

## RESEARCH ON ALTERNATIVE METHODS FOR REDUCING CORROSION IN SOLAR WATER HEATER

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### ABSTRACT

The solar water has many uses, it has some comings. The main problem encountered in the corrosion formed in the welding areas of inner tank in solar water heater. Addition to that the material used in the manufacturing of the inner tank also plays a major role in the formation of the corrosion. In order to over come the corrosion problem we suggest four methods, which will reduce corrosion and gives good result.

**KEYWORDS:** solar water heater, stainless steel, paste method, threading method.

### I. INTRODUCTION

Even though the solar water has many uses, it has some shortcomings. The main problem encountered in the corrosion formed in the welding areas of the inner tank in solar water heater. Addition to that the material used in the manufacturing of the inner tank also plays a major role in the formation of the corrosion. The corrosion is happened at the welding point of the inlet and outlet pipe and next one, the corrosion is encountered at the joining of a sheet. Usually the inner tank is manufactured by rolling the sheet and the welding process is carried out to join the ends to form the cylinder. In this particular joining position, the corrosion is encountered.

### II. METHODOLOGY

The problem encountered in the water heater is solved by following some methodology, the following flowchart is the methodology used for solving the problem.

#### General study

In the first step, a general study is made on the existing working of the solar water heater, material used for the different components and its manufacturing process.

#### Understanding the problem

The second step is to understand the problem which is encountered in solar water heater, the reason for the corrosion formation is studied and analyzed.

#### Material analysis

In third step, the material analysis is done to replace the existing material with a new material, which has more resistant to the corroding property.

#### Alternative methods

In fourth step the possible alternative methods for the existing method is found and the analysis is done in order to ensure more efficiency and reducing corrode.

#### Solution

Then in final step a complete solution is given for the solar water heater in order to reduce the corrosion occurrence. Some of the suitable methods also suggested for reducing the corrosion.

### III. METHODS AND ANALYSIS

#### Selection of Material

At present the solar water heater collector tank is made up of 316 stainless steel. In MAS Solar they use 316L Stainless steel. The problem encountered is that there is a formation of corrosion in the inner part of the inner tank.

In order to overcome this problem, we suggest the two material **SS444** and **317L** for the manufacturing of the inner tank.

#### Stainless Steel 317L

Alloy 317L is a low carbon corrosion resistant austenitic chromium-nickel-molybdenum stainless steel. The high levels of these elements assure the alloy has superior chloride pitting and general corrosion resistance to the conventional 304/304L and 316/316L grades. The alloy provides improved resistance relative to 316L in strongly corrosive environments containing sulfurous media, chlorides, and other halides

The low carbon content of Alloy 317L enables it to be welded without intergranular corrosion resulting from chromium carbide precipitation enabling it to be used in the as-welded condition. With the addition of nitrogen as a strengthening agent, the alloy can be dual certified as Alloy 317.

Alloy 317L is non-magnetic in the annealed condition. It cannot be hardened by heat treatment, however the material will harden due to cold working. Alloy 317L can be easily welded.

#### Stainless Steel 444

Type 444 is a low carbon, low nitrogen, ferrite stainless steel that provides pitting and crevice corrosion resistance superior to most ferrite stainless steels. Applications requiring superior corrosion resistance and resistance to chloride stress corrosion cracking are ideal for this alloy. It is used in Food processing, brewery and wine making equipment, hot-water tanks, heat-exchanger tubing and automotive components

According to the comparison between the material 316L and SS444, the SS444 possess good chemical property. The carbon content is less which is good for the welding process. The yield strength and ultimate strength is high compared to 316L material.

The following is the cost comparison between 316L, 317L and SS444.

Table 1; Cost Comparison between 316L, 317L and SS444

PRICE	316L	317L	SS444
Cost per ton	US \$ 1000-3000	US \$ 1200-2200	US \$ 2500-3500

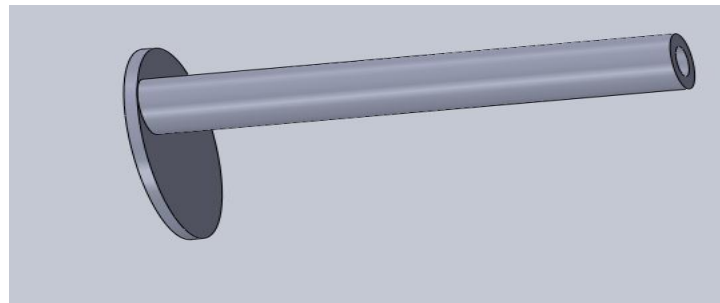
#### Joining Pipe By Different Methods

##### Paste Methods

The method we suggest is that the pipe is joined by the use of m-seal instead of welding. The main advantage is that the welding is completely eliminated and hence the chance of corroding is minimized. The main point to be kept in the mind is that the m-seal should not be applied in the inner side of the pipe, as it is dangerous to human body.

##### Threading Method

**This method idea is similar to the above joining type, instead of applying the m-seal, the threading is done on the outer side of the extent and inner side of the pipe and they locked together. It can be applied in the condition when the thickness of the side cover is more. It is more efficient method when compared to previous type.**



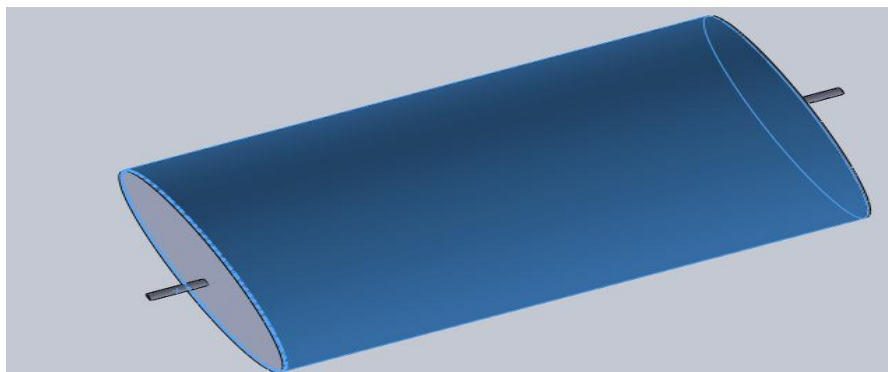
**Fig-1:** Assembled View of the System

### Advanced Evacuated Method

In the existing method, the evacuated tube is used for collecting the heat from the sun and with the help of that heat, the water is heated. Then the heated water is collected and stored in the collector tank. The problem is that there is a more chance of corrosion.

The idea we suggest is that the long evacuated tube is not used, instead of that the collector tank should be made up of the evacuated glass tube material with its same property of arresting the heat. The evacuated type collector tank is the only component used. It consist of two holes, one for inlet and another for outlet.

The evacuated type collector tank is kept in the sunlight, the heat is passed into the tank and heats the water, and the heat remains inside due to the evacuated material property. Then the water is drawn through outlet pipe and it is used for domestic purpose.



**FIG-2:** Cad Model of Advanced Evacuated System

## IV. CONCLUSION

The solar water heater tends to be one of the important application in the solar energy. It is widely used in many countries for heating the water. The problems like corroding makes the solar water heater unstable and causes many issues as we discussed earlier.

By implementing the paste method and thread method, the welding for joining the pipes is eliminated, the SS444 material possess good chemical and mechanical property as compared to the existing 316L. The Advanced Evacuated method will be the future for solar water heater, as the complexity in components is reduced and the chance of corrosion is minimized.

The solar energy will be one of the promising energy for the future applications and promises to be the best renewable source.

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