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"Design and Fabrication of Storage Tank For Acetylene-Aspirated Petrol Engine"

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Abstract: ***Design and fabrication of storage tank is done to store the gas which is used as an alternative fuel for petrol engine. The paper focuses on fabrication of tank, so that the chemical reaction of mixture of water and calcium carbide (limestone) should take be carried out properly and efficiently, Also the pressure required for running the vehicle should be obtained as per the requirement. The design of tank is done in such a way that it should not explode or blast due to the high pressure***
Therefore pressure gauge, 2 relief valve, regulator is installed in the tank.
Keywords: Physical Properties of fuel, Material and Parameters Installed in tank.

I. INTRODUCTION

The paper contains the information regarding the fabrication of tank which is high pressure cylinder for vehicle use for acetylene gas. Tank is constructed from number of different material based upon it availability and cost of the material, ease of fabrication ,resistance to corrosion, compatibility with the fluid stored. Sometimes specialized composites and techniques are used in tank.

II. FLUIDS STORED IN STEEL TANK

Tanks can be full or empty at the moment of failure during events of natural hazards. The content of these tanks is very important because it can avoid extreme failure of the shell depending on the quantity and on the physical properties of the liquid.

A. Density and Specific Gravity

The density of the liquid is its mass per unit volume. Water has a density of 1 gm/cm^3 at 4°C. The density of a liquid plays an important role in the design of a tank, because larger densities require thicker shells. Specific gravity is another important physical property of the liquid stored. It is a measure of the relative weight of one liquid compared to water. Specifically it is the ratio of the density of the liquid divided by the density of the water at 15.5°C. For example, petroleum oil, kerosene, gasoline and acetylene have a specific gravity of 0.82, 0.80 ,0.70 and 0.907, respectively. Care must be exercised if there is a significant increase in the specific gravity of the new liquid because the effective hydrostatic pressure acting on the tank walls will be greater if the design level is not reduced, and could cause damage on the cylindrical shell.

B. Vapor Pressure and Boiling Point

The vapor pressure of a pure liquid is the pressure of the vapor space above the liquid in a closed container, and increases with increasing temperature. It is an important consideration in order to select the type of tank and its roof and is crucial for the purpose of characterizing fire hazardousness. The boiling point is also important. It is necessary to know the temperatures at which some liquids should be stored, always below its boiling point. For example, some flammable and combustible liquids are prohibited by the fire codes to be stored at temperatures above their boiling point.

C. Pressure

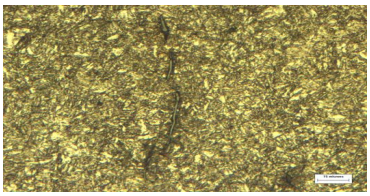
Pressure is defined as force per unit area. In the United States, the engineers working in this field commonly use inches of water column or ounces per square inches to express the value of pressure or vacuum in the vapor space of a tank, because the pressures are usually very low relative to atmospheric pressure. According to this pressure the designer should determine the strength and thus thickness of the tank. For both cylindrical and spherical shells, the most complex part of the tank to design is the junction between the roof and the cylinder because several conditions may occur: (a) When the pressures dominate on the cylinder, the roof deflects to accompany the lower shell; (b) When there is an internal pressure that exceeds the weight of the plates and framing of the roof, this junction tends to separate from the shell. This area is the first to show damage. Both external pressures due to wind loads, and internal negative pressure can cause similar damage to the structure. The difference of pressure between the inside of the tank, its

vapor space, and the local barometric pressure (atmospheric pressure) is called the internal pressure. When this pressure is negative, it is called a vacuum. To measure this pressure, it is necessary to read it at the top of the liquid in the tank, because the liquid itself exerts hydrostatic pressure, which increases to a maximum value at the base of the tank. If a tank has an internal pressure exceeding the value of 100 KN/m^2 relative to atmospheric pressure, they are classified as pressure vessels and are covered by the code for "Boiler and Pressure Vessels" of ASME (American Society of Mechanical Engineers). Such cases are beyond the scope of this work. An external pressure implies that the pressure on the outside of the tank or vessel is larger than that on its interior, such the wind pressure due to a hurricane. For an atmospheric tank, the development of a vacuum in the interior also results in external pressure. External pressures can be extremely damaging to tanks because their surface areas are
large and this generates very high forces. The excessive external pressure results in buckling of the shell walls or total collapse.

Properties	Density	Auto ignition (k)	Flammability	Lower Calorific value	Ignition delay
Acetylene (C2H2)	1.092	598	2.5-81	48225	0.019

TABLE(1): PROPERTIES OF ACETYLENE FLUID

III. MATERIAL



Fig(1): MATERIAL IN MICRO STRUCTURE

A. Seamless pipe

1) Advantages

a) Thin wall (Thickness to OD ratio= 0.2%)

b) Dimension accuracy (prevent eccentricity and thickness deviation

c) Improved inner surface (prevent roll roll-in scale)

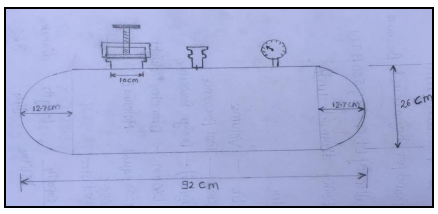
2) Standard

JIS G 3429(Seamless Steel Tubes for High Pressure Gas Cylinder)

3) Grade

STH 22 (Chrome Chrome-molybdenum steel tube)

Fig.(2): SEAMLESS PIPE



Fig(3): SKETCH OF TANK SHOWING DIMENSION

IV. COMPONENTS OF TANK(CYLINDER)

A. Pressure Gauge

Presser gauge is the analysis of an applied force by a fluid (liquid or gas) on a surface. Presser is typically measured in units of force per unit of surface area. Many technique have been developed for the measurement of presser and vacuum. Instrument used to measured and display pressure in an integral unit are called pressure gauge.

B. Cylinder Valve

These valve comfort to the Indian standard specification IS:3224 for cylinder valve, in each respect. These valve are duly approved by chief controller of explosives, Nagpur and supplied under BIS scheme of certification.

Valves are used where flow is needed only in one direction. It prevents reverse flow. The four basic types are- swing check, lift check, non-slam check and combined stop and check.

In the swing check valve flow moves through the valve in approximately a straight line. The check mechanism of the design incorporates a disk which swings on a hinge.In the lift check valve, flow moves through a changing course. They must be installed with pressure under the disk.

C. Regulator

A pressure regulator is a control valve that reduce the input pressure of a fluid to a desired value at its output. Regulators ae used for gases and liquids, and can be an integral device with an output pressure setting, a restrictor and a sensor all in one body. A pressure regulator's primary function is to match the flow of gas through the regulator to the demand for gas place upon and maintain a constant output pressure.

D. Carbide And Water Inlet Arrangement

In this inlet an chamber is installed so that from that chamber carbide and water is filled into the tank. This chamber is fully air tight so that no air or gas is liked from the tank so that high pressure gas is fill into the tank so that tank is full of gas. That full gas tank is utilized for running of vehicle.

E. Presser Relif Valve

Pressure relief valve s a type of safety valve used to

Control or limit the pressure in a system, pressure might otherwise build up and create a process upset, instrument or equipment failure, or fire. The pressure is relieved by allowing the pressurized fluid to flow an auxiliary passage out of the system. The relief valve is designed or set to open at a predetermined set pressure to protect pressure vessels and other equipment from being subjected to pressures that exceed their design limit. In some cases, a called by pass valve.

F. Insulated Copper Gas Pipe

The gas pipe is an important component of the kit. It is usually a strong copper tube that transfers gas (in liquid form) from the tank to the engine. This pipe needs to be strong to prevent leakage, and the installer must take care not to route this pipe close to the exhaust system or around any electrical components that can cause a fire.

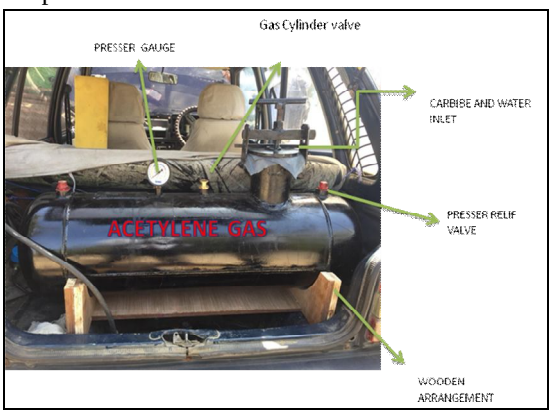


Fig.(4): ACTUAL FABRICATION OF TANK

V. TANK SPECIFICATION

A. Material :- Steel
B. Cylinder Volume:- 50 Liters
C. Working Pressure:- 3 MPa
D. Weight : 26.7 Kg
E. Total Length of Tank :- 92 cm
F. Area Of Tank

VI.CONCULSION

Successfully Design and Fabricated Acetylene Tank as alternative fuel in using in Maruti 800 as Hybrid vehicle.
Acetylene Fuel Tank are Design for fuel system that required Fuel to be Supplied to the pressure regulator in gaseous form. Acetylene tank are design as a donate shape. Donate tank generally have more capacity, but will take more space in vehicle. Donate tank are designed to fit in the spare will space of vehicle. In vehicles having large empty space, multiple tank can be used to increase fuel storage capacity. For safety purpose extra relief valve are fabricate. This is mainly for venting out excess gases. Tank are equipped with pressure relief valve that will release fuel (gas) to the atmosphere to prevent tank explosion under abnormally high pressure condition.

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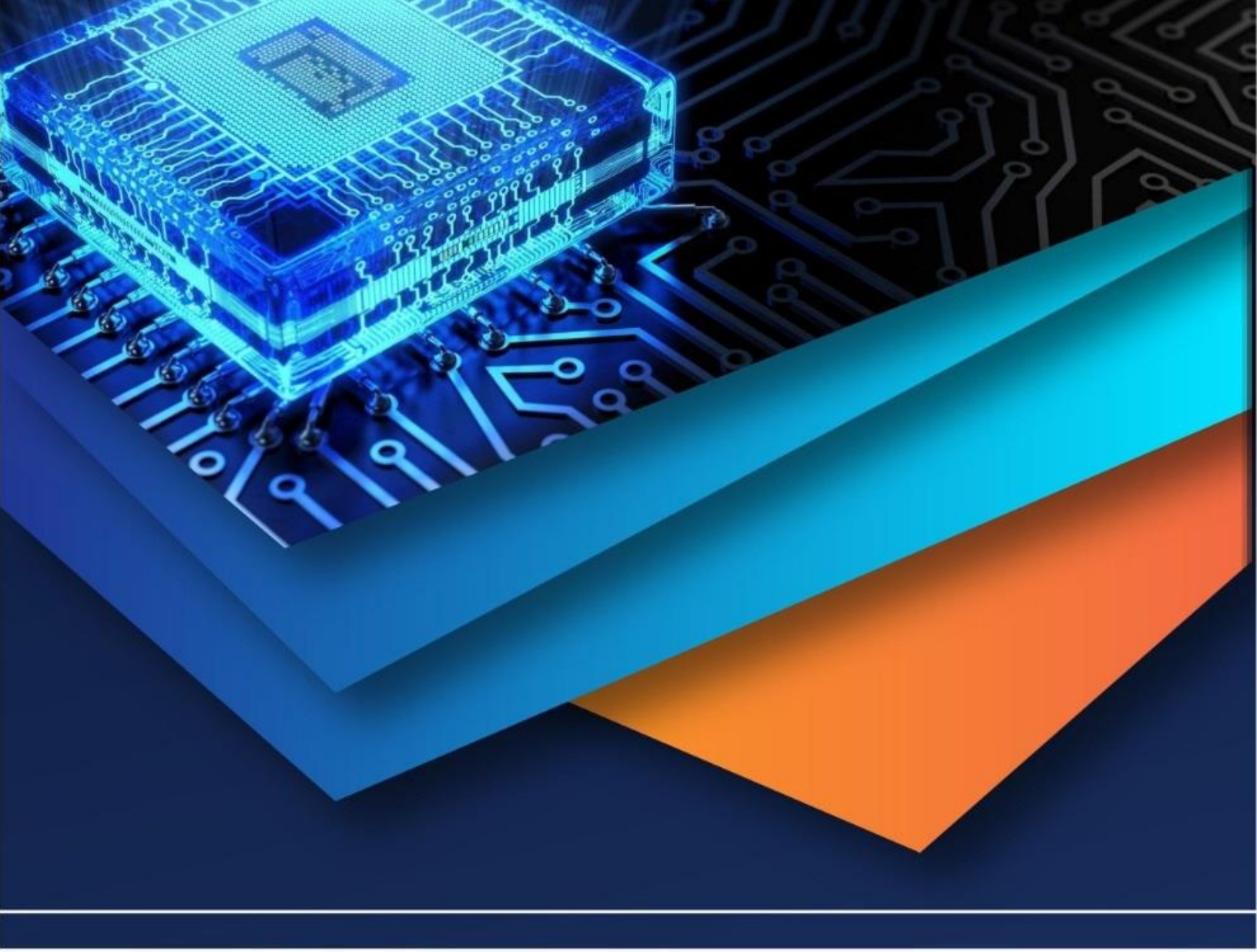

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