BARCELONA SMARTMOTO CHALLENGE

SMARTMOTO CHALLENGE 2019

Rules 2019a*

www.smartmotochallenge.org

- **As usual in red rules changes from 2018 event**

Those rules are subject to possible slight variations until November 30th, 2018

PURPOSE OF THE PROJECT

On the one hand, to provide to engineering and design schools the possibility of working in a real project for developing an electrical light motorcycle. The students, with their participation, will acquire the skills of workgroup capacities, working by objectives, last minute technology and knowledge on future markets among others. On the other hand the manufacturers of the motorcycle industry will have a laboratory of ideas and an additional source of future market and product technicians.

OBJECTIVE OF THE PROJECT

After those six editions of Barcelona Smartmoto Challenge, from the organization we have been able to see that young engineers see technology in the mobility sector as an argument to compete. To compete against other universities in innovation, development, and also, with the chronometer. That is why, seeing the type of technological / sporting events that exist today around the world for young engineers, and always in the field of electric mobility, Barcelona Smartmoto Challenge will focus on a sector in which Spain / Catalunya was a leader, and in which today also exist, different specialties of great impact on media and entertainment. This sector is ***OFF-ROAD***, which first 2017edition was a very successful small test. This year, and next , the objective will be to present an electric motorcycle, off-road type, prepared to compete, having as target the motorcycles of the famous raid Dakar. This document establishes the regulation for the off-road bikes for this 2019 edition. During the event a real off-road track will be used.

The phases during the project will include market analysis, definitions on product and its design, and as a consequence of this, building a real prototype of an electrical light motorcycle. It will be also mandatory to work on a business plan that explains how each team evaluates the launch of its vehicle in terms of production, prices, dealers, markets...

The purpose of this document is to define what are the variables, constraints and criteria to use during the execution until the event in Barcelona.

PROJECT SCOPE

The scope of the project this year is limited to engineering degree universities as well as the participation of mixed teams with departments or design schools from other European universities. Even technical schools as only member previous agreement with organization The final projects will be presented for verification in a workshop (1 week) at the racetrack of Circuit de Castelloli (Barcelona) 50 km north from Barcelona city, with no more than 20 teams.

Figure 1. Can you design, construct and sell something similar using electric technology ? Ready for competition?

1.- BARCELONA SMARTMOTO CHALLENGE 2019 RULES

1.1- EXECUTION TIME FOR PROJECT

The calendar project will be announced on the website ***www.smartmotochallenge.org*** and the project must be defended in a near Barcelona off-road racetrack in the form, place and conditions than will be specified later in this document.

1.2- WHO CAN TAKE PART IN THE EVENT

The project is for multidisciplinary teams of students that during 2018 and 2019 are studying or have studied in any of these kinds of schools this period:

• Industrial Engineering,
• Mixed teams of students from schools of industrial engineering and

- Industrial Design Schools
- Telecommunications Engineering
- Computer Engineering.
- Other Technical Universities.

- Some Technical Colleges by agreement with BSMC organization

The number of students from each team must be between 8 and 20 students with the conditions described later, and it must have a faculty advisor as responsible. The faculty advisor must be present during the competition.

Mixed teams will be accepted from various training centers. Although, they must have only one faculty advisor that must be from the engineering university.

The BSMC Organization recommends to the teams to be segmented into groups of marketing, product design and engineering, in order to implement the project properly in all its aspects: From product design to construction and marketing.

The geographical location of universities and educational institutions will have no restrictions.

Important: Teams should submit the list of the team members with the signature of the principal of the university or the person with legal capacity to sign that the students are enrolled in School of the team they are working for.

1.3- PROJECTS ACCEPTED

The project presented can be a full new motorcycle or an improved version from some previous version. Depending on which category A or B (less than 10 kW or less than 30 kW) a minimum of main changes will be mandatory.

In case of Type A, a minimum of 2 of this listed items must be changed

- Engine
- Battery Management System
- Controller
- Frame
- Front Suspension System
- Rear Suspension System
- Battery structure (new cells type, voltage, modular structure, quick change…)
- Noticeable Body work

In case of Type B a minimum of 1 of this listed items must be changed

- Engine
- Battery Management System
- Controller
- Frame
- Battery structure (new cells type, voltage, modular structure, quick change…)

But for both cases the project must look as new: painted as new, sticks, no scratches, no dents….

1.3.1- Number of projects per Team

Each university under the same registration fee can present one project for Type A category and a second project for Type B category. Both projects can share drivers and engineers but will act as different teams.

1.4- STAGES OF THE PROJECT

The competition is composed on six stages. Each one evaluates different aspects of the project:

STAGE Ia	Registration and first part of payment from a form submitted by the organization.	From November 15th to December 31st 2018
STAGE II	Design brief. The document written as a file will be specified before December 15th.	Deadline March 31st 2019
STAGE Ib	Second part of payment for registration and camping site	Deadline May 31st 2019
STAGE III	Presentation of the final Product Design (PDA) and Cost Report (CR). It will be previously specified before March 21st.	Deadline June 30 th 2019
STAGE IV	Presentation of the prototype during the competition.(*)	July 2019
STAGE V	Theory evaluation of the industrial development, design event and business plan presentation during the competition.	July 2019
STAGE VI	Dynamic testing of the prototypes during the competition.	July 2019

(*) Prototypes presented at the stage IV must pass all tests required for getting the approval, demonstrating that they are safe and that they meet all the requirements for driving on public roads under EU rules. Otherwise the vehicle will not be evaluated at stage VI.

1.5- MAIN CHALLENGE ADMINISTRATIVE ACTS

1.5.1- REGISTRATION (Stage I)

The teams wishing to participate on the fourth edition of the BSMC should fill and send the registration form between 15th November and 31th December following the procedure that will be announced on Smartmoto Challenge website, www.smartmotochallenge.org.

The total cost for registration has two charges. One as registration fee (1) and the other as accommodation fee (2a or 2b). Registration fee is 1200 € but is paid in two times. In this way if team does not finish the project at time, it is no necessary pay the second part of registration fee. The accommodation fee if using organization camping site is 45 € per student.

(1)	Registration fee part 1	600€ + VAT per team
(2a)	Part 2 + Accommodation fee using camping site	600 + 45€ per student + VAT
(2b)	Part 2 without using camping site	600 + VAT

The registration fee (1) is mandatory for all the teams participating in SMC. Accomodation fee with charge per student will only be charged to the teams that need to stay in the camping site in Barcelona racetrack during the days of the competition. If not are going to use Parcmotor camping site, only 600 + VAT

The camping site has fresh water, toilettes, showers and energy (220 V). If the number of students of each team changes, the final amount of money will be adjusted during the event. You can find more detailed and refreshed cost information in the website.

1.5.2- PROJECT DOCUMENTATION AND SPECIAL TASKS

STAGE II	Presentation of design briefing with main features of the prototype.	Before March 31st at 20.00h BCN time PENALTY -5 POINTS IN TOTAL SCORE
Between **STAGE II** and **STAGE III** the organization should receive the list of all the team members signed by an academic authority of the corresponding university according that the team members are studying. If any change occurs in the team along the project, the team responsible has to inform the SMC organization.		
STAGE III	Presentation of the final product design and technical justification of the project	Before June 30 th at 20.00h BCN time PENALTY -5 POINTS IN TOTAL SCORE

1.5.3- TERMS OF USE OF THE EQUIPMENT RELEASED BY SPONSORS

The use of components provided by the sponsors will be mandatory during the project if some component is given before finishing STAGE II.

1.5.4- TEAMS

The teams will consist of a minimum of 8 and a maximum of 20 components, which will formalize the registration before 31th December, 2018, coordinated by a tutor as faculty advisor, from the university they belong to. In addition to the tutor, one of the team members should be appointed as manager who will be responsible for the partner functions with the organization.

It is mandatory that all participating students had passed more than 50% of grade credits in Engineering degree or challenge allowed educational institution.

The maximum number of teams for this year is 20. If the number of requests exceeds this maximum, there will be a filter between those candidates who meet the eligibility requirements, according to the filing date of registration.

1.5.5- INSURANCE

Entered universities should integrate the work done, during the days in Spain, in the training curriculum for challenge inside the activities covered by school insurance.
However, each team should have a private insurance as cover against any accident that may happen where Organization will not be responsible. This insurance must be shown to SmartMoto Challenge organization team.

1.6- PROJECT EVALUATION

During the days of projects presentation in Barcelona, jury will score the prototypes. For this, it has been necessary define a scale from 0 to 1000 for evaluating the dynamic and static aspects of each project.

1.6.1 CATEGORIES

This year two categories will be considered: Type A and Type B. Type A will contain projects with engines smaller o equal **to 10 kW**. Type B for engines greater than **10 kW until 30kW**. Theses data as nominal values. Voltages will be until 60 V (low voltage) for type A and until 120 V (high voltage) for type B. Also nominal values

1.6.2 STATIC EVENTS

1.6.2.1. Product Design Analysis. (PDA)

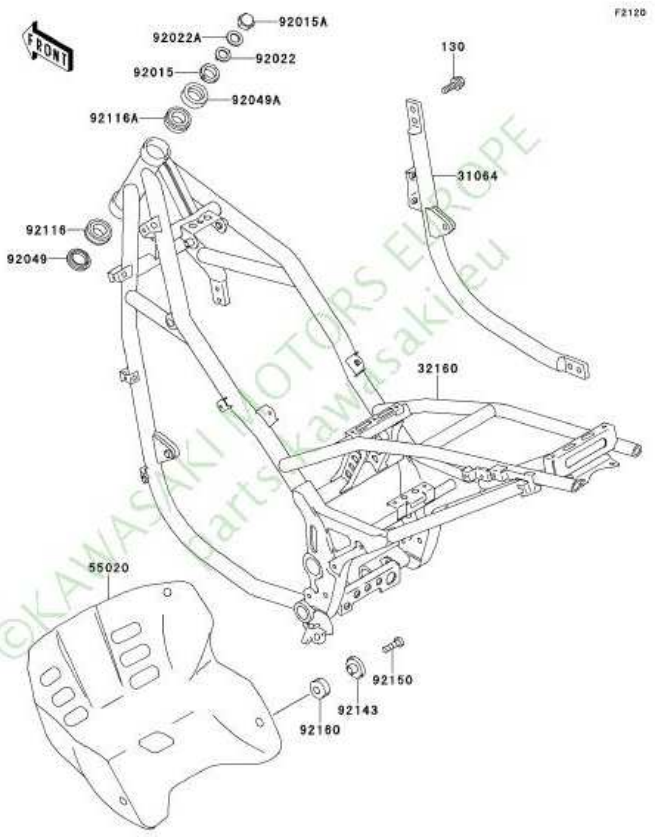
This document must justify in detail the bearing capacity of the vehicle. This document will have had a previous evaluation during project development. It will be analyzed each and every one of the documents of the equipment by the judges for this purpose defined by the organizing committee. For evaluation some questions may be done by the judges assigned to that purpose by the organizing committee. From 0 to 250 points divided into: structure and brakes 50 points, lights and ergonomics 25 points, 50 points smart components 50 points, energy recovery and reuse of components 100 points, usability and maintenance 25 points
This document must content, as minimum, the template specifications. Must be presented as the result in STAGE III

1.6.2.2. Cost Report (CR) (NEW !!!!)

For this edition and next, it will be mandatory two cost reports documents, first, CR for prototype and then CR for commercial product. Both information must be used for Business Plan discussion and presentation.

The objective of this document is to justify the final cost of the prototype and to try to justify the production cost and final price into the market for this new product.

The document must contain the motorcycle split into subsystems as picture below and for each component of it write:



- The cost for you if it has been bought to a supplier
- The cost of raw material, the construction process, the number of hours for producing it, the cost of each labor hour in your company/university, the total cost of it, the time for assembling and its cost.
- The cost of assembling all subsystems
- These calculations must be done twice; in case of your prototype, and in case on starting commercial production.

At the end, the final cost of the all prototype and de final cost of your serial product must be known. To the serial product you can add the commercial margin and you will have the commercial price into the market.

Only the CR document must be sent at the end of STAGE III, no preliminary document is mandatory.

During the event each team must have a CR printed version for discussion with judges

The CR document will score up to 100 points

1.6.2.3. Business Plan (BP)

A document with a presentation in ppt, prezzi, or equivalent, by the teams which shall contain the following mandatory items:

1. *Executive summary (resume)*
2. *Innovation Team*
3. *Industry background*
4. *Competitor analysis*
5. *Market analysis*
6. *Marketing plan*
7. *Production plan*
    a. *Plan Projected sales and profits the first 3 years*
8. *Operational plan*
9. *Financial and economical plan*
    a. *Plan Projected sales and profits the first 3 years*

Your presentation must be referred to one specific country and you will dispose 20-25 minutes with a ppt. or similar tool for its exposition

No separate report is required for your Business Plan, only your presentation but it is up to you give a copy to the judges.

1.6.2.4. Design and Cost Report discussion

After reading the documents sent on June, judges will discuss with each team its content Detailed questions will ask judges to the teams in the area event/schedule assigned during the event, but for sure last event day.

Teams will receive on paper a table resume os of patial scores on Design, Cost and Business Plan at the end of the event similar to this:

	Weak				Good	
Topic	***0***	***1***	**2**	**3**	**4**	**5**
Product Design Analisys PDA						
Body and brakes						
Lights and ergonomy						
Smart Components + Power Train						
FEA works						
Energy recovery and reuse of components						
Usability and maintenance						
Cost Report CR						
Detailed cost description						
Realistic values						
Business Plan BP						
Executive summary						
Innovation team						
Industry background						
Competitor analysis						
Market analysis						
Marketing plan						
Production plan						
Operational plan						
Financial and economical plan						
SELF TEAM SCORE		**REFERED TEAMS SCORE**				

Table 0. Score table for teams

1.6.3 PREVIOUS TEST BEFORE DYNAMICS EVENT

Before start the vehicles, they must pass the following tests and standard safety check carried out by engineers from well known sector companies.

1.6.3.1. Rules verification

Engineers from BSMC staff will control that the model fits the design and standards sent to the organization during STAGE III. Judges can ask for showing any part of the motorcycle.

Specific stick after passing this evaluation

1.6.3.2. Sealing

During 60 seconds (type A) and 120 seconds (type B) the vehicle will be submitted to a rain test. **The traction must be ON** from the beginning, and the test will be passed if the system after STOP it runs as it should run.

Specific stick after passing this evaluation

1.6.3.3. Brakes

- Verification following Homologation Test for braking vehicles.
- Leaving standing start and operating the front brake at 5 meters, the bike must stop in 3 meters.
- Leaving standing start and operating the rear brake at 10 meters, the bike will stop in 5 meters.
- If the bike has full braking is applied only the second criterion

The usage of the brakes will disable the throttle, i.e. it is not possible to brake and accelerate simultaneously.

Specific stick after passing this evaluation

1.6.3.4 Noise

There must be a beep of over 70dB in a radius of 2 meters around the motorcycle when the system state switches to ready to drive. The duration of the sound shall be between 1 and 3 seconds. The sound shall be easily recognizable, i.e. no animal sounds, human voices, songs, etc.

1.6.3.5 Emergency button

There shall be an emergency button to stop the whole system if necessary. A wristband that disconnects the system in case of being at more than 50cm of the handlebar will also be accepted.

1.6.3.6 Kickstand

The motorcycle shall dispose of a kickstand. In case it is in use, the traction system shall be deactivated (the system cannot be in drive ready state if kickstand in use).

1.6.3.7 Lights

Front and rear lights shall be on always the system is in drive ready, to ensure pedestrians and other drivers know the motorcycle is ready to drive.

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1.6.3.8 Drive ready indicator

The display on the handlebar shall have a drive ready icon to know the system is in this state. Taking in consideration new 2017 European rules, driver must access to this state doing two volunteer actions. (ej. Key on + button...)

1.6.3.9 Horn

The motorcycle must have a homologated horn as acoustic signal sender

1.6.3.10 Mirrors

The motorcycle must have 2 mirrors in front for left and right view

1.6.3.11 Safety stick

For having the safety stick, and thus, being ready for dynamic events **1.6.3.4, 1.6.3.5, 1.6.3.6, 1.6.3.7, 1.6.3.8, 1.6.3.9, 1.6.3.10 + 2.3.1** must be right.

1.6.3.12 Competition number

The motorcycle must have 3 areas for having a number. One in front, two on both sides. Must be visible.Each number with size 10cm high, 2cm wide in black colour.

1.6.4 DYNAMIC EVENTS

All dynamics events must be done with the complete body and accessories of each smartmoto which will be presented on design event. It is not allowed change some parts of the body during dynamic events. The valuation will have a total of 500 points and consist of:

1.6.4.1 Acceleration

With 1 driver, 50 meters standing start. It wins the fastest time. 4 attempts each team, with 2 drivers, and choose the best result. 4 runs (2+ 2). Will be done on off-road track

1.6.4.2 Acceleration +

With 1 driver, 50 meters standing start. It wins the fastest time. It wins the last in a one to one challenge. 1 driver per team. Will be done on off-road track

1.6.4.3 Cones/Trial track

With standing start, a serial of cones, 0.5 km long the all narrow path, with slow parts, must be passed It wins de fastest. 4 attempts each team, with 2 drivers, and choose the best result. 4 runs (2 + 2) This test also serves to check the dampers. Will be done on off-road track

1.6.4.4 Enduro/Scrambler track

The quickest between two drivers each team. 4 runs (2+2) in one lap along an *off-road* track of 1 km long. Will be done on an off-road track

1.6.4.5 Endurance

Based on the regularity and with 2 drivers: 30 laps on a motocross race track whose total distance will be approx 30 km., with 2 mandatory changes of driver, first mandatory on the lap number 10. The track will be the Enduro/Scrambler track used before.
For type A and B teams **BATTERIES CHANGES WILL BE OPTIONAL.**
The clock will not stop during all the event.
Motorcycles must start with all body components installed. Only in case of danger for driver, the motorcycle will be stopped during event and organization will allow to repair it without stopping time.


Figure 2 . Some images from the area where enduro track and endurance events from Barcelona Smartmoto Challege will take place

1.6.4.6 Scoring Dynamic events

Each cone moved during any event, 5 SECONDS OF PENALTY
Teams that will be on time during any dynamic event, 5 POINTS AS GIFT at the global scoring. If a team is on time during all events will have 25 points more at the end of BSMC classification. Been on time means do the event into the time slot assigned during the event that appears on the schedule.

The best will be assigned with the highest score. The worst, if finishes the test, its score will be **half the highest**. This means that for acceleration 50, Cones/trail track and Enduro/Scrambler Track 37,5 and Endurance 75.
The time difference will be used to proportionally distribute the subtraction of points from the winner to the other.
If a team can not finish the test **0 points**.

1.6.4.7 General scoring overview

Score	5	10	25	50	75	100	150	250	500
STATIC EVENTS									
Product Design Analisys								x	
Body and brakes				x					
Lights and ergonomy				x					
Smart Components + Power Train					x				
FEA works			x						
Energy recovery and reuse of components			x						
Usability and maintenance			x						
Cost Report						x			
Detailed cost description						x			
Business Plan							x		
Executive summary	x								
Innovation team	x								
Industry background		x							
Competitor analysis		x							
Market analysis		x							
Marketing plan			x						
Production plan			x						
Operational plan		x							
Financial and economical plan				x					
TOTAL STATIC EVENTS									x
DYNAMIC EVENTS									
Acceleration						x			
Acceleration +						x			
Cones					x				
Enduro Track					x				
Endurance							x		
TOTAL DYNAMIC EVENTS									x

Table 1. Score table for the project

1.7 - ORGANIZATION

The organization of the event Barcelona Smartmoto Challenge BSMC is provided by the Smartmoto Challenge (SMC) Association,
303 Galileo street 08028 Barcelona (Spain), +34 653964485 (contact: Dr. Emilio Hernández emilio.hernandez@smartmotochallenge.org).

To review the various project areas SMC has defined three commissions for evaluation:

Theoretical project evaluation Commission
Static events evaluation Commission
Dynamic events evaluation Commission

Those committees will evaluate the project based on a score table that will be published together with the regulations. Their decisions will be final.

1.8- AWARDS (provisional)

Awards will be those for each category (A and B):

1.7.1 To the overall winner and second : Based on the score

1.7.2 To the best theoretical development and second: Based on the score

1.7.3 To the best dynamic behavior and second: Based on the score

1.7.4 To the winner of ACCELERATION +

Common Awards:

1.7.5 To the best SMART solution

1.7.6 To the best body and brakes design

1.7.7 To the best Battery Package Solution

1.7.8. The best newbie team

Other awards could be defined later

1.9- INDUSTRIAL PROPERTY

Due to the direct relationship with industry, project has defined the following clauses that refer to industrial property of the projects presented:

-Each university can reach economic agreements along the event with any company involved indirectly or indirectly as a sponsor at the event.

-If the company does not participate in the event as a sponsor, agreement will be with the organization and the university at the same time.

-If the university has patented the business object, only university can negotiate with any company.

1.10- LANGUAGE

The official language for the event is English. All written documentation submitted by the organization and / or participants will be written or spoken in English. The final defense of the projects will be in English.

1.11- MEDIA

The official Barcelona Smartmoto Challenge website is www.smartmotochallenge.org. The official Barcelona Smartmoto Challenge facebook page is: **www.facebook.com/smartmotochallenge**.

1.12- TEAMS AND EVENTS AREAS

Teams will be housed as a camping on site at the racetrack of Circuit de Castelloli (Barcelona-Igualada)
The static events will be carried out on the racetrack facilities following schedule on the website.
The dynamic events and, also, design and business plan events at the racetrack of Circuit de Castelloli (Barcelona-Igualada) on July following schedule to will be uploaded in event website.

1.13- MANDATORY EQUIPMENT FOR RIDERS

Homologated helmet, gloves, off-road boots, **body/arms/legs/knees protections**, heavy long pants, and glasses, will be mandatory for TYPE B teams. Homologated helmet, gloves, heavy long pants, and glasses will be mandatory for TYPE A teams. Never shorts and short sleeve shirts will be allowed.

2.- TECHNICAL REGULATIONS

Described below are the rules to apply in the construction of the vehicle which should be under type A category (Maximun nominal voltage 60 V and maximum nominal engine power **10 kW**) or type B category. (Maximun nominal voltage 120 V and maximum nominal engine power between 6 and **30 kW**)

2.1 FREE PARTS AND MATERIASL USED IN THE PROJECT

2.1.1- FRAME

They may use any material that is used in frames of bikes already on the market. For using a different material, it must demonstrate its technical feasibility on the preliminary design report. For **TYPE A** projects the frame must be designed and constructed by teams and must be not used during the BSMC edition before. For **TYPE B** projects the frame can be designed and constructed by teams or can use a commercial one modified by the teams for using during the BSMC event.

2.1.2- SWINGARM

They may use any material that is used in swingarms of bikes already on the market. For using a different material, it must demonstrate its technical feasibility on the preliminary design report. For **TYPE A and TYPE B** projects the frame must be designed and constructed by teams and must be not used during the BSMC edition before.

2.1.3- SUSPENSION

For **TYPE A and TYPE B** projects, they may use any commercial suspension for front and rear position.

2.1.4- WHEELS

Only vehicles with 2 wheels will be accepted. The only restriction is that the minimum size for rims in TYPE A is 15" and for TYPE B is 16". All tires used must exist in the market. No tyres prototype are allowed. The tyres will be the same for all the event. It is not allowed changes tyres between asphalt and off.road tracks.

2.1.5- LIGHTS

The lights must be powered from the same source as the engine and must form a structure following the European Standard. You can use light bulbs, halogen headlamps

or with LED technology ... or any technology that meets the Standard, with a maximum supply voltage of 12 volts.
Must have also 4 turn signals in amber colour (blinkers) with warning option (4 ligths working at time) included.
The lights must remain on during all dynamic events. Penalty 1 sec in case of finishing some dynamic event with some light off.

2.1.6- BRAKE SYSTEM

They should be powered by cable, hydraulic circuit to one or both wheels simultaneously. They can have an energy recovery system associated to the electric power train.. The components of the braking system, except in the subsystem of energy recovery must follow the European Standard. Systems ABS and brake assist systems are allowed.

2.1.7- VEHICLE SMART COMPONENTS

Because the development is related with a motorcycle for adventure and fun, we must be sure that in case of problems we can be safe. That's for the reason because this year the motorcycle must be able to send a message with position, kilometers that can run and level of battery when we define a minimum level that we can define previously. This information must be sent as web page, e/mail or sms message to some friend, company. IoT technology can be used instead of standard sim devices, Motorcycles Bluetooth embedded systems connected to a mobile are also allowed.

2.1.8- BODY AND SEAT

It can use any type of material approved for building motorcycles in Europe. The body can partially cover the wheels of the vehicle. Designs will not be accepted with sharp edges capable of producing incisions in the body at speeds below 10 km / h. The seats must have a part permanently attached to the frame or can turn around a fixed axis on the frame. Optionally ready for two people. **The vehicle can have 2 mirrors**, left one mandatory, right one optional one for each road side. One front plate number and one right side and other left side will be mandatory. Roadbook device is optional.
Front and rear mud guards mandatory.

2.1.9- POWER TRAIN (ECU+BATTERY+ENGINE)

From this edition ECU, battery and electrical engine could be anyone. Cells must be homologated in Europe. Depending on category different restrictions appear. Water can be used as coolant

2.1.9.1- ENGINE

Type A projects up to **10 kW** nominal in wheel or inside frame,
Type B projects between **10 and 30 kW** nominal
For both cases it is mandatory to include the technical sheet of it inside the PRELIMINARY DESIGN REPORT.

2.1.9.2- ECU

For both categories, ECU can be developed for teams or a commercial one..

2.1.9.3- BATTERY

For Type A projects, maximum 60 V nominal. For type B projects maximum 120 V nominal.
For Type A projects it is optional removable batteries. They must be capable to reach 30 km from endurance event without change it.
For Type B projects it is OPTIONAL the removable battery or modules of it. They must be capable to reach 30 km from endurance event with two battery change.
Battery Manage System (BMS) can be commercial or developed for team members

2.2 MAXIMUM WEIGHT

For type A, including battery, 140 kg
For type B, including the minimum battery size used on endurance test, 190 kg.

2.3 MANDATORY PARTS AND MATERIALS USED FOR THE EVENT.

2.3.1- SAFETY REQUIREMENTS

For this event some special requirements in safety aspects will be mandatory:

1- The smartmoto must start to move after two conscient actions. For example: key + button. (type A + type B)
2- The usage of the brakes will disable the throttle, i.e. it is not possible to brake and accelerate simultaneously. (type A + type B)
3- The smartmoto will be locked electrically with Kickstand deployed. (type A + type B)
4- If using high voltage system (voltage > 60 Volts nominal) some added safety considerations must be included (Appendix A (only type B))
5- Bodywork amd metal work without sharp edges (type A + type B)
6- In order to increase event safety, a short video (max 1 minute) from each driver using a TT motorcycle must be sent to organization in order to allow each driver to run the autocross and endurance event. The motorcycle can be the electric one or a combustion one.
7- Protected chain or belt transmission is mandatory (type A + type B)

8- In order to increase event safety, a short video (max 1 minute) from each driver using a TT motorcycle must be sent to organization in order to allow each driver to run the autocross and endurance event. The motorcycle can be the electric one or a combustion one.
9- Rain test for type B will be during 120 seconds. For type A, 60 seconds.
10- Mandatory wear the clothes described on 1.12 chapter


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APPENDIX A

Appendix A SAFETY RULES FOR HIGH VOLTAGE PROJECTS (TYPE B)

All those rules in APPENDIX A are mandatory for Type B category and only recommended for Type A category

A1-DEFINITIONS

Definition High Voltage (HV) and Low Voltage (LV)
Any circuit with a difference of potential greater than 60 V DC, will form part of the vehicle's High Voltage (HV) system. Below that voltage, it will be considered as part of the Low Voltage (LV) system. The maximum allowed voltage of the HV system will be 120 V DC (batteries full load)

High Voltage System (HVS)
The High Voltage System (HVS) consists of all electrical parts which form part of the engine, controller, battery or any other part connected to them. The HVS must be electrically insulated from the frame or mass of the vehicle. The accumulator or also battery of the HVS system is defined as any cell, battery or Super-capacitor (or all of them), capable of storing electric energy for the electric propulsion system. The HVS will use a control device between the engine and the accumulator, not allowing direct connection between the engine and the accumulator.
It is mandatory to include clearly visible danger warning labels in the enclosures or areas close to the components that work with Alta Voltage (HV), which include the text "HIGH VOLTAGE" like picture below.
A display shall be installed on the instrument panel indicating in voltage between terminals of the HVS system. The BSMC organization may carry out random measurements to check whether the value shown on the display corresponds to the actual value of the HVS

Low Voltage LV System connected to ground (Ground Low Voltage System - GLVS)
The LV grounded system (GLVS) is formed by any circuit or electrical part of the vehicle and therefore is not part of the HVS. The GLVS will be an LV system, ie a voltage less than 60 V DC.

A2- SYSTEMS DISTRIBUTION

Separation of HVS and GLVS

HVS and GLVS systems must be physically separated. There shall be no contact between the HVS and the vehicle frame or any metal part exposed to the outside.
If any part or part of the HVS and the GLVS must be together in the interior of a container, it must respect the minimum separation as indicated below, except in the exceptional cases described later.

HVS voltage Separation distance:
< 100 V DC 10 mm
> 100 V DC 20 mm

The distances reflected will not be mandatory when that components of the HVS and GLVS are separated by a moisture barrier, which complies with a degree of resistance to temperature above 150 ° C.
In the case that certain components belonging to the HVS and GLVS are installed on the same motherboard, they will be placed in clearly differentiated and marked for this purpose on the plate. The separation between both shall be at least 6.4 mm on the surface, 3.2 mm through the air and 2 mm if under cover (these distances may not be respected in the case of opto-couplers whose rated voltage is equal to or greater than the voltage of the HVS).

Positioning the HVS system

All components of the HVS system must be contained within a reinforced structure that guarantees its integrity in case of accident.
The frame of the motorcycle may be considered as a protective structure of the HVS system, assuming that its design and construction protects to the all system in case of an accident

Grounding

All metal parts of the vehicle that may transmit electricity for being less than 100 mm far from the HVS or GLVS must be connected to the mass (ground) of the motorcycle.

Isolation between HVS and GLVS

The HVS and the GLVS system must be galvanically isolated. In the case of use of a DC / DC converter, it must comply with that specification.

Insulated and Wiring

All components of the HVS system must be properly insulated and protected against direct contact.
The protection of the HVS system mut be ensured in such a way that impossible to reach the HVS connections with a cylindrical probe of 100 mm in length and 6 mm in diameter.

- HVS connections must be encapsulated by insulated components.
- Cables or conductors belonging to the HVS system must be no fire grade UL-94 V0, FAR25 or equivalent.

A3- BATTERIES

Permissible accumulation systems

Any type of energy storage system shall be permitted as battery, except for batteries of molten salt (thermal batteries) and batteries made out of fuel. Super-capacitors are allowed.

The supplied voltage of the batteries will be of a maximum of 120 V DC with fully charged accumulator. The connection scheme used must be presented to the BMSC organization (cells in series and in parallel).

Battery container

All battery cells and/or super-capacitors that are part of the accumulator, must be installed inside a battery container. The use of several battery containers is permitted. Each of them must comply with the requirements required for the case of single battery container.

If the battery container is not readily accessible, the BSMC organization may, at any time, require photographs of the layout and assembly of this. It will be mandatory to provide a detailed description of the battery container before assembling.

It will be also mandatory the delivery of photographs of the different phases of the assembly, showing all the components used.

Electrical configuration for accumulator

If the container is made of electrically conductive material, the terminals of the cells or super-capacitors, must be correctly protected and insulated with an electrically insulating material.

If the container is made of electrically conductive material (metals, carbon fiber, etc.), the body of the cells can not be directly in contact with the inner wall of the crankcase.

It must ave used an isolated material between them. Prismatic cells with rigid isolated are excluded from this requirement.

- Each container shall include at least one fuse, which rated current is below the cut-off power of the contactor.
- Each container shall include at least one type line contactor normally open, one installed in the positive terminal of the accumulator.
- The closing of the line contactor, and therefore the presence of High Voltage (HV) at the outlet of the accumulator, must be marked through a red light signal located on the dashboard
- *Direct connection by means of welding between cell terminals is not permitted.* Indirect welding is permitted through a material conductor (plates, plates, cables, fusible wire).
- Welding Battery Management System (BMS) drivers to the terminals it is allowed

Mechanical configuration of the accumulator

Battery containers shall be constructed from a material mechanically resistant and properly anchored to the frame. The battery container may be part of the frame of the motorcycle, provided which complies with the appropriate stiffness and strength conditions.

Battery containers that are not part of the frame should be protected against lateral impacts by the frame of the motorcycle itself.

- Cells shall be properly protected to any relative displacement (horizontal and vertical) inside the container.
- Only communication holes between the inside and the outside of the container for the passage of the conductor cables correctly isolated and for cooling and ventilation.
- The ventilation openings may not occupy a complete side of the container.
- The ventilation openings must include some type of filter element, to prevent the possible entry of dust, particles and liquids into the container.
- If a container is completely sealed in shall include an exhaust valve to prevent the concentration of gases reach a critical pressure.
- It is allowed the use or adaptation of commercial containers or crankcase, provided that they comply with the characteristics imposed in the present rules

Battery Management System (BMS)

It is mandatory to install a battery management system (BMS).The BMS should read the voltage of each cell to keep the cells inside of the voltage limits indicated by the manufacturer.

The BMS system should read the temperature of the cells at their most warm through a compatible temperature sensor. It will be mandatory read the temperature of at least 4 cells installed, with at least two at the areas which are expected to be higher temperatures.

In the case of the use of a passive balancing or cells equaling (optional), resistors shall be capable of dissipating the energy corresponding to the rolling, in such a way that during the rolling process never exceed the temperature indicated by the manufacturer of the resistance (or BMS) and does not affect battery cells or near printed circuits.

In order to improve the roll speed, it is allowed the activation of the cooling of the battery container during the swinging or rolling.

The BMS system must deactivate the traction of the vehicle in case of the voltage of one of the cells is discharged to the critical minimum voltage or exceed the maximum critical temperature of the cell, according to the indicated by the manufacturer. This mandatory deactivation must be punctual with the opening of the battery accumulator contactor.

It is allowed to decrease the electrical power delivered to the engine until it is equal to zero at the cell's critical voltage point or the maximum temperature of the cell.

The BMS system must also deactivate the recharging system when exceed the maximum levels of voltage or cell temperature.

A4- ENGINE

engine controller

It is understood by engine controller, or engine drive, as the device hardware that controls the speed and torque of an electric engine. The controller is part of the HVS and can integrate a part of the GLVS.

- The use of any type of commercial controller is allowed.
- The controller's own development is allowed, or the adaptation of any commercial device.
- The hardware components shall be compatible with the voltage values and work intensity.
- The controller must comply with all requirements that may affect him on those rules

Control software
The engine control software is freely configurable and can be used both commercial software tools and own development.

- The management map of the propulsion system is freely configurable.
- The implementation of different management maps is allowed.

A5- OPERATIONS

Preload circuit
It is mandatory to install a pre-charge circuit before closing the contactor of the accumulator. The minimum level of pre-load must reach 90% of the actual voltage of the accumulator, and / or 10 V of maximum voltage difference between terminals.
When the disconnection circuit is open also must open the preload circuit.

HVS Activation Notice
A red light will be installed, which will stay on when the HVS is activated, ie when the accumulator contactor is closed.

HVS Disconnect Circuit
The disconnect circuit manages the closing and opening of the line contactor.
The disconnection circuit shall consist of at least:
- A General Traction System Switch (Tractive System Master Switch - TSMS).
- An Emergency Switch.
- An Isolated monitoring device (IMD).
- The disconnection system managed by the BMS.

The disconnection circuit shall comply with one of the following:

- Disconnection circuit with contactor directly controlled by the disconnection circuit:
- Disconnection circuit with contactor directly controlled by the controller:

In the event that the coil of the contactors of the battery accumulator is controlled directly by the engine controller (or by another device), then the disconnection circuit shall ensure the shutdown of the controller (or the corresponding device) and therefore the shutdown of the contactor coil, ensuring its opening

Once the disconnection circuit (open contactor) is opened by the actuation of any of the devices provided (TSMS, Emergency Switch, BMS or IMD) the system will be in the "not ready to drive" state, and will necessary that the pilot reactivate it manually and voluntarily (eg restarting the controller), before the shutdown circuit closes again

Disconnection from the GLVS system
To ensure independent power on and off of the GLVS system, a Low Voltage System General Switch must be installed (GLVMS).

Deactivating the DC / DC converter
In the case of using a DC / DC converter as an LV power source, complete disconnection of the inverter must be guaranteed in order to avoid self-consumption.

HV Fuses
The circuit on the HV side shall be protected by at least one fuse, the conditions indicated above
The rated current of the fuse will be below the calculated short circuit, and by the above the maximum service current.
If multiple cell banks are placed in parallel, each of these must be protected with its separate fuse.
The fuse or fuses must be installed inside the container or crankcase of batteries.

GLVS Fuses
All circuits on the GLV side must have a protect the driver and the device to which it feeds, preventing them from being the maximum permissible

Chargers
All types of chargers with a nominal power of less than or equal to nominal 22 kW (maximum 32 nominal amps in configuration three-phase network side).
Serial or parallel configurations of different shippers provided that the total sum of the unit powers of the loaders does not exceed the power indicated above
The loader must have its corresponding ground conductor properly connected to the charger housing.

Network connection
The mains connection may be single-phase (230 VAC, 50 Hz) or (400 VAC, 50 Hz).
The connection of the ground conductor to the socket is mandatory.

Connection to the bike
The connection between the charger and the motorcycle must comply with security minimum conditions.

- The load connector on the motorcycle must have a manual or automatic closing.
- The conductors of the recharging connector present on the motorcycle shall be inaccessible when the connector is closed.
- The load connector on the motorcycle must meet a degree of IP- 65 when closed.
- The load connector shall be located in a protected area of the motorcycle before possible drops, contacts or projections.

Recharge operation
The process of recharging the accumulators must be carried out safely.
During the recharging operation of the motorcycle during all event, mandatory presence of at least one member of the team at all times that knows the detail of the recharge maneuver.
The member of the team responsible for the reloading operation must be prepared to face any type of performance during recharging (manual disconnection, deactivation, etc.) to isolate the vehicle from the network before any eventuality.
A fire extinguisher suitable for extinguishing electric fire (agent CO2 extinguisher or similar) shall be provided within two meters of the during the recharge maneuver.
The BMS system shall have a device for controlling recharge process.

Isolated Monitoring Device (IMD)
The Organization will provide a isolated (IMD) BENDER to ensure correct electrical isolated between the HVS and the prototype frame during BSMC event
The correct functioning of the Isolated Monitoring Device shall be during Technical Verifications,

A6- WIRING

General Isolation
All cables and connectors shall be covered with material insulation, except for direct ground connections.
Areas, elements and systems with a high electrical risk should be correctly protected against possible contacts and manipulations. We recommend the installation of rigid insulated casings for greater protection.

Dimensioning
All wires and connectors must be dimensioned correctly based on the requested current levels**.**

Moisture protection
Ensure that the components of the propulsion system are properly highly protected against moisture. An IP65 degree of protection.

Wiring
The length of the cables should be the correct one, so it is forbidden to length of excess cable.
The passage of the electrical installation should be avoided, as far as possible, for possible hot spots.
The electrical installation must be perfectly integrated into the motorcycle, leaving no distances greater than 15 cm of wiring without holding.
Consideration should be given and possible interference avoided. present the electrical installation with any mechanical system of the motorcycle, throughout the entire range of geometries (during the entire range of direction, suspensions, etc.

ADITIONAL INFORMATION

Appendix B SMALL SCHEME FOR TIPICAL ELECTRIC LIGTH MOTOBIKE