

Proposed Design for Water Leakage Prevention Attachment in Water Tanker Lorry

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Abstract: At present most of the cities in Tamil Nadu drinking water is supplied to the customers and the people by using tanker lorries. But this tanker Lorries do not have the efficient way to protect the water, which escapes from the top of the tanker inlet valves, during the travelling period. This problem arises due to the poor design of the tanker and the bumpy road conditions of our environment. So enormous amount of water is wasted due to this problem. Our main intention is to give a solution for this problem. Therefore we had provided the water holding cup and the return line to send the excess water into the tanker. So the water cannot escapes beyond this setup. The installation of this setup will be cost efficient to serve for the public and to save water for the future generations. Sloshing refers to the movement of liquid inside another object which is, typically also undergoing motion. Sloshing in a container can destabilize the vehicle due to the leakage aspects in a tanker lorry. It results in the unstable control of the driver during driving when the content inside the tanker is full. So the leakage in the municipal lorry will result in the threat to the public may lead to the slippery of road conditions, scarcity of water, huge probability for the occurrence of the accidents, etc. This situation could also be avoided by means of our evenly distributor system to avoid the leakage system. The design for the leakage prevention system is done in the CATIA software with the detailing work. So this renovated design will prevail the previous design of the leakage prevention system designed by us with an intention to avoid crisis of drinking water all over the country.

Keywords: Design analysis environmental issues and tanker lorry.

1. Introduction

The three basic needs in human life are food, air and water. Amongst which the three water occupy 1/3 portion of the whole globe. While the water is ubiquitous, the supply of water is limited. Water is not replaceable, human needs are growing rapidly and the need for water is also growing. So sufficient water is needed for domestic and drinking purposes. We all know water is the "ELIXIR OF LIFE", without water we cannot live and survive. Therefore water plays a vital role in Tamil Nadu that we all aware of it. Because now a days we are so struggling to get the water for our daily needs and requirements. Thirty years back people were drank the water which was directly taken from the bore well. But now a day it is not happening, because currently we are drinking the mineral

water. And the main thing is we are spending Rs.25-35 to get 20 liter mineral water. The above contents expresses the necessity and the current situation of the water. We all know the importance of the water. Even we are wasting the water in various ways from brushing to cleaning. In Tamil Nadu the districts like Chennai, Thirupoor, Karur, Vellore lot of tanker Lorries are available for supply the water to the people and factories. In Chennai there are nearly 3000 to 3500 water tanker lorries are available including metro water tanker lorries. But these tanker Lorries waste the water during the travelling period. Currently we are seeing this issue, but we are ignoring this issue. Because this incident is not happened by us. This issue is still happening by the tanker Lorries. During the travelling period of the tanker Lorries the enormous amount of water exits from the inlet valves. This water is directly falls into the ground or road through the connection pipes attached to the tanker Lorries. Due to this the people and the environment gets disturbed. Which means the people who are travelling on the road got slipped due to the water leakage on the Lorries over the road. And also the water is spilling to the person who is travelling near to the tanker lorry or travelling side of the tanker lorry. So the people get disturbed. When we come to environment it makes some problems to our public properties. Which means the water erodes the particles of the road. Beyond this issue the vehicle also gets damaged. Which means the tanker area and the chassis of the vehicle and some other parts like bolts and nuts and rear axle including spring also gets corroded, due to the existing leakage on these components. Due to this problem more amount of money is spent to cure this problem. Which means welding, painting, coating process. And main important thing is for ten year once the new tank is inserted instead of old one. So the tanker lorry owner wasting too much of money for this problem. And also enormous amount of water is wasting when the vehicle travelling on the bumpy roads and also vehicle tires hit the speed brake. But the money is not consider for this water waste. Because it's a casual one in our country. The tanker lorry driver doesn't consider it like a big thing, and the customer also doesn't consider it. Because they know about this issue. The following content will show the money waste report.

2. Motivation

In Chennai, 3500 number of water tanker Lorries have been operated. But the problems are poor maintenance, not closing the inlet valves properly and the taken for granted mentality of people. This leads to wastage of water approximate 240 liters. This problem initiates us to design and development attachment to prevent water leakage.

A. Methodology

The following methodologies were used in our project with the proper guidance from department faculties.

- Design
- Design calculation
- Design analysis
- Planning
- Material selection
- Fabrication and implementation

The above methodologies were used for this project. Each process done by under the guidance of our department faculties.

B. Material Used

- 2mm thick MS plate
- 4inch pipe 3mm thick
- 2inch pipe 2mm thick
- Ethoxylated Polyethyiemine coating
- Arc Welding and
- Gas Welding

C. Problem Identifications

D. The following below diagrams going to shows the problem occurs in the inner and outer surface of the tanker, and the current design of the tanker ,as well as what kind of setups are provided for avoid the water escapes from the tanker inlet valves

E. Current design of the water tank lorry



Fig. 1. The above diagram shows the current design of the tanker lorry available in Tamil Nadu



Fig. 2. Water pouring valve



Fig. 3. Water filled up to the top of the inlet port

F. Corrosion on vehicle parts due to leakage of water



Fig. 4. Corrosion on cap of the pouring valve



Fig. 5. Corrosion on vehicle chassis

G. Environmental Issues



Fig. 6. Water leaks on road from tanker lorry



Fig. 7. Water leaks on road from tanker lorry

The environment gets some trouble, due to the water falls on the road and some other properties. People also face some issues due to this one. Which means people get slip when they move their vehicle like two wheeler or bicycle on the water

which escapes from the tanker valves. And also the water damages the road particles. The following below diagram shows the environmental issues.

H. Reasons for leakage of water:

The following are the main reasons

- Poor design of the tanker.
- Road conditions.
- Improper maintenance of tanker.
- Water filling up to the top of the pouring valve.
- Excess of water falls on the tanker surface when filling the water into the tanker.
- Traffic of the environment.
- Not applying epoxy coating on inner and outer surface of the tanker.

I. Modifications in tanker

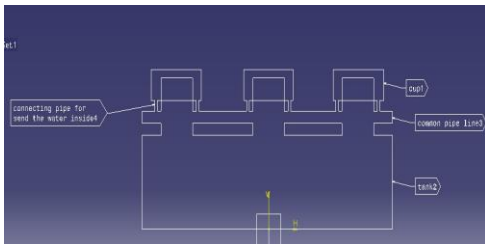


Fig. 8. Tanker modifications

The above diagram clearly explains the modifications done in the tanker.

This setup consists of following below

- Common pipe.
- Water holding cup.
- Connection pipes.
- Tanker.

The above are the main elements of the modified tanker. In this setup the water holding cup is fixed under the inlet valve. And the main thing is the water holding cup height is higher than the inlet valve, which is shown in the above fig. A common pipe is inserted throughout the three port. And the pipe connections are provided to connect the water holding cup and the common pipe, for send the water inside of the tanker which exits from the inlet ports during the running period. This is also explained in the above diagram.

J. Design Calculations

(1) Total volume of the tank = $1000 \times 600 \times 300 = 0.18 \text{ m}^3$
 1000 litres of water can be stored in 1 m^3 of the vessel.
 So 180 litre of water can be stored in 0.18 m^3 of the vessel.
 Specific weight of water = 10 kn/m^3

The atmospheric volume of water may create a pressure of 1 n/mm^2 which causes a stress of 100 n/mm^2 , Where the water stored in a closed vessel.

- $P = 10 \times 1 (\text{kn/m}^3) \times (\text{m}) = \text{kn/m}^2$
- $P = 10 \times 10^3 \times 10^{-6}$
- $P = 10^{-2}$.

• $W = 10 \text{ kn/m}^3$
 Thickness of the plate can be calculated by using this formula.

Formula $\sigma = pd/2t$

- Stress = $1 \times 300 / 2t$
- $t = 1.5 = 2 \text{ mm}$
- So thickness of the shell may be considered 2mm.
- If the dia is 300mm, $t = 2 \text{ mm}$
- If the dia is 600mm, $t = 3 \text{ mm}$

K. Material selection

- 1.2 mm alloy material selected for the fabrication process.
- Oxy acetylene gas.
- Welding electrodes.
- Coating agents.
- Pipes.

L. Working

During the travelling period enormous amount of water exits from the inlet port area. Mostly the water exits when the driver applies the brake, and when the driver drives the vehicle on the bumpy roads and also when wheels hit the speed brake. So in this setup when the water exits from the inlet port or pipe connections, which is provided on the cap of the inlet valve is directly falls inside of the water holding cup, which is provided under 100mm from the top of the tanker surface. And then the water is directly passed to the common pipe line through the pipe connections. And finally the exit water is directly passed inside of the tanker. This process is continued again and again. So there is no chance for water to be escaped from the tanker area. In water pouring valve or inlet valve the common pipe is closed except small blow holes. Reason for this setup is to avoid more amounts of water escapes through common pipe. Less amount of water only goes inside of the common pipe, if incase any heavy collision occurs. But the water goes inside of the common pipe does not exit beyond the setup of water holding cup. All the setup are shown in the above diagrams.

M. Working diagram

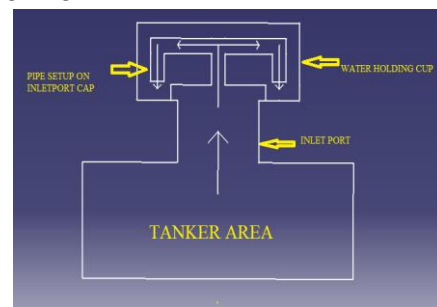


Fig. 9. Working diagram

When the collision occurs inside of the tanker, the water escapes from the inlet port area and the water directly goes inside of the pipe setup which is provided on the cap. And then the water falls on the cup.

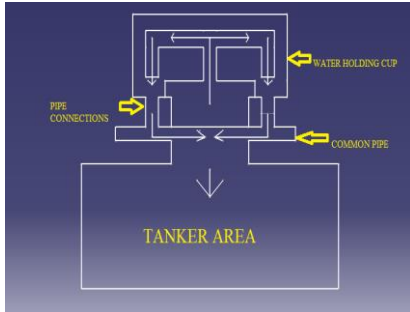


Fig. 10. Working diagram

The water from the cap or pipe setup provided on the cap is directly falls on the water holding cup. And the water is directly goes inside of the common pipe through pipe connections. And again it is goes inside of the tanker itself. This process is continued again and again in all situations like sudden braking, turning and when travelling on bumpy roads.

N. Detailing view of the tanker

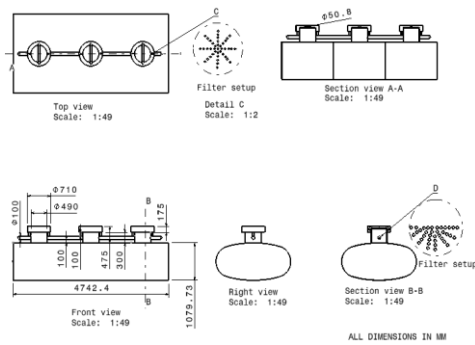


Fig. 11. Drafting work for water tanker

O. Proposed design for conventional tanker various view of the tanker

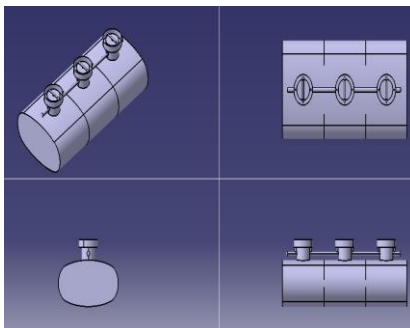


Fig. 12. Isometric, front, top, side views

P. Overall view of the newly concluded tank

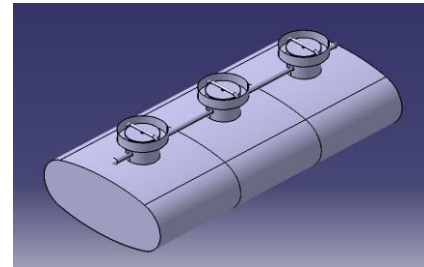


Fig. 13. Concluded design of the water tank

Q. Old and modified tanker lorry



Fig. 14. Tanker view before fabrication process



Fig. 15. Tanker view after fabrication process

R. Highlights

Using our attachment, leakage of water is completely prevented in tanker Lorries.

3. Conclusion

Even though water crisis is there, people didn't realize the issue and lot of water wasted every day. So we need a pool proof system. Which save water automatically without the knowledge of people handling it, our design is so efficient that it can save approximately 8,40,000-12,60,000 litre of water per day in Chennai alone.

References

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