



ExSAM

External Starter Alternator Motor

Project Goal

- Although Hybrid Electric Vehicles have proven to significantly reduce the fuel consumption, the technology still suffers from high investment cost. For commercial heavy vehicles, the high capital expenditure can be a stopper from investing in hybrid vehicles
- The project goal is to present an alternative electric machine design according to the requirements related to heavy hybrid application but to a reduced cost compared to the first generation Volvo Hybrid commercial vehicles

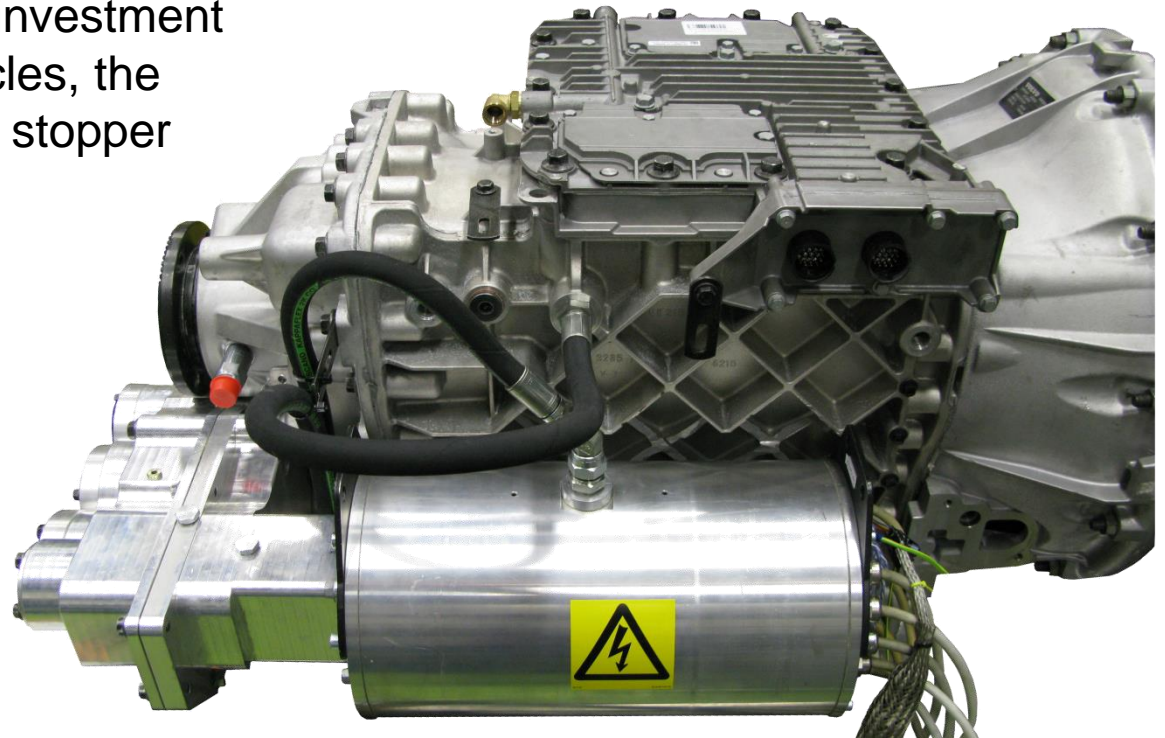


Figure 1 The prototype machine mounted on the side of a Volvo AMT gearbox for heavy vehicle applications

Project Scope

- Connect the Electric Machine via a mechanical gear in order to reduce the torque and thereby size and cost of the machine. This also increase the flexibility for the EM design in a strictly limited geometrical space
- Design and build a conventional IPM radial flux machine to be used as reference within the project
- Design and build an alternative machine design utilizing laminated winding technique that allows for enhanced cooling during longer periods of overloading

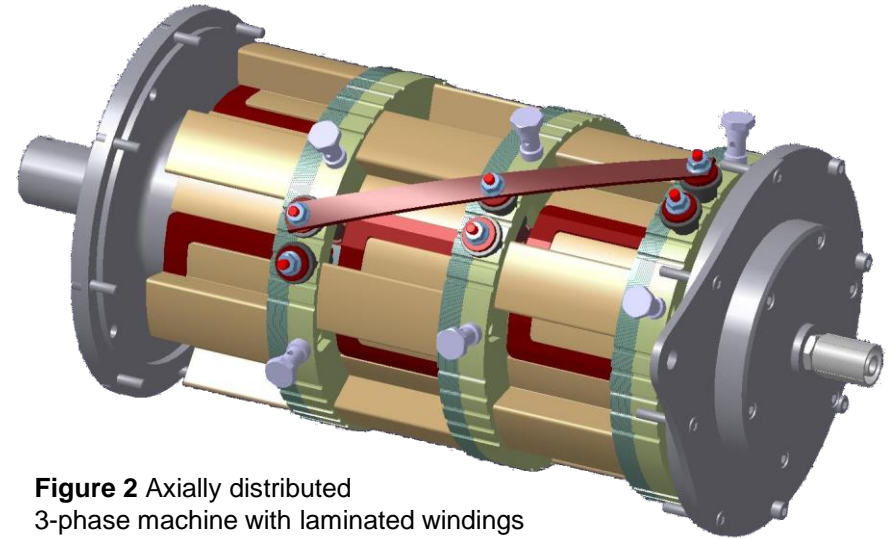


Figure 2 Axially distributed 3-phase machine with laminated windings for enhanced cooling during overload conditions

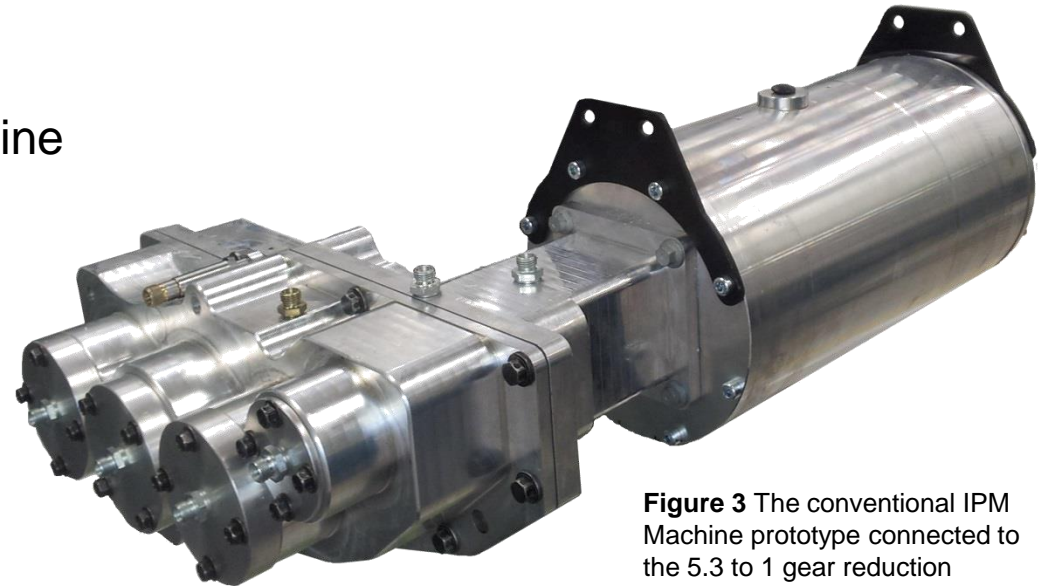


Figure 3 The conventional IPM Machine prototype connected to the 5.3 to 1 gear reduction

Partners, Resources & Timeframe

- **Partners**

- AB Volvo
- Sibbhultsverken AB
- MagComp AB

- **Resources**

- Lab resources at AB Volvo and Lund University
- Test facility at Sibbhultsverken AB
- Prototype preparations at Sibbhultsverken AB and MagComp AB

- **Timeframe:**

- Start: 2010
- Finish: 2014



Figure 4 The prototype installed at the test facility at Sibbhultsverken AB

Contact Information ...

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- **Secretary**

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More material:

- **Papers:**

- Andersson, R., Reinap, A., Alaküla, M. (2012), “Design and Evaluation of Electrical Machine for Parallel Hybrid Drive for Heavy Vehicles”. *20th International Conference on Electrical Machines (ICEM2012)*, Marseille, France, Sept. 2-5, 2012, pp. 2622-2628
- Andersson, R., Högmark, C., Reinap, A., Alaküla, M. (2012), “Modular Three-phase Machines with Laminated Winding for Hybrid Vehicle Applications”. *International Electric Drives Production Conference and Exhibition (EDPC2012)*, Nuremberg, Germany, Oct. 16-17, 2012.
- Reinap, A., Marquez-Fernandez, F.J., Andersson, R., Högmark, C., Alaküla, M., Göransson, A. (2014), “Heat transfer analysis of a traction machine with directly cooled laminated windings”. *4th International Electric Drives Production Conference and Exhibition (EDPC2014)*, Nuremberg, Germany, 30 Sept. - 1 Oct., 2014.

- **Reports**

- [ExSAM drive for a Commercial Vehicle Hybrid Transmission](#)
 - *FFI Project number: P32750-1*

- **Thesis:**

- [Electric Traction Machine Design for Heavy Hybrid Vehicles](#)
 - *Licentiate thesis, Rasmus Andersson, TEIE-1074, 2014*