STUDENT'S DECLARATION

I hereby certify that the work which is being presented in the major project entitled **"Effect of Fouling on Performance of Vapour Compression Refrigeration System"** in partial fulfilment of the requirements for the award of the degree of Master of Engineering in Thermal Engineering, submitted to the department of Mechanical Engineering, is an authentic record of my own work carried under the supervision of **Dr. Akhilesh Arora, Asstt. Professor** of Mechanical Engineering Department, Faculty of Technology, University of Delhi, Delhi.

I have not submitted the matter embodied in this major project as whole or in part, for the award of any other degree.

NAVEEN SOLANKI

ME (Thermal Engineering)

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CERTIFICATE

Date: ___________

This is to certify that the dissertation entitled **"Effect of Fouling on Performance of Vapour Compression Refrigeration System"** submitted by **Mr. NAVEEN SOLANKI (**01/THR/ME/PT/09), (**University Roll. No.14041**) in partial fulfilment for the award of the Degree of Master of Engineering in Thermal Engineering of University of Delhi, is an authentic record of student's own work carried out by him under my guidance and supervision. He has completed his work with utmost sincerity and diligence.

The work embodied in this major project has not been submitted for the award of any other degree to the Best of my knowledge.

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ABSTRACT

In the present work effect of fouling on performance of a simple vapour compression system has been evaluated by varying condenser coolant inlet temperature $T_{in,cond}$ (i.e. 35^{o}C, 37.5 ^{o}C and 40 ^{o}C), and also by varying condenser and evaporator conductances individually, and simultaneously between 0% to 50% for refrigerants R134a, R1234yf, and R1234ze, While keeping the $T_{in,evap}$, efficiency of compressor constant. A computer program has been made in EES for simulation purpose. The same has been validated with literature available before calculating the results. The effect of condenser and evaporator fouling simultaneously with variation in condenser coolant temperature decreases the COP more as compared to condenser and evaporator fouling individually, while condenser fouling has larger effect on compressor power with variation of condenser coolant inlet temperature $T_{in,cond}$. The second law efficiency also decreases with decrease in condenser and evaporator conductances of the system.

The data generated and presented reduces the amount of experimentation and helps to reliably predict relevant quantities for the vapour compression refrigeration system by combining data from each of the heat exchangers at fouled conditions to predict those same quantities in more complex fouled condition.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

NOMENCLATURE

C	Minimum value of the thermal capacitance rate (kWK^{-1})
CFCs	Chloro-fluoro-carbons
COP	Coefficient of performance
EES	Engineering equation solver
EOS	Equation of state
GWP	Global warming potential
HCFCs	Hydro-chloro-fluoro-carbons
HFO	Hydro-Fluoro-Olefin
m	Refrigerant mass flow rate (kg s^{-1})
mod	Model
υ	Specific volume (m^3 kg^{-1})
ODP	Ozone depletion potential
P	Pressure (MPa)
Q	Rate of heat transfer (kW)
T	Temperature (K)
UA	Overall conductance (kWK^{-1})
VCRC	Vapour compression refrigeration cycle
VCRS	Vapour compression refrigeration system
W	Power requirement (kW)

Greek

η	Efficiency (%)
Є, Epsilon	Heat exchanger effectiveness

Subscripts

act	Actual
cl	Clean condition
cd, cond	Condenser
cp	Compressor
dl	Discharge line
e	Exergy
error	Percentage error
ev, evap	Evaporator
f	Fouled condition
in	Entering
isn	Isentropic
min	Minimum
mod	Model
ref	Refrigerant
rev	Reversible cycle
sl	Suction line
th	Thermal
I	First-law
II	Second-law

1	Condenser exit state
2	Evaporator inlet state
4	Compressor inlet state
6	Condenser inlet state
7	Air inlet state in evaporator
8	Air outlet state in evaporator
9	Coolant inlet state in condenser
10	Coolant outlet state in condenser