2.1 NECESSARY REQUIREMENTS (pages from 12 to 15)

RT0001	Both karts are built with termic engine, lately converted at hybrid system.
RT0002	Models must work in full hybrid, as they can work completely in 100% electric if required
RT0003	Applied current intensity must be not dangerous for users (lower than 50 V.)
RT0004	Both karts must be carried out with a 10.000€ budget or lower.
RT0005	Karts must be easily moved and transported.
RT0006	Both karts chassis must have same dimensions
RT0007	Both karts must have same weight before hybrid system is installed.
RT0008	Mechanical and electrical faults must be easily simulated to exercise whit students.
RT0009	Both models must be restored to the original condition and all material reused for different students, groups or classes
RT0010	Both hybrid models must be clearly shown and understood by anyone interested in them. (f.e – Electric schemes linked to each kart)
RT0011	Models must be build complaining whit safety rules and standard specifications.
RT0012	Models must comply with aerodynamics and ground effect, in order to guarantee safety standards after hybrid system installation.
RT0013	After hybrid system installation both karts must have same weight (max difference allowed 5%).
RT0014	Two testing trials must be executed, an intermediate and a final one to be carried out by companies operating on e-mobility, to correct faults and give motivational impulse to vocational students.
Thermic engine requirements	
RT0015	4 strokes engines must be used because their emmisions and consumption are lower, in spite of being more heavy and less powerfull.
RT0016	Cooling system must utilize air (lower dimensions, more space for other supplies).
RT0017	The engines should have electric start
RT0018	Every kart must have a battery recharging system
Electrical engine requirements	
RT0019	Power of electrical engines must be the same for both models
RT0020	Power transmitted to wheels must be the same for both models

MODEL 1S (series) – Specific requirements	
RT0021	Model 1S must have a series hybrid system.
RT0022	Model 1S must have a power of 6 HP or more (max power at 3500 gpm)
RT0023	Model 1S must utilize an electrical engine with a power of 9 Kw.
RT0024	Model 1S must be tested before transformation in hybrid to check consumption.
RT0025	Model 1S must be tested before transformation in hybrid to check emissions.
MODEL 2P (parallel) - Specific requirements	
RT0050	Model 2P must have a paralel hybrid system.
RT0051	Model 2P must have a power of 12 HP or more(max power at 3500 gpm)
RT0052	Model 2P must utilize an electrical engine with a power of 9 Kw.
RT0053	Model 2P must be tested before transformation in hybrid to check consumption.
RT0054	Model 2P must be tested before transformation in hybrid to check emissions.
Didactical requirements	
RD0001	Hybrid transformation have to be realized totally by students
RD0002	An electric technology booklet must be produced, covering safety requirements and real materials and technology applied on cars.
RD0003	Carrying out the activity some informations resarch and working out phases must be sheduled to point out technologies and building methods applied.
RD0004	During the model setting, some specific moments to apply brainstorming and problem solving methods have to be scheduled.
RD0005	In the projecting phase the components scaling (batteries pack, procelle parts, motor wheel…) must be scheduled
RD0006	During planning a technical design should be supplied showing electrical and mechanical devices.
RD0007	During checking and testing phase, relevant test of electrical measures must be scheduled
RD0008	During checking and testing phase, relevant trial test must be scheduled to guarantee all mechanical components corret working together whit the 100 electric running and on board recharging.
RD0009	During the trial test a research of defects and faults of electro-mechanical devices should be scheduled
RD0010	During checking and testing phase, maintenance activity should be

	scheduled.
RD0011	During checking and testing phase, emission control should be scheduled.
RD0012	During checking and testing phase, energy loss control should be scheduled.
RD0013	Supporting realization, a booklet on safety should be produced.
RD0014	Supporting realization, a booklet on electric technology should be produced.
RD0015	The technology booklet should include, physics and chemistry knowledge required to fully understand the technology.
RD0016	The technology booklet should include all mathematics needed to fully understand the technology.
RD0017	Booklet should be easily divided to be provided separately for different purposes.
RD0018	If necessary, booklets should be easily joined in a unique support
RD0019	Lessons on safety should last 8 hours
RD0020	Lessons on electric and hybrid technology should last 20 hours
RD0021	Knowledge about safety rules should be realized by a specific test.
RD0022	Knowledge about technology applied in electric and hybrid vehicles should be realized by a specific test.
RD0023	A practical test on trainee should be scheduled, to check their ability to work with this technology.

2.2 SECONDARY REQUIREMENTS pages from 16 to 17 (21 requirements)

This set of requirements cover this expectations:

- Graphic and design
- Cooperation between other subjects of study course
- Use of innovative instruments for materials (ebooks, blog and multimediality)
- Performance target (similar technical performance, better performance on consumption and emissions)

2.3 FUNCTIONAL REQUIREMENTS (pag. 18)

RF0001	Utilized Batteries should be Lithium-ion batteries
RF0002	Electric indunction engines should be used, because costs are lower, reliability is good and performance higher.
RF0003	Primary engine should be thermic
RF0004	Accumulation system should be used
RF0005	The kart should work 100% electric if required, and autonomy should be tested
RF0006	The kart should work 100% electric if required, and powerfulness should be tested
RF0007	Minimum power to work in hybrid should be defined

3. PERFORMANCE REQUIREMENTS (pag. 19 – 7 requirements)

This section states which area are to be tested.

- Speed
- Acceleration
- Consumption
- Emissions
- Engine power
- Electric absorption

4. QUALITY REQUIREMENTS (page 20 – 9 requirements)

This requirements cover three focus area:

- Duration and participation
  - batteries should last at least 1 years,
  - students involved should be minimum 15
- Testing and performance quality
  - Testing activity should consider more than one trial,
  - There should be a report of this activity
  - Benchmarks should be defined to evaluate performances
- Technical quality
  - Targets on autonomy and power after hybrid conversion should be defined.

5. OTHER REQUIREMENTS (pag. 21 – 6 requirements)

This section defines requirements about logo and graphic of models and manuals.
The primary target is to highlight the project and partners logo and to make more interesting the material.

6. PRE REQUISITES (pag. 22)

This section defines which requirements are needed to successful participate at this training activity.
Basic competences in technology of traditional engines (acquired for example during first year of vocational training course)
Electric background is not requested, requirements would be supplied during activity.