



# *Pflichtenheft*



*Learning model on e-mobility*

by Massimo Maragoni e Alessandro Scaldafeno





**Learning model on e-mobility**  
by Mauro Marzegan e Alessandro Scaldaferrò





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# LEARNING MODEL ON E-MOBILITY



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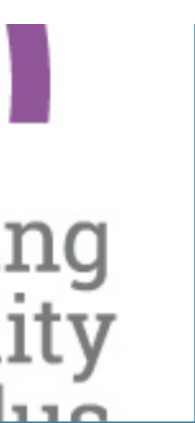
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# X



# SUMMARY OF MAIN CHARACTERISTICS



## 0.3 AIM AND APPLICATIONS

This handbook completes the Lastenheft in the same lesson plan and it absorbs the subjects. It highlights the real possibility of fulfillment and the order of priorities. For each specifications the reasons why they are included and how they are intended to realize in the final plan are analyzed in details.

The book is not a handbook for the fulfillment of the teaching act in a technical environment in the vocational education on the topic of the electrical mobility.

The book is a set of guidelines to create the best scenery in a learning environment. It's useful to the development of the subjects. For this reason this handbook is flexible to be used in various situations in the vocational education in accordance with the defined requisites.

### LIST OF CONTENTS OF THE EQUIPMENT

The handbook contains an equipment section in order to identify each Section/Chapter/Module to give the necessary for the achievement of different topics. The main photos are of small scale models and are not intended to be used for the development of the final work.

This section is built up with many tables for consultation. The items are indicated by the year and by the name of the material.

Section 2: Based on Chapter 2 of the book in this section there is the analysis of the materials which were indicated on the handbook. For each material the use is indicated and the required. The analysis of each material can be used as a guide for the teacher of a subject.

The materials specified are in the following handbook section in the equipment table:

- 1. Equipment
- 2. Equipment materials
- 3. Equipment items
- 4. Equipment figures
- 5. Equipment

Examples to be used in the activity each topic is important to have knowledge connected with the use of the equipment. The handbook contains many examples in the tables. To see them in detail they are also in the handbook in the section 2 of the book. It is possible to find the handbook in the equipment table.

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## 0.5 THE CONTENTS OF THE DOCUMENT

The document is divided into different sections in order to be easily used.

Section 1 (Chapter from 1): it has got the instructions for the achievements of different output. The main phases are indicated to be followed but they are flexible to meet specific demands of the didactic work.

This section is built up with easy tables for consultation. The times are indicated but they are useful to skip a waste of resource.

Section 2 (from chapter 2 to 5): in this section there is the analysis of the instructions which were indicated on the Lastenheft. The same plan is kept so the two sections can be compared.

The analysis of each requisite can accept many requests and give details of the method for the translation of a requisite.

For each activity specified on the following handbook, a master is built up in a table:

1. Competence
2. final manager
3. achievement managers
4. expected times
5. additional figures
6. final outcome

1. Knowledges to impart during the activity: each output is important to learn knowledge connected with electrical mobility. Cross or basic knowledge are not indicated on the table. Since they are essential they are also in the first section of the handbook where it's possible to find the instructions for each output.

2. Final Activities Manager: for each aspect a manager must be indicated. He should check the activities out.

3. Activities Manager: he should be clearly indicated and mentioned for the real achievement of the activities.

4. Expected times for the activities: they must be mentioned because the master is the output of many actions and their synchronization is necessary to be repeated in future. These times can vary in order to meet different demands, face possible problems, give any clarification the users can consider important to be cleared.

5. Possible additional figures: on this section possible consultants must be indicated because they are important for the achievement of the activities.

6. Final output: it indicates how the final output of the activities is presented.

On the document people and outputs are generically indicated but the person who is going to do some activities must explain people and times involved (the beginning and the end).



# SECTION ONE

## Technical instructions for the outputs realization



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### 1.1 INSTRUCTIONS FOR KART'S REALIZATION



Realization steps  
(estimated timetable)

- Skills to teach and develop:**
- Basic working skills on typical systems (cables and power) according through the complexity of the task.
  - Manage the resources (time, budget and all the expense) steps from a planned realization of activities.
  - Set up references and steps needed to every stage of activity according to quality objectives and expected results.
  - Check: Reliability of instruments, tools, part materials, performing routine maintenance activities.
  - Set up of working writing systems according to quality objectives (control sheets, reports, records, documents, etc.)
  - Set up of safety and environmental risks.
  - Register all the work of a task, activity and technical documents, and specific activities.
  - Conduct the testing activities through the fulfillment of the requirements.
  - Build skills in working with personal and possible development activity.
  - Report working results.
  - Monitor working quality.



Example 1

1.1 HYBRID KART WITH SERIES CONNECTIONS AND HYBRID KARTS WITH PARALLEL CONNECTIONS

1.2 EDUCATIONAL MATERIAL ABOUT SAFETY

1.3 EDUCATIONAL MATERIAL ABOUT ELECTRIC TECHNOLOGY

1.4 TESTING REPORT AND PERFORMANCE EVALUATION

1.5 ACTIVITY FLOW CHART



## *1.1 INSTRUCTIONS FOR KART'S REALIZATION*



### **Skills to reach and develop:**

- Basic working skills on hybrid systems (series and parallel) acquired through the comprehension of technical features.
- Translate the planning phases of the project and all the operative stages from a general description of activities.
- Set up instruments and tools needed in every stage of activity according to quality standard and expected results.
- Check functionality of instruments, tools and machines, performing common maintenance activities.
- Set up and managing working spaces according to quality and safety standard
- Work according to quality standard defined by the management
- Turn into real activities the customer/user needs
- Fit together all the parts of a kart reading and technical documents and specific instructions.
- Conduct the testing activities, check the functionality of the components.
- Basic skill on defining weak points and possible damage of the vehicle
- Team working skills
- Problem solving skills



*Realization steps  
(estimated timetable)*

CASES	DESCRIPTION	TIMES
1	Work Planning Instruments and tools setup Definition of check points	2 hours
2	Workspaces arrangement	
3	Making of the support for the kart	1 hour
4	Positioning of the karts following concepts of stability, moving and working easiness	1 hour
5	Remove the engine from the kart	3 hours
6	Remove all the unnecessary parts	3 hours
7	Installation of the <u>thermic</u> engine and components adaptation	3 hours
8	Installation of the electric engine and components adaptation	4 hours
9	Installation of battery pack	2 hours
10	Mechanical functioning test	2 hours
11	Electrical functioning test	2 hours
12	Required adjustments	1 hour
13	Testing	1 hour
14	Failure scouting	2 hours
15	Failure repair	2 hours
16	Substitution of defective components	1 hour

# *Example 1*

*<https://www.dropbox.com/s/yj8bla0x31rarzn/PRESENTAZIONE%20%28LINK%201%20al%20manuale%29.doc?dl=0>*

# SECTION TWO

## Requirements analysis and realization



<https://www.dropbox.com/s/118b9149e40a171117948e29943439e4/0219.docx?dl=0>

### Example 2

2

2. ANALYSIS OF REQUIREMENTS: REQUIREMENT SPECIFICATION

4

4. REQUIREMENTS ANALYSIS: QUALITY REQUIREMENTS

6

6. FEATURE DEVELOPMENT

- The realization of the learning model should be a starting point for the introduction of e-vehicles in corridors activities
- This module introduces a series of enhancements that could be realized in the operational training used to develop this learning area.
- For example:
  - If the site activities apply on different car models. This handbook could be used as a starting point for the activity.
  - If they are hybrid car to study its technology and alternative fuels.
  - If they are electric car (this should be the first point).
- Other improvements could be defined later.

3

3. REQUIREMENTS ANALYSIS: PERFORMANCE REQUIREMENTS

5

5. REQUIREMENTS ANALYSIS: OTHER REQUIREMENTS



7

7. FIND DEVELOPMENT

- The document could be a check list that should be used by the operational training school to measure the quality of the activities, respecting the requirements and the subjects.
- The results should...
- The main objectives have been listed.
- The main activities have been identified and their expected results have been defined for the end of the module.
- The results should only be the results before the end.



For the analysis of the single requisite the previous document (Lastenheft) is to be followed adding some columns to see how each requisite has been analyzed.

REQUISITE CODE/ STARTING REQUISITE/JUDGEMENT REQUISITE/PRIORITY/ANALYSIS OF THE REQUISITE  
AND ITS DEVELOPMENT/ MANAGER REQUISITE

**JUDGEMENT REQUISITE:** the requisite can be meant POSSIBLE or IMPOSSIBLE.

The most important elements to analyze the real achievement of the requisite come from:

- Final addressees of the lesson plan and general targets
- Economic resources and equipment
- Human resources and real knowledge

He is responsible for the final check, the respect of the instructions and the achievement of the requisite.

In case of impossible requisite the reasons why the requisites can't be accepted must be described.

**PRIORITY:** In case of a possible requisite, priority can be high, medium, low.

**HIGH:** It's essential for a positive outcome of the learning plan. Therefore it's important to pay attention not to void the outcome and the activities.

**MEDIUM:** it's a possible requisite to change in case of technical problems or excessive request of resources.

If a requisite is not respected, the reasons must be explained with details of the changes.

**LOW:** it's connected with a requisite to get, but it's not essential for the positive outcome for the learning plan. In case of problems the requisite can be cancelled or not respected.

For the reduced effect on the learning plan the details of the modifications are not requested.

#### **INTERPRETATION OF THE REQUISITE**

It describes the instructions to achieve the requisite in the learning plan highlighting the times and the stages.

#### **ACHIEVEMENT MANAGER**

He is responsible for the final check, the respect of the instructions and the achievement of the requisite.

*analysis and realization*

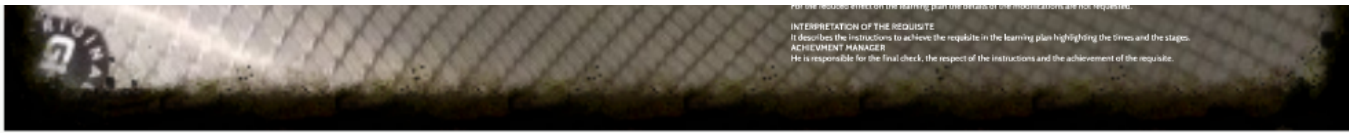
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**Example 2**



For the second time on the learning plan the details of the requirements are repeated.  
INTERPRETATION OF THE REQUISITE  
It describes the instructions to achieve the requisite in the learning plan highlighting the times and the stages.  
ACHIEVEMENT MANAGER  
He is responsible for the final check, the respect of the instructions and the achievement of the requisite.

## 2

### ***2. ANALYSIS OF REQUIREMENTS: TECHNICAL AND FUNCTIONAL***

#### ***2.1 NECESSARY REQUIREMENTS***

#### ***2.2 SECONDARY REQUIREMENTS***

#### ***2.3 FUNCTIONAL REQUIREMENTS***

<https://www.dmpbox.com/>  
**Example 03**  
[www.made.com/brand/1/](https://www.made.com/brand/1/)

3

*3. REQUIREMENTS ANALYSIS: PERFORMANCE REQUIREMENTS*

5

# 4

## *4. REQUIREMENTS ANALYSIS: QUALITY REQUIREMENTS*

# 5

## *5. REQUIREMENTS ANALYSIS: OTHER REQUIREMENTS*



# 6

## **6. FUTURE DEVELOPMENTS**

- *The realization of the learning model should be a starting point for the introduction of e-mobility in curricular activities.*
- *This section introduces a series of improvements that could be realized by the vocational training school to develop this learning area.*
- *For example:*
  - *1) Do this action again on different car models. This handbook could be used as a starting point for the activity*
  - *2) Buy an hybrid car to study its technology and simulate failures.*
  - *3) Buy an electric car (this should be the final point).*
- *Other improvement could be defined later*



# 7

## 7. CHECK INSTRUMENTS

- *The document ends with a check list that should be used by the vocational training school to summarize the quality of the activities, comparing the expectations and the outputs.*
- *The control is about:*
  - \* *How many expected requirements have been found*
  - \* *How many cooperation activities between different organizations have been realized during each process*
  - \* *The main problems faced during each process*
- *The results should improve the model, before or later.*

*Example 4*



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