Experiment study of solar water heater with circulating pump and using of Aluminum tube.

Pankaj Kumar Mongre
ME IV Sem. Student Jabalpur Engg College Jabalpur
Dr. Bhupendra Gupta
ASSISTANT PROFESSOR JABALPUR ENGG. COLLEGE JABALPUR

ABSTRACT :-

In this paper, the summary of Experiment study of solar water heater with circulating pump and using of aluminum tube in this paper also include device, such as, circulating pump, Glass, Insulator, Aluminum tube, water container, Base material., This paper also gives Experimental approach in solar water heating system. A combined system of solar water heater with circulating pump and using of aluminum tube has been designed and tested. An experimental parameter of solar water heater is described in this paper . The testing of collector and system were carried out during September 2012 –November 2012

Key word: - solar energy circulating pump, Glass, Insulator, Aluminum tube, experimental approach

Introduction: - Solar water heaters, sometimes called solar domestic hot water systems, may be a good investment for you and your family. Solar water heaters are cost competitive in many applications when you account for the total energy costs over the life of the system. Although the initial cost of solar water heaters is higher than that of conventional water heaters, the fuel (sunshine) is free. Plus, they are environmentally friendly.

In a "close-coupled" SWH system the storage tank is horizontally mounted immediately above the solar collectors on the roof. No pumping is required as the hot water naturally rises into the tank through thermo siphon flow. In a "pump-circulated" system the storage tank is ground- or floor-mounted and is below the level of the collectors; a circulating pump moves water or heat transfer fluid between the tank and the collectors.

When a solar water heating and hot-water central heating system are used in conjunction, solar heat will either be concentrated in a pre-heating tank that feeds into the tank heated by the central heating, or the solar heat exchanger will replace the lower heating element and the upper element will remain in place to provide for any heating that solar cannot provide. However, the primary need for central heating is at night and in winter when solar gain is lower. Therefore, solar water heating for washing and bathing is often a better application than central heating because supply and demand are better matched. In many climates, a solar hot water system can provide up to 85% of domestic hot water energy. This can include domestic non-electric concentrating solar thermal systems. In many northern European countries, combined hot water and space heating systems (solar comb systems) are used to provide 15 to 25% of home heating energy.

Passive and active systems

Passive systems rely on heat-driven convection or heat pipes to circulate water or heating fluid in the system. Passive solar water heating systems cost less and have extremely low or no maintenance, but the efficiency of a passive system is significantly lower than that of an active system, and overheating and freezing are major concerns. Active systems use one or more pumps to circulate water and/or heating fluid in the system. Though slightly more expensive, active systems offer several advantages: The storage tank can be situated lower than the collectors, allowing increased freedom in system design and allowing pre-existing storage tanks to be used. The storage tank can always be hidden from view. The storage tank can be placed in conditioned or semi-conditioned space, reducing heat loss. Drainback tanks can be used. Superior efficiency. Increased control over the system.

Modern active solar water systems have electronic controllers that offer a wide-range of functionality, such as the modification of settings that control the system, interaction with a backup electric or gas-driven water heater, calculation and logging of the energy saved by a SWH system, safety functions, remote access, and various informative displays, such as temperature readings.

Experimental setup

A flat plate collector consists of a thin absorber sheet (of thermally stable polymers, aluminum to which a black or selective coating is applied) backed by a grid or coil of fluid tubing and placed in an insulated casing with a glass or polycarbonate cover. Fluid is circulated, using either mains or solar electricity, through the tubing to remove the heat from the absorber and to transport it to an insulated water tank, sometimes directly or otherwise to a heat exchanger or to some other device for using the heated fluid. Some fabricants have a completely flooded absorber consisting of 2 sheets of metal stamped to produce a circulation zone. Because the heat exchange area is greater they may be marginally more efficient than traditional absorbers. One flat collector with having area 2.16 m^2 are consist for in this study, Embedded design of solar absorber is shown in fig. 1 And 2 .The whole and glass cover in encased in ferrous metallic box with 5 mm glass thin and used the insulator below the absorber to reduce bottom losses

fig . 1 show the solar absorber

Fig. 2 show the setup

Using component Table . 1

Sr.No.	Component	Specification
1	Capacity of storage tank	200L
2	collectors	Flat type
3	Area of collectors	2.16 m^2
4	Tube diameter	0.01125mm
5	Tube material	coppers
6	Plate thickness	0.01mm
7	Air gap	5mm
8	Thickness of insulation	5mm
9	Thickness of glass	3mm
10	Angle of collectors	30 degree
13	ac motor	220 v

Result and discussion –

The instantaneous efficiency= Gain factor –Loss factor (Tfi-Ta)/I(t)

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

Initial condition apply –

Tf at x=0 , Tf= Tfi 1

Tf at x=L , Tf= Tfo 1

Where

Tfi=Initial fluid temperature

Tf= fluid temperature

Ta=ambient temperature

I(t)= Incident solar in w/m^2 = 1353w/m^2

Gain factor – 0.64

Loss factor = 5.18

Before change parameter in experimental setup in September 2012, October 2012, November 2012

Table. 2

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	20
2	10:30	24
3	11:00	30
4	11:30	35
5	12:00	40
6	12:30	44
7	13:00	50

Ta =12 degree C

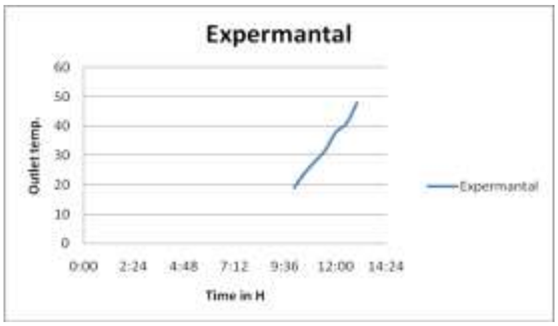
Graph .1– Hourly variation of outlet temperature in month of September 2012

Table.3.

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	19
2	10:30	24

3	11:00	28
4	11:30	32
5	12:00	38
6	12:30	41
7	13:00	48

Ta =11 degree C

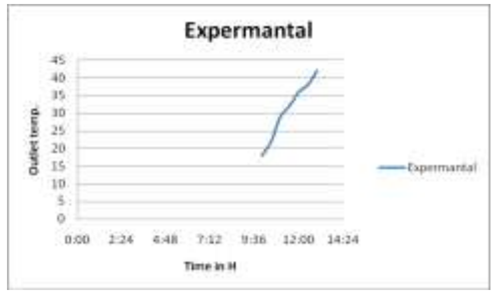


Graph .2– Hourly variation of outlet temperature in month of October 2012

Table.4.

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	18
2	10:30	22
3	11:00	29
4	11:30	32
5	12:00	36
6	12:30	38
7	13:00	42

Ta =10degree C



Graph .3– Hourly variation of outlet temperature in month of November 2012

1- Tf = 44 Degree C = 44+273=317K

Ta = 12 Degree C = 12+273=285K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

Gain factor – 0.64 ,Loss factor = 5.18

I= 1353w/m^2

ή = 51.77%

2- Tf = 41 Degree C = 41+273=314K

Ta = 11 Degree C = 12+273=284K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

Gain factor – 0.64 ,Loss factor = 5.18

I= 1353w/m^2

ή = 52.51%

3- Tf = 38Degree C = 38+273=311K

Ta = 10 Degree C = 10+273=283K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

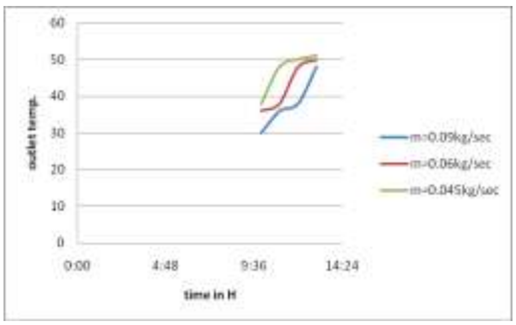
Gain factor – 0.64 ,Loss factor = 5.18

I= 1353w/m^2

ή = 53.32%

Table .5

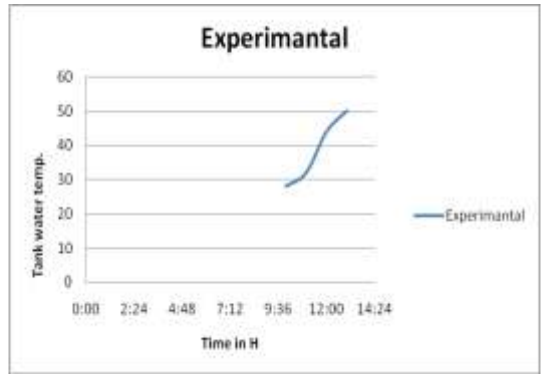
Sr.No.	Time In H	Water temp. at mass flow rate of water m= 0.09kg/sec	Water temp. at mass flow rate of water m= 0.06kg/sec	Water temp. at mass flow rate of water m= 0.045kg/sec
1	10:00	30	36	38
2	11:00	36	38	48
3	12:00	38	48	50
4	13:00	48	50	51



Graph .4.Hourly variation of outlet temperature by varying the mass flow rate of water in month of November 2012

Table .6

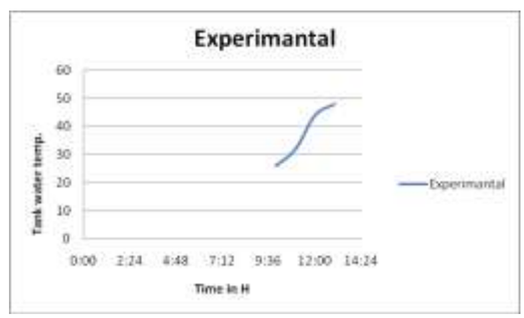
Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	28
2	11:00	32
3	12:00	44
4	13:00	50



Graph.5- Hourly variation of tank water temperature in month of September 2012

Table .7

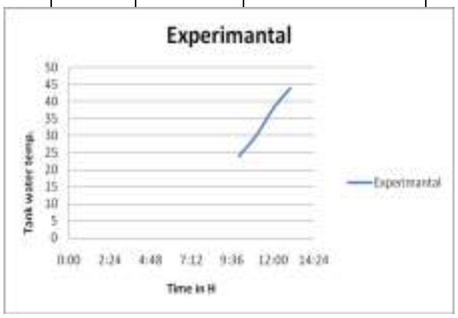
Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	26
2	11:00	32
3	12:00	44
4	13:00	48



Graph.6- Hourly variation of tank water temperature in month of October 2012

Table .8

Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	24
2	11:00	30
3	12:00	38
4	13:00	44



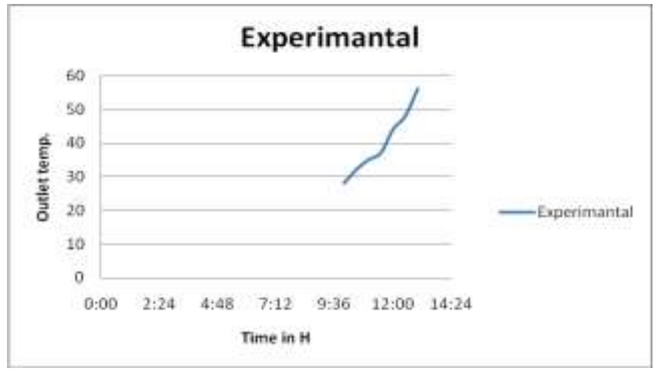
Graph.7- Hourly variation of tank water temperature in month of november2012

After change parameter in experimental setup in September 2012, October 2012, November 2012

Table.9

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	28
2	10:30	32
3	11:00	35
4	11:30	37
5	12:00	44
6	12:30	48
7	13:00	56

Ta =23 degree C

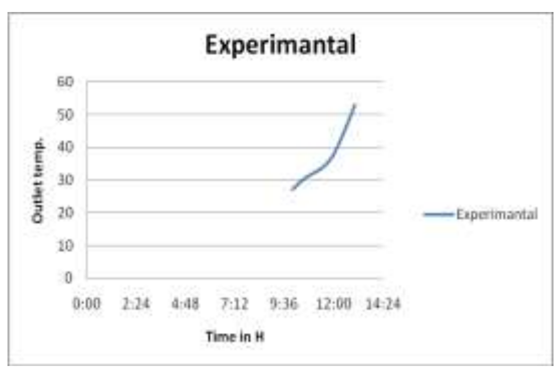


Graph .8– Hourly variation of outlet temperature in month of September 2012

Table.10

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	27
2	10:30	30
3	11:00	32
4	11:30	34
5	12:00	38
6	12:30	45
7	13:00	53

Ta =21 degree C

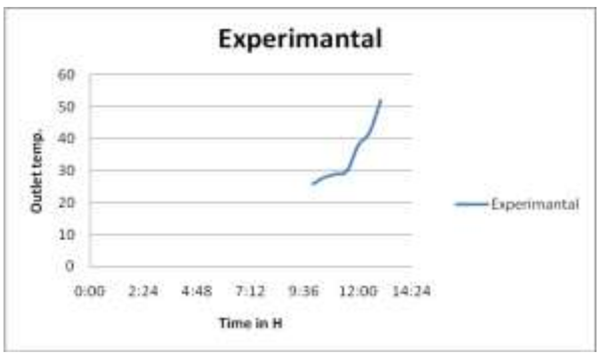


Graph .9– Hourly variation of outlet temperature in month of October 2012

Table.11

Sr. No.	Time in H	Outlet temperature in degree C
1	10:00	26
2	10:30	28
3	11:00	29
4	11:30	30
5	12:00	38
6	12:30	42
7	13:00	52

Ta =19degree C



Graph .10– Hourly variation of outlet temperature in month of November 2012

1- Tf = 48 Degree C = 23+273=321K

Ta = 23 Degree C = 23+273=296K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

Gain factor – 0.64, Loss factor = 5.18

I= 1353w/m^2

ή = 54.46%

2. Tf = 45 Degree C = 45+273=318K

Ta = 21 Degree C = 21+273=294K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

Gain factor – 0.64, Loss factor = 5.18

I= 1353w/m^2

ή = 54.83%

3. Tf = 42Degree C = 42+273=315K

Ta = 19 Degree C = 19+273=292K , At 12:30

$$\eta_i = (\propto \tau)_{eff} - U_L \frac{T_{fi} - T_a}{I(t)}$$

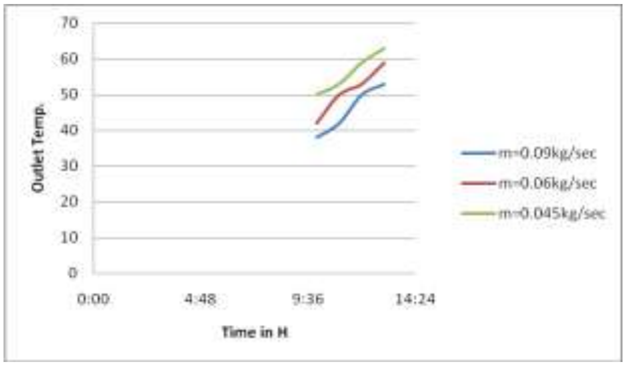
Gain factor – 0.64 ,Loss factor = 5.18

I= 1353w/m^2

ή = 55.24%

Table .12

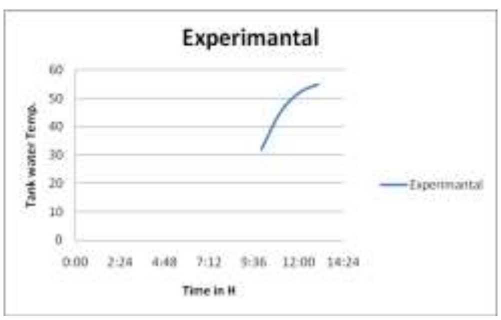
Sr.No.	Time In H	Water temp. at mass flow rate of water m= 0.09kg/sec	Water temp. at mass flow rate of water m= 0.06kg/sec	Water temp. at mass flow rate of water m= 0.045kg/sec
1	10:00	38	42	50
2	11:00	42	50	53
3	12:00	50	53	59
4	13:00	53	59	63



Graph .11– Hourly variation of outlet temperature by varying the mass flow rate of water in month of November 2012

Table .13

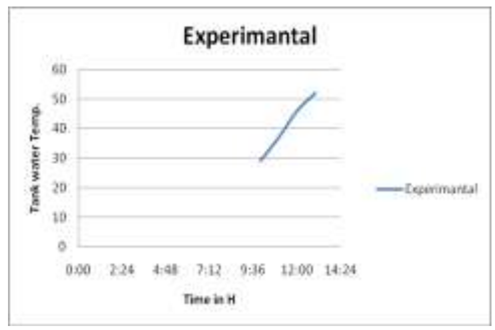
Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	32
2	11:00	45
3	12:00	52
4	13:00	55



Graph.12- Hourly variation of tank water temperature in month of September 2012

Table .14

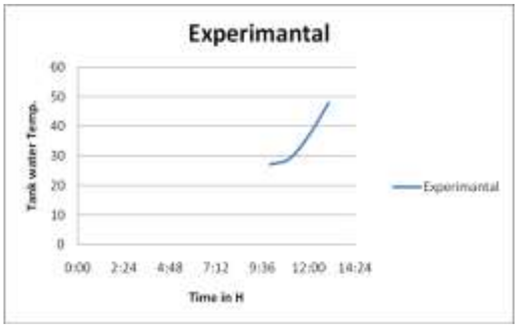
Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	29
2	11:00	37
3	12:00	46
4	13:00	52



Graph.13- Hourly variation of tank water temperature in month of October 2012

Table .15

Sr. No.	Time in H	Tank water temperature in Degree C
1	10:00	27
2	11:00	29
3	12:00	37
4	13:00	48



Graph.14- Hourly variation of tank water temperature in month of november2012

Conclusions

The results also indicate that there is a significant increase in the instantaneous efficiency 55.24 % due to increase in glazing area. This system can be installed at remote areas for fulfillment of hot water requirements. The paper is give the summery of experiment study of solar water heater with circulating pump and using of Aluminum tube. In this paper has the Experimental approach with circulating pump and using of aluminum tube in this Experimental study is also include the circulating pump, Glass, Insulator, Aluminum tube, water container, Base material.

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