

HYBRIDS - Safety



<http://projektstepahead.sk/>

Ahead Step

Erasmus+

STEP AHEAD: The support of Professional development of VET teachers and trainers in following of New trends in Automotive Industry

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Tento projekt je spolufinancovaný Európskou úniou v rámci programu ERASMUS+.

The aim of the activity: Introduction of the topic of “safety”, linking to the knowledge gained on the previous lessons and on the information related to safety in the work with classic vehicles, comparison with the hybrids.

STEP 1.

Brief description of the activity: Video, watching and discussion, brainstorming on the topic of safety in working with classic vehicles. Students watch the video and describe what they saw. During the brainstorming1 teacher writes down terminology related to classic vehicle work safety – topic students are already familiar with. Introduction of the topic of safety related to hybrid vehicles.

Instruction: Watch the video. What is it about?

What comes to your mind when you hear about safety related to working with classic vehicles? Which basic safety rules do you remember? Together we will write them down on a blackboard/flipchart..

STEP 2.

Brief description of the activity: Brainstorming again – safety rules related to hybrid vehicles topic. Writing the key words on a blackboard.

Instruction: What do you think, which safety rules should be observed while working with and maintaining hybrid vehicles? What do you think would be the main differences when you compare it with classic vehicles in terms of safety?

Tools for the activity: Video - Annex 1 /projection on the wall/projector/notebook, internet, blackboard/flipchart

Estimated time: 10 min.

Sources:

<https://www.youtube.com/watch?v=WnSacRjQxWw>

<https://www.youtube.com/watch?v=m2qvGJwTuBo>

<https://www.youtube.com/watch?v=UxuqHcUbSQ0>

<https://www.youtube.com/watch?v=o9WWVMDih9s>

<https://www.youtube.com/watch?v=4YWu-sA3UyU>

EVOCATION

The aim of the activity: Deepening and consolidating the knowledge related to safety issues related to hybrid vehicles, work with the text.

STEP 1.

Brief description of the activity: Students work in 3 groups, using the text from the Annex 2. Group A) Introduction, Danger B) component location, high voltage locations, highly magnetic locations C) before maintenance, during maintenance, interrupted maintenance

In the text they underline the key terminology.

Instruction: Each group will receive a text. Your task will be to read it carefully and underline the information that you consider to be the key one. If needed, make notes on a paper/exercise book. You will use this information in the next activity.

APPRECIATION

STEP 2.

Brief description of the activity: Practical application of the gained theoretical knowledge. Design of posters including basic safety rules and recommendations. Presentation of the outputs. Group work, 3 different posters as an outcome.

Instruction: Continue working in 3 groups. Each group will work with different text from the Annex 2, using flip paper and markers. Your task is to propose/design the poster listing basic key safety rules and recommendations. Imagine that your poster will hang on a wall in concrete workplace. Use your creativity but do not forget to list the key issues.

Tools for the activity: Text in Annex 2 for each student, flip papers, markers, exercise books, pens

Estimated time: 20 min.

Source: ©IMI eLearning

REFLECTION

The aim of the activity: Summary of the knowledge, practical application.

STEP 1.

Brief description of the activity: Presentation of the posters. Each group will work on a different content. Teacher supervises the activity, ensuring all the key information is mentioned.

Instruction: After finishing your work, each group presents their own proposal. Describe what you considered while working on it, and what kind of a work place would you recommend to place the poster at (eg. workshop, service...). What do you think, which key information – rules should not be missing on this kind of poster? Write them all down in your exercise books.

STEP 2.

Brief description of the activity: Homework assigned – work with the portal/interactive screens

Instruction: As a homework, work on the learning screens on the portal <http://projektstepahead.sk/>. These are related to the topic of safety.

Tools for the activity: Flip papers, notebook/internet access, portal logins

Estimated time: 10 minutes + homework time/work with the portal

Annex 1

For an introduction of the topic of safety, you can use some of these videos.

- <https://www.youtube.com/watch?v=WnSacRjQxWw>
- <https://www.youtube.com/watch?v=m2qvGJwTuBo>
- <https://www.youtube.com/watch?v=UxuqHcUbsSQ0>
- <https://www.youtube.com/watch?v=o9WWVMDih9s>
- <https://www.youtube.com/watch?v=4YWu-sA3UyU>

Annex 2

A)

Introduction

Integrated motor assist (IMA) hybrid vehicles use high voltage batteries so that energy can be delivered to a drive motor or returned to a battery pack in a very short time. The Honda Insight system, for example, uses a 144V battery module to store re-generated energy. This energy is then be used to drive the IMA motor. This decreases the load on the fuel engine, resulting in reduced emissions and increased efficiency. The Toyota Prius originally used a 274V battery pack but this was changed in 2004 to a 202V pack, which reduced weight by 26%.

Clearly, there are safety issues when working with hybrid vehicles.



Figure 1 / The world land speed record for a Prius hybrid is 130.794 mph!

Danger

Hybrid vehicle batteries and motors have high electrical and magnetic potential that can severely injure or kill if not handled correctly. It is essential that you take note of all the warnings and recommended safety measures outlined by manufacturers and in this resource. Any person with a heart pacemaker or any other electronic medical devices should not work on an integrated motor assist (IMA) system since the magnetic effects could be dangerous.

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B)

Component location

Most of the hybrid components are combined in the power unit (or integrated power unit, IPU). This is located behind the rear seats or under the luggage compartment floor. The unit is a metal box that is completely closed with bolts. A battery module switch is usually located under a small secure cover on the power unit. The electric motor is located between the engine and the transmission or as part of the transmission.

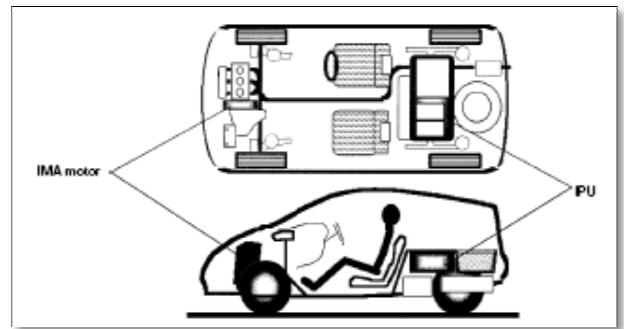


Figure 2 / IMA motor and power unit (PU) locations

High voltage locations

All high voltage components (except the motor) are located in the power unit. The electrical energy is conducted to or from the motor via three thick orange wires. Whenever these wires have to be disconnected, SWITCH OFF the battery module switch. This will prevent the risk of electric shock or short circuit of the high voltage system. High voltage wires are always orange.

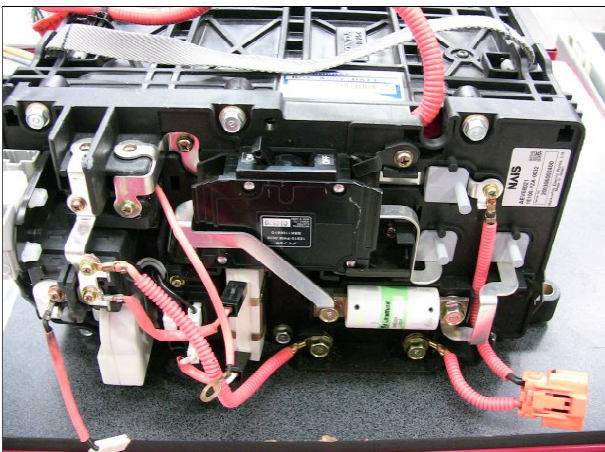


Figure 3 / Honda battery pack (integrated power unit)

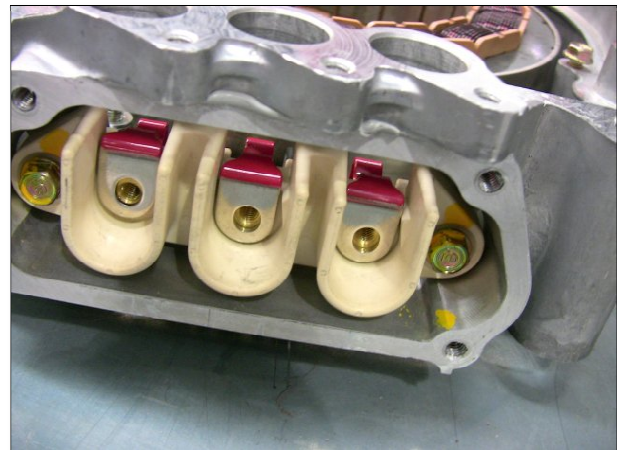


Figure 4 / Motor power connections

Highly magnetic locations



Any person with a heart pacemaker or any other electronic medical devices should not work on the IMA system. The magnetic fields present can affect these devices and is therefore a very significant danger. The use of any magnetic storage media near the IMA system should be avoided. In the presence of the system's strong magnetic field, data could be partially or totally erased. A mechanical or electronic wristwatch would also be damaged.

Figure 5 / The core or rotor is made of very strong rare earth metal permanent magnets

c)

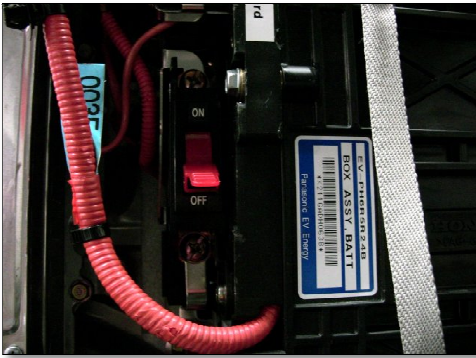


Figure 6 / High voltage battery power switch

Before maintenance

- ❖ Turn OFF the ignition switch and remove the key.
- ❖ Switch OFF the Battery Module switch.
- ❖ Wait for 5 minutes before performing any maintenance procedures on the system. This allows the large storage capacitors to be discharged.
- ❖ Make sure that the junction board terminal voltage is nearly 0V.



Figure 7 / Insulated gloves. Note these are not the same as general working gloves

During maintenance

- ❖ Always wear insulating gloves.
- ❖ Always use insulated tools when performing service procedures to the high voltage system. This precaution will prevent accidental short-circuits.

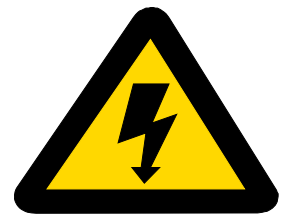


Figure 8 / Electrical warning

Interrupted maintenance

When maintenance procedures have to be interrupted while some high voltage components are uncovered or disassembled, make sure that:

- ❖ The ignition is turned off and the key is removed.
- ❖ The Battery Module switch is switched off.

No untrained persons have access to that area and prevent any unintended touching of the components.

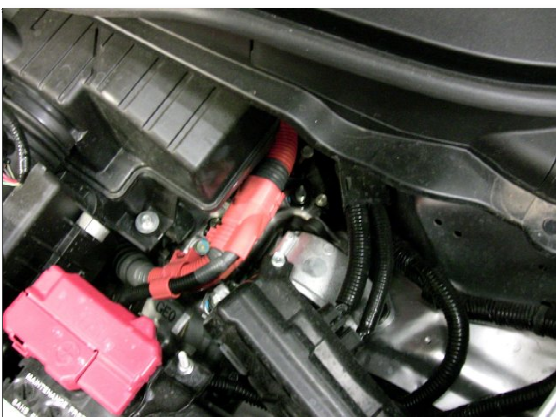


Figure 9 / High voltage cables are always orange

After maintenance

Before switching on the battery module switch make sure that:

- ❖ All terminals have been tightened to the specified torque.
- ❖ No high voltage wires or terminals have been damaged or shorted to the body.
- ❖ The insulation resistance between each high voltage terminal of the part you disassembled and the vehicle's body has been checked.

Summary

Working on hybrid vehicles is not dangerous IF the previous guidelines and manufacturers procedures are followed. Before starting work, check the latest information – DON'T take chances.

