL. 1.00" OD x 0.095" wall or 25mm OD x 2.5mm wall. Must be 1 piece & extend to lowest frame member. 380mm apart (inside dim.) where attaches to bottom tubes of the Major Structure. Above Major Structure, must be within 10° of vertical. No part angled rearwards more than 10° from vertical. Smooth bends with no wrinkles. See F.5.7		Visual/Physical Check
Main hoop bracing	MUST BE STEEL. One brace each side, 1.00" x 0.065" or 25mm x 1.6mm minimum, attached within 16cm of top. Minimum 30 deg. included angle with hoop. If main hoop is not vertical, bracing must not be on same side of vertical as main hoop. No bends. No rod-ends. Proper construction for removable braces (capping etc.) on BOTH ENDS. Must take load back to bottom of main hoop and node of upper side-impact tube thru proper triangulated structure. See F.5.8 If any item which is outside the envelope of the Primary structure is attached to the Main Hoop braces not at a node, additional bracing must be added to prevent bending loads in the braces in any rollover attitude. (eg.. suspension mounts, radiators or wings).		Visual/Physical Check
Bolted joints	Edge of any bolt hole located > 1.5 x hole diameter from nearest edge of the material (Primary structure joints only) See F.5.10		Visual/Physical Check
Shoulder harness mounting bar	1.00" OD x 0.095" wall or 25mm OD x 2.5mm wall steel or equiv. Gussets or braces if not straight to main hoop.		Visual/Physical Check
Front hoop	Must be closed section metal tube. 1.00" OD x 0.095" wall or 25mm OD x 2.5mm wall steel, or equiv. Can be multi-piece. Must extend down to lowest frame member. Maximum 20 deg. to vertical. No lower than top of steering wheel. Maximum 250mm horizontal distance to steering wheel. See F.5.6		Visual/Physical Check
Front hoop bracing	Two forward facing braces, 1.00" OD x 0.065" or 25mm OD x 1.6mm steel or equivalent, attached within 5cm of top. Extra rearward bracing required if Front Hoop leans backwards more than 10 degrees		Visual/Physical Check
Other side tubes	Design prevents driver's neck hitting bracing or other side tubes.		Visual/Physical Check

PRIMARY STRUCTURE (CONT)			
Side impact protection	Minimum of two (2) tubes + diagonal must connect main and front hoops. Upper tube must be entirely in a zone that is parallel to the ground between 240mm and 350mm above the lowest point of the top surface of the Lower Side Impact member. Lower tube can be lower frame member. At least one diagonal per side must connect the upper and lower members between the main and front hoops. All tubes to be 1.0" OD x 0.065" wall or 25mm OD x 1.6mm wall steel or equivalent. If Upper Side Impact tube is multi piece or bent, must have triangulating supporting tube from the furthest part of deviation from the straight line, back to a node on the chassis and the bent tube and support must be minimum 35mm x 1.2mm; See F.6.6.4	Visual/Physical Check	
Front bulkhead	1.0" OD x 0.065" wall, or 25mm x 1.6mm wall, steel tube or equiv. No non-crushable objects forward of bulkhead. See F.6.1	Visual/Physical Check	
Front bulkhead support	Support back to front roll hoop; minimum 3 tubes per side, all 1.00" OD x 0.049" wall steel tube or equivalent 1 bottom; 1 top within 50mm of top of bulkhead, and connecting within 4" above and 2" below upper side impact support (SIS) tube; 1 or more node-to-node diagonal to completely triangulate connections to upper and lower side impact support (SIS) tubes. (25mm x 1.5mm and 26mm x 1.2mm metric tubes OK) See F.6.2	Visual/Physical Check	
Impact attenuator	Impact Attenuator forward of bulkhead, 200mm long x 200mm wide x 100mm high. No wing supports through the IA. Bonded, or bolted to Plate with four 8mm bolts plus additional support. See F.8.4	Visual/Physical Check	
Impact attenuator mounting	All cars must have 1.5mm steel, 4mm Al, or approved equivalent IA anti-intrusion plate. Plate must be capable of taking transverse and vertical loads (welded or minimum eight 8mm bolts). Same size as outside dimensions of Front Bulkhead if bolted or to tube c/l if welded. Standard Impact Attenuator Plate: requires diagonal brace if the outside edge of the Plate is >1" from the edge of the Standard Impact Attenuator on any side. See F.8.5	Visual/Physical Check	
Seat	Insulated against heat conduction, convection and radiation. Lowest point no lower than bottom of side rails OR must have longitudinal 1.00" OD x 0.065" steel tube underneath. See T.1.5	Visual/Physical Check	
Monocoque	Must see laminate test specimens (2 or more) for both side impact support (SIS) and primary structure constructions. Steel backing plates (>2mm thick) used at attachment points. See F.7	Visual/Physical Check	
Thermal Protection	Protection when entering or exiting vehicle, exhaust, coolant hose or through the seat or floor.		
AV AIR AND FLUID PLUMBING for STEERING, SUSPENSION, BRAKES V3			
Ground clearance	Sufficient clearance so that no part of the car other than the tyres will contact the track surface.	Visual/Physical Check	
Suspension	Fully operational with dampers front and rear; 50mm minimum wheel travel with driver in vehicle. Safe clearance for any plumbing lines.	Visual/Physical Check	
Suspension pickup points	Inspected thoroughly for integrity.	Visual/Physical Check	
Brakes	Dual hydraulic system & reservoirs, operating all 4 wheels, (one brake on limited slip OK). System protected by structure/shields from d/train failure & minor collisions. No plastic brake lines or brake-by-wire. No parts below chassis/tub in side view. Brake pedal capable of 2000N (450 lbs-f) with no failures (tested only by organizers.) See T.3	Visual/Physical Check	
Steering wheel	Continuous perimeter, near round (no concave sections) with driver operable quick disconnect. 25cm maximum from Front Hoop	Visual/Physical Check	
AV Steering Mechanism	All steerable wheels must have positive stops to prevent linkage lock-up or tyres contacting any part of the car. 7 degrees maximum freeplay at the steering wheel. NO STEER-BY-WIRE on front wheels. Rear steer limited to 6° total, with mechanical stops. No bonded joints in column. Fittings and Security See V.3.2	Visual/Physical Check	
Fasteners	Intake manifold, fuel rail, steering, braking, impact attenuator (IA), harness & suspension system use SAE Grade 5, Metric Grade 8.8 or higher (AN/MS) with visible positive locking mechanisms, no Loctite or lock washers. Minimum of 2 exposed threads. Rod ends in single shear are captured by a washer larger than the ball diameter. Adjustable rod ends have jam nuts to prevent loosening. No button head cap, pan head or round head screws in critical locations, e.g., cage structure or harness mount. Nylon locknuts not for use above 80°C, i.e., near exhaust. See T.8	Visual/Physical Check	

INTERIOR		T.2 – DRIVER ACCOMMODATION	
Lap belt mounting	Must pass over pelvic area at between 45-65 deg. to horizontal for upright driver, 60-80 deg. for reclined. Pivoting mounting with eye bolt or shoulder bolt attached securely to Primary Structure	Visual/Physical Check	
Driver restraint harness	SFI 16.1, SFI 16.5 or FIA spec 5, 6 or 7 point and be labelled. 50mm wide shoulder belts OK with FHR. 50mm lap belts OK for FIA & SFI 16.5, All lap belts must have Quick Adjusters. Reclined drivers must have 6 or 7 point, and Quick Adjuster sub-belts or 2 sets of sub belts. Sub belts cannot touch frame tubes or holes in seat. Belts expire 2yr from manufacture date or after expiration month (if SFI); or 5 years after year (31 ST December) marked on label (if FIA)	Visual/Physical Check	
Harness mounts	No belts can pass through a firewall. (Belts must mount on driver side of firewalls.) All belts attached securely to primary structure - 1.00" OD x 0.065" steel tube minimum. Any tabs to be 1.0" x 0.063" thick minimum. Double shear preferred. Bolt-on tabs use minimum of two 1/4" diameter Gr 5 bolts	Visual/Physical Check	
Shoulder harness mounting	Mounting points 178mm to 229mm apart. Angle from shoulder between 10 deg. up and 20 deg. down to horizontal. Attach to Primary Structure not to put bending loads into Main Hoop Bracing w/o extra bracing	Visual/Physical Check	
Firewall	Fire resistant material; must separate driver (line-of-sight up to mid-height of driver's helmet) from fuel, cooling & oil systems. Wire/cable pass-throughs OK with grommets. Multiple panels OK w/ gaps sealed. No gaps at sides or bottom	Visual/Physical Check	
Floor closeout panel	Required from foot area to firewall; solid, non-brittle material; multiple panels are OK if gaps less than 3mm. See T.1.7	Visual/Physical Check	
Belt attachment fasteners	Attachment bolt must be a minimum of 10mm Metric Grade 8.8 (3/8" SAE Grade 5). Applies to all belts	Visual/Physical Check	
Head restraint	Meets SFI or FIA listed materials. Min 38mm thick, min 15cm wide, min height 28cm. Max 25mm from helmet, Helmet contact point 50mm minimum from any edge. Adjustable or changeable for different drivers. See T.2.8	Visual/Physical Check	
Roll bar padding	Meets SFI or FIA listed materials. Rollbar or bracing that could be hit by driver's helmet must be covered with 12mm thick (hard) padding. Pipe insulation and foam not permitted. See T.2.9	Visual/Physical Check	
Vehicle controls	All controls, including shifter, must be inside cockpit. No hands, arms or elbows outside side impact system to actuate.	Visual/Physical Check	
Visibility	100 deg. minimum field either side. Head rotation OK or mirrors. If mirrors, must be firmly installed and adjusted.	Visual/Physical Check	
Drivers' foot protection	Feet must be rearward of the Front Bulkhead and no part of shoes or legs above or outside the Major Structure in side or front views when touching pedals. See T.1.3	Visual/Physical Check	
Drivers' leg protection	Covers inside cockpit over sharp parts or moving suspension and steering components.	Visual/Physical Check	
REAR COMPARTMENT			
High pressure hydraulics	Pumps and lines must have 1mm thick steel or aluminium shields to protect driver and workers	Visual/Physical Check	
Scatter shield materials	For chains, 2.7mm minimum thick STEEL, 3 x chain width. For belts, 3mm minimum thick aluminium 6061-T6, 1.7 x belt width. A scatter shield is also required for motors which have outer casings rotating around the stator or have holes in the outer casing. This shield only has to be 1.0 mm Thick Al. alloy or 1 mm Steel	Visual/Physical Check	
Scatter shields general	Required for clutches, chains, belts, CVT rotating parts, motors with rotating outer casings or holes in the casing, etc. No holes. 6mm diameter M8.8 or 1/4" diameter Grade 5 fasteners minimum. End parallel to lowest part of front and rear sprockets	Visual/Physical Check	
Drivetrain finger guards	Required to cover all drivetrain parts that spin while car is at rest. No holes >12mm diameter.	Visual/Physical Check	
Visible access	To all items on Tech Sheet	Visual/Physical Check	
ELECTRICAL			
Battery	Attached securely to frame or chassis; hot terminal insulated; wet-cells in marine box if inside cockpit; must be marked identifiable as Pb or Li; All Li based batteries must show manufacturer protection circuit info, be rigid, sturdy, have fire retardant casing, and be separated from the driver by a firewall, while meeting the enclosure requirements. See T.9	Visual/Physical Check	

SPECIALISED TESTS			
Autonomous Computing Unit/s	Inspection for Location, Mounting, Security and Safety.	Visual / Physical Check	
Scanners / Cameras	Inspection for Location, Mounting, Security and Safety.	Visual / Physical Check	
Driver Template Position	Seat adjusted to rear most position, pedals to forward most position, Bottom circle placed in seat bottom and between centre of circle and rear most face of the pedals is no less than 915mm. This dimension must be retained. If not it must comply before Dynamic events. Loss of points for Design Score. See IN.6.2 PERCY See F.5.5.5	Visual/Physical Check	
Impact attenuator	The tested sample of the AI, including Anti Intrusion Plate must be presented and be same as IA on car, unless standard attenuator design is used. See F.8	Visual/Physical Check	
Cockpit opening	Template passes down from above cockpit to 25mm below lowest point of the top of the Side Impact Structure to less than or equal to 320mm above the lowest point inside the cockpit.. Steering wheel & column, seat & padding may be removed. No removing firewall. Fore/aft translation of template OK. See T.1	Visual/Physical Check	
Cockpit internal cross section	Pedals in most forward position. Vertically and may be moved horizontally, Template to pass from cockpit to 100mm rear of pedals. Steering wheel and padding removable with no tools & with driver in seat. Seat remains, Steering wheel can be removed. See T.1.2	Visual/Physical Check	
NON COMPLIANCE/S / COMMENTS:			

AV WEIGHING

Weight =	Record on Vehicle Sticker Panel	
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AV TILT TABLE INSPECTION

Lead Scrutineer:		Start Date/Time:
Liquid spillage	No Fluid spill permitted when car is tilted to 45 degrees in the direction most likely to create spillage. The test will be conducted with the vehicle containing the maximum amount of fluids it will carry during any test or event.	<input type="checkbox"/> PASS
Vehicle stability	All wheels in contact with tilt table when tilted to 60 degrees to the horizontal. The test will be conducted with the tallest driver in the normal driving position.	<input type="checkbox"/> PASS
Underside inspection	Inspect for untidiness, wiring, cables, extended bolt threads or anything that may hit or catch on the ground.	<input type="checkbox"/> PASS

AV TILT TABLE INSPECTION COMPLETE

Approved by:	Date/Time:
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ONCE ALL ITEMS ARE PASSED, THE "TILT TABLE" STICKER SHOULD BE FITTED TO THE VEHICLE. THE TEAM MAY THEN PROCEED TO EGRESS TESTING.

NON-COMPLIANCE/S / COMMENTS

NOT REQUIRED FOR AV DEMONSTRATION - 2022

AV

DRIVER COCKPIT CHECKS

IN.5.2 EGRESS TEST

DRIVER CLEARANCE Helmet Line - Helmet of tallest driver to be 50mm below line between top of front and main roll hoop.

Head Restraint - Fore & aft, 25.4mm maximum to back of helmet.

Head Restraint - Helmet contact point 50mm minimum from any surface.

Forward Head Restraint (if fitted) fitted and worn correctly with helmet and shoulder straps.

Lap Belt - Over hip bones and tight.

Shoulder Belts - 10 deg. up & 20 deg. down to horizontal and tight

Crotch Belt/s – Tight

Arm Restraints - Correctly fitted

Egress – Fully restrained, Hands in driving position on fitted steering wheel. Less than 5 seconds to exit to side of vehicle with BOTH feet on ground from fully seated position in full safety wear.

Must include actuation of Cockpit Master switch. ALL DRIVERS

Driver's Name	Helmet Line	Head Rest-Fore & Aft	Head Rest-To Edges	FHR Y OR N	Lap Belt	Shoulder Belts	Arm Restraints	Sub Belts	Egress	Driver's License	Inspector

AV MECHANICAL TECHNICAL INSPECTION COMPLETE

Approved by:

Date/Time:

ONCE ALL ITEMS ARE PASSED, THE "TECH INSPECTION" STICKER SHOULD BE FITTED TO THE VEHICLE. THE TEAM MAY THEN PROCEED TO ELECTRICAL TECHNICAL INSPECTION (PART 2)

AV ELECTRICAL TECHNICAL INSPECTION (PART 2) - FUNCTIONAL DEMONSTRATION

Lead Scrutineer:

Start Date/Time:

ACCUMULATOR MANAGEMENT SYSTEM

Cell Voltage Monitoring	AMS must monitor the cell voltage of each cell	Activate AMS system and show measurement data of the AMS for each cell (e.g., via laptop)
Cell Temperature Monitoring	AMS must monitor the temperature of at least 30% of cells in pack	
AMS indicator light	A red LED marked "AMS" or "BMS" must be installed in the cockpit that lights up, if the AMS shuts down the car	Visual Check (function must not be demonstrated)

CHARGER

Check and mark charger	Charger needs to be professionally built, with no damaged insulation on cables	Visual Check
Check and mark charger	Charger must have current electrical 'test and tag' tag	Visual Check

TEST AT HIGH VOLTAGE

All driven wheels have to be off the ground! Car has to be jacked up with driven wheels removed

TS only allowed to be powered up, when GLVS is powered up	Try to switch on Tractive System with GLVS Master switch in Off-Position	No voltage above 60VDC allowed at measurement points.
TS only allowed to be powered up, when GLVS is powered up	Switch on Tractive System and then switch off GLVS Master switch	Tractive system must switch off as well
Tractive System Voltage	Measure HV during following tests. Must be less than or equal to 600VDC	Measured Voltage: _____ [V]
Pre-Charge Circuit	A circuit that is able to pre-charge the intermediate circuit to at least 90% of the current accumulator voltage before closing the second AIR has to be implemented	Check with multi-meter during power up of the tractive system that the system is pre-charged before the second AIR closes.
Accumulator Indicator Light / Voltmeter	Accumulator Indicator Light or analogue voltmeter has to show if voltage above 60VDC is present outside of the container	Visible check
Tractive system active light	The TSAL must be switched on whenever outside of accumulator container exceeds 60V DC or 40V AC RMS or when the accumulator insulation relays are closed	Visual check / use multi-meter
Tractive system active light	The TSAL must be red	Visual Check
Tractive system active light	The TSAL has to flash continuously with a frequency between 2Hz and 5Hz	Visual Check
IMD	IMD indicator light inside the cockpit must be marked with "IMD" and must be RED	Visual Check
Calculate IMD Test-Resistor Value	$R_Test = (\text{maximum TS voltage} * 250\Omega/V) - BPR$	R test [kΩ]:
IMD Test. Note: Teams should have a test lead manufactured with insulated banana plugs and with appropriate resistor in place.	Activate Tractive System, Connect R_Test between HV+ and GLVS ground	TS voltage must decrease below 60VDC in 5 sec, IMD may take up to 30s to react
	Activate Tractive System, Connect R_Test between HV and GLVS ground	TS voltage must decrease below 60VDC in 5 sec, IMD may take up to 30s to react

TEST AT HIGH VOLTAGE

All driven wheels have to be off the ground! Car has to be jacked up with driven wheels removed

IMD	IMD status must be shown to the driver (visible in bright sunlight)	Visual Check	
IMD or BMS Error disables TS	The tractive system may not automatically return to active state after the IMD test resistor was removed or a BMS error disabled it. The Driver must not be able to reactivate the tractive system	Demonstrated by the team	
Seal all important parts after the IMD test was passed successfully	Accumulator container, Motor Controller Housing, etc.		
Prove correct function of all shutdown devices. Note: Care must be taken not to overheat pre-charge or discharge resistors during tests. Allow cooling off time if required.	All switches on --> GLVS master switch off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
	All switches on --> TS master switch off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
	All switches on --> Left Shutdown button off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
	All switches on --> Right Shutdown button off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
	All switches on --> Cockpit Shutdown button off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
	All switches on --> Brake -Over Travel Switch off	Voltage at TS test points must fall to below 60VDC within 5 seconds	
Inertia Switch	Unmount inertia switch. Activate TS and measure HV voltage. Shake the switch and check if TS is shutdown. TS is not allowed to reactivate without a manual reset e.g. by the driver	Voltage at TS test points must fall to below 60VDC within 5 seconds	
Ready-To-Drive-Mode	Only closing the shutdown circuit must not set the car to ready-to-drive mode. The car is ready to drive as soon as the motor(s) will respond to the input of the torque encoder/ acceleration pedal	Check that car is not automatically Ready-To-Drive, when TS is activated	
Ready-To-Drive-Mode	Additional actions are required by the driver to set the car to ready-to-drive-mode e.g. pressing a dedicated start button, after the tractive system has been activated. One of these actions must include the brake pedal being pressed as ready-to-drive-mode is entered	The team must demonstrate how the car is set to Ready-To-Drive mode by the driver (pressing the brake pedal is mandatory)	
Ready-To-Drive-Sound-Test	The car must make a characteristic sound, once but not continuous, for at least 1 second and a maximum of 3 seconds when it is ready to drive The sound level must be a minimum of 70dBA, fast weighting, in a radius of 2m around the car The used sound must be easily recognizable. No animal voices, song parts or sounds that can be interpreted as offensive will be accepted	Check/measure during Ready- To-Drive-Mode test	
Torque Encoder / Brake Pedal Plausibility Check	Torque encoder is at more than 25% and brake is actuated simultaneously. The motors have to shut down. The motor power shut down has to remain active until the torque encoder signals less than 5% pedal travel, no matter whether the brake pedal is still actuated or not	Check that driven axles turn with torque encoder > 25%. Then additionally activate the brake- Motors must stop. Release brake-> motor is still shutdown Slowly drop torque encoder until it is below 5%. Motors are allowed to move again after torque encoder has gone below 5%	

TEST AT HIGH VOLTAGE

All driven wheels have to be off the ground! Car has to be jacked up with driven wheels removed

Torque Encoder Implausibility Check	<p>If an implausibility occurs between the values of two torque encoder sensors the power to the motor(s) has to be immediately shut down completely. It is not necessary to completely deactivate the Tractive System, the motor controller(s) shutting down the power to the motor(s) is sufficient</p> <p>Implausibility is defined as a deviation of more than 10% pedal travel between the sensors</p> <p>If three sensors are used at least two sensors have to be within 10% pedal travel, etc.</p>	<p>Check that driven axles turn, then disconnect at least 50% of the sensors and check that the power to the motors is shut down</p> <p>The sensor should be disconnected while the axles are turning</p>	
Brake System Plausibility Device	<p>A standalone non-programmable circuit must be used on the car such that when braking hard (without locking the wheels) and when a positive current is delivered from the motor controller (a current to propel the vehicle forward), the AIRs will be opened. The current limit for triggering the circuit must be set at a level where 5kW of electrical power in the DC circuit is delivered to the motors at the nominal battery voltage. The action of opening the AIRs must occur if the implausibility is persistent for more than 0.5s.</p>	<p>The team must devise a test to prove this required function during Electrical Tech Inspection.</p> <p>However, it is suggested that it should be possible to achieve this by sending an appropriate signal to the non-programmable circuit that represents the current to achieve 5kW whilst pressing the brake pedal to a position or with a force that represents hard braking</p>	
Brake System Plausibility Device	<p>The Brake Plausibility Device may only be reset by power cycling the GLVS Master Switch or via a RESET button, located out of reach from the driver</p>	<p>Check that TS is only reactivated, after the GLVS has been cycled or reset button pressed</p>	
Brake Light	<p>One (!) RED brake light, clearly visible from the rear; on vehicles centreline; height between wheel centreline & driver's shoulders. Round, triangle, or rectangular on black background. 15cm² minimum illuminated area. Sufficient brightness for visible activation in bright sunlight</p>	<p>Visible check during the tests containing brake pedal actuation</p>	
Energy Meter	<p>The energy meter will be checked to ensure it is functioning correctly</p>	<p>Download the data from the meter. Ensure correct functionality</p>	

AV ELECTRICAL TECHNICAL INSPECTION - COMPLETION AND PART SEALING

VEHICLE MUST HAVE TS SHUTDOWN, HVD DISCONNECTED AND TSMS KEY REMOVED AND LOCK REINSTALLED

Car movement	Check car movement with all electrical systems deactivated	Try to move the car manually with deactivated TS (press throttle)	
Seal important parts after the TS tests have been passed successfully	Accumulator container(s) including spares	Part Sealed:	
	Motor controller housing	Part Sealed:	
	Energy meter housing	Part Sealed:	
	IMD housing	Part Sealed:	
	TSAL circuitry housing	Part Sealed:	
	Additional part:	Part Sealed:	
	Additional part:	Part Sealed:	
	Additional part:	Part Sealed:	






AV ELECTRICAL TECHNICAL INSPECTION (PART 2) COMPLETED

Approved by:

Date/Time:

ONCE ALL ITEMS ARE PASSED, THE "EV TECH INSPECTION" STICKER SHOULD BE FITTED TO THE VEHICLE. THE TEAM MAY THEN PROCEED TO AUTONOMOUS SYSTEM TECHNICAL INSPECTION.

NON-COMPLIANCES/COMMENTS

AV AUTONOMOUS SYSTEMS (AS) TECHNICAL INSPECTION			
Lead Scrutineer:		Start / Date Time:	
PERSONNEL, DOCUMENTATION AND SAFETY EQUIPMENT			
Teams are expected to have appropriate safety equipment to allow them to work on their vehicle. All safety equipment should be in good condition.			
Identify Autonomous Systems Responsible (ASR)	The Autonomous Systems Responsible is the first point of contact for all autonomous driving matters. Do they know their responsibilities? FS S4.4	Ask for ASR	
Identify Electrical Systems Officer (ESO)	The Electrical Systems Responsible is the first point of contact for all Electrical safety matters. This could be the ASR or a dedicated ESO person.	Visual Check	
Remove HVD	Check HDV is removed and TSMS ASMS locks are in place.	Visual Check	
Equipment and Resources required:	Remote Emergency Stop (RES) Control. Equipment needed to arm EBS. Photographs of any inaccessible AS hardware. Autonomous Systems Form (ASF)	Visual Check	
FSAE-A AV Data logger	Ensure that the FSAE-A AV Data logger has been installed as per the 2022 AV Data logger technical directive.	Visual check	
AUTONOMOUS SYSTEMS MASTER SWITCH (ASMS)			
 All Master Switches are located above 80% of shoulder height of Percy. On right side of vehicle, easily accessible next to each other.			
Identify ASMS	 <p>ASMS is installed, easily accessible, on right side of vehicle, clearly labelled and located next to the TSMS and LVMS</p> <p>ASMS  TS  LV </p>	Visual Check	
ASMS Lockout	ASMS must be fitted with a lockout / tag out" capability to prevent accidental activation of the autonomous system.	Visual Check	
Tractive System Switches	Two Shutdown buttons installed next to Main hoop, right and left side, approx. height of driver's head. ≥ 39mm One in cockpit. ≥ 24mm Marked with Red sparkled sticker.	Visual Check	
High Voltage Disconnect	Clearly marked "HVD". Inside rollover protection envelope, Easily visible from behind. Distance to ground >350mm.	Visual Check	
REMOTE EMERGENCY STOP (RES)			
RES Installed	Compliant RES receiver device is installed in the vehicle.	Visual Check	
RES Control	RES Control is present and only to be used by the delegated ASR.	Visual Check- acknowledge with Team member	

AUTONOMOUS SYSTEM STATUS INDICATORS (ASSI)			
ASSI Allocations	ASSIs are mounted behind the driver's compartment on both sides of the vehicle, min 160mm below the top of Main hoop and 600mm above the ground. The rear ASSI is mounted on the vehicle centreline, near vertical, min 160mm below top of Main hoop and 100mm above the Brake light. Round, triangle or rectangular on Black background. 15cm ² min or LED strip length greater than 150mm with elements <20mm apart.	Visual Check Visual Check	
AV	AUTONOMOUS SYSTEM TECHNICAL INSPECTION	FUNCTIONAL DEMONSTRATION	
Lead scrutineer:	Start Date / Time:		
TEST AT HIGH VOLTAGE All driven wheels have to be off the ground! Vehicle has to be jacked up with driven wheels removed.			
EMERGENCY BRAKE SYSTEM (EBS)			
EBS vs ASF	Emergency Braking system is identical to the system described in the ASF. Ensure that the EBSD is using only passive systems with mechanical energy storage.	Visual Check	
EBS Mounting	All parts of the EBS are properly mounted and no leaks can be seen.	Visual Check	
Push-in Fittings	No push-in or one-touch fittings are used in EBS critical circuits.	Visual Check, cross check with ASF for number of fittings.	
EBS Activation	EBS cannot be activated if ASMS is switched off.	Team must explain their solution.	
EBS Release	The method of releasing EBS is tool less. EBS release is clearly labelled and accessible. Marked with 100mm x 20mm red arrows Verify function by monitoring EBS CAN messages from FSAE-A AV Data logger	Team must explain the method of releasing EBS. Manual release points are clearly visible.	
ASB	Manual braking must always be possible.		
ASB Deactivation points	ASB can be deactivated by a max of two deactivation points, working without electrical power. Have a red handle and mounted near the ASMS or on the top side of the vehicle between front bulkhead and front roll hoop. Marked with "Brake release"		

AUTONOMOUS SYSTEM TEST			
1.	Switch on LVMS and select inspection mission (AMI)	ASSI should remain off. Verify function by monitoring EBS CAN messages from the FSAE-A AV Data logger.	
2.	Switch on ASMS. Activating tractive system from cockpit button should not be possible.	Test that TS does not activate.	
3.	Activate TS and press RES "Go" button.	Vehicle enters "AS Ready" state, ASSI are yellow and continuous. Vehicle is not R2D. All ASSI are bright and at least one ASSI is visible from any angle view of the vehicle. Was CAN message observed on the Data logger?	
4.	Press RES "Go" button.	Vehicle transitions to "AS Driving" state, ASSI are yellow and flashing. Drivetrain is slowly spinning and steering system is actuating in sine wave. Was CAN message observed on the Data logger?	
5.	Wait for transition to "AS Finished".	Vehicle transitions to "AS Finished" state within 30s after step 4. ASSI are blue and continuous. Brakes are engaged. EBS is not triggered and ASSI are not flashing. Was CAN message observed on the Data logger?	
6.	Blue ASSI is clearly visible in sunlight.	Visual Check.	
7.	Deactivate tractive system and turn off ASMS. Reset EBS if needed.	TS turns off, ASSI turn off. Allow teams to reset EBS with manual action if needed. Brakes are disengaged. Was CAN message observed on the Data logger?	
8.	Power cycle LV system and enter "AS Ready" state.	Vehicle enters "AS Ready" state, ASSI are yellow and continuous. Vehicle is not R2D. Was CAN message observed on the Data logger?	
9.	Press on-board shutdown button while vehicle is in "AS Ready" state.	Vehicle transitions to "AS Emergency" state, ASSI are blue and flashing. EBS is activated and brakes engaged. Was CAN message observed on the Data logger?	
10.	Turn off ASMS and reset EBS. Power cycle LV system and enter "AS Driving" state again with inspection mission still selected.	Vehicle transitions to "AS Driving" state, ASSI are yellow and flashing. Drivetrain is slowly spinning and steering system is actuating in sine wave. Was CAN message observed on the Data logger?	
11.	Press RES Shutdown button.	Tractive system deactivates without significant delay. Vehicle transitions to "AS Emergency" state, ASSI are blue and flashing. EBS is activated and brakes are engaged. The reaction time between opening the SDC must not exceed 200ms FS T15.4.1 Was CAN message observed on the Data logger?	
NON-COMPLIANCES / COMMENTS:			

AV RAIN TEST INSPECTION

Lead Scrutineer:

Start Date/Time:

Rain proof	EVs must pass the rain test as defined to compete in the dynamic events. The car is lifted off the ground. Tractive system has to be active (TSAL ON). Water like rain will be sprayed at the car for 120sec. – Passed if the Insulation Monitoring Device does not react and shut down the Tractive System (TSAL ON) during and 120 seconds after the rain test. No driver is allowed to sit in the car during the test. Total test duration 240 seconds See IN.11	<input type="checkbox"/> PASS
Temporary Sealing	Inspect electrical joints/plugs and socket fittings for any use of removable tape, which is not acceptable It must be removed before the test.	<input type="checkbox"/> PASS

NON-COMPLIANCES / COMMENTS:

RAIN TEST INSPECTION COMPLETE

Approved by:

Date/Time:

ONCE ALL ITEMS ARE PASSED, THE “RAIN TEST” STICKER SHOULD BE FITTED TO THE VEHICLE. THE TEAM MAY THEN PROCEED TO EMERGENCY BRAKE SYSTEM TEST.

AV EMERGENCY BRAKE SYSTEM TEST

Lead Scrutineer:	Start Date/Time:	
Braking performance	During the brake test, the vehicle must accelerate in autonomous mode up to at least 40km/h within 20 m. From the point where the RES is triggered, the vehicle must come to a safe stop within a maximum distance of 10 m. In case of wet track conditions, the stopping distance will be scaled by the officials dependent on the friction level of the track.	

EBS TEST PROCEEDURE

Position Vehicle	Allow team to position vehicle at the staging/start area. Allow the EBS to be readied, manually if necessary.		
LVMS	Switch on LVS and select "EBS Test" mission	Check correct mission selected on AMI.	
ASMS & TS	Switch on ASMS and TSMS. Activate TS.	ASSI is yellow and continuous, vehicle is stationary. TSAL is red and flashing.	
Clear Area	Ensure that the test track is clear and all personnel are behind physical barriers.	Visual Check	
Begin Test	Instruct ASR to press "GO" button on RES.	ASSI begins flashing yellow. Vehicle begins to accelerate.	
Activate RES	ASR must press RES "Stop button" when the vehicle is at the brake point.	Vehicle stops within 10 m and has a stable deceleration. Speed at brake point is close to 40km/h. ASSI is blue and flashing. TSAL is green and continuous.	
Recover Vehicle	Recover vehicle if the previous stage is cleared and the ASSI and TSAL indicate that the vehicle is safe to approach.		

AV EBS TEST INSPECTION COMPLETE
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Approved by:	Date/Time:
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ONCE ALL ITEMS ARE PASSED, THE "BRAKE TEST" STICKER SHOULD BE FITTED TO THE VEHICLE. THE TEAM MAY THEN PROCEED TO DYNAMIC DEMONSTRATIONS.

AV NON COMPLIANCE / COMMENTS: