

Upgraded Design for Flash port of HHO Dry cell Generator

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Abstract- This paper discussed about Hydrogen Fuel Cell which comprise of a fuel tank and is loaded with demineralized water which have zero conductivity and sodium hydroxide. This power device is intended to work on the technique for Electrolysis by isolating hydrogen and oxygen. This system applied the electrochemical technique to part hydrogen and water and recombine to shape HHO gas (hydroxyoxygen), which we can additionally use for creating warmth and power. Consequently gives us a finish of utilizing the resultant warmth for different purposes like welding and so forth. However, this paper gives a short clarification about how to increase the efficiency of the bubbler.

Index Terms- Oxy hydrogen (HHO), CPVC (Chlorinated polyvinyl chloride) Electrolysis, Hydrogen gas, bubbler, port, Sodium Hydroxide (NaOH), Potassium hydroxide (KOH), Fuel Tank, Pulse Width Modulator, Six Sigma

INTRODUCTION

HHO is the combination of hydrogen gas (H₂) and oxygen gas (O₂) together is called HHO. It is also known as oxyhydrogen and Brown's Gas. HHO is fuel. Burning HHO creates water vapor, in other words – water HHO is a very green fuel.

Electrolysis is the process of using electricity to split water into hydrogen and oxygen. Typically we seek hydrogen gas or oxygen gas. When both are bubbled up and collected together – we create a burnable fuel. Then split molecules named as H₂O to HHO. Hydrogen is a hazardous gasses. It utilize extraordinary alert in testing and stick to wellbeing rules in our construction. It will cause property harm or genuine damage may happen. Putting away hydrogen there are some other fuel which can be used for about an unsafe practice. However HHO should never be put away. On the off chance that started HHO can explode inside the fixed stockpiling compartment. Try not to enable HHO to aggregate. By configuration join streak venting into HHO gear. Self-fixing streak ports, flashback silencers, bubblers, and motor on control exchanging are center segments to a safe HHO sponsor framework.

In this research we will find the best method to nearly slow down the combustion inside the bubbler. The major cause of the combustion inside the bubbler is flashback which occur because of the pressure difference near the nozzle. To perform this activity we need a setup of reactor, fuel tank, PWM. The first thing that occur in my mind is that to create a bubbler but

the only creation of the bubbler is not the only way to come on final result

It need whole setup of the HHO gas that is the reactor, fuel tank, PWM. That will become more costly. So we find some source on internet that on which place the whole setup will available, so we find some location on internet with proper experimental setup that is in Ahmedabad, Mumbai, Bhopal and many more, but the best suitable location for me is in Jaipur, so we find one research firm or institute in Jaipur where the whole setup is present. In that setup we also find bubbler that is the most important thing which is required. But that bubbler is not up to mark or that we need so we suggest some enhancement work on that bubbler and the respective firm also agreed on that enhancement.

So in this research we will find the best way to increase the efficiency of the bubbler and life span of the bubbler. It all happen when we will find the best way to decrease the combustion level in the bubbler, by doing this we can increase the efficiency of the bubbler. In the whole setup the first step is to generate the hydrogen or HHO, this gas is generated by the electrolysis process, for doing the electrolysis we need reactor.

After that the HHO gas go to the fuel tank which is connected to the reactor, after that it goes to first bubbler and after second bubbler and that gas can be used for welding, cooking and many more uses.

Melting point: -260°C

Isotopes: 3

Atomic Number: 1
Atomic mass: 1.007 g/mol
Boiling point: -253°C
Octane number: +130
Triple point pressure: 0.077bar
Density: 0.0899 g/l at STP

BASIC SYSTEM CONFIGURATION

Pulse Width Modulator

Pulse width Modulator (PWM), a part of the energy unit is for controlling the fire of HHO. Pulse width Modulator (PWM) is additionally known for expanding the generation of HHO gas without expanding the present rating (amp). One of the primary and most imperative segments to a decent HHO gas framework is the PWM (Pulse Width Modulator). This little electronic circuit board dwells in the EC electronic control box and screens the electrical heartbeats streaming all through the HHO framework and manages the stream so the most ideal hydrogen gas is created by the on request hydrogen generator.



Fig: - 1 Pulse width Modulator

Fuel Tank

The real utilization of the fuel tank is that it store demineralized water, and in that water there must be some measure of electrolyte must be included, there are the distinctive sorts of electrolyte are utilized with the end goal that potassium hydroxide (KOH), sodium hydroxide (NaOH), the best electrolyte which is gainful for us is sodium hydroxide (NaOH), on the grounds that it is less expensive and it is effectively accessible in the market. That water with some measure of electrolyte is put away in the fuel tank.



Fig: - 2 Fuel Tank

Bubbler

At the point when HHO gas is delivered from a dry cell, some water vapor is created also. This water vapor can convey minor particles of electrolyte which can cause harming erosion. As the HHO rises rise the section of water inside the bubbler they are "cleaned" of any electrolyte particles that were appended to the water vapor. The outcome is much cleaner HHO gas. This is a basic yet essential piece of any HHO framework.

The bubbler has many benefits but in below we have discussed four benefits:-

It shields your generator from a flashback (caused by blowback)

It goes about as a channel to clean the air pockets that are made by your generator, from undesirable particulates that might be available, contingent upon your picked electrolyte and different elements.

Cleaning the HHO gas.

It provides and act as a safety obstruction

Hydrogen generator

The HHO generator includes in the creation of hydrogen and oxygen with an assistance of procedure of electrolysis. In this procedure, Direct Current is gone through cathodes to water, because of substance response, the positive plates produce Oxygen and negative plates create Hydrogen. Unadulterated water does not lead power. Adding a base to the water makes an electrolytic arrangement and expands conductivity, enabling electrolysis to happen. Refined water and KOH is the favored electrolyte. An electrolysis gadget is also called an electrolyze cell, the way toward utilizing DC supply to the organized electrodes which are drenched into the electrolysis split water into together—purported profoundly burnable fuel is created.

SIMULATION AND RESULT

Flat Plate Unipolar Cell Configurator Cell Dimension Instructions - Uputstvo

Settings

Start by entering Operating Voltage and Number of Plates 2 to 2.5 volts is recommended Per Water Cell Area

Operating Volts DC	# Series Plates	# Stacks	Volts Per Water Cell	# Water Cells
220	110	1	2.02	109

Settings

Next enter size of Plates and Operating Amps Number of Plates and Amperage will determine HHO Liter/Minute

Rectangle Gaskets

Active surface	Operating Amps Per Stack	11	LPM	13	Generator Size
Plate Length (cm/in.)	Maximum Amps Per Stack	8.04	HHO	12.517	Length
Plate Width (cm/in.)	Total Amps	11.00	H2	8.347	Width
Plate SQ (cm/in.)	Watts	2420.00	O2	4.170	Depth
12					9
8					35.90
96.00					63.15

Fig 3: - HHO Hydrogen Generator Cell Configurator [5]

To perform the experiment we have taken a four reading in four different compression state of spring. That is in how much weight a spring will compress in 100% compression, 75% compression, 50% compression and in 25% compression.



Fig 4 (a)



Fig 4 (b)
Setup of the Spring Compression



Fig 4 (c)

Table 1:- Reading of spring under different compression percentage

Spring Compression	25%	50%	75%	100%
Load	2.720kg	3.625kg	4.705kg	7.201kg



Fig 5:- Glass ball under testing in UTM



Fig 6:- Universal Testing Machine



Fig 7:- Dimension of Glass ball

So, we have applied this concept on actual bubbler
 Height = 64.20mm
 Width = 50.86mm

First step is to calculate the volume of combustion chamber:-

$$V_{\text{Combustion}} = \text{Total volume of combustion chamber} = \pi \times r^2 \times h$$

$$= \pi \times 32.1^2 \times 50.86$$

$$= 164640.35 \text{ mm}^3 \dots\dots\dots (i)$$

To calculate the how many balls will fill in the glass. We took again the help of water. In further step we filled water in the glass to a height of 22mm. and calculated the how much area the water has covered.

$$V_{\text{Water}} = \text{Volume of water} = \pi \times r^2 \times h$$

$$= \pi \times 32.1^2 \times 22$$

$$= 71216.82 \text{ mm}^3 \dots\dots\dots (ii)$$

We used both the above equation. And to determine how much volume the glass ball has occupied. We subtract the both equations.

$$V_3 = \text{Volume occupied by glass ball}$$

$$= \text{Total volume of combustion chamber} - \text{Volume of water}$$

$$= 164640.35 - 71216.82 \text{ mm}^3$$

$$= 93423.53 \text{ mm}^3$$

The above result show that the how much volume is covered by the glass ball. So to calculate how many ball is in the glass we have used simple mathematics equation.

$$\text{Number of glass balls} \times \text{Volume of each glass ball} = \text{Volume occupied by the glass balls}$$

To calculate the volume of each glass ball=

$$\frac{4}{3} \times \pi \times \frac{(14.8)^3}{8}$$

$$= 1693.15 \text{ mm}^3$$

So, the number of glass ball present in the container are:

$$\frac{93423.53}{\frac{4}{3} \times \pi \times \frac{(14.8)^3}{8}}$$

$$= 55.17 \approx 55$$

4.1 Enhanced Bubbler Six Sigma Calculation

To calculate the sigma value of the bubbler we have generated around 14,400 pulses that is the number of opportunities in term of the six sigma and form that opportunities we have calculated sigma value. To calculate the sigma the two most important term is required is that number of opportunities and number of defect. From this two term we can calculate the sigma. So, the number of opportunities is equal to the times flashback is generated to calculate this we performed some experiment, from the experiment we have detected that in around 3sec. the 1 pulse is generated.

So as per calculation we performed this experiment for 12 hour.

$$= 1 \text{ hour} = 3600 \text{ sec}$$

$$= 12 \text{ hour} = 43,200 \text{ sec}$$

$$= 1 \text{ pulse is generated in } 3 \text{ sec.}$$

$$= \frac{43,200}{3} = 14,400$$

14,400 pulses is equal to the number of opportunities. From 14,400 pulse in last around 75 pulse we found some difficulties that is the leakage of the gas, but later we fixed it by tightening the upper portion of the port

So, 75 pulses showed us the defect
 Number of opportunities= 14,400 pulses
 Number of Defect = 75 pulse
 So, (Number of opportunities- Number of defects)/
 Number of opportunities

$$= \frac{(14,400 - 75)}{14,400} = 0.994791666 \cong 0.9947$$

$$= 0.9947 \times 100$$

$$= 99.47\% = \square.\square\square\square$$

4.2 Older Bubbler Six Sigma Calculation

Number of opportunities= 15,000 pulses
 Number of Defect = 900 to 1000 pulses
 So, (Number of opportunities- Number of defects)/
 Number of opportunities

$$= \frac{(15,000 - 1,000)}{15,000} = 0.933333 \cong 0.933$$

$$= 0.93333 \times 100$$

$$= 93.33\% = \square.\square\square$$

It clearly sees that there is rise of **1.06** sigma level in the enhanced bubbler. The enhanced bubbler is more efficient than the previous bubbler.



Fig 8:- Old Bubbler



Fig 9:- Enhanced Bubbler

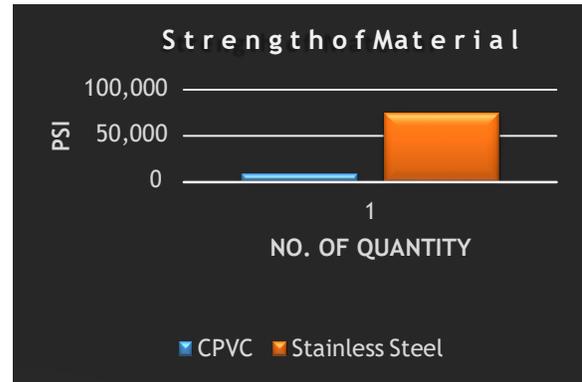


Fig: - 10 Material graph

The above graph shows the data between the CPVC and the stainless steel, as it clearly shows that the strength of the stainless steel is quite high, the PSI of the stainless steel is around 75,000



Fig: - 11 Washer comparison graph used in two bubbler

The above graph shows the data between the washer which is used in the different types of bubbler that is CPVC bubbler and stainless steel bubbler, this type of washer has used in the bubbler port, as it clearly shows that the temperature generated in the stainless steel is low and the life of the washer becomes quite high

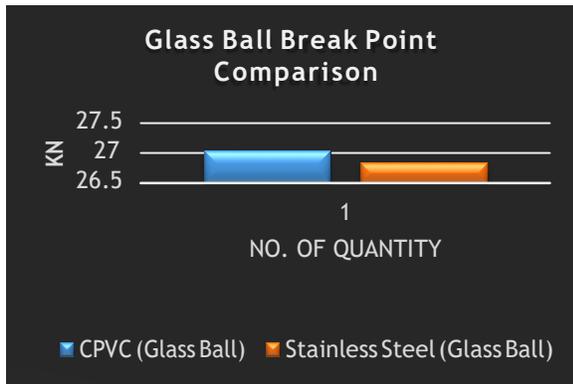


Fig: - 12 Glass ball breakpoint tested in UTM
The above graph shows the data between the glasses balls which is used in the port, in the previous port the glass ball which is used is break around 27.04 KN but in the new port it breaks around 26.84 KN. Glass ball is used because it releases the pressure inside the bubbler by popping up.

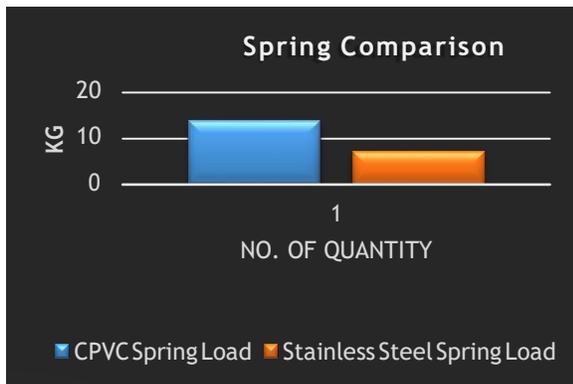


Fig: - 13 Spring comparison graph used in two bubbler

The above graph shows the data between the two springs which is used in the port, in the previous port the maximum spring compressed is around the 14 kg, but in the port the combustion inside the bubbler is low which makes the spring comparison low that is 7.201 kg. Combustion inside the bubbler is low that make the life expectancy ratio high.

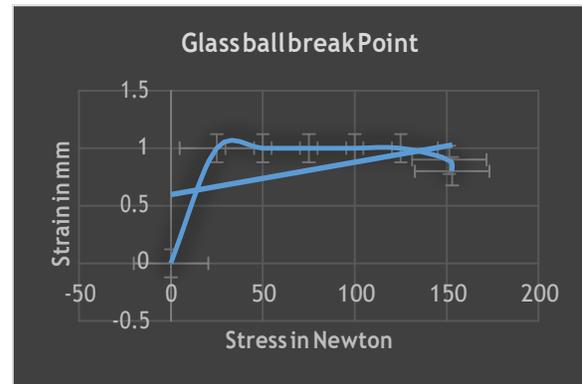


Fig: - 14 Glass ball break point
The above graph shows the data of the glass ball breaking point on different stress, this testing is done on the UTM (Universal Testing Machine).
Summary of the different graphs

Quantity	PSI	Temperature	KN	Kg
CPVC	8,200	140	27.04	14
Stainless Steel	75,000	86	26.84	7.201

Conclusion

From the above discourse it can state that the Enhanced bubbler is considered as the best for the better effectiveness. This is on account of the upgraded bubbler performs better in every one of the parts of correlation i.e. Quality, Temperature, Reduction in the ignition territory, Use of the glass ball, high caliber of spring. The upgraded bubbler turns out to be exceedingly viable for the Flashback fire in satisfactory conditions. Upgraded bubbler gives a snappy and exact task. So Enhanced bubbler ought to be considered for the advancement of the encompassing, less blast zone and change in the proficiency of the bubbler.

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