

**ANALYSIS AND OPTIMIZATION  
OF  
SOLAR COLLECTORS FOR HEATING OF FLUIDS**

by  
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\* TO MY GRANDFATHER \*  
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to

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## ABSTRACT

The present thesis focuses on various design aspects of flat-plate solar collectors, which do affect the performance of the system to a great extent. On the basis of theoretical computer models, few design parameters are optimized which are justified experimentally afterward in some cases.

Various heat losses from flat-plate collector are studied and mathematical relations are derived for selecting the optimum gap according to the temperature requirement. A criteria for using the heavy gases in the enclosed space between glass cover and absorber plate is proposed. The effect of internal spacing of glass covers is studied and a new two glass cover system is proposed in which the upper enclosed space is evacuated. This study may be useful in tubular collectors.

An indoor calorimetric test set-up is made to study the conductance of the pipe/fin junction in flat-plate collectors and various type of bonds are tested experimentally.

The effect of various design parameters and different duct shapes is studied thoroughly and on the basis of computed results a most cost-effective system is evolved.

A transient study of the compact built-in-storage water heater is carried out and effect of glazing, depth of storage tank, insulation cover and baffle plate is studied. In all the cases the optimum depth of the storage tank is found out. Theoretical results are also tested experimentally.

A new and simple polynomial is suggested for the theoretical computation of instantaneous solar radiation.

A transient study of the flat-plate air heater is done and the effect of thermal capacity of various collector nodes, effect of heat transfer coefficients and flow rate etc. is studied. Three different type of air heaters are tested experimentally and their thermal performances are compared.

## TABLE OF CONTENTS

	<u>Page No.</u>
ABSTRACT	1 - 2
<u>CHAPTER - 1</u>	
GENERAL INTRODUCTION	1 - 23
<u>CHAPTER - 2</u>	
CALCULATION AND MINIMIZATION OF HEAT-LOSSES FROM FLAT-PLATE COLLECTOR	24 - 68
2.1 INTRODUCTION	24
2.2 OVERALL HEAT-LOSS COEFFICIENT FROM FLAT-PLATE COLLECTORS	26
2.3 EFFECT OF VARIOUS OPERATING CONDITIONS ON THE OVERALL EFFICIENCY OF THE COLLECTOR	31
2.4 EFFECT OF GAP SPACING	38
2.4.1 Effect of Gap Spacing on Heat Losses	38
2.4.2 Heat Losses in a Single Cover System	42
2.4.3 Heat Losses in a Two Cover System	45
2.4.4 Effect of the Internal Spacing of Covers	48
2.4.5 The Heat Conductance Curve	50
2.5 SELECTION OF ALTERNATE MEDIUMS	50
2.6 PARTIALLY EVACUATED COLLECTORS	54
2.7 CONCLUSION	57
2.8 NOMENCLATURE	60
2.9 REFERENCES	64

CHAPTER - 3

STUDIES ON BOND-CONDUCTANCE IN FLAT-PLATE COLLECTOR	69 - 101
3.1 INTRODUCTION	69
3.2 THE FLAT-PLATE COLLECTOR	70
3.3 EFFECT OF BOND-CONDUCTANCE ON THE EFFICIENCY	77
3.4 CHOICE OF FIN MATERIAL	83
3.5 CHOICE OF PIPE MATERIAL	85
3.6 PIPE LOCATION	86
3.7 THEORY OF THE EXPERIMENT	86
3.8 INDOOR CALORIMETRIC TEST	89
3.9 RESULT	92
3.10 CONCLUSION	96
3.11 NOMENCLATURE	98
3.12 REFERENCES	100

CHAPTER - 4

OPTIMIZATION OF FIN AND TUBE PARAMETERS IN FLAT-PLATE COLLECTOR	102 - 130
4.1 INTRODUCTION	102
4.2 COLLECTOR THERMAL EFFICIENCY	103
4.2.1 Plate Efficiency Factor	103
4.2.2 Cost of the Collector	104
4.3 COLLECTOR SYSTEM	106
4.4 FILM HEAT TRANSFER COEFFICIENT	106

	<u>Page No.</u>	
4.5	RESULT AND DISCUSSION	113
4.6	OPTIMUM COLLECTOR CONFIGURATION	124
4.7	NOMENCLATURE	126
4.8	REFERENCES	128
<u>CHAPTER - 5</u>		
PARAMETRIC STUDIES ON BUILT-IN-STORAGE SOLAR WATER		
HEATER		
		131 - 186
5.1	INTRODUCTION	131
5.2	DESIGN OF BUILT-IN-STORAGE WATER HEATER	133
5.3	EXPERIMENTAL SET-UP	134
5.4	THEORETICAL STUDY	135
	5.4.1 Transient Study Without any Insulation Cover.	
	Case-1 : With single glazing	140
	Case-2 : With double glazing	141
	5.4.2 When System is Covered with Insulation	144
	5.4.3 When System is Having a Baffle Plate	147
5.5	RESULT AND DISCUSSION	159
5.6	CONCLUSION	179
5.7	NOMENCLATURE	182
5.8	REFERENCES	185

CHAPTER - 6

ANALYSIS, DESIGN AND TESTING OF SOLAR AIR HEATERS	187 - 240
6.1 INTRODUCTION	187
6.2 SOLAR RADIATION REPRESENTATION	
6.2.1 Introduction	189
6.2.2 Analysis	190
6.2.3 Conclusion	198
6.3 TRANSIENT ANALYSIS OF SOLAR AIR HEATERS	
6.3.1 Introduction	204
6.3.2 Analysis	206
6.3.3 Results and Discussions	212
6.3.4 Conclusion	219
6.4 EXPERIMENTAL STUDIES OF SOLAR AIR HEATERS	
6.4.1 Introduction	219
6.4.2 The Performance Equation	222
6.4.3 Types of Air Heaters Tested	224
6.4.4 Experimental Study	228
6.4.5 Results and Discussions	229
6.4.6 Conclusion	235
6.5 NOMENCLATURE	236
6.6 REFERENCES.	238

BIO-DATA