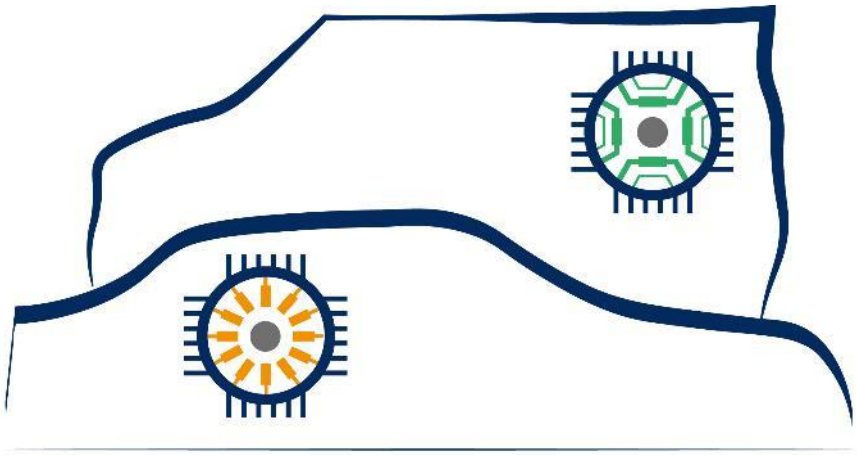
Rare Earth Free e-Drives Featuring Low Cost Manufacturing



ReFreeDrive

Collaborative Project
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Title of the deliverable: Power Electronics for the 200kW power setting

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Lead contractor for this deliverable:	**IFPEN**
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Abbreviations

PE: Power Electronics
IFPEN: IFP Energies Nouvelles
UAQ: University of L'Aquila
SiC: Silicon Carbide
DC: Direct Current
WP: Work Package
KPI: Key Performance Indicator
IFPEN: IFP Energies nouvelles

1 Executive Summary

The present deliverable 6.10 provides an overview on the activities concerning the manufacturing of the 200 kW High Power Range Power Electronics (PE) for the ReFreeDrive Project based on the design accomplished within the Work Package 5 (WP5), task 5.2.

One of objectives of WP6, task 6.3, is to manufacture a high power range inverter (200kW) attempting to build synergies and common strategies whenever possible between high (200kW) and medium (75kW) power inverter fulfilling the requirements defined within the WP2 for the 200kW motor applications.

The Key Performance Indicators (KPIs) at component level in Table 1 are:

Table 1: PE KPI for 200kW application

PE KPI	200 kW baseline	Tesla S60 (200kW baseline)	RFD GOALS	RFD 200 kW (Design)
Specific Power (kW/kg)	10 - 12	13,3	13,7	18-20
Power Density (kW/ liter)	10 - 12	11,7	12,9	20-22
Efficiency (%)	95 - 97	TBD	98-99	98,5
Power electronics Cost ($/kW)	5 - 7	TBD	3,8	TBD

The previous design phase related to the deliverable 5.2 within WP5 was delivered without impact on the project progress. The current 6.10 deliverable focuses on the 200kW Power electronics manufacturing tasks. Inverter design and manufacturing for the high power range inverter have been led by IFP Energies Nouvelles (IFPEN) with the support of Mavel in what mechanical design is concerned. As well, component and supplier choice information were regularly discussed with the University of L'Aquila (UAQ) and R13 (75kW inverter design and manufacturing) in order to increase the synergy between high and medium power range power electronics.

This document presents the steps of the high power range power electronics manufacturing and laboratory testing (risk management).

The High Power range Silicon Carbide (SiC) based inverter will be validated and used within the next WP7 along with the motor testing.

The main goals of deliverable D6.10 consist in:

- PCBs manufacturing
- Key components manufacturing
- Assembling the power electronics and control unit boards
- Mechanical assembly related to the boards
- Preliminary tests

The D6.10 deliverable fulfilled these objectives. The deviation in time is explained by the underestimated time to manufacture some mechanical key components such as 800V laminated busbars which had to be produced by an experienced supplier as well as the mechanical housing. The manufacturing of these components could not have been anticipated as the power electronics were under design step.

However, there is no impact of the D6.10 on the following tasks (WP7, task 7.1) and deliverables as the high power range PE (Figure 1) is:

- Manufactured and ready for testing in standalone and integrated housing
- Tested on a motor by anticipation of WP7 tasks

before ReFreeDrive motor availability for testing.

Figure 1: High Power Range 800V Power Electronics prototype (435kVA)

The impact of the deliverable D6.10:

- Design procedure of the driver boards dedicated to SiC power modules
- SiC Power module operating characteristics and use know-how
- 800V laminated Direct Current (DC) bus bar design and manufacturing know-how