



Heavy Duty Gas Engines integrated into Vehicles

EUROPEAN COMMISSION

Horizon 2020

H2020-MG-2014

GA No. 653391



Deliverable No.	HDGAS D2.1	
Deliverable Title	System Layout	
Dissemination level	Confidential (CO)	
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Status	Draft 1.0 / Draft 2.0 / Final	2016-02-02

H2020-GV-2014 – 653391 – Heavy Duty Gas Engines integrated into Vehicles

Acknowledgement:

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

Project partners:

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- 2 - BWR - Borgwarner Ludwigsburg GmbH - DE
- 3 - BOSCH - Robert Bosch GmbH - DE
- 4 - DAI - Daimler AG - DE
- 5 - DINEX - Dinex Ecocat OY - DK
- 6 - FPT - FPT Industrial S.p.A. - IT
- 7 - IDIADA - Idiada Automotive Technology S.A.- ES
- 8 - IVECO - Iveco Espana SL - ES
- 9 - MAN - MAN Truck & Bus AG - DE
- 10 - POLIMI - Politecnico di Milano - IT
- 11 - RCD - Ricardo UK Limited - UK
- 12 - SAG - SAG Motion GmbH - AT
- 13 - TNO - Nederlands organisatie voor toegepast natuurwetenschappelijk onderzoek - NL
- 14 - TUG - Technische Universiteit Graz - AT
- 15 - UEF - ITA-Suomen Ylipisto (University of Eastern Finland) - FI
- 16 - UASE - Hochschule Esslingen - DE
- 17 - UNR - Uniresearch BV - NL
- 18 - VOLVO - Volvo Technology AB - SE
- 19 - VIF - Virtual Vehicle Research Center - AT

Disclaimer:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 653391.



Definition of the system layout of a LNG tank system

Introduction

The development of long haul heavy duty vehicles powered by liquefied natural gas (LNG) is technically very sophisticated. One major challenge remains in the storage of the LNG in the vehicle. For the liquefaction of natural gas it has to be cooled down to a temperature range of approximately -110°C to -162°C at pressures between 1 bar and 10 bar. The storage system within the vehicle must therefore be able to withstand cryogenic fluids and to make sure that the temperature and pressure level within the vessel increases as less as possible. Therefore the LNG tanks consist of double-walled vacuum isolated stainless steel for the purpose of minimizing the heat input into the tank. Furthermore the refueling process needs to be standardized with the aim to develop components and processes, which ensure a safe refueling and make a misuse impossible.

Requirements to the “System Layout”

For the HDGas-project three different tank systems will be developed. A low pressure system, a medium pressure system and a high pressure system contingent on different engine concepts required gas supply pressure. All systems have different characteristics and therefore exhibit different components and a different dimensioning in some parts. Table 1-1 gives an overview of needed components based on the usage of different tank systems.

Table 1-1: Overview about the systems used by the OEMs

	OEM 1	OEM 2	OEM 3
Tank system	Medium pressure system	Low pressure system	High pressure system
Engine	Spark ignited engine (SI)	Dual fuel engine	High pressure gas injection engine (HPGI)
After treatment system	Similar to current NG system (three-way catalyst)	Similar to current diesel plus methane oxidation catalyst	Similar to current diesel plus methane oxidation catalyst

The main task of the “System layout” is to define on the one hand all relevant system boundaries of the LNG tank system, like for example the determination of the interfaces between the tank and the vehicle as well as the positioning and dimensioning of components and sensors. On the other hand the specification of technical and environmental requirements, which have a direct influence on the functionality and the lifetime of the LNG tank, has a priority.

Main outcome of first studies

Results regarding the packaging of a LNG powered heavy duty long haul truck are illustrated in Figure 1-1. The analysis of the system layout showed that the most sophisticated component of the tank system is the LNG pump. Furthermore this pump is responsible for the biggest difference between the three different tank systems. The pressurization of the LNG is very important in order to provide the optimal fuel supply pressure for the combustion engine. The necessary pressure for the low pressure system amounts according the agreement with the HDGas-internal OEMs to approximately 12 bar (a), the pressure for the medium pressure system has been coordinated to 50 bar (a) and the optimal pressure of the high pressure system is approximately 300 bar. This points out that especially for the high pressure pump the technical requirements regarding the seals and the pressure built up are so high, that this component is most challenging while the development phase.

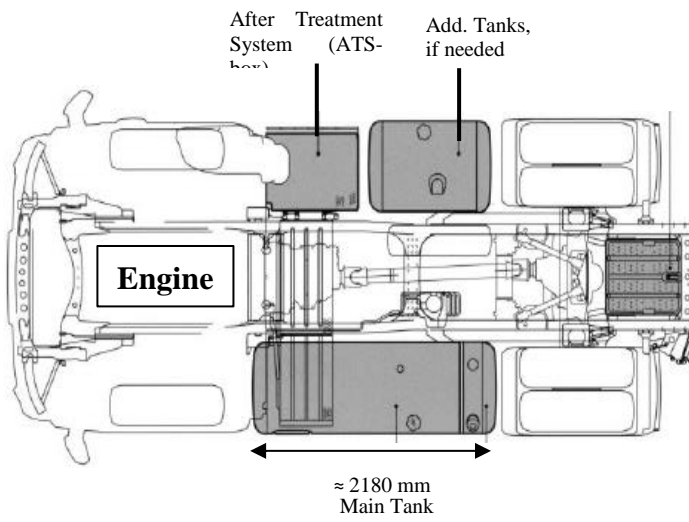


Figure 1-1: Exemplary depiction of the packaging of a long haul heavy duty truck

6. Acknowledgment



This project has received funding from the European Horizon 2020 Programme for research, technological development and demonstration under grant agreement no 653391

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