

INFORMATIONS

University:
Vehicle number:
ESF PASSED:
TS VOLTAGE:
BODY PROTECTION R:
ABS:

Present the vehicle for inspection in following order:

- Pre-Inspection
1. Accumulator Inspection
 2. Low Voltage Inspection
 3. Mechanical Inspection
 4. High Voltage Inspection
 5. Tilt Test
 6. Rain Test
 7. Brake Test

USED SYMBOLS:

- Information
- ▶ Action
- △ Check in responsibility of the team
- Check

NOTES:

- This form must always stay with the push bar!
- Technical inspection approval voids if inspection sheet is lost.
- If there is a conflict between this form and the rules, the rules prevail.

PART I: PRE-INSPECTION

APPROVAL

| Inspector Names | Date and Time | Signatures when passed |
|------------------|---------------|------------------------|
| 1. _____ / _____ | | |
| 2. _____ / _____ | | |

TIRES

- | | |
|---|---|
| 1 ○ DRY TIRES - Make: _____ | 4 ○ WET TIRES - Make: _____ |
| 2 ○ DRY TIRES - Size: _____ | 5 ○ WET TIRES - Size: _____ |
| 3 ○ DRY TIRES - Compound: _____ | 6 ○ WET TIRES - Compound: _____ |
| | 7 ○ WET TIRES – 2,4 mm min. tread depth molded by tire manufacturer _____ |

DRIVER GEAR & SAFETY

- | | |
|--|---|
| 8 ○ FACE SHIELDS - Made of impact resistant material. | |
| 9 ○ UNDERWEAR - Must be made from acceptable fire-resistant material as listed in T 13.3.11 and must cover the driver's body completely from neck down to ankles and wrists | 41.1/2020 FIA 8860-2010, FIA 8860-2018, FIA 8859-2015 (with SA 2015), FIA 8858-2010 (with SA(H) 2010). Closed Face, no Open Face, must have integrated shield (no dirt bike helmets). No camera mounts. |
| 10 ○ SOCKS - Nomex or equivalent, fire-resistant socks (no cotton, no polyester, no bare skin). | 14 ○ DRIVER SUITS - SFI 3.2A/5 (or higher) • SFI 3.4/5 (or higher) • FIA Standard 8856-2000 • FIA Standard 8856-2018 |
| 11 ○ GLOVES - Fire resistant material. No holes. Leather allowed only over fire resistant material. | 15 ○ HAIR COVER - Fire resistant (Nomex or equiv.) balaclava of full helmet skirt REQUIRED FOR ALL DRIVERS. |
| 12 ○ ARM RESTRAINTS - SFI Standard 3.3 or equivalent. | 16 ○ SHOES - SFI 3.3 or FIA 8856-2000/2018 |
| 13 ○ HELMETS - Snell K2010, K2015, K2020, M2010, M2015, M2020, SA2010, SAH2010, SA2015, SA2020, EA2016, SFI 31.1/2010, 31.1/2015, 31.1/2020, 41.1/2010, 41.1/2015, | |

NON-COMPLIANCE / COMMENTS

PART II: EGRESS TEST

APPROVAL

| | | |
|------------------|---------------|------------------------|
| Inspector Names | Date and Time | Signatures when passed |
| 1. _____ / _____ | | |
| 2. _____ / _____ | | |

DRIVER POSITION

- | | |
|--|---|
| <p>17 <input type="radio"/> ARM RESTRAINTS- Must be installed so the driver can release them and exit unassisted regardless of vehicle's position.</p> <p>18 <input type="radio"/> HEAD RESTRAINT- Near vertical. Max. 25 mm from helmet. Helmet contact point 50 mm min. from any edge.</p> <p>19 <input type="radio"/> MAIN HOOP & FRONT HOOP HEIGHTS - Helmet of driver to be 50 mm below line between top of front and main roll hoop AND</p> | <p>between top of main hoop to rear attachment point of main hoop bracing.</p> <p>20 <input type="radio"/> LAP BELT MOUNTING - Must pass over pelvic area between 45 - 65 deg. to horizontal for upright driver, 60-80 deg. For reclined. The lap belts must not be routed over the sides of the seat.</p> <p>21 <input type="radio"/> SHOULDER HARNESS MOUNTING - Angle from shoulder between 10 deg. up and 20 deg. down to horizontal.</p> |
|--|---|

DRIVER EGRESS TEST

- | | |
|---|---|
| <ul style="list-style-type: none"> • All drivers must be able to exit the vehicle in less than 5s. | <ul style="list-style-type: none"> • Driver must be seated in ready to race condition. |
|---|---|

EGRESS PROCEDURE

- | | |
|--|--|
| <ul style="list-style-type: none"> ▶ Both hands on the steering wheel. (In all possible steering positions) ▶ Pressing cockpit-mounted shutdown button | <ul style="list-style-type: none"> • The egress time will stop when the driver has both feet on the ground. |
|--|--|

DRIVER APPROVAL & RUN DOCUMENTATION

| | Driver Name | Driver ID | Signature when passed | Acc | SkidPad | AutoX | Endurance |
|----|-------------|-----------|-----------------------|-----|---------|-------|-----------|
| 1. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |
| 2. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |
| 3. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |
| 4. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |
| 5. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |
| 6. | _____ | _____ | _____ | □□ | □□ | □□ | □□ |

DV Class

- ▶ Connect charger (do not activate charger) to accumulator, keep AIRs opened.
- ▶ Measure resistance: $R_{iso+} = \quad k\Omega$
- 45 Resistance is much higher than minimal value⁴.
- ▶ Connect insulation tester to TS- and LV ground.

- ▶ Measure resistance: $R_{iso-} = \quad k\Omega$
- 46 Resistance is much higher than minimal value⁴.
- 47 Resistances are nearly equal.
- ▶ Open container housing, remove maintenance plugs.
- ▶ Check if no voltage is present.

ASSEMBLY

- 48 All components and parts of the accumulator container are properly fixed.
- 49 TS potentials are insulated against the inner wall of the accumulator container if the container is made from conductive material.
- 50 All used fasteners must be secured by the use of positive locking except they are non-conductive and non-structural.
- 51 Tabs of pouch cells do not carry mechanical loads. Pouch cells carry mechanical loads only on the large surface areas.
- 52 No soldering in high current path
- 53 Every container contains at least one appropriately sized and rated fuse.
 - ▶ Check the datasheet of fuse, main wire and cells and compare them to ESF.
- 54 Every container contains at least two appropriately sized and rated isolation relays (current and voltage).
- 55 Isolation relays and fuses are separated from cells by a barrier according to UL94-V0 or equivalent.
 - ▶ Check datasheet of pre-charge relay and compare to ESF
- 56 Pre-charge relay is of mechanical type with appropriate voltage rating.

- 57 Maintenance plugs are located at both poles of each stack (including first and last stack). Removable from both poles.
- 58 Maintenance plugs are removable without tools.
- 59 Maintenance plugs have a positive locking mechanism.
- 60 Maintenance plugs must not be able to unintentionally create circuits or short circuits.
- 61 Stacks separated by Maintenance plugs ≤ 120 VDC.
- 62 Stacks separated by Maintenance plugs ≤ 6 MJ.
- 63 Stacks are insulated and separated by a fire-resistant barrier according to UL94-V0 for min. used thickness or equivalent.
- 64 Holes in container only for wiring harness, ventilation, cooling or fasteners, mechanical properties are not influenced.
- 65 External openings for cooling or mounted connected cooling ducts are not pointing towards the driver, or if the accumulator is out of the car, towards the operator of the accumulator hand cart.
- 66 Check openings in TS enclosures, try to reach TS potentials with an insulated test probe (100 mm length, 6 mm diameter).
- 67 If fully closed, an equalizing valve is implemented.
- 68 Spare accumulators of the same size, weight, and type.

WIRING

- 69 All TS wires have proper overcurrent protection.
- 70 No other wires than TS wires are orange.
- 71 Securely anchored to withstand at least 200 N, if outside of enclosure.
- 72 Located out of the way of possible snagging or damage.
- 73 TS and LV wires separated (not valid for Interlock).
- 74 Every wire used in the Accumulator container (TS and LV) is rated for maximum TS voltage.

- 75 Ask team to prove that TS wires fulfill temperature rating $> 85^\circ\text{C}$ and voltage rating
- 76 Positive locking mechanism or if no positive locking possible, automotive certified components.
- 77 Connectors outside of TS enclosures are physically impossible to electrically connect in other than the design intended configuration
 - ▶ Check if insulated tools needed for the assembly of certified components are available
- 78 Insulation is not only insulating tape or rubber-like paint

INDICATOR LIGHT OR VOLTMETER

- 79 Indicator light or voltmeter installed
- 80 Marked with "Voltage Indicator"
- 81 Visible while opening the battery connector.
- 82 Hard wired electronics, supplied by TS

- ▶ Connect power supply with $60 V_{DC}$ to accumulator TS connector.
- 83 Indicator light on or voltmeter showing present TS voltage.
- 84 Red (in case of indicator light) and visible in bright sunlight.

ACCUMULATOR MANAGEMENT SYSTEM

- 85 A minimum of 30 % of cells are monitored with temperature sensors.
- 86 Every temperature sensor is placed on the negative terminal of the monitored cell or in < 10 mm distance on busbar.
- 87 If multiple TSACs are used, each one has its own, full AMS and includes exclusive SDC
 - ▶ Ask the team to prepare TSAC for charging.
 - ▶ Connect charger to battery/batteries, start charging process.
 - ▶ Do following procedure for all TSACs, if applicable
 - ▶ Disconnect AMS current sensor connector

- 88 The AMS must open the shutdown circuit within 0.5 s.
 - ▶ Disconnect one SINGLE voltage sense wire, if any wires are used.
- 89 The AMS must open the shutdown circuit within 0.5 s.
 - ▶ Ask the team to connect their laptop to the AMS.
- 90 Cell voltages can be displayed.
- 91 Cell temperatures can be displayed.
 - ▶ Disconnect AMS internal connector used for cell temperature measurement
- 92 Respective failed cell temperature measurement is displayed
- 93 Plausible accumulator current can be displayed.

CHARGER SHUTDOWN CIRCUIT

- 94 IMD is integrated into the charging system
 - ▶ Connect charger to battery/batteries, start charging process
- 95 Voltage indicator shows that HV is present
 - ▶ Press shutdown button
- 96 AIRs open

- 97 Voltage indicator shows voltage < 60 V
 - ▶ Start charging, unplug TS accumulator connector
- 98 AIRs open.
- 99 Charger disabled, no voltage at charger connector

INSULATION MONITORING DEVICE

- 100 One IMD ground line is connected to the accumulator container and one ground line is connected to the charger casing by a separate wired connection
 - ▶ $R_{T\text{est}} = \quad k\Omega$ ⁶
 - ▶ Activate charger output, connect $R_{T\text{est}}$ between TS+ and LV GND.

- 101 Shutdown circuits opens within 30 s.
- 102 TS voltage decreases below $60 V_{DC}$ within 5 s after shutdown circuit opens.

⁴ Minimal Resistance = $500 \Omega/V \cdot U_{max} + BPR$

⁵ 60 V or half the nominal tractive system voltage, whichever is lower

⁶ $R_{T\text{est}} = (\text{max. TS voltage} \cdot 250 \text{ Ohm/V}) - BPR$

DV Class

- 103 Reactivation of charger output is not possible.
 - ▶ Push the reset button, if any.
- 104 Reactivation of charger output is not possible.
 - ▶ Remove R_{Test} . Wait 40 s until IMD resets status output.
- 105 Reactivation of charger output is not possible.
 - ▶ Activate TS, connect R_{Test} between TS- and LV GND.
- 106 Shutdown circuits opens within 30 s

ACCUMULATOR CONTAINER

- ▶ Invite mechanical scrutineer for assistance with point #107
- ▶ Team must show approved SES for the accumulator container.
- ▶ Team must show SES test samples for the accumulator container if alternative materials are used.
- 107 Accumulator container manufactured according to SES.
- 108 Internal vertical walls have to be rigidly fastened to the container. Minimum 75% of the height of the external walls. Divide the accumulator in sections of max. 12 kg.
- 109 Barriers do not divide any accumulator segment
- 110 Cells securely fastened towards all 3 directions.
- 111 Vehicle number, university name and ESO phone number(s) written on a high contrast background.
- 109 Roman Sans-Serif characters of at least 20 mm high are used.
- 110 Warning stickers with side length of ≥ 100 mm and text "Always Energized" and "High Voltage" (if TS > 60 V) installed. (Triangle with black lightning bolt on yellow background)
- 111 Check if all parts and the cover/lid of the housing are rigidly fastened.

HAND CART

- 112 Hand cart present with four wheels. Max. dimensions 1200 mm x 800 mm.
- 113 Hand cart has an always-on type brake system.
- 114 Hand cart provides a firewall with same width as the hand cart, starting at the lowest point of the hand cart (excluding wheels) and is >30cm higher than the handle.
- 115 The accumulator must be mechanically fixed to the hand cart while on the hand cart.
- 116 The accumulator must be protected from vibrations and shocks.
- 117 Label according to point #110 still visible while on hand cart.

SEALING OF COMPONENTS

- ▶ After all tests have been passed successfully seal the inspected TS housings:
- 118 Accumulator container(s) including spares
- 119 Charger
- 120 Additional Part:
- 121 Additional Part:

TIS STATUS UPDATE

- ▶ Inform Scut management about attempt result
- ▶ update attempt info table on the beginning of the section

NON-COMPLIANCE / COMMENTS

PART IV: ELECTRICAL INSPECTION

APPROVAL

| Inspector Names | Date and Time | Signatures when passed |
|------------------|---------------|------------------------|
| 1. _____ / _____ | | |
| 2. _____ / _____ | | |

TIS STATUS UPDATE / TIMER

- Set online TIS status
 Add timer to the car
 Start timer

REQUIRED RESOURCES

- 122 An ESO must attend.
- TSAC mounted into vehicle
 - LV battery or cell datasheet
 - For self-developed LV battery packs: an opened LV battery pack, laptop, and cables to display data of the LV battery AMS
- Datasheets for used wiring, insulation materials, and TS components. (Printed or properly sorted on one laptop, not on a cell phone)
 - At least all non-passed parts of the ESF. (Printed or properly sorted on one laptop, not on a cell phone)
 - Samples of all wire types used for the tractive system
 - Photographs of all inaccessible TS connections

LV BATTERY

- 123 Voltage $\leq 60 V_{DC}$
- 124 Rigid and sturdy casing
- 125 Only for wet-cell batteries: IPX7 rated and acid resistant casing if inside cockpit
- 126 Behind Firewall
- 127 Short circuit protection (e.g., fused)
- 128 Proper insulation of internal electrical connections
- 129 Proper mounting of cells
- 130 Complete battery pack inside rollover protection envelope
- 131 Has overpressure relief, gas vent behind firewall (only applies to fully enclosed battery case)
- Following checks only for Li-Ion batteries other than LiFePO4:
- 132 UL94-V0 for min. used thickness or equivalent casing
- 133 Overcurrent protection that trips below max. discharge current
- 134 Overtemperature protection of at least 30 % of the cells (max. 60°C or datasheet, whichever is lower)
- 135 Voltage protection of all cells
- 136 Signal failures electrically disconnect the LV battery (SCS) (check the schematics of LV battery AMS)
- Ask the team to connect their laptop to the AMS
- 137 Cell voltages can be displayed
- 138 Cell temperatures can be displayed

MASTER SWITCHES

- 139 TSMS & LVMS installed easily accessible on the right side of the vehicle and located next to each other
- 139 All master switches are located above 80% of shoulder height of Percy
- 140 Rigidly mounted and no need to be removed during maintenance
- 141 Rotary type with removable handle
- 142 Handle length ≥ 50 mm
- 143 "ON" position in horizontal
- 144 "ON" and "OFF" positions marked
- 145 TSMS with locking mechanism for "OFF" position
- 146 LVMS marked with "LV" and symbol showing a red spark in a white edged blue triangle
- 147 LVMS mounted on a red circular area on high contrast background
- 148 Circular area diameter ≥ 50 mm
- 149 TSMS marked with "TS" and triangle with black lightning bolt on yellow background
- 150 TSMS mounted on an orange circular area on high contrast background
- 151 Circular area diameter ≥ 50 mm

MEASURING POINTS

- 152 Two TS measuring points on exclusive orange background
- 153 A black LV ground measuring point installed
- 154 Next to the master switches
- 155 4 mm shrouded banana jacks
- 156 Nonconductive cover
- 157 Cover removable without tools
- 158 Correctly marked ("TS+", "TS-", "GND")

TS SHUTDOWN DEVICES

- 159 Two shutdown buttons installed next to the main hoop, right and left on the vehicle at approx. height of the driver's head. Push Pull or Push-Rotate-Pull functionality
- 160 Marked with red sparked sticker
- 161 Diameter > 39 mm
- 162 One cockpit shutdown button installed. Push-Pull or Push Rotate-Pull functionality
- 163 Marked with red sparked sticker
- 164 Easy actuation by the driver
- 165 Diameter ≥ 24 mm
- 166 Inertia switch rigidly mounted to the chassis with correct orientation (according to datasheet) and can be unmounted for functionality test
- Check interlocks on ...
- 167 TS accumulator container(s)
- 168 Inverters
- 169 HVD
- 170 Power distribution boxes
- 171 Data Logger box
- If outboard wheel motors are used:
- 172 Outboard wheel motors. (Interlocks must act before a TS wiring failure.)
- 173 Suspension member (interlock must act in case of suspension failure)

TS VOLTAGE

- Measure voltage at TS measuring points
- 174 Equal or less than 60 V_{DC}

DIS-CHARGE CIRCUIT AND BODY PROTECTION RESISTORS

- ▶ Switch off LV. Measure resistance between TS+ and TS- measuring points
- 175 Resistance is 2x BPR⁷+ discharge resistor. If not measurable, ask for explanation and alternative measurement procedure

- 176 Body protection resistor power rating is sufficient⁸
- 177 Dis-charge power rating is sufficient for continuous dis-charge

TS WIRING

- 178 All TS wiring and components have to be in the envelope and behind the impact structures
- 179 TS wires of outboard wheel motors must not be able to reach the cockpit opening in case of a wire break. Wiring outside of impact structure is the shortest possible distance.
- 180 All TS wires and connectors have proper overcurrent protection
- 181 Check the set value of OCP in the motor controller against ESF. If bought, check that no major changes regarding OCP have been made. With self-developed briefly check the schematic vs PCB of the HW OCP (SW OCP is not allowed).
- 182 TS wiring channels are orange
- 183 No other wires than TS wires are orange
- 184 TS wiring outside electrical enclosures in separate nonconductive enclosure or orange shielded cable

- 185 Securely anchored to withstand at least 200 N, if outside of enclosure
- 186 Located out of the way of possible snagging or damage
- 187 Shielded against rotating/moving parts
- 188 No wire lower than the chassis
- 189 TS and LV wires separated (n/a for interlock)
- 190 Ask team to prove that TS wires fulfill temperature rating > 85°C and voltage rating⁹
- 191 Suitable temperature rating for used position
- 192 Positive locking mechanism on every screwed connection. (Photographs for all inaccessible TS connections)
- 193 Insulation is not insulating tape or rubber-like paint

HV WARNING STICKERS

- ▶ Check for warning stickers on TS containing enclosures. (Triangle with black lightning bolt on yellow background)
- 194 Inverter(s)
- 195 Motor(s)

- 196 Power Distribution box(es)
- 197 Energy meter box
- 198 Other TS containing enclosures

TRACTIVE SYSTEM PROTECTIONS

- ▶ Check opening in TS enclosures, try to reach TS potentials with insulated test probe (100 mm length, 6 mm diameter)

- 199 Not possible to reach any TS potentials
- 200 TS components and containers protected from moisture

HIGH VOLTAGE DISCONNECT

- 201 Clearly marked with "HVD"
- 202 Distance to ground greater than 350 mm
- 203 Inside roll-over protected envelope
- 204 Easily visible while standing behind the vehicle
- 205 No remote actuation (e.g., through wires)

- 206 Integrated interlock
 - ▶ Ask not trained person to assist and ask for removing HVD
- 207 Removed within 10 s without tools
- 208 TS protection still given (insulated test probe). If a dummy connector is used, it must be stored at the push-bar.

TRACTIVE SYSTEM ACTIVE LIGHT

- 209 Mounted below highest point of the main roll hoop (no lower than 75mm) and within the roll-over protected envelope (including mounting)

- Cockpit indicator light . . .
- 211 . . . is inside the cockpit and marked with "TS off"
- 212 . . . is visible for the driver

DATA LOGGER

- 213 data logger is enclosed in a housing
- 214 All energy from accumulator flows through the data logger

- 215 The TS voltage sense connection is connected to the most positive and most negative pole of ACP. Connection must not carry any current.

FIREWALLS

- Separates any point of the driver (less than 100 mm above the bottom of the helmet of the tallest driver) from any TS component (including TS wiring) . . .
- 216 . . . behind the driver's back
- 217 . . . at the sides of the driver
- 218 . . . at the front of the vehicle

- 219 First layer, facing TS must be made of Aluminum with a thickness of at least 0.5 mm
- 220 Second layer, facing driver must be made of electrically insulated material (no CFRP)
- 221 Material meets UL94-V0 for min. used thickness or equivalent

ACCELERATOR PEDAL POSITION SENSOR (APPS)

- 222 Returns to original position if not actuated
- 223 At least two sensors with different transfer functions, each having a positive slope sense with either different gradients and/or offsets to the other(s) are installed. (For digital sensors, a checksum is necessary)
- 224 Sensors do not share supply or signal lines

- 225 Sensors are protected from being mechanically overstressed (positive stop of pedal)
- 226 Minimum two springs installed to return pedal
- 227 Each spring still returns pedal with the second one disconnected (springs in the torque encoders not counted)

⁷ Body Protection Resistor (BPR)

⁸ sufficient to short circuit TS+ and TS-

⁹ max. TS voltage

BRAKE LIGHT

- 228 Only one brake light
- 229 Located on vehicle centerline, height between wheel center line and driver's shoulder

- 230 Round, triangle, or rectangular on black background
- 232 Δ 15 cm² minimum illuminated area OR LED strips with a total length greater than 150 mm with elements <20 mm apart

INSULATION MEASUREMENT TEST

- ▶ Choose test voltage according to IN 4.1.1¹⁰
- ▶ Connect insulation tester to T-+ and LV GND measuring point
- ▶ Measure resistance: $R_{iso+} =$ k Ω
- 233 Resistance is much higher than minimal value¹¹
- ▶ Connect insulation tester to T-+ and LV GND measuring point
- ▶ Measure resistance: $R_{iso-} =$ k Ω
- 234 Resistance is much higher than minimal value¹²
- 235 resistances are nearly equal

GROUNDING CHECKS

• Measure resistance between any conductive parts of the vehicle within 100 mm around any TS component, the seat mounting points and the harness attachment points and the LV GND measuring point:

| Part (if applicable) | Conductive (max. 300 m Ω @ 1 A) | May become conductive (max. 100 Ω @ 0 A) |
|---|--|---|
| Main Roll Hoop | <input type="checkbox"/> | |
| Frame / Monocoque | <input type="checkbox"/> | <input type="checkbox"/> |
| Driver harness mounting points | <input type="checkbox"/> | |
| Seat mounting points | <input type="checkbox"/> | |
| Firewall(s) | <input type="checkbox"/> | |
| Carbon fiber part within 10 cm around TS parts: | | <input type="checkbox"/> |
| Suspension Front left | <input type="checkbox"/> | <input type="checkbox"/> |
| Suspension Front right | <input type="checkbox"/> | <input type="checkbox"/> |
| Suspension Rear left | <input type="checkbox"/> | <input type="checkbox"/> |
| Suspension Rear left or right | <input type="checkbox"/> | <input type="checkbox"/> |
| Accumulator container | <input type="checkbox"/> | |
| Accumulator Management System Data Connector | <input type="checkbox"/> | |
| Conductive housings with TS parts inside | <input type="checkbox"/> | |
| Radiator | <input type="checkbox"/> | |
| Additional Part: | <input type="checkbox"/> | <input type="checkbox"/> |
| Additional Part: | <input type="checkbox"/> | <input type="checkbox"/> |
| Additional Part: | <input type="checkbox"/> | <input type="checkbox"/> |
| Additional Part: | <input type="checkbox"/> | <input type="checkbox"/> |
| Additional Part: | <input type="checkbox"/> | <input type="checkbox"/> |

TIS STATUS UPDATE /

- ▶ Inform scrut management about attempt result
- ▶ update attempt info table on the beginning of the section

¹⁰ $U_{max} \leq 250 V_{DC} \rightarrow U_{test} = 250 V_{DC}$
 $U_{max} > 250 V_{DC} \rightarrow U_{test} = 500 V_{DC}$

¹¹ Minimal Resistance = 500 $\Omega/V \cdot U_{max} + BPR$

¹² Minimal Resistance = 500 $\Omega/V \cdot U_{max} + BPR$

PART V: MECHANICAL INSPECTION

APPROVAL

| | | |
|------------------|---------------|------------------------|
| Inspector Names | Date and Time | Signatures when passed |
| 1. _____ / _____ | | |
| 2. _____ / _____ | | |

- The time limit for this part of the inspection is 75 minutes. Continuation of the inspection is possible after requeuing.
- During technical inspection all work carried out on the vehicle must be approved by a technical inspector.
- Only tools needed for the (dis)assembly of parts for mechanical inspection.

TIS STATUS UPDATE / TIMER

- Set online TIS status
 Add timer to the car
 Start timer

VEHICLE WITH TALLEST DRIVER READY TO RACE

- | | |
|---|--|
| <p>236 <input type="radio"/> FIRE EXTINGUISHERS - Two (2) hand-held, 0.9 kg (2 lb.) minimum, dry chemical (10BC, 1A10BC, 34B, 5A 34B, 20BE or 1A 10BE), with pressure/charge gauge, Aqueous Film Forming Foam (AFFF) fire extinguishers are prohibited, 1 WITH VEHICLE securely installed on push-bar, 1 in paddock. (Must see BOTH at Tech.). On-board fire system possible.</p> <p>237 <input type="radio"/> PUSH BAR (red color) - With vehicle, securely attached to vehicle, detachable, push & pull function for 2 people. University name on it.</p> <p>238 <input type="triangle-up"/> CAMERAS - Must be secured by two points on different sides of the camera body, see T11.10.5. No cameras mounted to helmet.</p> <p>239 <input type="radio"/> VISIBILITY - Minimum of 100 deg. field either side. Head rotation allowed or mirrors. If mirrors, must be firmly installed and adjusted</p> <p>240 <input type="triangle-up"/> VEHICLE CONTROLS - All controls, including shifter, must be inside cockpit. No arms or elbows outside the SIS plane.</p> <p>241 <input type="radio"/> DRIVER FLUID PROTECTION - A firewall (rigidly mounted cover plate for cooling systems using plain water) must extend sufficiently far upwards and/or rearwards such that any point, less than 100 mm above the bottom of the helmet of the tallest driver, is not in straight line of sight with any of the following parts: fuel supply system, hydraulic fluid (except brake system and dampers), flammable liquids and low voltage battery.</p> <p>242 <input type="radio"/> ROLL BAR PADDING - Roll bar or bracing that could be hit by driver's helmet must be covered with 12mm thick, SFI spec 45.1 or FIA 8857-2001 padding.</p> | <p>243 <input type="triangle-up"/> OTHER SIDE TUBES - Design prevents driver's neck hitting bracing or other side tubes</p> <p>244 <input type="radio"/> HEAD RESTRAINT - Near vertical. Must take 890N load. 40mm thick, SFI 45.2 standard or FIA technical list n°17 type B. Max. 25mm from helmet. Helmet contact point 50mm min. from any edge. May be changed for different drivers. Minimum 150x150mm.</p> <p>245 <input type="radio"/> DRIVER RESTRAINT HARNESS - SFI 16.1, SFI 16.5, SFI 16.6, or FIA 8853/2016. 6- or 7-point system – Two-piece lap belt (min. width 50mm), two shoulder straps (min. width 75mm) and two leg or anti-submarine straps (min. width 50mm). (7-point system must have three anti-submarine straps). Must be securely attached to prim. structure (25.4 x 2.4mm or equal.)</p> <p>246 <input type="radio"/> LAP BELT MOUNTING - Pivoting mounting with eye bolts or shoulder bolts attached securely to Primary Structure. Min. tab thickness 1.6mm. Attachment brackets to the monocoque must be steel, see T5.3.2.</p> <p>247 <input type="radio"/> SHOULDER HARNESS MOUNTING - Mounting points 180 - 230mm apart (measured center to center). Angle from shoulder between 10 deg. up and 20 deg. down to horizontal. Attach to Primary Structure - 25.4 x 2.4mm or 25.0 x 2.5mm steel tube min. NOT to put bending loads into Main Hoop Bracing without extra bracing. Additional braces if not straight to main hoop. Cannot pass through a firewall. Attachment brackets to the monocoque must be steel.</p> <p>248 <input type="radio"/> SUSPENSION - Fully operational with dampers front and rear; 50mm minimum wheel travel (minimum jounce of 25mm) with driver in vehicle.</p> |
|---|--|

VEHICLE WITHOUT DRIVER

- | | |
|--|---|
| <p>249 <input type="triangle-up"/> TECH STICKER SPACE - 45mm x 175mm on centerline of front of vehicle in front of the cockpit opening</p> <p>250 <input type="triangle-up"/> SCHOOL NAME & OTHER DECALS - School Name, or recognized initials - min. 50mm tall (all letters). on both sides in Roman letters. Must be clearly visible.</p> <p>251 <input type="triangle-up"/> VEHICLE NUMBERS - On front & both sides of vehicle, minimum 150mm tall, 20mm stroke & spacing, 25mm min. between number and background edge, Black on White, White on Black only, specified background shapes. Must be clearly visible, font: Roman Sans-Serif characters.</p> <p>252 <input type="triangle-up"/> BODYWORK EDGES - edges that could contact a pedestrian must have a minimum radius of 1.0mm (safety requirement)</p> <p>253 <input type="triangle-up"/> BODY & STYLING - Open wheeled, open cockpit, formula style body. Vertical keep out zones 75mm in front and behind tires (no aero exceptions), tires unobstructed from sides.</p> <p>254 <input type="radio"/> BODYWORK - Min. 38mm radius on nose. No large openings in bodywork into driver compartment in front of or alongside driver, (except cockpit opening).</p> <p>255 <input type="radio"/> AERODYNAMIC DEVICES - Securely mounted. The deflection may not exceed 10mm when a force of 200N is applied over a surface of 225 cm² and not more than 25mm when a point force of 50N is applied.</p> <p>256 <input type="triangle-up"/> AERODYNAMICS - ALL aerodynamic devices maximum 250mm rearward of rear tires, maximum 700mm forward of front tires. Devices lower than 500mm from the ground rearward of the front axle must be no wider than vertical plane from the outside of the</p> | <p>front and rear tires. Devices higher than 500mm behind the front axle must not be wider than the inside of the rear tires.</p> <p>257 <input type="triangle-up"/> AERO VERTICAL HEIGHT - Devices forward of a vertical plane through the rearmost portion of the front face of the driver head restraint support, excluding any padding, set to its most rearward position, must be lower than 500mm from the ground. Rear device max 1.2 m above ground (incl. end plates); Front device max 250mm above ground outside of the inside plane of the front tires inside this plane max 500mm.</p> <p>258 <input type="radio"/> EDGES/RADII - Edges that could contact a pedestrian must have a minimum radius of: horizontal leading edges min 5mm; vertical forward facing edges min 3mm. All other edges must have a minimum radius of 1.0mm</p> <p>259 <input type="radio"/> AIR INTAKE SYSTEM ROLL OVER PROTECTION - All parts of air intake system (including throttle body or carb, air intake ducting, air cleaner & air box) must be within a surface defined by the top of the main hoop and the outside top edge of the tires.</p> <p>260 <input type="radio"/> AIR INTAKE SYSTEM - Must be supported if cantilevered (isolated to frame, rigid to engine). Any portion < 350mm above ground must have side and rear impact protection to rule CV 1.3.2. Intercooler after throttle body.</p> <p>261 <input type="triangle-up"/> SEAT - Insulated against heat conduction, convection and radiation. Lowest point no lower than top of the upper surface of the lowest SIS member OR must have longitudinal, 25.4 x 1.65mm steel tube underneath.</p> |
|--|---|

- 262 ○ **COCKPIT OPENING** - Fig. 11 (left) template passes down from above cockpit to below the upper side impact member. Steering wheel, seat & padding can be removed. No removing of firewall.
- 263 ○ **COCKPIT INTERNAL CROSS SECTION** - Fig. 11 (right) template passes from the cockpit opening to 100mm rear of rearmost pedal

contact area (in most forward position). Steering wheel and paddings can be removed (without tools).

- 264 △ **STEERING WHEEL** - Continuous perimeter, near round (no concave sections) with driver operable quick disconnect. 250mm max from front hoop.

REMOVE BODY PANELS

- 265 ○ **DRIVER'S LEG PROTECTION** - Covers inside of cockpit over any sharp edges or moving suspension / steering components.
- 266 ○ **DRIVER'S FOOT PROTECTION** - Feet must be rearward of the Front Bulkhead and no part of shoes or legs above or outside the Major Structure (25x1.2 or equivalent) in side or front views when touching the pedals.
- 267 ○ **PERCY** - Helmet of 95th percentile male (PERCY) to be 50mm below the lines between top of front and main roll hoops and between top of main hoop to rear attachment point of main hoop bracing. Center of bottom circle placed minimum 915mm from pedals.
- 268 ○ **BRAKES** - Dual hydraulic system & reservoirs, operating on all four wheels, (one brake on limited slip differential is OK). System must be protected by structure or shields from drivetrain failure or minor collisions. No plastic brake lines. No brake-by-wire. No parts below chassis in side view. Brake pedal capable of 2000N, no failures if official exerts max force (seated normally in vehicle).
- 269 △ **BRAKE OVER TRAVEL SWITCH** - In the event of a failure in one or both brake circuits the brake pedal over travel will result in the shutdown circuit being opened.
- 270 ○ **TUBING & MATERIALS** - Team must show an APPROVED SES. No Magnesium tubes in primary structure.
- 271 ○ **MONOCOQUE** Must see laminate test specimen. All samples must be marked with the following non-removable (e.g.: permanent marker or engraving, but no sticker) information: laminated structure ac-ronym and date of testing. Steel backing plates (=>2mm thick) used at attachment points (must be fully supported).
- 272 ○ **BOLTED JOINTS** in primary structure - Distance hole centerline to the nearest free edge > 1.5 x hole diameter.
- 273 ○ **MAIN HOOP** - MUST BE STEEL. Check dimension as shown in approved SES. Must be made of one piece and extend to lowest frame member. Above Major Structure, must be within 10 deg. of vertical plane. Smooth bends without wrinkles.
- 274 ○ **MAIN HOOP BRACING** - MUST BE STEEL. One straight brace on each side. Dimension as shown in the approved SES. Attached within 160mm from the top. Min. 30 deg. Included angle with hoop. If main hoop is not vertical, bracing must not be on same side of the vertical plane as the main hoop. No bends. No rod-ends. Proper design for removable braces (capping etc.) on BOTH ENDS. Must take load back to bottom of main hoop and node of upper side impact tube through proper triangulated structure. (25.4 x 1.2mm or equivalent)
- 275 ○ **FRONT HOOP** - Must be closed section metal tube. Can be multi-piece with gussets or additional attachments to the monocoque. Must extend down to lowest frame member. No lower than top of steering wheel. Max. 20 deg. to vertical. Check dimension as shown in approved SES. Requires 6 attachment points – 2 on each side connecting to front bulkhead support structures and two connecting to front hoop bracing.
- 276 ○ **FRONT HOOP BRACING** - Two straight forward-facing braces, 25.4 x 1.65mm or 25.0 x 1.75mm or 25.4 x 1.6mm wall steel or

equivalent, attached within 50mm of top and must have a minimum distance of 100mm between each other at the front hoop . Extra rearward bracing required if Front Hoop leans backwards more than 10 deg.

- 277 ○ **SIDE IMPACT PROTECTION** - Min. of 2 tubes + diagonal must connect the main and front hoops in straight line. Upper tube between 240 - 320mm above lowest inside chassis point between FH and MH. Dimension as shown in approved SES.
- 278 ○ **FRONT IMPACT PROTECTION** - No non-crushable objects forward of bulkhead. IMPACT AT-TENUATOR forward of bulkhead, 200mm long x 200mm wide x 100mm high. No portion of the required 100x200x200mm³ volume of the IA can be positioned more than 350 mm above the ground. No wing supports through the IA. IA must be se-curely fastened directly to AIP capable of taking transverse & vertical loads (no tape, etc.) Test piece presented and same as IA on vehicle. Standard IA: Requires diagonal brace if bulkhead >25.4mm from IA on any side.
- 279 ○ **ANTI INTRUSION PLATE** - A 1.5mm solid steel or 4.0mm solid aluminum sheet. Must be welded (size: min. to centerlines) or min. 8 screws M8 Grade 8.8 critical fasteners T10) (size: min. outside dimensions). CFRP plate is accepted if SES approved.
- 280 ○ **FRONT BULKHEAD SUPPORT** - Support back to front roll hoop; 3 tubes per side, all 25mm x 1.5mm wall steel tube or equiv. 1 bottom; 1 top within 50mm of top of bulkhead and connecting within 100mm above and 50mm below upper SIS tube; 1 or more node-to-node diagonal to completely triangulate connections to upper and lower SIS tubes.
- 281 ○ **INSPECTION HOLES** - 4.5mm inspection holes required in non-critical areas of front & main hoops. Inspectors may ask for holes in other tube(s).
- 282 ○ **JACKS** - One or two devices that must be available to safely lift up and hold all driven wheels min. 100mm above the ground. In lifted position the jack (s) must be locked/secured and function without the support of a person or additional weights. It must be safe for driver to enter and exit the vehicle. The device must not extend out of the area defined by the footprint of the four tires. Device pick-up points must be indicated by orange triangles on both sides. University name on it.
- 283 ○ **WHEELS** - 203.2mm (8") min. diam. No Aluminum or hollow wheel bolts. Single retaining nut must incorporate a device to retain the nut. Aluminum wheel nuts must be hard anodized.
- 284 ○ **FIREWALL** Fire resistant material; must separate driver compartment from cooling, oil system & LV battery. Passthroughs OK with grommets. Multiple panels OK if gaps sealed. No gaps at sides or bottom. Must be rigidly mounted to the chassis. Material must meet UL94-V0, FAR 25.853(a)(1)(i) or equivalent (THICKNESS NEEDED IN DATA SHEET).

VEHICLE LIFTED AND WHEELS REMOVED

- 285 ○ **SUSPENSION PICK-UP POINTS** - Inspected thoroughly for integrity.
- 286 ○ **FASTENERS** - Steering, braking, harness and suspension systems must use SAE Grade 5 or Metric Grade M8.8 or higher specs (AN/MS) with visible positive locking mechanisms, no Loctite or lock washers. Minimum of 2 exposed threads with locking nuts. Rod ends in single shear are captured by a washer larger than the ball diameter. Adjustable tie-rod ends must have jam nuts to prevent loosening. No Nylon lock nuts for Brake calipers or Brake discs. No button head cap, pan head or round head screws in critical locations, e.g. cage structure or harness mount. Primary structure e/D > 1.5.
- 287 ○ **STEERING** - All steerable wheels must have positive stops placed on the rack to prevent linkage lock up or tires from contacting any part of the vehicle. 7 degrees max. free play at the steering wheel. NO STEER-BY-WIRE on front wheels. Rear wheel steering, max. 6 deg.

and mechanical stops installed. No bonded joints in steering column.

- 288 △ **FLOOR CLOSEOUT PANEL** - Required from foot area to firewall; solid, non-brittle material; multiple panels are OK if gaps less than 3mm.
- 289 ○ **GAS CYLINDERS** - Proprietary manufacture & labeled, Nonflammable gas, regulator on tank, securely mounted, axis not pointed at driver, within the rollover protection envelope, or in structural side pod, insulated from exhaust, appropriate lines & fittings. Positively retained, i.e., no tie-wraps. Gas cylinders/tanks and their pressure regulators must be shielded from the driver. The shields must be steel or aluminum with a minimum thickness of 1 mm.
- 290 ○ **SCATTERSHIELDS INCL. MOUNTING** - Required for clutches, chains, belts, etc. No holes. 6mm diam. Grade 8.8 minimum. End parallel to lowest part of the sprocket/pulley in front and rear.

- 291 **△ SCATTERSHIELD MATERIALS** - For chains, 2mm min. thick solid STEEL, 3 x chain width. For belts, 3mm min. thick Al 6061-T6, 3 x belt width. Finger guards: cover all drivetrain parts that spin while vehicle is stationary. No holes > 12mm dia.
- 292 **○ LV BATTERY** - Attached securely to frame or chassis.
- 293 **○ HIGH PRESS HYDRAULICS** - Pumps and lines must have 1mm steel or aluminum shields protecting driver and workers.
- 294 **△ COOLANT** - 100% water. NO ADDITIVES WHATSOEVER.
- 295 **○ CATCH TANKS** - Any coolant overflow or combustion engine lubrication system vents must have separate catch tanks. 0.9 l or 10% of the fluid being contained minimum volume each, whichever is greater. 100 deg. C material, behind firewall, below shoulder level. 3mm min. dia. vent away from driver down to the bottom level of frame. Trans or diff., cooling systems using plain water, unless sealed, require 100 ml catch tanks.
- 296 **△ FLUID LEAKS** - Oil, grease, coolant, fuel, Brake fluid -> none permitted
- 297 **○ BELLYPANS** - In total minimum of two venting holes of at least 25mm diameter in the lowest part of the structure to prevent accumulation of liquids. One in each enclosed chassis structure. Additional holes are required when multiple local lowest parts exist in the structure.
- 298 **○ ACCUMULATOR CONTAINER POSITION** - All accumulator containers must lie within the primary structure of the frame lower than the top of the SIS. All accumulator containers must be protected from side or rear impact collisions. If an accumulator container or parts of it are mounted outside of the primary structure (EV.3.5.1, EV 3.5.3) an additional impact structure according to T3.2 must be built to protect the accumulator.
- 299 **○ ACCUMULATOR CONTAINER ATTACHMENT** - Accumulator container must be attached to the primary structure with fasteners min. Grade 8.8. Fasteners have to follow T10. Mounting as designed in SES. Brackets 1.6 mm steel or 4 mm aluminum with gussets to withstand bending loads. Monocoque needs 2mm steel backing plates or equivalent, mentioned in SES.
- 300 **○ PROTECTION OF TRACTIVE SYSTEM PARTS** - In side view no part of the tractive-system can project below the lower surface of the frame or the monocoque, whichever is applicable
- 301 **○ PROTECTION OF TRACTIVE SYSTEM PARTS** - All parts belonging to the tractive system including cables and wiring must be contained within the envelope of any part of the frame which is made from any regulated tubing defined in T3.2. If tractive system parts are mounted in a position where damage could occur from a rear and side impact (below 350 mm from the ground), they have to be protected by a fully triangulated structure with tubes of a minimum outer diameter of 25.4 mm and a minimum wall thickness of 1.25 mm or equivalent
- 302 **○ MOTOR CASING** - 3mm Aluminum 6061-T6 or 2 mm steel. If rotating around the stator or the motor case is perforated a scatter shield around the motor should be installed of 1 mm 6061-T6 aluminum or steel.

TIS STATUS UPDATE

- ▶ Set online TIS status

NON-COMPLIANCE / COMMENTS

PART VI: HIGH VOLTAGE INSPECTION

!! TEST AT HIGH VOLTAGE !!

APPROVAL

| Inspector Names | Date and Time | Signatures when passed |
|------------------|---------------|------------------------|
| 1. _____ / _____ | | |
| 2. _____ / _____ | | |

☐ TRACTIVE SYSTEM POWER-UP

- ▶ Suggest team to limit maximum motor speeds for upcoming inspections
- ▶ All driven wheels are off the ground, driven wheels removed
- ▶ Connect multimeter between TS+ and TS- measuring points
- ▶ Switch on TSMS with LVMS deactivated
- 303 ○ Voltage at TS measurement points less or equal 60 V_{DC}
- ▶ Switch on LVMS with TSMS deactivated
- 304 ○ IMD and AMS and TS Cockpit indicator light illuminate for 1 s to 3 s for visible check
- 305 ○ Voltage at TS measurement points less or equal 60 V_{DC}
- ▶ Switch on TSMS and all shutdown buttons
- ▶ Reset any IMD or AMS errors
- 306 ○ TS still deactivated
- ▶ Activate TS, measure TS voltage during TS power-up
- 307 ○ System is pre-charged before second AIR closes
- ▶ Switch off TSMS
- 308 ○ TS voltage decreases below 60 V_{DC} within 5 s
- ▶ Try to power-up TS with switched off TSMS
- 309 ○ TS still deactivated
- ▶ Switch on TSMS
- 310 ○ TS still deactivated

☐ TRACTIVE SYSTEM SHUTDOWN

- ▶ Connect multimeter between TS+ and TS- measuring point
- ▶ For every of the following switches, deactivation leads to TS shutdown, voltage decreases below 60 VDC within 5 s
- 311 ○ LVMS
- 312 ○ Shutdown button left
- 313 ○ Shutdown button right
- 314 ○ Cockpit shutdown button
- 315 ○ Inertia switch
- 316 ○ Break-over-travel-switch
- ▶ Show schematic of TS with all interlocks (ESF)
- 317 ○ Interlocks

☐ TRACTIVE SYSTEM ACTIVE LIGHT

- ▶ Activate LVS
- 318 ○ TSAL and Cockpit Indicator (CI) is green only, visible in bright sunlight
- ▶ Activate TS
- 319 ○ TSAL flashes red with freq 2 Hz - 5 Hz, and CI is off
- 320 ○ TSAL has fully illuminated surface visible by a person standing 3 m away from TSAL (1.6 m eye height) - use dedicated tool
- ▶ Disconnect power supply, remove HVD, override HVD interlock (!! cover TS potentials !!), activate TS
- 321 ○ TSAL and CI is off
- ▶ restore car into ready-to-race condition
- ▶ Ask the team to demonstrate safe state of TSAL by disconnecting any signal influencing green light
- 322 ○ TSAL is completely off (no red nor green light)

☐ INSULATION MONITORING DEVICE

- 323 ○ One IMD ground line is connected to the accumulator container and one ground line is connected to the main hoop by a separate wired connection
- ▶ R_{Test} = _____ kΩ¹³
- IMD indicator light . . .
- 324 ○ . . . is inside the cockpit and marked with "IMD"
- 325 ○ . . . is red and visible in bright sunlight, even from outside (check during power-on self-test)
- 326 ○ . . . is visible for the driver
- ▶ Activate TS, connect R_{Test} between TS+ and LV GND
- 327 ○ Shutdown circuits opens within 30 s
- 328 ○ IMD indicator light illuminates
- 329 ○ TS voltage decreases below 60 V_{DC} within 5 s after shutdown circuit opens
- 330 ○ Reactivation of TS is not possible
- ▶ Push the reset button which is not accessible to the driver, if any and/or restart LVMS
- 331 ○ Reactivation of TS is not possible
- ▶ Remove R_{Test}. Wait 40 s until IMD resets status output
- 332 ○ Reactivation of TS is not possible
- ▶ Push all reset buttons in the cockpit if any
- 333 ○ Reactivation of TS is not possible
- ▶ Push the IMD reset button, which is not accessible to the driver, if any
- 334 ○ Reactivation of TS is possible
- ▶ Push and hold the reset button, which is not accessible to the driver, if any. Connect R_{Test} between TS- and LV GND measuring points
- 335 ○ Shutdown circuits opens within 30 s
- 336 ○ IMD indicator light illuminates

☐ ACCUMULATOR MANAGEMENT SYSTEM

- AMS indicator light . . .
- 337 ○ . . . is inside the cockpit and marked with "AMS"
- ▶ Disconnect TS accumulator
- 338 ○ . . . is illuminated red and visible in bright sunlight, even from outside
- 339 ○ . . . is visible for the driver

¹³ R_{Test} = (max. TS voltage · 250 Ohm/V) - BPR

READY TO DRIVE ACTIVATION SEQUENCE

- ▶ Activate TS, press torque pedal
- 340 No turning of motors
 - ▶ Let the team set the vehicle to ready to drive mode
- 341 Pressing brake pedal WHILE activating is necessary
- 342 Brake light in red color
 - ▶ Repeat the activation sequence, but push the brake pedal only once before finally pushing the activation button
- 343 No ready to drive mode possible
- ▶ Disconnect the brake sensor
- 344 No ready to drive mode possible
 - ▶ Set vehicle to ready to drive state
- 345 Ready to drive sound duration is 1 s to 3 s continuously
- 287 Ready to drive sound is min 80 dBA (2 m around the vehicle)
- 346 Ready to drive sound is easy recognizable and no animal sound or song part

APPS AND BSPD

- ▶ Set vehicle to ready to drive state
- ▶ Disconnect $\geq 50\%$ of APPS
- 347 Motors do not turn
 - ▶ Disconnect all APPS
- 348 Motors do not turn
 - ▶ Set car to ready to drive state. Press accelerator pedal > 25%. Push brake pedal.
- 349 Motors stop turning.
 - ▶ Release brake, while accelerator pedal still activated.
- 350 Motors do not turn.
- ▶ Release accelerator pedal slowly.
- 351 Motors turn again when APPS position is <5%.
 - ▶ Team simulates 5 kW power (complete BSPD circuitry must be used), press brake representing hard braking (>0.5 s)
- 352 TS shuts down
 - ▶ Reactivate TS. Disconnect current sensor, press brake representing hard braking (>0.5 s)
- 353 TS shuts down
- 354 Reactivation of TS is only possible after 10 s without implausibility

EMERGENCY BRAKE SYSTEM

- 355 Emergency Brake System is identical to the system described in the ASF.
- 356 All parts of the Emergency Brake System are properly mounted, no leaks.
- 357 No push-in fittings are used.
- 358 A pictographic description of the location of the EBS release points is clearly visible in proximity to the ASMS (if there are any manual release points).
- 359 Manual release points are marked by a red arrow with "EBS release" in white on it.
- 360 Arrows have a length of 100 mm and a shaft width of 20 mm
- 361 All release points are in proximity to each other and are easily accessible without the need for tools/removing any body parts/excessively bending into the cockpit.

AUTONOMUS SYSTEM TEST

- ▶ Switch on the LVMS and select the inspection mission (AMI).
- 362 The ASSIs remains off.
 - ▶ Switch on the ASMS and the TSMS.
- 363 Activating the TS using the cockpit activation button is not possible
 - ▶ Activate the TS via the external activation button.
- 364 The ASSIs light up in yellow continuously after a self check ("AS Ready").
 - ▶ Press RES "Go" button within 5 s after "AS Ready".
- 365 "AS Driving" (ASSIs flashing yellow) has not been entered.
- 366 Vehicle is still not in R2D.
- 367 Check functionality and visibility of AMI.
- 368 All 3 ASSIs are clearly visible in very bright sunlight. At least one ASSI is visible from any angle of the vehicle.
- 369 Brakes are closed.
 - ▶ Press the RES "Go" button.
 - !! CAUTION WHEELS AND STEERING SYSTEM ARE MOVING !!**
- 370 The ASSIs start flashing yellow ("AS Driving").
- 371 Drivetrain is slowly spinning and steering system is moving.
 - ▶ Wait for the transition from "AS Driving" to "AS Finished".
- 372 The ASSIs light up in blue continuously within 25 s to 30 s and brakes are engaged ("AS Finishes"). ASSIs must not start flashing.
- 373 ASSIs are clearly visible in very bright sunlight.
- 374 TS is deactivated.
 - ▶ Turn off the ASMS and release the Brakes via the deactivation points.
- 375 Brakes are disengaged, manual steering is possible, ASSI is off.
 - ▶ Try to activate TS again and enter "AS Ready" state.
- 376 TS stays disabled and system does not enter state "AS Ready".
- ▶ Power cycle LV system or press the reset button and re-enter "AS Ready" state.
 - ▶ Press one shutdown button while autonomous state is "AS Ready".
- 377 ASSIs start flashing blue ("AS Emergency").
- 378 Brakes are closed.
- 379 Intermittent sound for 8 s to 10 s (1 Hz to 5 Hz, 50 % duty cycle).
- 380 EBS error indicator inside the cockpit is off.
- 381 TS is deactivated.
 - ▶ Turn of ASMS and reset the EBS (manual actions may be required).
 - ▶ Reset the EBS and re-enter "AS Driving" state with inspection mission selected, before each of the following tests.
 - ▶ 1. Press RES 2. Press any shutdown button 3. Switch off the ASMS
- 382 TS is deactivated.
- 383 Transition to "AS Emergency", ASSI is blue flashing, EBS is activated, EBS activation sound.
- 384 EBS error indicator is off.
 - ▶ Test all operating errors (e. g. manual valves) and some (choose randomly 1 to 3) EBS failure modes (e.g. disconnectsensors/energy supply/pneumatics/hydraulics. . .).
- 385 System has detected a failure.
- 386 EBS indicator light illuminates.
- 387 When ASSI is "AS Ready" or "AS Driving" state, the system has to enter "AS Emergency".
- 388 When ASSI is "AS OFF" state no transition to "AS Ready" is possible when switching on ASMS and activating the TS (without LVMS power cycle).

SEALING OF COMPONENTS

- ▶ After all tests have been passed successfully seal the inspected TS housings:
- 389 Motor Controller housing
- 390 Energy Meter housing
- 391 IMD housing
- 392 TSAL circuitry housing
- 393 BSPD casing /BSPD calibration
- 394 Additional Part:
- 395 Additional Part:

DATA LOGGER

- △ Check data logger functionality and connectivity

TIS STATUS UPDATE

- ▶ Inform scrut management about attempt result
- ▶ update attempt info table on the beginning of the section

NON-COMPLIANCE / COMMENTS

PART VII: TILT TEST

APPROVAL

| | Inspector Names | Date and Time | Signatures when passed |
|----|-----------------|---------------|------------------------|
| 1. | _____ / _____ | | |
| 2. | _____ / _____ | | |

TILT TEST

396 **FLUID LEAKAGE** - No fluid spill permitted when vehicle is tilted to 60 degrees in the direction most likely to create spillage. Tanks must be filled to scribe line with non-moveable fuel level line 12-25 mm below top of sight tube.

397 **VEHICLE STABILITY** - All wheels in contact with tilt table when tilted to 60 degrees to the horizontal.

398 **FUEL TYPE:** 98 or ethanol

399 **GROUND CLEARANCE** - At least 30 mm min. with driver.

NON-COMPLIANCE / COMMENTS

PART VIII: RAIN TEST

APPROVAL

| | Inspector Names | Date and Time | Signatures when passed |
|----|-----------------|---------------|------------------------|
| 1. | _____ / _____ | | |
| 2. | _____ / _____ | | |

BRAKE TEST

- ▶ The vehicle is lifted off the ground. Tractive system has to be active (TSAL ON)
- 400 Tractive system voltage is present at TSMPs
 - ▶ RAIN PROOF - No driver is allowed to sit in the vehicle during the test. Water like rain will be sprayed at the vehicle for 120 sec. Another 120 sec. of waiting without water spray.
- 401 The Insulation Monitoring Device does not react and not shut down the tractive system.
 - ▶ Connect RT est between any TSMP and LVS GND.
- 402 Shutdown circuits opens within 30 s.

NON-COMPLIANCE / COMMENTS

PART IX: BRAKE TEST

APPROVAL

| | Inspector Names | Date and Time | Signatures when passed |
|----|-----------------|---------------|------------------------|
| 1. | _____ / _____ | | |
| 2. | _____ / _____ | | |

BRAKE TEST

403 **BRAKING PERFORMANCE** - Must lock all four wheels and stop the vehicle in a straight line at the end of an acceleration run specified by the officials without electrical braking from motors. The tractive system has to be shut down by the driver before braking. The Tractive System Active Light has to be Green during breaking or shortly after the vehicle stopped (may take up to 5 sec. after shut down).

404 **BRAKE LIGHT** - must be clearly visible even in bright sunlight.

NON-COMPLIANCE / COMMENTS