International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

PERFORMANCE ANALYSIS OF DOMESTIC REFRIGERATION USING TEST RIG

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Abstract - *Refrigeration is one of the most equipment used in home appliances utilizing vapor compression cycle in its process. In this experiment used Domestic Refrigerator R-134a, 185 liter capacity to perform its operation. The main objective of this experiment is to find out coefficient of performance of refrigerator and Actual COP , Avg. COP etc. In this experiment we used Refrigerant R-134a to calculate the COP at particular time and measure temperature and pressure. The project setup run in 2 hrs to evaporate refrigeration measure for COP of Domestic Refrigeration. The thermocouple and pressure gauge are used to measure temperature and pressure of all unit. Four thermocouple J and K type PT 100 is used to measure temperature and Burdontubed type pressure gauge is used to measure pressure at Inlet and outlet of the compressor. The heater plate is used to reduce the temperature in the refrigeration to varying load.*

Key words: **R-134a, Refrigerator, thermocouple, COP, Refrigerator Test Rig.**

1. INTRODUCTION

Refrigeration is used to produced cooling in combining of all compartment together and cooling effect produced by vapour compression cycle. Refrigeration is used to preserve the food and storage to spoilage of food . Refrigeration are used to remove heat from body at lower temperature to transfer the heat at high temperature body on expense external work supplied. vapour Compression Refrigeration cycle working substance is known as refrigerator R-143a is used to remove the heat and cooling substance. The refrigerator is employing the isentropic compression at lower pressure by Refrigeration. Compressor is a mechanical device used to compress the Refrigeration from leveling the evaporator at low pressure temp region and discharge to high pressure. Condenser is rejecting the heat to atmosphere from a Refrigeration process. Then expansion valve is throttle to control refrigerant flow to condenser to evaporator or in closed space. Expansion valve is called capillary tube. Then evaporation process is absorbing the heat from a refrigerated space and refrigerant against convent liquid to vapour and process completed and recycle.

Actual COP is defined as amount of heat absorbed by unit mass of refrigerant in the Evaporator.

Q act = V * I

Work of compression is defined as the amount of refrigeration occurred in Evaporator, required to compressor work.

Wc = (10/3200)*(3600/Time for 10 blinks)

Then,

COP = Qact / Wact

Again, theoretical COP we get,

COP th = m(h1-h4) / m(h2-h1)

COP th = (h1-h4)/(h2-h1)

The experiment set up test rig is used to analyze the performance of Domestic Refrigeration test rig .

2. PROBLEM STETMENT

Nowadays, refrigeration system is important in a wide variety used for domestic application . However, the actual performance of the refrigerator still unknown. So, we need some research to analyze the actual performance of refrigerator.

3 EXPERMENTAL SETUP

The experiment was conducted sequenced by ranking all of data manually given. The all four temperatures of point of thermocouple wire are connected to j-and k type thermocouple scanner. The thermocouple is temperature is measured at particular point such a vapour compression cycle . The temperature is measured between point is time increase is object that stable the reading on temperature indicator. Backside of test rig panel is connected the pressure gauge on suction side and discharge side of compressor to measure the pressure at vaccume and discharge .The data was recorded at time interval that load is provided in the domestic refrigerator by heater.

4 EXPRERIMENT PROCEDURE

- Put the machine proper position where it level is vertical well leveled and ventilared and machine must have at least 1.5m clearance from all sides.
- Apply 230v,50Hz of 1 phase supply to switch.
- Put the main switch ON.
- Start the refrigerator ny putting switch ON.
- Put heater switch ON. However it willnot give supply to heater on the thermometer will cut out.
- Run the system minimum 1 Hr.
- Record all reading according to as per observation table.
- Not down reading after regular interval of time as 5min.
- Calculate the result as per the procedure mentioned.
- Repeat the same procedure.

5 OBSERVATION TABLE

LOAD	LOW	MEDIUM	HIGH
T1	-4	-8.4	-6.5
T2	76	86	90.6
T3	49	54.5	53
T4	-10	1.5	4.8
SUCTION PRESSURE	11=0.75862	15=1.0344	17=1.1724
DISCHARGE PRESSURE	325=22.4138	380=26.206	410=28.27
TIME FOR 10 PULSES	90	86	80
V	120	145	180
I	0.21	0.26	0.32
Q =(V*I)	25.2	37.7	57.6

6 SAMPLE CALCULATION

T1=After Evaporation

T2=After Compration

T3=After Condantion

T4=After Expansion

The load varies from 25.2 watt

Suction pressure = 11psi =0.7586 bar

Discharge pressure = 325psi = 22.41 bar

Time for 10 blings = 90 sec

V = 120

I = 0.21

- Q = V * I = 25.2 watt
- Work of compressor
  Wc = (10/3200)*(3600/time required for 10 blings in sec)
  Wc = 125 watt

- Actual COP
  COPact = Q/Wc = 0.2.2

- Therotical COP = (h1-h4/h2-h1)
  COPth = Qact/Wact = 2.2777

- Carnot COP
  COPcarnot = (T lowest) / (T highest-T lowest)

- Relative COP = COPact / COP th
  =0.0885

- EER = 3.412 * COP act
  = 0.6879
- SEER = 1.12-[(1.2544-0.08*EER)^1/2 /(0.04)]

  SEER = 0.621

7 RESULT TABLE:

LOAD	LOW	MEDIUM	HIGH
RE act	25.2	37.7	57.6
W act	125	130.8	140.6
COP act	0.202	0.288	0.41
H1	386	245.72	246.92
H2	440	306.93	312.29
H3=H4	263	129.6	127
RE th	123	116.12	119.92
W th	54	61.21	65.37

COP th	2.2777	1.8970	1.8344
T lowest	269	264.6	266.5
T highest	349	359	363.6
COP carnot	3.363	2.803	2.745
COP relative	0.0885	0.1519	0.2233
EER	0.6892	0.9834	1.3978
SEER	0.6227	0.8915	1.2782

8 CONCLUSION

The performance of domestic refrigerant testing was evaluated with indicating COP and refrigeration effect is calculated by ranging of 20kw to 60kw. From result table concluded that COP act is less than COP th.

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