FÓRMULA SAE BRASIL 2024

TECHNICAL INSPECTION GUIDE PWT-IC

Inspeção Técnica - Powertrain IC

Informações Gerais

- Preenchimento da ficha de inspeção;
- Regulamento Powertrain - IC
- Regulamento Elétrica - IC
- Inspeção ETC.

***Caso exista diferenças entre esta apresentação e o regulamento, o regulamento Formula SAE Rules 2024 Version 1.0 prevalece.**

Inspeção Técnica - Powertrain IC

Ficha de inspeção

2024 FSAE: IC/EV TECHNICAL INSPECTION

IMPORTANT: Each page must stay with the car until that specific part of inspection has been completed.
Present the vehicle for inspection in the following order:

1a. Supporting Equipment Inspection (bring all items from the IN.3 section in the next page)
1b. Mechanical Technical Inspection
2. Fuel Station & Tilt Table Inspection
3. Noise & Braking Performance Inspection

CAR NUMBER	56	Team Name
		Stark Racing Team
SCHOOL NAME		Universidade Stark de Tecnologia
Capitain name		Peter Park
Cell number (Whatsapp)		11 - 989052305

NOTE: If there is a conflict between this form and the rules, the rules prevail

Check from the Technical Inspection Secretariat

Carimbo

Date: 02/08/24 Hour: 13:40	Date: 02/08/24 Hour: 14:50	Date: 02/08/24 Hour: 15:20	Date: 02/08/24 Hour: 15:55
Carol Danvers	Tony Stark	Bruce Bunner	Shuri Aja-Adanna

1 - Garage Inspetion

Supporting Equipment Inspection: IN.3

Check date	1/8/2024

Name	Judge	Judge	Horario de inico ficha			
Peter Park	Natasha Romanof	Carol Danvers	13:20	CAR #	56	1A
			Horario de fim ficha 13:40			

		Team	Check	Recheck	Non-Compliance (Write on the back if necessary)
1	**HELMETS - VE.3.2** - Closed-face with integral chin guard (no dirtbike helmets). - Face shield integral with helmet, impact resistant material. - Specification: Snell: K2010, K2015, K2020, M2010, M2015, M2020, SA2010, SAH2010, SA2015, SA2020; or SFI: 31.1/2010 thru /2015; 41.1/2010 thru /2015; or FIA: 8860-2004, 8860-2010, 8860-2018, 8859-2015. - No camera mounts: VE.2.5.3 - (Place sticker on left side)	OK	NOK X	ok ✓	Capacete com fivela quebrada e espeuma rasgada, casco deteriorado (Capacete retido) Equipe necessita de um "Novo Capacete"

Para o ano de 2024 teremos um conceito novo de Ficha de Inspeção Técnica, baseada em benchmarking (Baja Brasil e outras competições de FSAE), sugestões de juizes e analises de fluxos de fichas.

- **Azul** – Campo preenchido pela equipe
- **Laranja** – Campo preenchido pela Secretaria de Prova de Inspeção Técnica.
- **Verde** – Campo preenchido pelo Juiz avaliador (1° Check e Recheck final)

Processos:

1. A Equipe realiza o **Check list antes da competição**
2. **Levará impresso** e separada por areas funcionais de inspeção
3. **A ficha ficará no carro** em uma pasta para acesso dos juizes avaliadores.
4. No final de cada inspeção a ***ficha ficará retida*** na Secretaria de Prova.

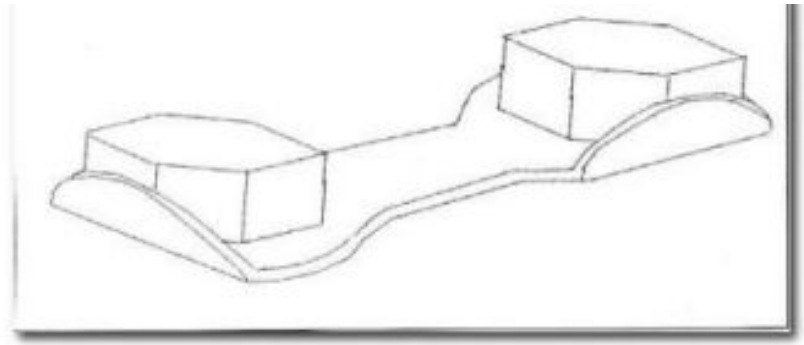
Inspeção Técnica - Powertrain IC

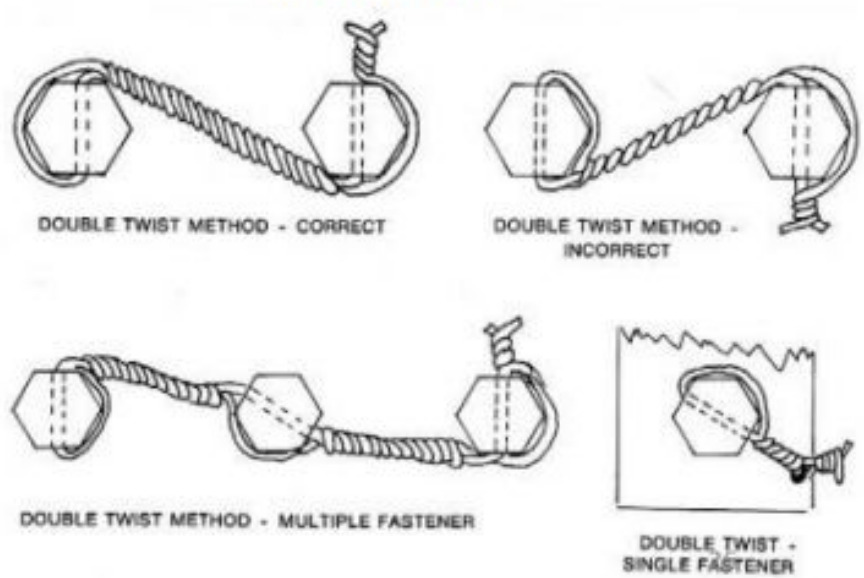
Início da Ficha de Inspeção de Powertrain 2024 - Seção 4

4 - Powertrain		Name	Judge	Judge	Start time			
Check date					End time	CAR #	0	4A
IC Powertrain								
Item	Description	Team	Check	Recheck	Recheck (Write on the back if necessary)			
S7	**LV BATTERIES, PRESSURIZED CYLINDERS - T.9.2.1, T.6.1.7** •Inside F.1.1 chassis •Below Shoulder Harness. •Below top of chassis ahead & behind & to the left & to the right •F.1.13-15 envelopes outside chassis not legal.							
67	**ENGINE - IC.1.1** Four-stroke piston engine, 710 cc maximum swept displacement. No hybrids. Waste heat recovery allowed.							
68	**COOLANT - T.5.4** (IC) Only 100% water. NO ADDITIVES WHATSOEVER. (EV) 100% water							
69	**INTAKE and FUEL SYSTEM LOCATION - IC.1.2** •All parts of air intake system (including throttle body or carb, air intake ducting, air cleaner & air box), AND •all parts of the fuel storage, supply and fuel control systems (including fuel rail, throttle body or carburetor), must be within a surface defined by the top of the roll bar and the outside top edge of the tires.							

Inspeção Técnica - Powertrain IC

POSITIVE LOCKING





Inspeção Técnica - Powertrain IC

67 ENGINE - IC.1.1

Four-stroke piston engine, 710 cc maximum swept displacement. No hybrids.

Anotar modelo do motor na ficha de inspeção.

Inspeção Técnica - Powertrain IC

68 COOLANT - T.5.4

(IC) Only 100% water. NO ADDITIVES WHATSOEVER.
(EV) 100% water

Pedir sempre para a equipe completar o nível até que seja possível fazer a inspeção do fluído.

Procedimento se alguém estiver com aditivo ou suspeita:

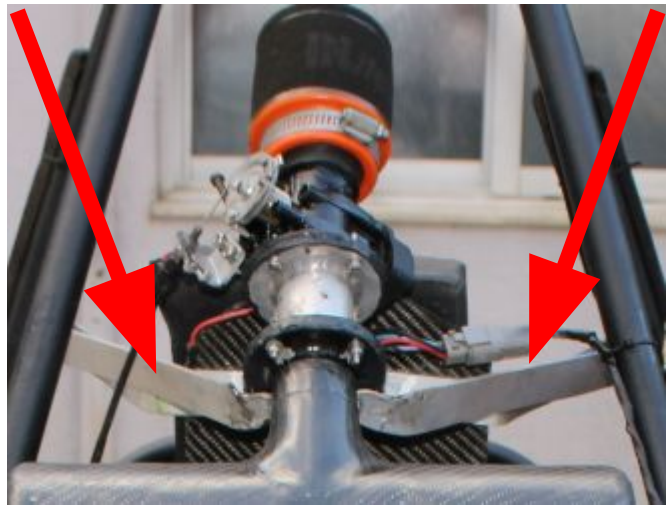
- **Interromper a inspeção imediatamente, reportar para o comitê;**
- **Enviar o carro para o box;**
- **Fazer uma lavagem no sistema de arrefecimento;**
- **Retornar para a fila de rechecks.**

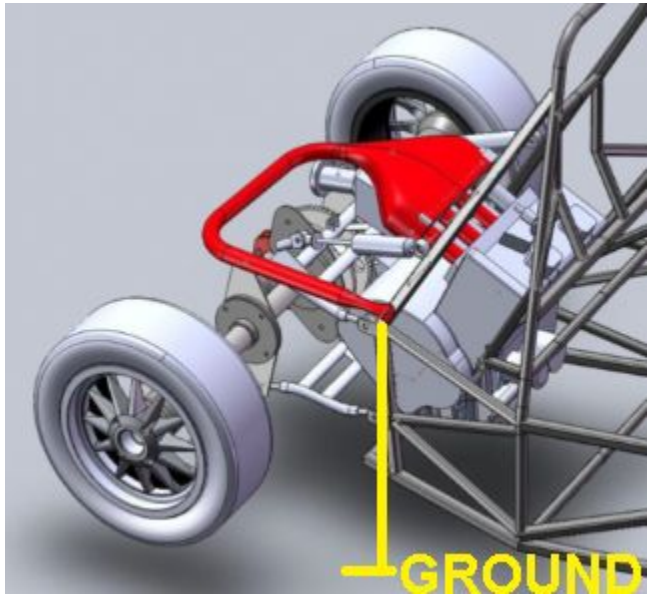
Inspeção Técnica - Powertrain IC

70 AIR INTAKE SYSTEM - IC.2.2 & .3

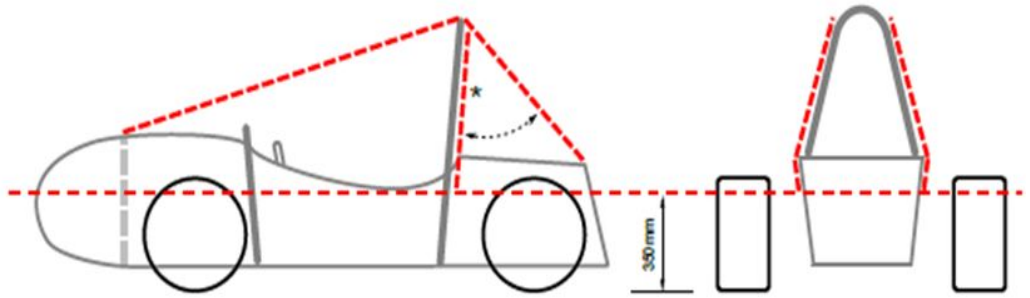
•Inside chassis •Below Shoulder Harness. •Below top of chassis ahead & behind & to the left & to the right •F.1.13-15 envelopes outside chassis not legal.

IC.2.2.2 **Any portion of the air intake system that is less than 350 mm above the ground must be shielded from side or rear impacts** by structure built per F.6.4 / F.7.6 as applicable.





Admissão deve ser rigidamente fixada ao motor e flexível em relação ao chassi.



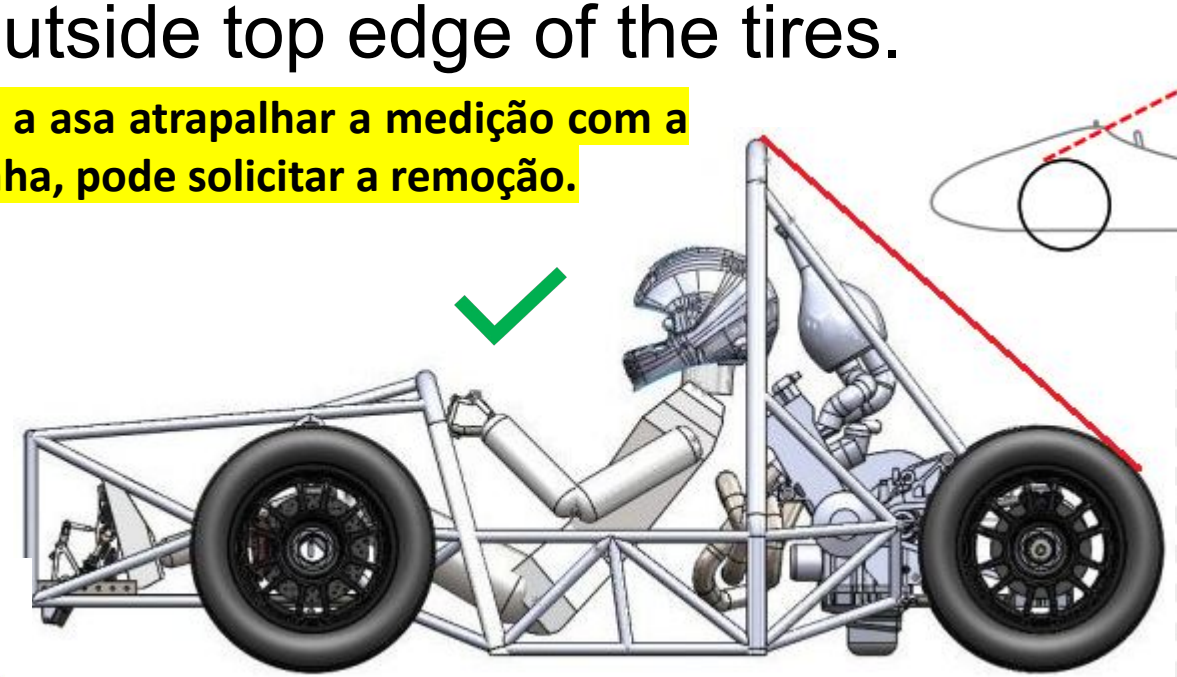
CRITICAL FASTENERS

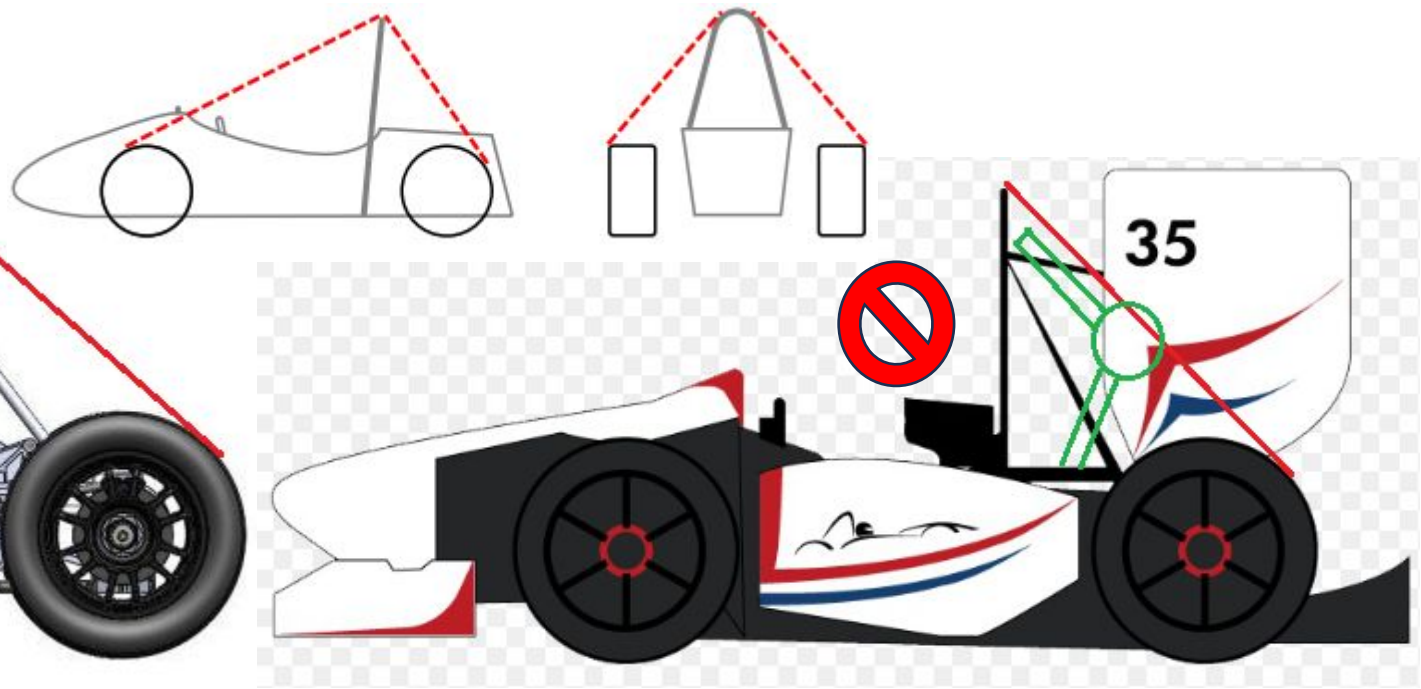
Inspeção Técnica - Powertrain IC

69 INTAKE and FUEL SYSTEM LOCATION - IC.1.2

•All parts of air intake system (including throttle body or carb, air intake ducting, air cleaner & air box), AND •all parts of the fuel storage, supply and fuel control systems (including fuel rail, throttle body or carburetor), must be within a surface defined by the top of the roll bar and the outside top edge of the tires.

Se a asa atrapalhar a medição com a linha, pode solicitar a remoção.



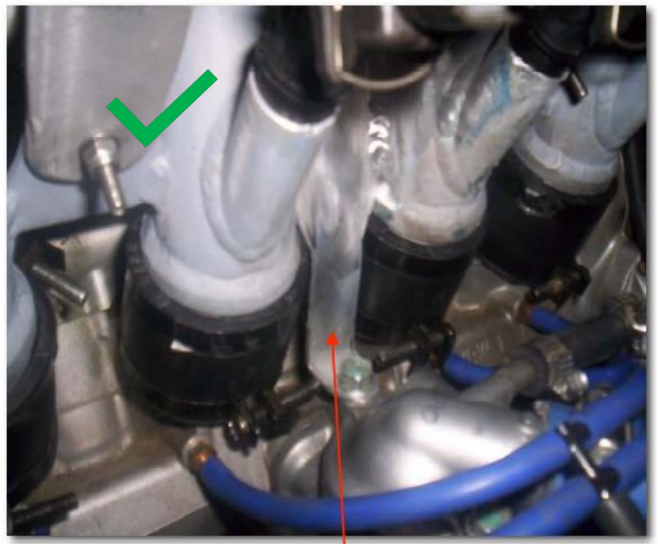


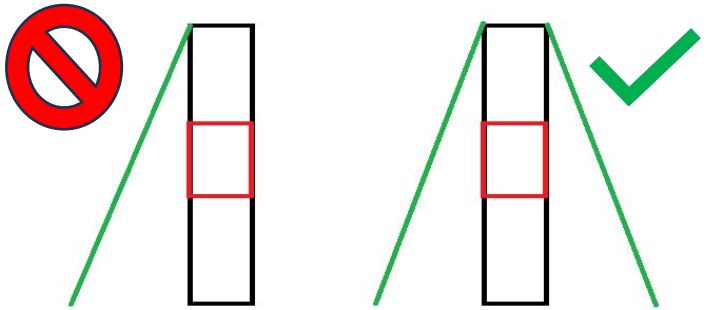
Inspeção Técnica - Powertrain IC

70 AIR INTAKE SYSTEM - IC.2.2 & .3

•Inside chassis •Below Shoulder Harness. •Below top of chassis ahead & behind & to the left & to the right •F.1.13-15 envelopes outside chassis not legal.

IC.2.3.1 The intake manifold must be securely attached to the engine block or cylinder head with brackets and mechanical fasteners. • Hose clamps, plastic ties, or **safety wires do not meet this requirement**. • The use of **rubber bushings or hose** is acceptable for creating and sealing air passages, **but is not a structural attachment.**





Arame de freno não pode ser utilizado como travamento positivo

CRITICAL FASTENERS

Inspeção Técnica - Powertrain IC

71 THROTTLE - IC.3

•Min qty of 2 springs at the TB, each capable of closing the throttle independently. TPS not acceptable as a return spring.
•Cable must have smooth operation with no binding or sticking. •Cable position min 50 mm from any exhaust component. •Idle air bypass control and throttle blippers are ETC and not allowed without ETC process

Durante a inspeção remover uma mola por vez e verificar se cada uma individualmente é capaz de retornar para posição de repouso.

Fazer o este do papel com 100% de pedal.

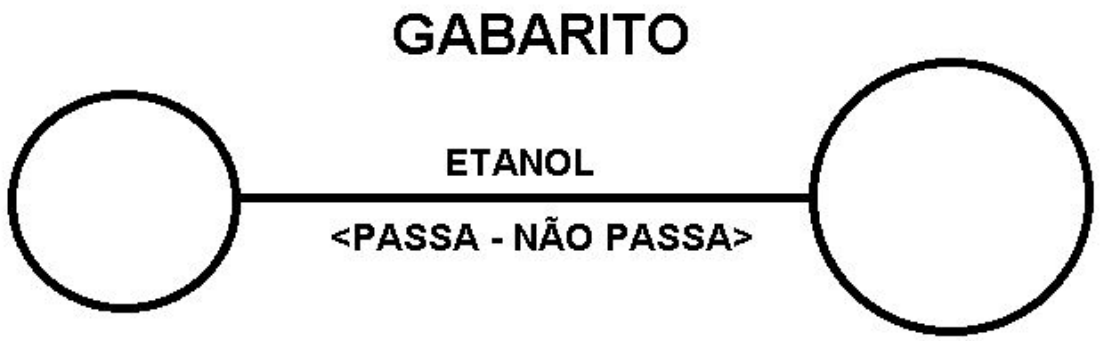
Inspeção Técnica - Powertrain IC

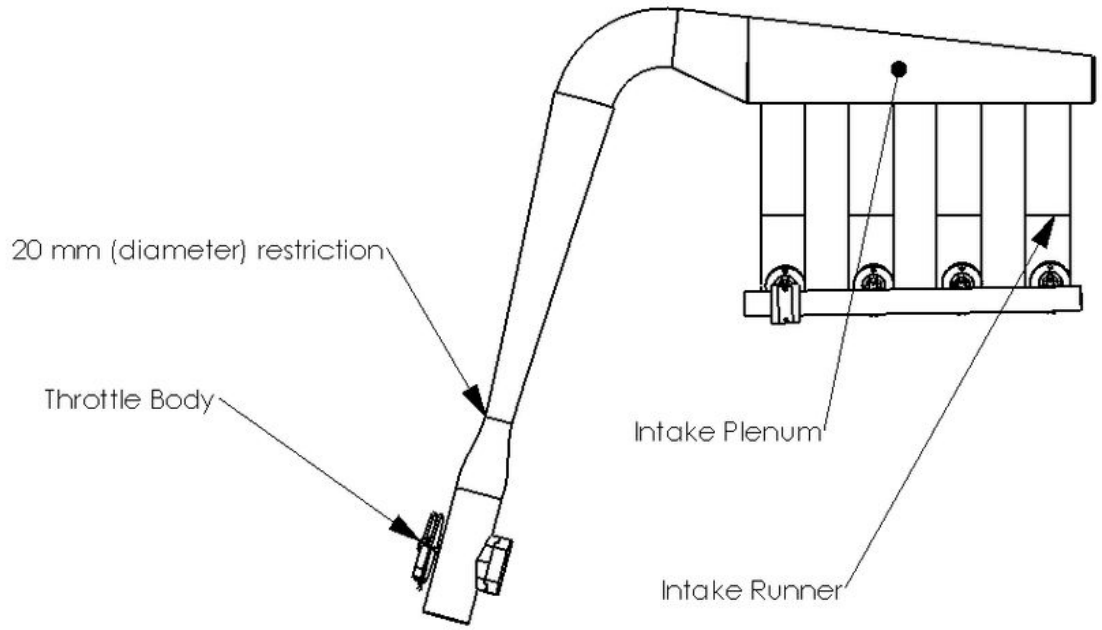
72 RESTRICTOR - IC.2.4

•Must be circular: max dia **20.0 mm for gasoline and 19.0 mm for Ethanol**. •Cannot be movable or flexible. •Installed per below:

NA: THROTTLE -> RESTRICTOR -> ENGINE

TURBO: RESTRICTOR -> COMPRESSOR -> THROTTLE -> ENGINE



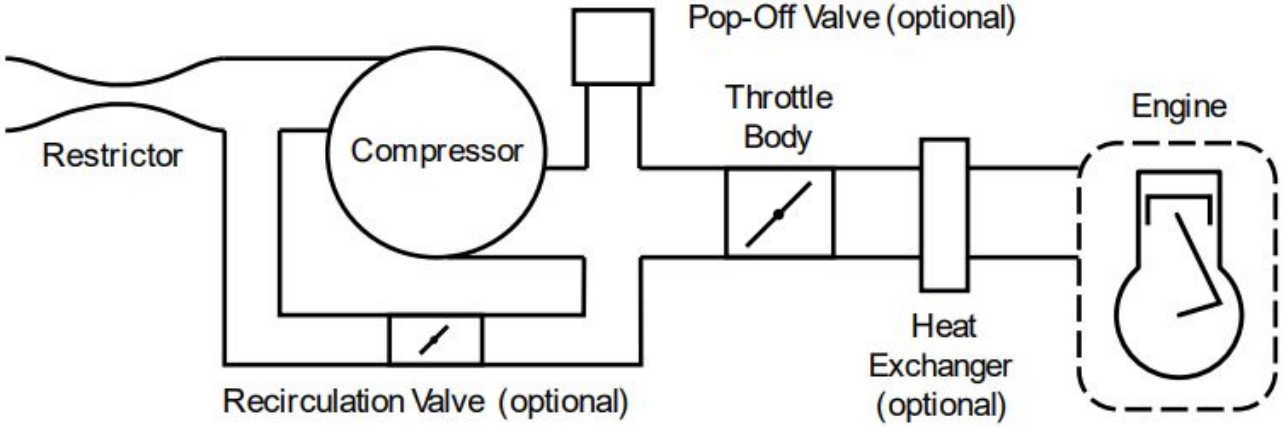


TESTAR O GABARITO EM DIVERSAS POSIÇÕES, POIS PODE SER UM BOCAL ELÍPTICO. PARAFUSOS DE ANTES E DEPOIS DO RESTRITOR DEVEM SER MARCADOS.

Inspeção Técnica - Powertrain IC

74 COMPRESSORS - IC.2.5

•Turbo or super chargers allowed if not OEM to engine. •Must be between restrictor and throttle. •Intercoolers downstream of throttle. •Carbs not allowed if compressors are used. •Compressor recirculation valves ok if downstream of restrictor.•No enlarged air chambers before throttle.



Inspeção Técnica - Powertrain IC

75 CATCH CANS - T.5.6

•Engine coolant (unless aircooled) and engine crankcase must have separate catch cans of 0.9 L min vol. •Oil(s) and water(s) must be separate. •100 °C-capable material. •Behind firewall, below shoulder level. •**3 mm min diameter vent**, **directed away from driver**. •Cannot connect breathers to exhaust. •Trans, diff, other systems (unless sealed): 10% or 0.5 L catch can.

T.5.6.5 Any catch can on the **cooling system** must vent through a hose with a minimum internal diameter of 3 mm down to the bottom levels of the Chassis.

Catch can de arrefecimento, deve ter uma mangueira de respiro que vá até o ponto mais baixo do carro.
Catch cans podem ser fixadas por tie wrap e outras abraçadeiras metálicas, desde que estejam bem presas

Inspeção Técnica - Powertrain IC

76 FLUID ACCUMULATION - T.5.5.5

Absorbent materials and open collection devices (regardless of material) are prohibited below the highest point of the exhaust system in compartments containing the engine, drivetrain, exhaust and fuel systems.

Inspeção Técnica - Powertrain IC

77 BELLYPANS - T.5.5.4

Must be vented to prevent accumulation of fuel: 2 holes each min of 25mm dia. •Specific locations: Lowest point in chassis; Aft of driver & front of fuel tank.

Inspeção Técnica - Powertrain IC

78 FLUID LEAKS - T.5.5.1

Not permitted. Firewalls must prevent contact w/ driver.

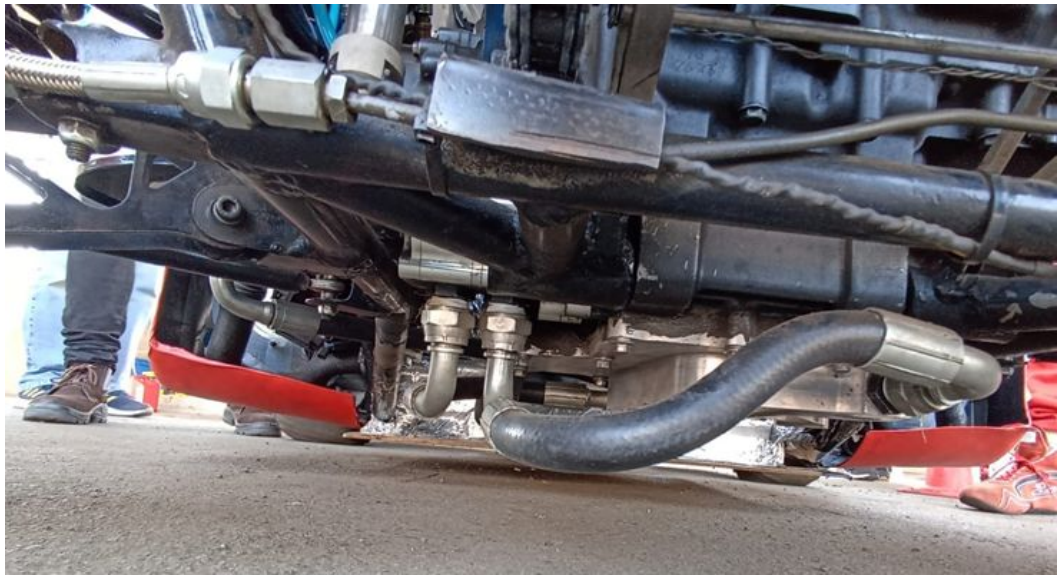
T.1.8.3 Positioning The Firewall must extend sufficiently far upwards and/or rearwards and/or sideways where any point on the drivers body less than 100 mm above the bottom of the helmet of the tallest driver must not be in direct line of sight with any part given in T.1.8.1

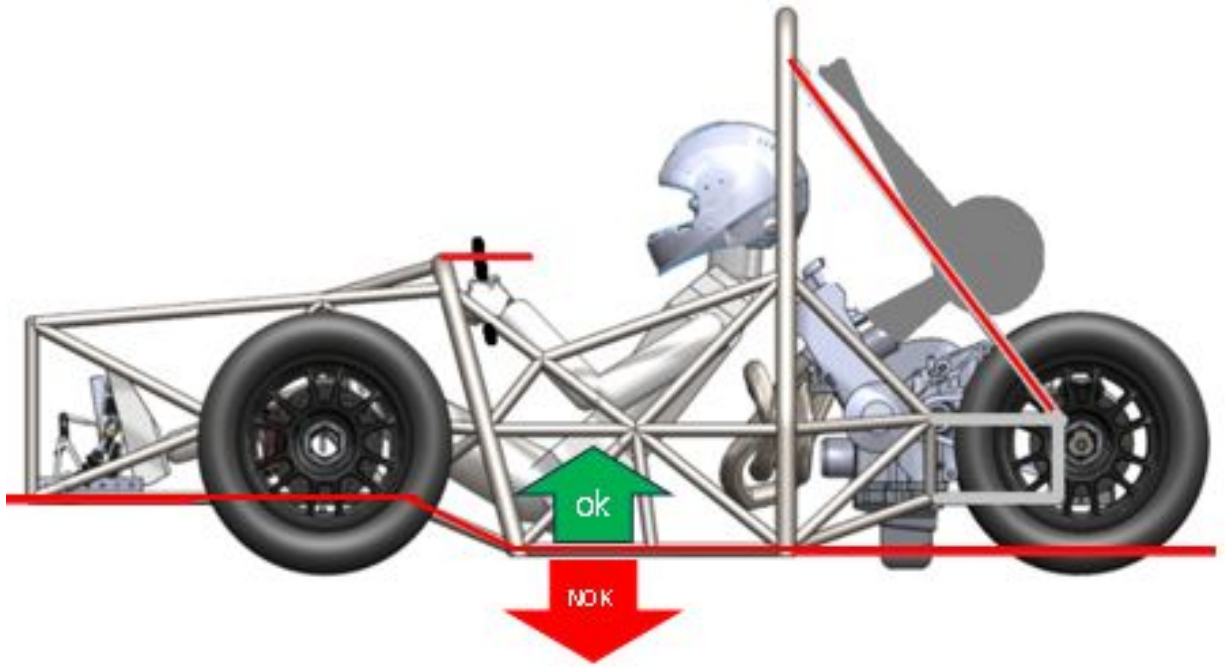
T.1.8.1 Requirement A Firewall(s) must separate the driver compartment and any portion of the Driver Harness from: a. **All components of the Fuel System, the engine oil, the liquid cooling systems, any lithium batteries**

Inspeção Técnica - Powertrain IC

78 FLUID LEAKS - T.5.5.1

Sistema de lubrificação não pode estar mais baixo que o ponto mais baixo do chassi

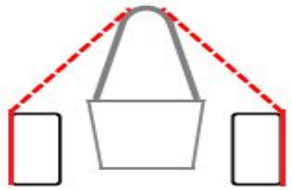


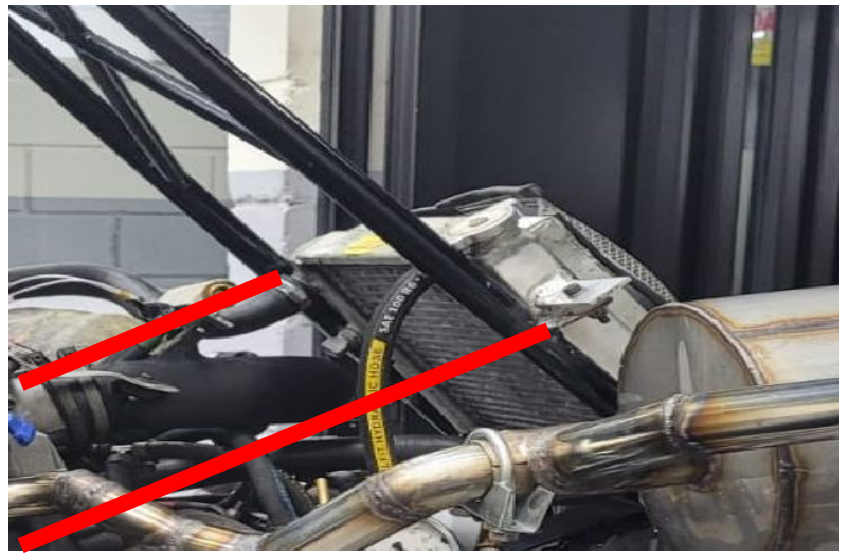


Inspeção Técnica - Powertrain IC

78 FLUID LEAKS - T.5.5.1

Sistema de arrefecimento deve ficar dentro do pacote lateral, mas não existe restrições para área traseira e superior.
Caso esteja preso nos MHB,pontos de fixação devem ser triangulados. Atenção F.5.11.29 External items

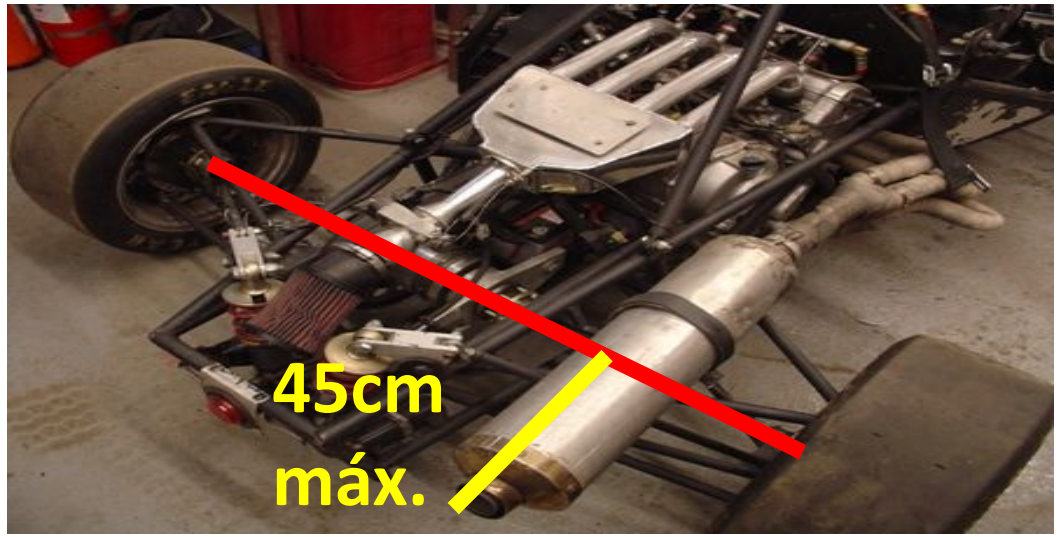




Inspeção Técnica - Powertrain IC

79 EXHAUST OUTLET - IC.7.2

•Outlet 45 cm (17.7”) max behind rear axle centerline and 60 cm (23.6”) max above the ground. •Located such that exhaust gases should not reach driver



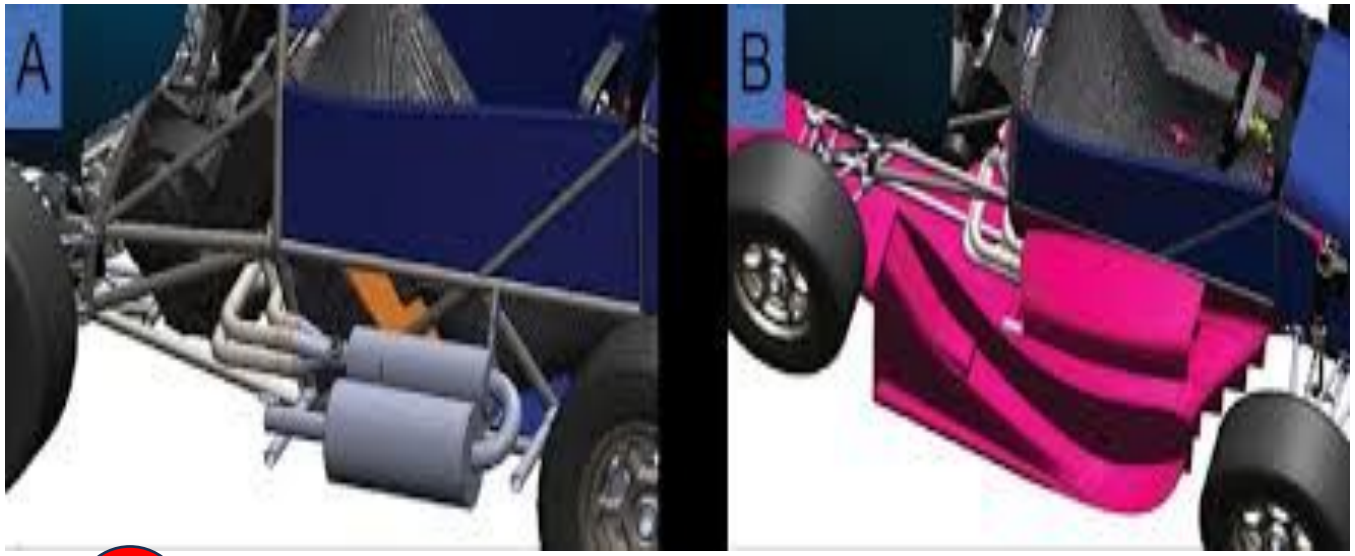
IN.10.2.1 Where the Exhaust has more than one Exhaust Outlet:
a. The noise test is repeated for each outlet
b. The highest sound level is used

Inspeção Técnica - Powertrain IC

80 EXHAUST SYSTEM - IC.7.2

•Exhaust components outside bodywork forward of main hoop must be shielded from people approaching the car. •No fibrous wraps around exhaust tubes.

Positive locking não se aplica para exaustão



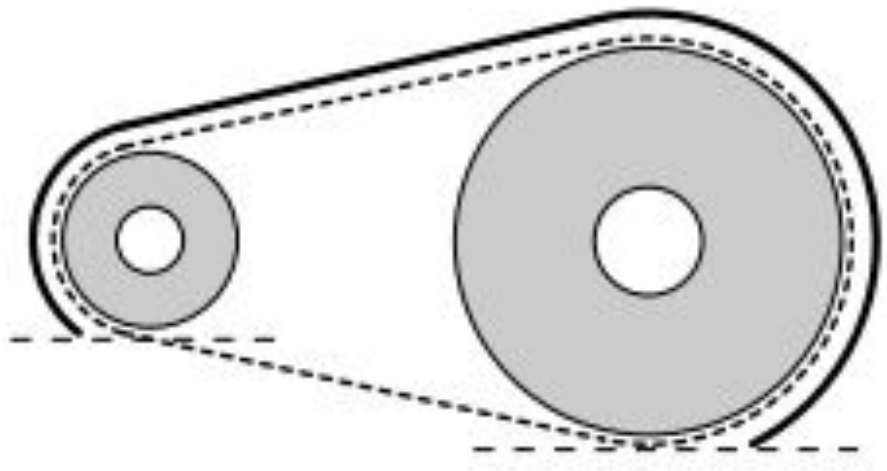
Não podem existir materiais colados na sidepod que possam absorver fluídos.

Inspeção Técnica - Powertrain IC

81 SCATTERSHIELDS GENERAL - T.5.2

•Required for clutches, chains, belts, CVT rotating parts, etc. •Not perforated. •End parallel to lowest part of front and rear sprockets. •Min 6mm fasteners •CRITICAL FASTENERS

T.5.2.7 Chain Drive - Scatter shields for chains must:
a. Be made of 2.66 mm (0.105 inch) minimum thickness **steel (no alternatives are allowed)**
b. Have a minimum width equal to **three times** the width of the chain
c. Be centered on the center line of the chain
d. Stay aligned with the chain under all conditions



Largura: 3x largura da corrente
Espessura: Aço 2.66mm (usar paquímetros disponíveis)

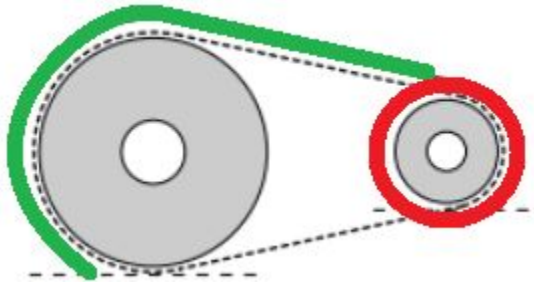
CRITICAL FASTENERS

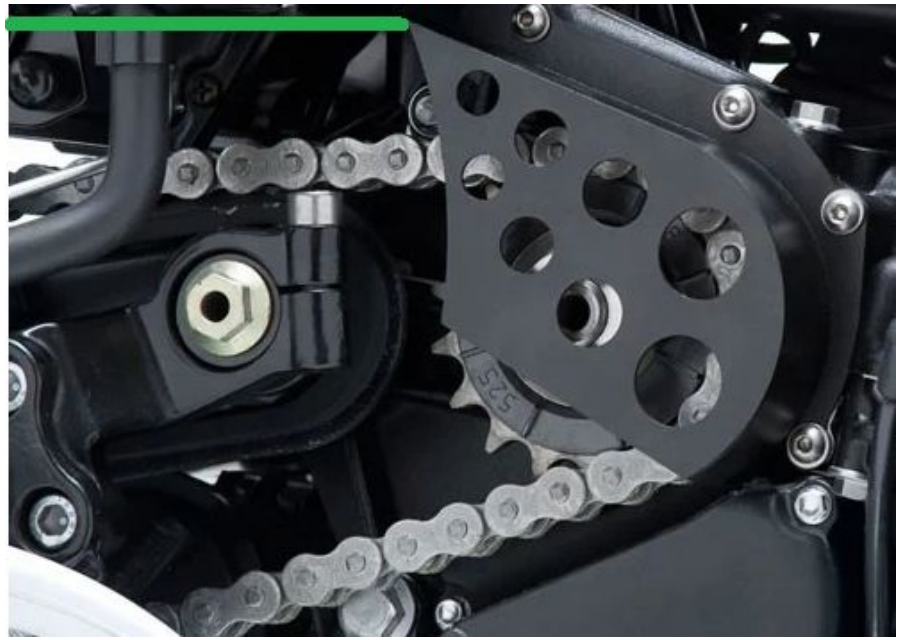
Inspeção Técnica - Powertrain IC

82 SCATTERSHIELD MATERIALS - T.5.2

•Size: for chains: 2.7 mm (0.105”) min thick steel, 3x chain width; for belts: 3 mm (0.12”) min thick aluminum 6061-T6, 1.7x belt width. **•OEM engine drive sprocket cover OK.**

Sistema de transmissão é obrigatório positive locking apenas na coroa e no suporte de coroa. Mancais, tensores e intertravamentos não serão cobrados travamento positivo

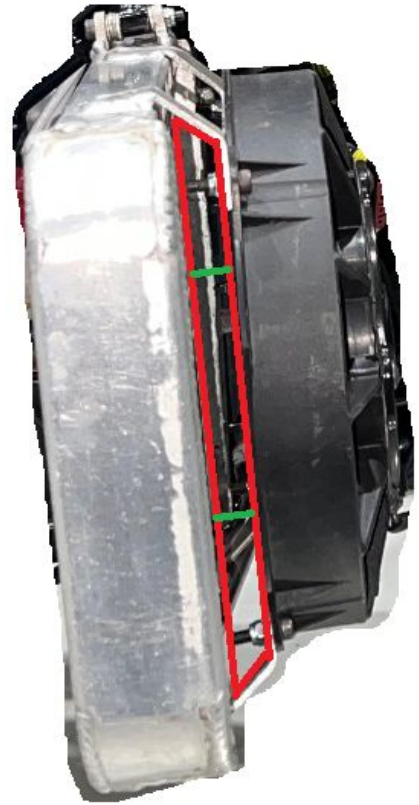




Inspeção Técnica - Powertrain IC

83 D'TRAIN FINGER GUARDS - T.5.2.10

Required to cover all drivetrain parts that spin while car is at rest. No holes >12 mm dia.



Sidepod não é considerada proteção, caso a equipe ligue o motor com o carro parado e sem a sidepod montada, ventoinha ficará sem proteção.

Inspeção Técnica - Powertrain IC

84 COMPRESSED GAS CYLINDERS - T.6

•Unmodified COTS cylinder (labeled). •Nonflammable gas. •Regulator on tank. •Securely mounted, axis not pointed at driver. •Rearward of Main Hoop within the frame envelope, or in structural sidepod; not in cockpit. •Appropriate lines & fittings.• <=150mm from exhaust: metal, or protected per T.1.6.3.

Adesivar todos cilindros da equipe aprovados, caso apresentem algum cilindro irregular, reter na secretaria da SAE até o fim do evento.

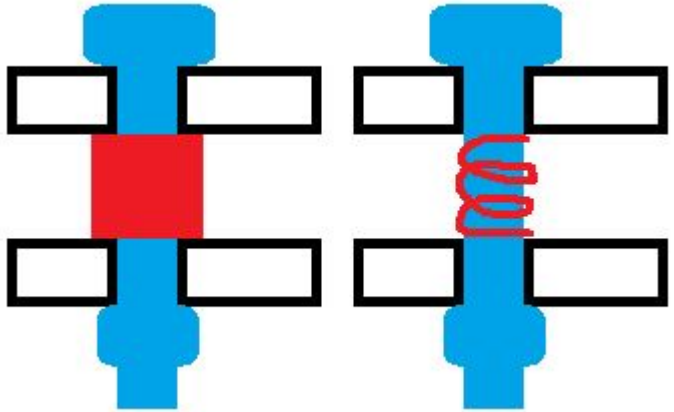
Validade de 5 anos.
Posicionamento:
-Dentro da estrutura primária;
-Abaixo do ombro do piloto(VERTICAL OU HORIZONTAL);
-Sem contato visual direto com o piloto(ATRÁS DA FIREWALL);
-Se for próximo da corrente, deve ter um protetor para o cilindro das mesmas caracteríticas do protetor de corrente padrão.

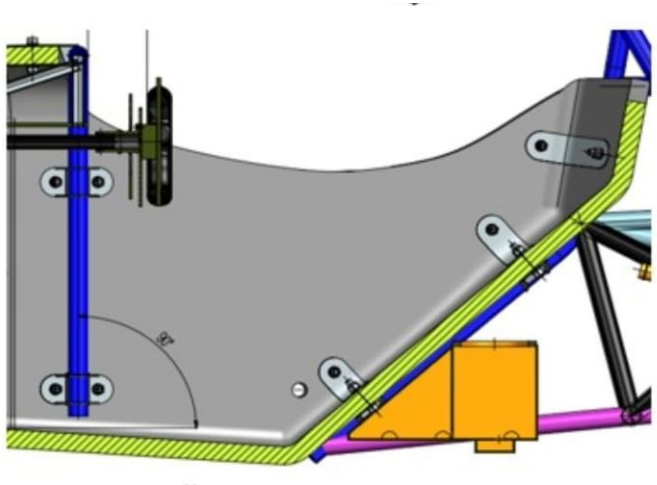
Inspeção Técnica - Powertrain IC

85 FUEL TANKS - IC.5.2 & .3, F.9

•Must lie within major structure of the chassis, with side impact protection. •Rigid tanks cannot carry structural load & must be flexibly mounted. •No portion of fuel system below lower surface of frame. •Firewall between all parts of fuel system & driver.

Tanque não pode sofrer carga estrutural, deve ser “flexível” em relação ao chassi.





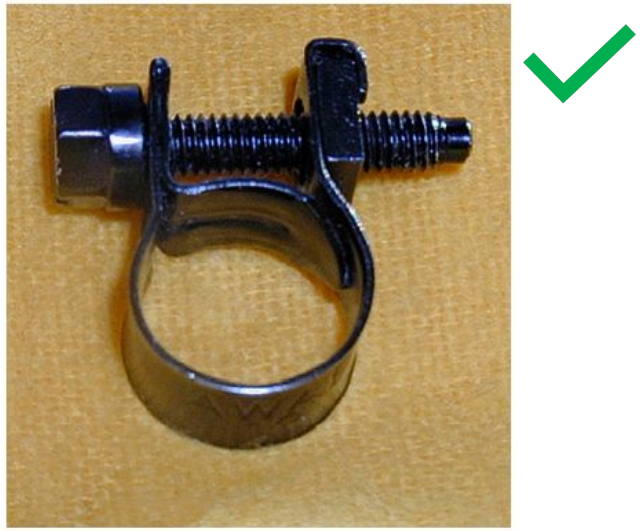
Equipe deve ter um meio de esgotar o tanque sem acionar nenhum sistema elétrico.

Sugestão: Bujão no fundo do tanque(Frenar)

Inspeção Técnica - Powertrain IC

86 FUEL LINES - IC.5.7

No plastic lines between tank & engine (reinforced rubber hoses OK). •Bulbs/barbs on hose connections. •No worm-gear clamps. •Must be securely attached, •protected from rotating equipment & collision damage. •Systems >10 bar see IC.6.2



Inspeção Técnica - Powertrain IC

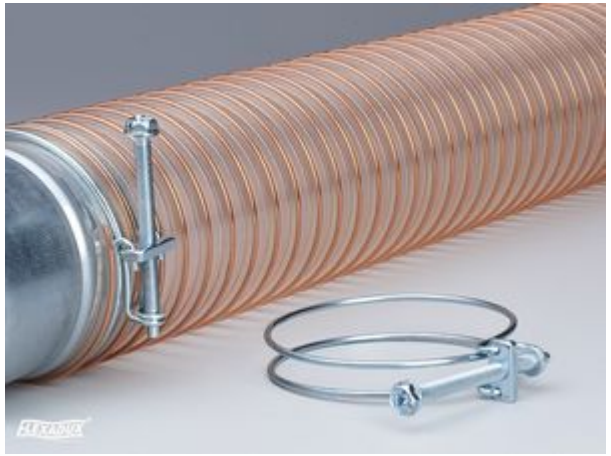
87 GOOD PRACTICES, fuel lines - GR.1.5

Hoses and fittings must be type-matched (no clamps on braided metal hoses, etc). •Fuel lines restrained and protected from stress, heat, and abrasion.

Inspeção Técnica - Powertrain IC

88 FUEL FILLER NECK - IC.5.4

Fuel-resistant materials, •min 35 mm inner dia, •within 30° of vertical. •Must prevent fuel spillage contacting driver, exhaust or ignition (add shields as needed). •Fueled w/o manipulating car in any way. •Cap secure and capable of withstanding pressurization (ie: threads or latch). •Easy access for common 2-gal jugs.

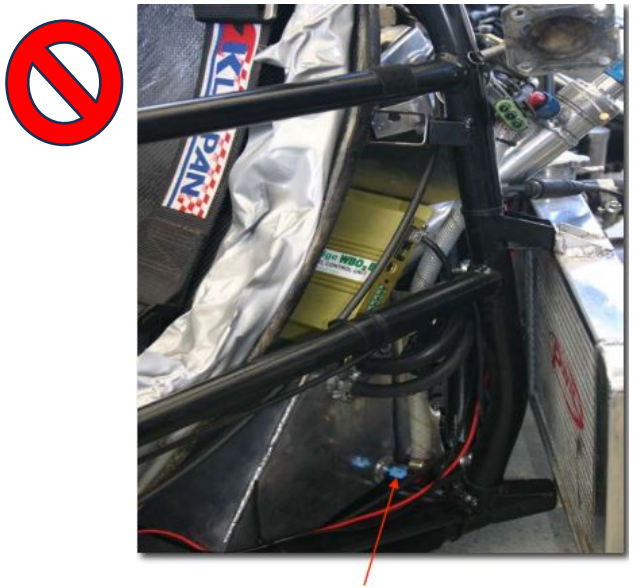


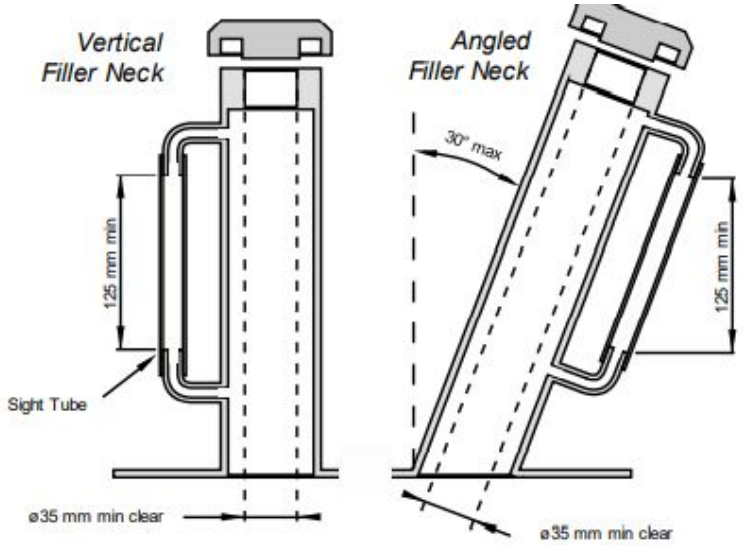
Deve ser obrigatoriamente utilizado Abraçadeira orbital ou arame duplo.

Inspeção Técnica - Powertrain IC

89 SIGHT TUBE - IC.5.4

•Fuel resistant materials, •transparent, •min 6mm inner dia. •Min 125 mm vertical height in area visible to fueler with vehicle fully assembled. •Sight tube must NOT run below top of tank. •Non-moveable fuel level line 12-25 mm below top of sight tube. (Clear filler neck OK as sight tube.)

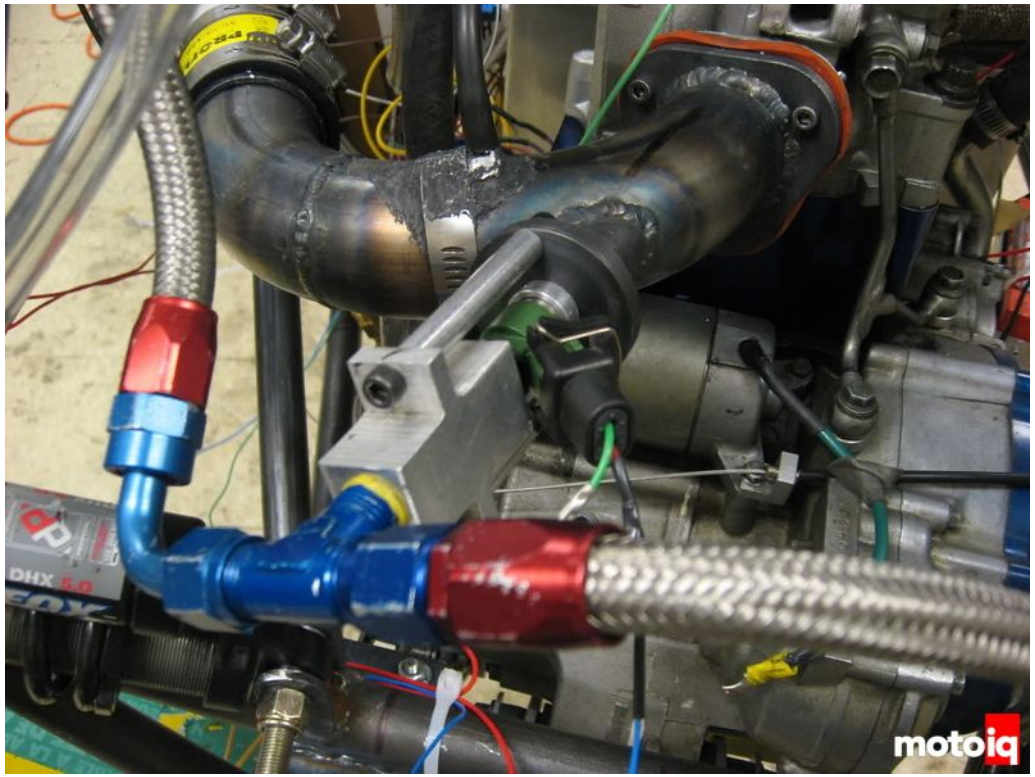




Inspeção Técnica - Powertrain IC

90 FUEL RAIL - IC.6.1

•Securely attached to block, head or intake manifold with brackets & mechanical fasteners. •No plastic or composite fuel rails, except if unmodified OEM part. •CRITICAL FASTENERS



Inspeção Técnica - Powertrain IC

91 FUEL TYPE - IC.5.1

93 octane gasoline | 100 octane gasoline | E-85 No agents other than the provided fuel and air may be induced into the combustion chamber.

•Place appropriate fuel sticker adjacent to fuel filler (**not on cap**)

Combustível BR(fornecido pela FSAE-Brasil):

-Gasolina PODIUM

-Etanol

Inspeção Técnica - Powertrain IC

92 FUEL VENTS - IC.5.6

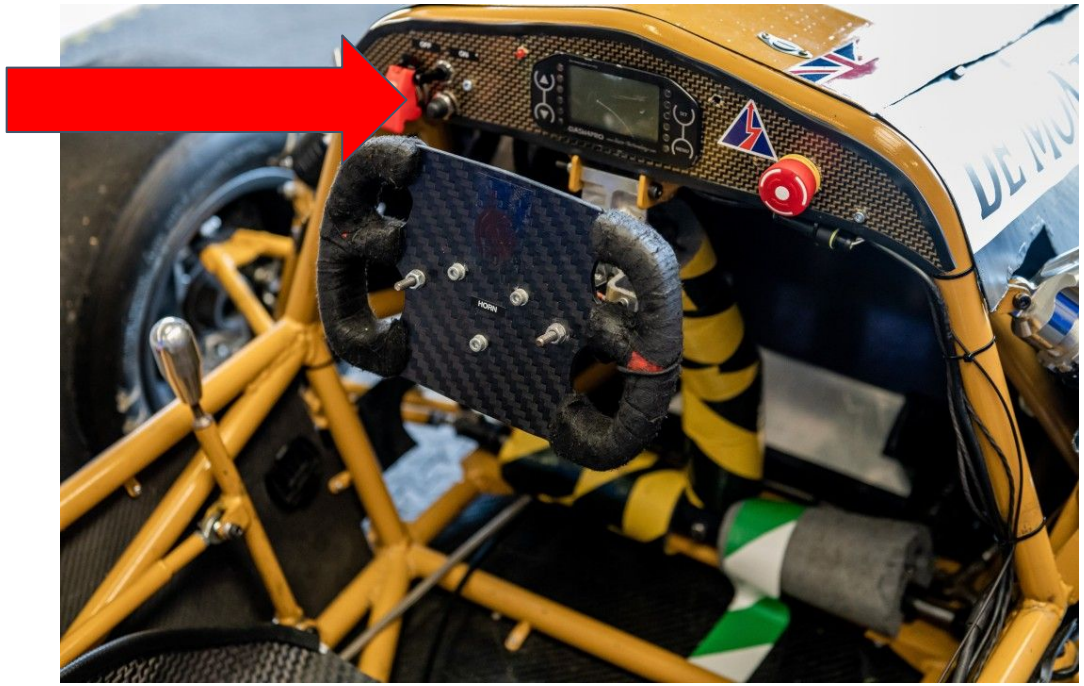
•Must exit outside of the bodywork. •Must include a check valve to prevent leakage if car inverted

Inspeção Técnica - Elétrica IC

93 ON-BOARD STARTER - IC.8.1

Required (remote starters and push-starts prohibited).

Each vehicle must start the engine using an onboard starter at all times



Inspeção Técnica - Elétrica IC

94 PRIMARY MASTER SWITCH - IC.9.3

•On driver's right, near roll bar. •Access from outside of car. •Rotary type. •No relay. •Must kill ALL electrical systems. •Marked with international symbol. •Lever horizontal when ON.

Inspeção Técnica - Elétrica IC

94 PRIMARY MASTER SWITCH - IC.9.3

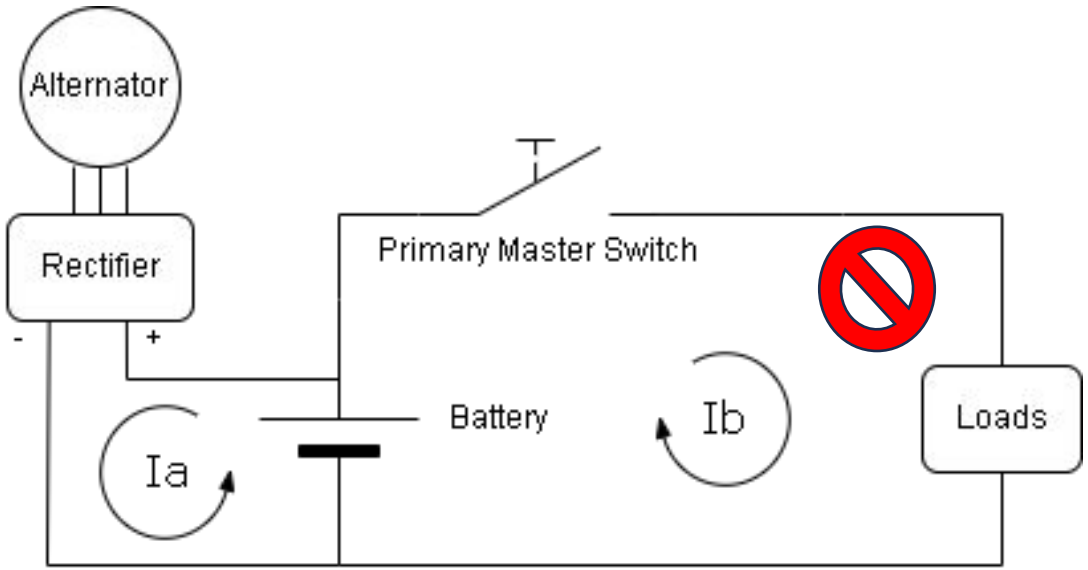
IC.9.3 Primary Master Switch

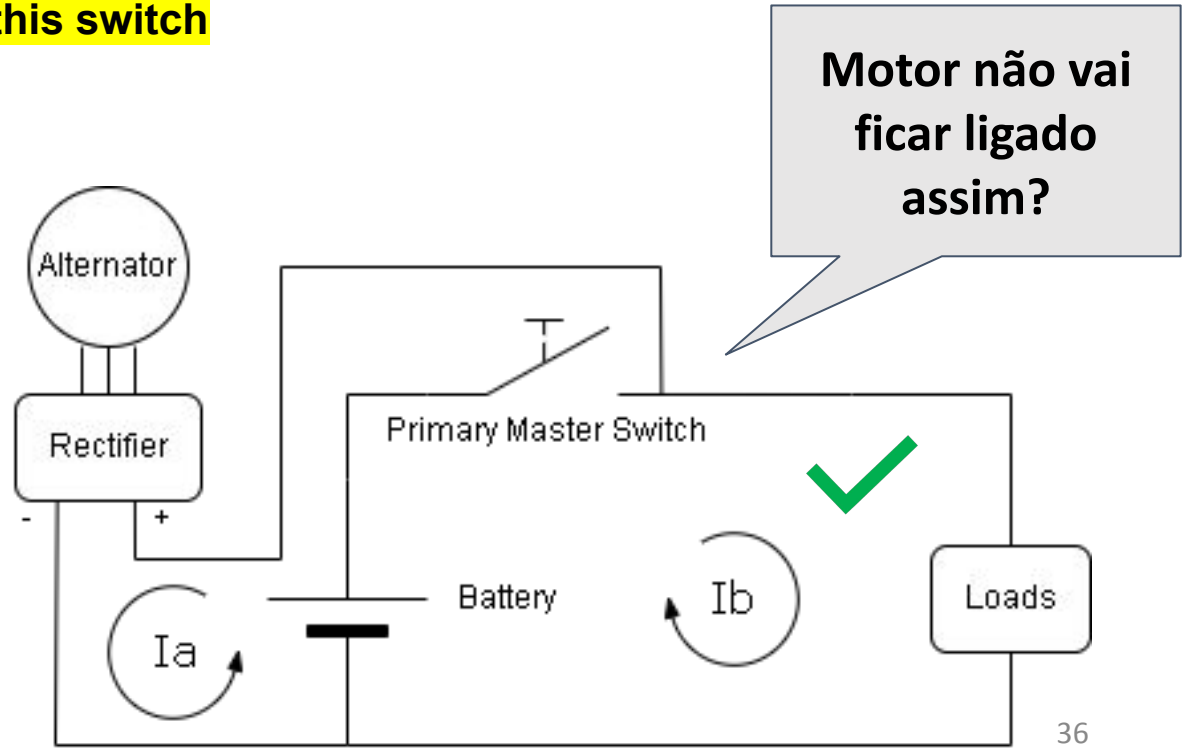
IC.9.3.1 Configuration and Location - The Primary Master Switch must meet T.9.3

IC.9.3.2 Function - the Primary Master Switch must:

a. Disconnect power to ALL electrical circuits, including the battery, alternator, lights, fuel pump(s), ignition and electrical controls. All battery current must flow through this switch

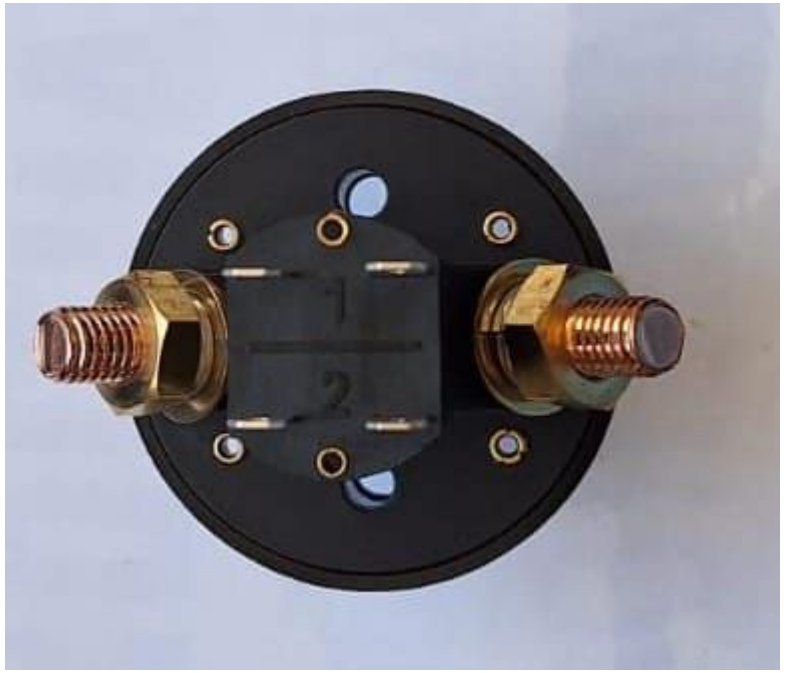
b. Be direct acting, not act through a relay or logic.

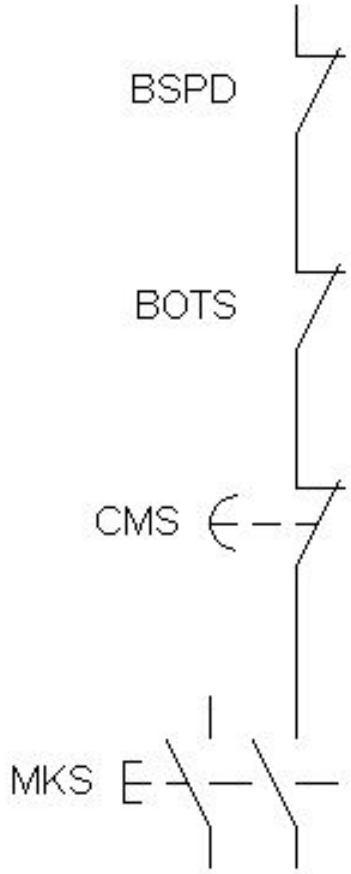




Inspeção Técnica - Elétrica IC

94 PRIMARY MASTER SWITCH - IC.9.3





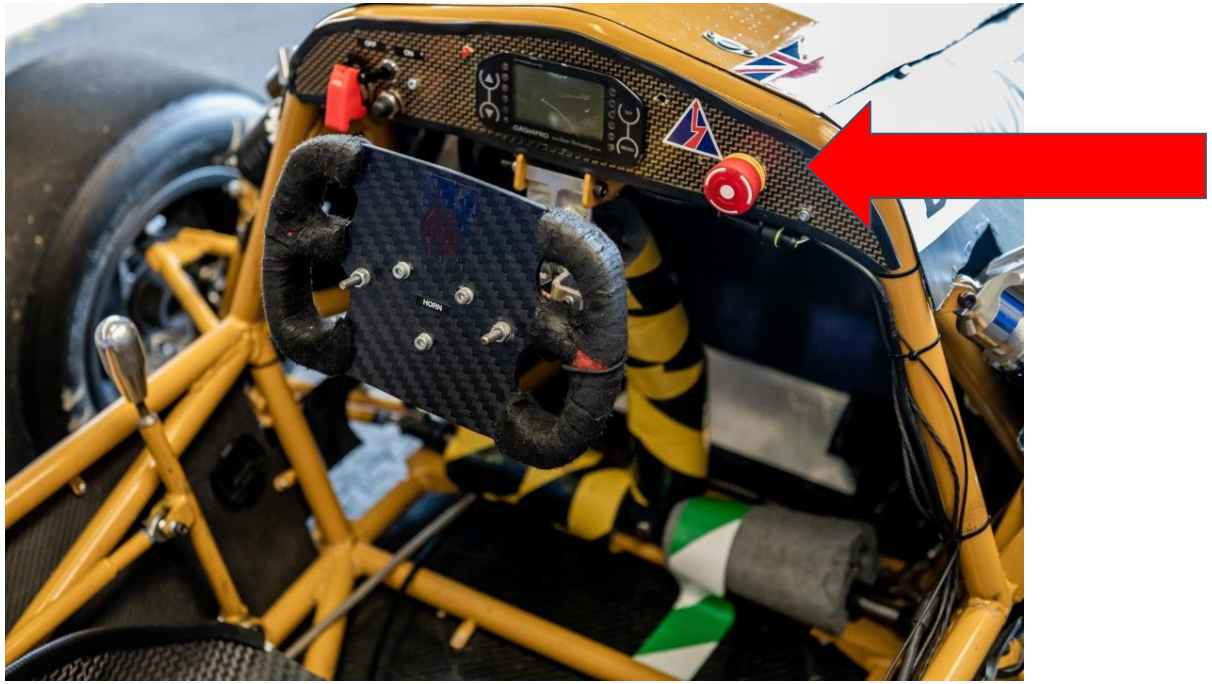
SUGESTÃO: Utilizar o contato NA em série com o Cockpit Main Switch , Brake Overtravel Switch e com o BSPD caso ETC seja utilizado, incluindo assim este contato NA no Shutdown Circuit.

Funcionamento será avaliado no Noise test.

Inspeção Técnica - Elétrica IC

95 COCKPIT MASTER SWITCH - IC.9.4

•Pull-ON, Push-OFF type. •Alongside & unobstructed by steering wheel, easily reached by driver. •Must kill ignition & fuel pump(s). •Min dia 24 mm. •Marked with international symbol.



Inspeção Técnica - Elétrica IC

96 BATTERY - T.9.2

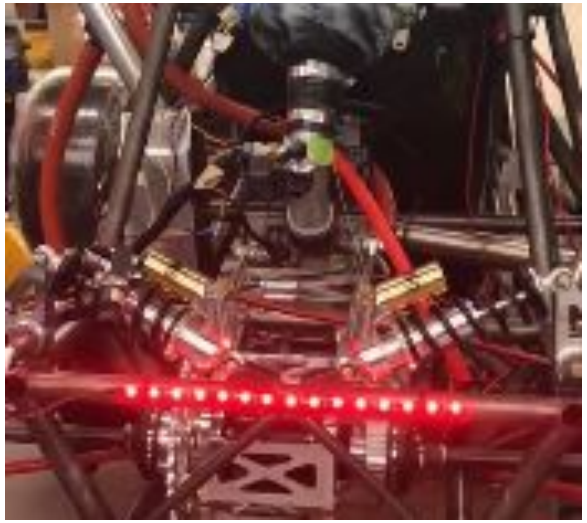
•Attached securely to frame or chassis. •Hot terminal insulated.
•Wet-cells in marine box if inside cockpit. •Type must be identifiable.
•Overcurrent protection • Lithium: firewall per T.1.8 between driver; OEM battery or with rigid nonflammable case. •No circuits > 60 VDC

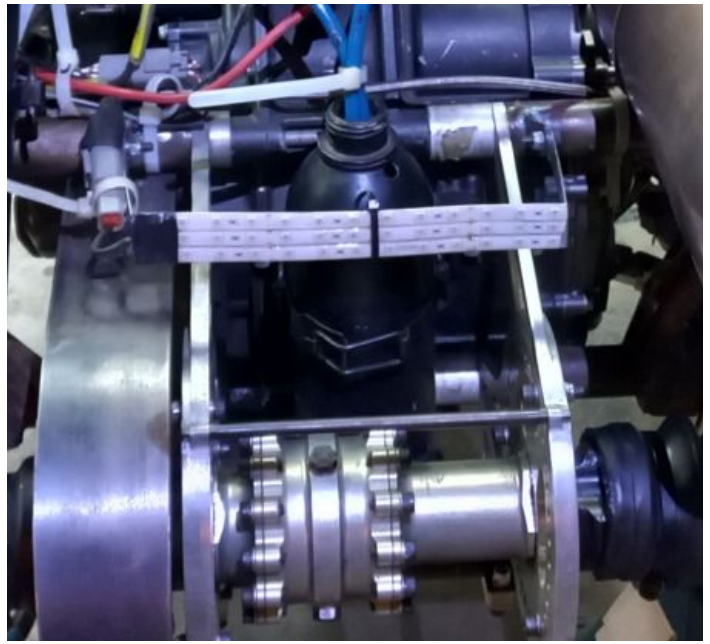
Fixações por velcro não serão aceitas.

Inspeção Técnica - Elétrica IC

22 BRAKE LIGHT - T.3.3

•RED color, •clearly visible from the rear, located on vehicle centerline. •Height between wheel centerline & driver's shoulders. •Round, triangle, or rectangular on black background. •15 cm2 minimum illuminated area. LED strips OK if elements closer than 20 mm apart and total length > 150 mm (5.9”). •Sufficient brightness for visible activation in bright sunlight





Inspeção Técnica - Elétrica IC

46 BRAKE PEDAL OVER TRAVEL SWITCH - T.3.3

•Must cut ignition & fuel pump. •No re-start if brake released or actuated a second time. •Must NOT rely on software to work. •Not resettable by driver

Inspeção Técnica - Itens gerais IC

97 GOOD ENGINEERING PRACTICES - GR.1.5

- Proper use of fasteners.
- Proper use of fluid lines and fittings.
- Appropriate selection of materials regarding fluids, heat.
- Protection from sharp edges - wiring, hoses, people.
- Protection from heat - wiring, hoses, people.
- Linkages not bound up or prone to over-articulation.
- No excessive lash in joints and pivots.

Inspeção Técnica - Itens gerais IC

98 VISIBLE ACCESS - IN.2.3

To all items on Tech Sheet without the use of mirrors, borescopes, etc

Caso necessário, podem solicitar para:
-Tirar carenagens;
-Tirar bico;
-Tirar asas;
-Tirar firewall;
-Tirar rodas;
-Erquer no jacking(pedir para sempre alguém da equipe ficar encima pra não cair;
-Erguer em cavaletes;
-Etc.