

Feasibility Analysis on Diesel Tank of Truck Vehicles

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Abstract— The fuel tank is an important component in any of the automobile vehicles. It is the place where the flammable liquid called diesel or petrol is stored to run a vehicle engine. Irrespective of the fuel tank designs, the volume of the fuel it carries is most important factor. Normally in the truck vehicles there are few designs to follow like cylindrical tank and rectangular tank, most commonly seen. Even there are some defects in the running tank design may be the corrosion of the tank. There are different material to compare with the existing fuel tank like Aluminum and High-Density Polyethylene (HDPE). Design of a fuel tank includes its material cost, manufacturing cost, transportation cost, and cost of mounting the tank and so on. Reliability, strength and performance also matters in the complete design of the fuel tank.

Keywords— Fuel tank, Cost, Materials, Plastic tank, HDPE, Manufacturing.

I. INTRODUCTION

The design of fuel tanks for truck vehicles is quite a complex task. There are many aspects of the tank to consider and there are numerous physical factors that need to be considered when designing an effective fuel tank. Fuel tanks in the heavy duty trucks were made with steel because of high strength and durability. Fuel tank is a safe container for flammable fluids like petrol, diesel or gas. The fuel system of automobile vehicles should perform within major safety parameters related to the importance of flammable substances such as diesel fuels which is extensively consumed worldwide. Important consideration in designing a diesel fuel tank are determining placement, choosing the shape and calculating the required volume. Side mounting is the most common placement of diesel tank for trucks. This is typically accomplished with the use of brackets, straps or a combination of both for the purpose of attaching the fuel tank to truck frame. There is other desirable and necessary design feature that should be incorporate into nearly every fuel tank. Integrating these features at the design stage, rather than adding them after the tank or the vessel has been built, presents a clear engineering and economic advantage. The choice of shape is generally influenced by the need for maximum fuel capacity and the desire for a stylish look. The most common diesel tank designs are cylindrical, rectangular and D-Style tanks. Cylindrical designs are often selected for their visual appeal while the rectangular tank is most often employed to maximize fuel volume for a given space.

II. LITERATURE SURVEY

Masilamani.R, P.Suresh, P.Tamilazhagan, N.Madhavan, S.Ponnuswamy: [1]: This paper deals with the analyzing the fuel tank of heavy vehicles with a plastic material i.e., High-Density Polyethylene (HDPE). A material comparison is also shown with their self weight of the tank. HDPE material is a low weight material, corrosion resistant, low manufacturing cost compared to steel tanks. The analysis is made to find out the von-mises stress and deformation of the plastic tank. From this it clearly shows that the usage of the plastic tanks gives better performance and low cost. This material is inert to the corrosive environment both from inside and outside the tank. It also makes the vehicle fuel efficient as because of low density material.

Gregory A. Keoleian, Sabrina Spatari, Robb T. Beal, Robert D. Stephens, Ronald L. Williams: [2]: This explains the complete life cycle analysis of both steel and HDPE fuel tanks. Initially the comparison of the tanks are made based on tank weight, coated material for the steel tank and usage of multi-layer HDPE tank for polyethylene tank. The scrap generation and emission of the gas during the manufacturing is abundant as compared to the manufacturing of HDPE tanks. No scrap rate is assumed in case of manufacturing of HDPE tanks as it is produced using blow molding or injection molding. Fuel consumption is monitored for the vehicle equipped with steel tank and HDPE tank. The consumption is higher in the steel tank compared to plastic tank.

Baseera Banushaik, I.Prasanna: [3]: The fuel tank of truck vehicle is mounted to the main frames using tank mounting brackets. Here this paper explains the static analysis and modal analysis of the different designs of mounting brackets. The stiffeners are given to the base design with a thickness of 15mm and the analysis is done. Comparing the deformation and stress values of three design modifications with base design, the design with three given stiffeners gives better deformation and stress values.

III. OBJECTIVES

The main objective is to find out better suitable material for diesel tank of truck vehicles upon their application. Preventing corrosion problem in the tank to increase the overall service life. To find-out feasibility analysis to know about manufacturing, life, corrosion resistant properties of the material chosen.

IV. MATERIAL COMPARISON

The suitable materials for fuel tanks are steel, aluminum and high-density polyethylene (HDPE). Here the comparison of above three materials is shown based on the self weight of the tank, and also fuel efficiency due to decrease in weight of fuel tank. The material properties are as shown below.

TABLE I: MATERIAL PROPERTIES

Parameter / Material	STEEL	ALUMINUM	HDPE
Density (g/cm ³)	7.89	2.70	0.95
Poisson's Ratio	0.3	0.33	0.46
Yield Strength (Pa)	210 × 10 ³	55 × 10 ³	26 × 10 ³
Capacity of the Tank (litres)	160	160	160
Self Weight of the Tank (kg)	77	27.25	9.77



Fig. 1 3D model of fuel tank

V. FEASIBILITY ANALYSIS

TABLE II: FEASIBILITY ANALYSIS FOR DIFFERENT MATERIALS

Sl. No.	PARAMETER	MATERIALS		
		STEEL	ALUMINUM	HDPE
1	Manufacturing	The raw material used is metal sheets. These tanks are made by welding the stamped sheet.		These tanks are made by blow molding or injection molding.
2	Corrosion Resistant	Steel tanks corrodes very rapidly and it is prevented by corrosion resistant paints and zinc coatings	It is also a corrosion resistant where coatings on the surface are not required	These tanks are non-corrosive for long life.
3	Easy Design	The complex shapes are difficult to manufacture and there are standard shapes like cylindrical and rectangular tanks.		As compared to the metal fuel tank manufacture, HDPE tanks are easy to manufacture to their complex shapes.

4	Recycle	Steel material can be recycled easily and used for further applications.	It is also having an advantage of recycling the material for other uses.	Recycle of this plastic material is hard because of lack of infrastructure and scrap rate is more compared to steel
5	Weight Difference	Weight of the steel tanks is high because of high density material (7.89g/cm ³).	Compared to steel tank it is lower in weight (2.7g/cm ³).	This is a lighter material and has a least weight (0.9g/cm ³).
6	Cost	Steel material is generally cheaper than the other two materials.	Cost of aluminum is slightly higher than compared to steel.	Material cost depends on low tooling cost for low volumes and high tooling cost for high volumes.

VI. CONCLUSION

Here there are three different kinds of materials that can be used as a fuel tank for automobile vehicles. The feasibility analysis is made on these material and the advantages, disadvantages are listed. Based on the application and requirement the above material can be chosen. Corrosion resistant is prime factor for the materials in any applications. So HDPE material can resist the corrosion or rust formation for a long period of time. Using this material also reduces weight of the tank that gives an increase in performance of the vehicle.

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