International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 4, July-Aug-2019, ISSN (Online): 2395-566X

Enhancement of Free Convection Heat Transfer from Horizontal Rectangular Fin Array with antagonistic space& Stepped Rectangular Notch

PG Student P.S.More N.G.Narve
Department of Mechanical Engineering
Yashoda Technical Campus
Satara, MH, India

Emiritus Prof. N.K.Sane
Department of Mechanical Engineering
Walchand College of Engineering
Sangli, MH, India

Abstract **- Heat transfer thanks to free convection of air from compensative, full rectangular fin array are investigated through an experiment. For study purpose short fin array has been designated that show single chimney flow pattern. Middle portion of fin array becomes in effective thanks to vaso constrictor distinction between getting in to air &fin surface. Therefore in gift study, middle portion is removed bycutting rectangular notch and more wherever more recent air are available contact with fin expanse. Results are obtained over vary of spacing from 12mm to 25mm and warmth input from 25W to 100W. Length & height of rectangular fin array was unbroken constant. Comparison has been created between full, compensative rectangular fin arrays. it's found that full rectangular fin array performed higher of course.**

Keywords- **Fin arrays, Average Heat transfer coefficient, Free convection, Spacing.**

I. INTRODUCTION

Starner and McManus, Harahan and McManus, Jones and Smith, Mannan have studied the final drawback of free convection heat transfer from rectangular fin arrays on a level by experimentation and on paper by Sane and Sukhatme. Throughout their investigations, flow visual image studies have additionally been conducted and it's been recognized that the only chimney flow pattern was mostpopular from the warmth transfer stand purpose and was gift in most ofthe lengthwise short arrays utilized in observe.The present paper is consists of AN experimental study on horizontal rectangular short fin arrays with notch, while not notch at the middle & counteractive space on fin surface dissipating heat by free convection. just in case of one chimney flow pattern, the chimney formation is because of cold air getting into from the 2 ends of the channel flowing within the horizontal direction and developing a vertical speed flow of air because it reaches the center portion of fin channel leading to the heated plume of air getting in the upwarddirection Full & compensative fin arrays are investigated with totally different spacing & heat inputs.

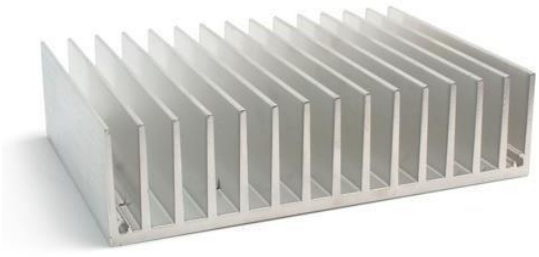

Fig.1 Rectangular fin array.

II. EXPERIMENTATION

The following procedure is used for the experimentation::

- The fin arrays are assembled by gluing the desired variety of fin plates by mistreatment epoxy resign and positioning the thermocouples at the suitable locations.
- Cartridge heaters (02 numbers) are placed in their position, connected in parallel with power circuit.
- Assembled array as on top of is placed within the slotted C4X insulating block.
- Thermocouples are placed within the C4X block for measurement conductivity loss. The assembled array with insulation is placed at center of associate degree enclosure.
- The determined heater input is given and unbroken constant byconnecting to stabilizer that is given dimmer stat voltage.
- The temperatures of base plate at totally different positions, C4X brick temperature and close temperature are recorded at the time intervals of fifteen min. up to steady condition. (Generally it takes two to three hours to achieve steady state condition).

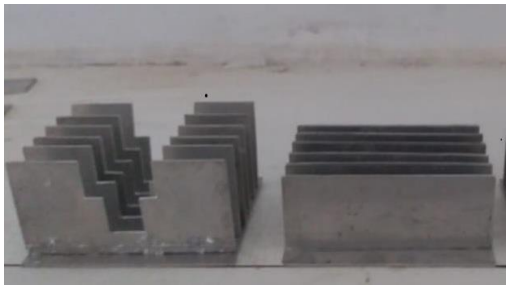

Fig.2 Fin Assembly

© 2019 IJSRET

International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 4, July-Aug-2019, ISSN (Online): 2395-566X

Table.1 Parameters of Experimentation

Spacing in mm	Heater input in watt	Length of fin array in mm	Height of fin array in mm
12	25	120	40
14	50		
18	75		
25	100		

Readings were recorded on reading table once the steady state was reached. Readings were taken a minimum of fourfold for four totally different configuration and heater input to confirm the validity and repeatability of readings. it's determined that variables for experimental work are spacing, heater input, and pure mathematics. Spacing are 12mm, 14mm, 18mm and 25mm. Heater inputs are 25watt, 50watt, 75watt & one hundred watt. The results were obtained from the observations.

Experimental Calculations

1. Conduction Loss =KA dTdx
2. Radiation Loss = □ □ A [Ts4 T□ 4]
3. Heat Transfer Coefficients = AΔTQ
4. Nusselt Number = hLK
5. Grashof number = gβ(Ts−T∞)Lc3
   U2

III. RESULT & DISSCUSSION

Results are obtained in terms of average heat transfer constant, base heat transfer constant, Heat loss, heat input etc.

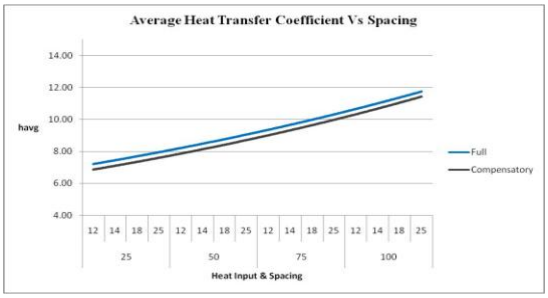

Fig.4 Graph of Average heat transfer coefficients Vs spacing.

Fig. 4 show the impact of fin spacing on ha with heater input because the parameter. Because the fin spacing will increase ha increases for full fin array, evidently. the best price of ha is thirteen.95 W/m2 K at the spacing of twenty five metric linear unit. The increasingtrend is steep upfrom
spacing concerning eighteen metric linear unit. Before that there's gradual rise. The trend of increase in ha and therefore within the Nusselt variety with fin spacing is determined just in case of the antagonistic array additionally with increase in ha values at each purpose. the total configurations yield higher values, therefore indicatingsuperiority over antagonistic fin arrays. Also fig.4 shows the relative performance of fin array with full that of antagonistic.

It's evident from the graph that angular distance can increase with the heater input, maintaining the prevalence of full array. it's clear that for the given heater input angular distance of full array is eight to 100% on high of corresponding antagonistic fin array. Average heat transfer constant of compensative fin array is 100%more than full fin array for 12mm spacing.. By doing information analysis, share increase in average
heat transfer constant of full fin array as compared with compensative fin array is augmented because the spacing will increase. it's last that fourteen metric linear unit spacing is simpler once comparison are created between compass active & full fin array.

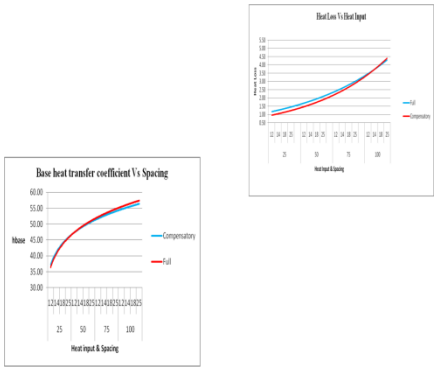

Fig.5 Graph of Base heat transfer coefficients Vs Spacing.

As Fig. 6 shows Heat input & spacing verses Heat loss. There are 2 losses 1) conduction loss 2) Radiation Loss. Heat loss is directly proportional to heat input & Spacing. As comparison has been done between losses, radiation losses are negligible. It shows that compensatory fin array has 16 % additional heat loss as compare to full fin array for spacing twelve millimeter. except for remaining spacing full fin array has 2-3% additional heat loss as compare to ant compensatory fin array.

It's ended that full fin array dissipated additional heat by conduction & radiation to close as compare to compensatory fin array. Fig. 5 show the effect of fin spacing on hemoprotein with heater input because the parameter. From the figure it's clear that the values of hemoprotein decreases as fin spacing will increase. It starts to its minimum worth at fin spacing regarding twelve metric linear unit and once more decreases step by step. This trend will be attributed to restriction of entry of air within the channel at smaller fin spacing. The trend of

© 2019 IJSRET

increase in base heat transfer constant with the maxima at a fin spacing
of fourteen metric linear unit is ascertained just in case of the total fin array. it's thus all over that performance of full fin array is amelioratory terms of base heat transfer constant. At thespacing of 18mm, hemoprotein is sort of sixty one W/m2 K for the total fin array and is of the order of fifty four W/m2 K for

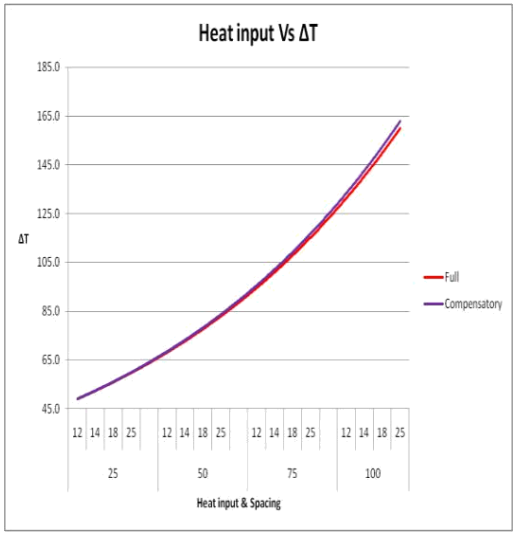

Fig.6 Graph of ΔT Vs Heat input

Temperature distinction between close & Base plate is directly proportional to heat input & spacing. consistent with Newton's law of Cooling, ΔT having giant price then Convection heat transfer is large. From fig. 6, it's shown that compensative fin array has giant temperature distincti on compare to full fin array as spacing is inflated. except for 12mm spacing compensative fin array has less temperature distinction as compare to full fin array. This shows that less spacing develop obstruction to flow of air over fin & ineffective section because of same temperature of fin & close. Best fin spacing ought to be fourteen to twenty millimetre that temperature distinction is giant. th us heat is transferred to encompassing is giant.

IV. CONCLUSION

The problem of free convection heat transfer from horizontal rectangular fin array has been the subject of experimental as well as theoretical studies. The important findings of the experimentation are as follows:

- Single chimney flow pattern rumored to be most well-liked by earlier investigators is maintained within the notched fin arrays moreover by activity easy smoke tak e a look at.
- Study shows that full horizontal rectangular fin array is more practical than that compensative fin array.
- Rise in angular distance for full fin arrays exhibit 8-10% above corresponding compensative fin array configuration.
- Average Nusselt variety for full fin arrays is 8- 10% above corresponding compensative fin array.
- hemoprotein &Base Nusselt variety is endlessly decreas ing with increase in spacing for compensative fin array.
- hemoprotein & Base Nusselt variety is high at spacing 14mm & then decreasing with increase in spacing for full fin array.

Nomenclature

A Cross Sectional Area of C4X bricks dxdt Temperature Gradient along bricks
Emissivity of Brick
Stefan Boltzmann's constant g Acceleration due to gravity
β Coefficient of volume expansion
Ts Average Temperature of fin surface T∞ Temperature of Air
Ʊ Kinematic viscosity of air
K Thermal Conductivity of C4X bricks

REFERENCES

1. N.G.Narve1, N.K.Sane2, R.T.Jadhav3, 'Free convection Heat Transfer from symmetrical triangular fin arrays on vertical surface'. International Journal of scientific & Engineering analysis, Volume 4, Issue 5, May 2013.
2. Starner K. E. and McManus H. N.: 'An experimental investigation of free convection heat transfer from rectangular fin arrays',Journal of warmth Transfer, Trans ASME, series C,85,273(1963).
3. Harahan, F and. McManus H. N: 'Free convection heat transfer from horizontal rectangular fin arrays', Journal of warmth Transfer, Trans ASME, series C,89, 32(1967).
4. Jones C. D. and Smith L. F.: 'Optimum arrangement of rectangular fins on horizontal surfaces without charge convention heat transfer', Journal of warmth Transfer, Trans ASME, series C,92,6(1970).
5. Sane N.K. and Sukhatme S.P., Free convection heat transfer from horizontal rectangular fin arrays, in: Proc. Of fifth International Heat Transfer Conference Tokyo, Japan, Vol. 3, NC3.7, pp. 114–118, 1974.
6. Sane N. K., Kittur M. B. and Magdum J.D.: 'Free convection heat transfer from horizontal rectangular fin arrays with an oblong notch at the centre', proceedings of initial ASME ISHMAT Conference and twelfth National heat and mass transfer conference, R.E.C. Suratkal, paper No. HMT-94-046 343-348. (January 1994).
7. Shalaby M.A.I., Gaitonde U. N. and Sukhatme S. P.: 'Free convection heat transfer from rectangular fin arrays', Indian Journal of Technology, 22,321.(1984).
8. Cohen-Bar and Rohsenow W.M.: 'Thermally best spacing of vertical, natural convection cooled, parallel plates', ASME Journal of warmth Transfer 106 116–123,(1984).
9. Sane N.K. and Sukhatme S.P., Natural convection heat transfer from horizontal rectangular fin arrays, in Proc. Of fifth International Heat Transfer Conference,

Tokyo, Japan, Vol. 3, NC3.7, pp. 114–118, 1974.
10. Shalaby M.A.I., Natural convection heat transfer from rectangular fin arrays, Ph.D. Thesis, I.I.T. Mumbai, India, (1983).
11. Shalaby M.A.I., Gaitonde U. N. and Sukhatme S. P.: 'Natural convection heat transfer from rectangular fin arrays', Indian Journal of Technology, 22,321. (1984).
12. Karagiozis A.N.: 'An examination of bedded fre convection heat transfer from equal finned surface', PhD thesis, Universityof Waterloo.(1991).

© 2019 IJSRET