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Experimental Accomplishment with Monitoring of COP and TR for HR12 Vapour Compression Refrigeration System

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Abstract: ***Experimentations remain endowed for examining effect of HR12 refrigerant on system accomplishment with monitoring in terms of COP and TR. Temperature and pressure got measured by different temperature and pressure gauges mounted at several predetermined locations. Additionally, power consumption by refrigeration system also got measured from the installed energy meter readings. Altogether, it summarizes the tabular inscriptions of the variations of COP_{th}, COP_{act} and COP_{rel} with TR for HR12 refrigerant. Besides, it also demonstrates the graphical representation of the corresponding variations of COP_{th}, COP_{act} and COP_{rel} with TR for HR12 refrigerant. As expected, it stands observed (from both the stated table and figure) that both COP_{th} and COP_{act} increase with TR, however, the COP_{rel} decreases with the same for said HR12 refrigerant. Furthermore, the stated variations of COP_{th}, COP_{act} and COP_{rel} with TR remain observed as approximately linear, independently. That's why, both COP_{th} and COP_{act} stand directly proportional to TR, however, the COP_{rel} stands inversely proportional to the same owing to almost linear relationship between the COP_{th}, COP_{act} and COP_{rel} with TR, separately.***

Index Terms: ***HR12 Refrigerant, COP, TR, Experiment, Accomplishment, Refrigeration System.***

I. INTRODUCTION

Vapour compression refrigeration stays as the ultimate noteworthy exercise for removal of heat in chilling of any kind of items/goods. It is a cooling practice where coefficient of performance (COP) and tons of refrigeration (TR) of preferred pressure and temperature gets produced through removal of heat using refrigerants. Refrigeration practices remain influenced through external power supply to the unit. Here, cooling ensues on account of combined heat amputation from the refrigeration system.

Important aim of refrigeration exercises remain to hold goods/items for receiving coldness of desired COP and TR using HR12 refrigerant throughout its epoch. In refrigeration practices, the major concern of customer requirements is coldness. COP and TR remain primarily outcomes of process parameters (refrigerating conditions) pressure and temperature. Numerical or experimental evaluations on COP with TR remain extant in collected works [1-7].

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Computational and experimental researches stand also described [8-44]. Present investigation stays as exploring the influence of HR12 refrigerant on COP and TR for the stated refrigeration system. Study includes determination of best levels of thermal parameters for getting ideal the COP and TR using first principle. Besides, thermal variables (i.e. P and T) stand correlated with accomplishment results (COP with TR).

II. TEST ARRANGEMENT

Preparation elucidates enthusiastically about the basics of modern refrigeration system block diagram along with experimental setup components.

A. Description of Block Diagram of Refrigeration System

Figure 1 describes the colorful block diagram of refrigeration system. It involves compressor, condenser, expansion device and evaporator, sequentially.

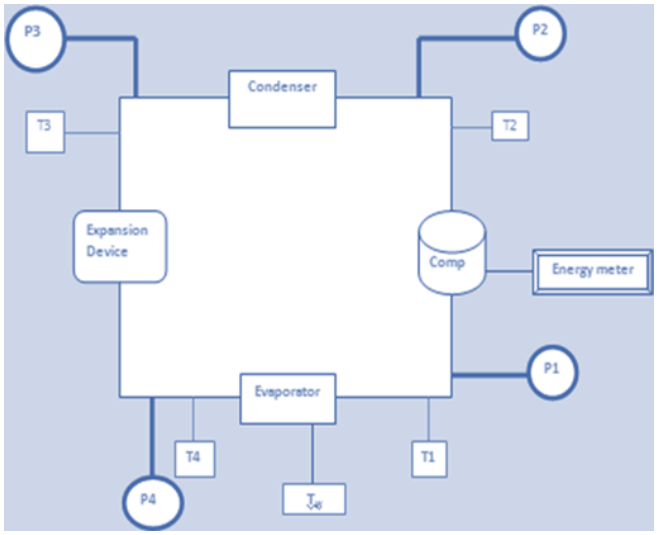

Figure 1. Representation of block diagram of refrigeration system

B. Depiction of Components of Experimental Setup

It encompasses accounts of the colorful components of the experimental setup. The exploded colorful photos of compressor, condenser, dryer and capillary tube are illustrated in figures 2 to 5, respectively. These components are fabricated and assembled to produce the desired experimental setup concerning with the refrigeration system.

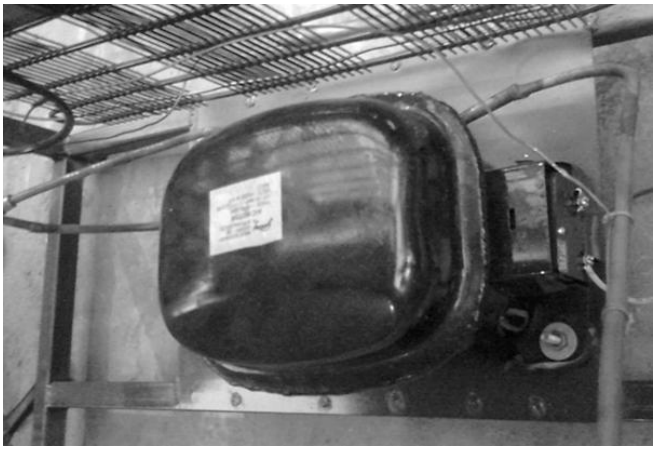

Figure 2. Exploded photo of compressor

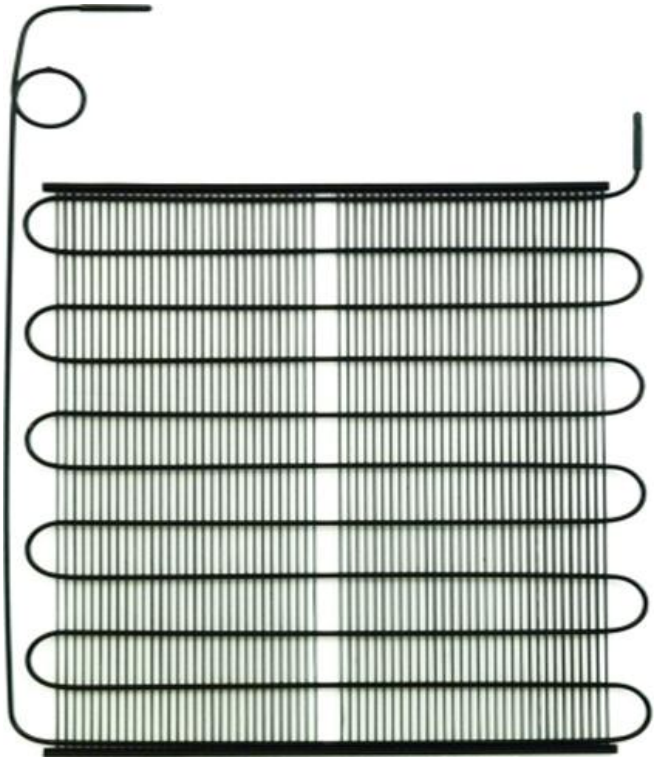

Figure 3. Exploded photo of condenser

Figure 4. Exploded photo of dryer

Figure 5. Exploded photo of capillary tube

III. EXPERIMENTAL PRACTICES

It entangles the apparatus readings of under declared variables.

A. Measurement of Pressure

Pressure stand measured by both high pressure (0 to 35 kg/cm^2) and low pressure (-2 to -10 kg/cm^2) gauges (mounted at different predetermined locations) as depicted in figures 6 and 7, respectively.

Figure 6. Exploded photo of high pressure gauge

Figure 7. Exploded photo of low pressure gauge

B. Measurement of Temperature

Temperature stand measured by different mercury thermometers (-50ºC to 360ºC) mounted at several predetermined locations.

IV. RESULTS AND DISCUSSIONS

Experiments stand performed for investigating the influence of HR12 refrigerant on system accomplishment with monitoring in terms of COP and TR. Temperature and pressure got measured by different temperature and pressure gauges mounted at several predetermined locations. Additionally, power consumption by refrigeration system also got measured from the installed energy meter readings. Like this 5 such observations got obtained with half an hour time interval between the 2 consecutive intervals. After finishing all such observations and noting down related data, power supply to refrigeration system got switched off. Subsequently, the stated refrigerant got discharged from the compressor for making the system once again ready if required to accomplish experiments by filling or introducing another refrigerant.

Effects of HR12 Refrigerant on Accomplishment of Refrigeration System

As already described HR12 refrigerant got introduced into the compressor of the stated refrigeration system. It is aimed at critically examining the effect of HR12 on accomplishment of the said refrigeration system in terms of COP and TR.

A. Variations of COP_{th} with TR for HR12 Refrigerant

Table 1 précises the tabular inscriptions of the variations of COP_{th} with TR for HR12 refrigerant. Figure 8 also demonstrates the graphical representation of the corresponding variations of COP_{th} with TR for HR12 refrigerant. As expected, it stands observed (from both the stated table and figure) that the COP_{th} increases with TR for said HR12 refrigerant. Furthermore, the stated variations remain observed as approximately linear. In other words the COP_{th} stays directly proportional to TR because of approximately linear relationship between the COP_{th} and TR.

Table 1. The COP_{th} of HR12 refrigerant at different TR

COP_{th}	9.33	7.9	7.8	6.3	5.12
TR	0.198	0.169	0.16	0.134	0.109

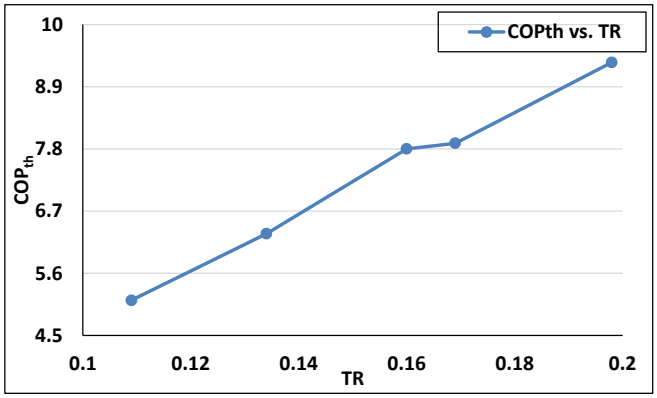

Figure 8. COP_{th} vs. TR with HR12 refrigerant

B. Variations of COP_{act} with TR for HR12 Refrigerant

Table 2 précises the tabular inscriptions of the variations of COP_{act} with TR for HR12 refrigerant. Figure 9 also demonstrates the graphical representation of the corresponding variations of COP_{act} with TR for HR12 refrigerant. As expected, it stands observed (from both the stated table and figure) that the COP_{act} increases with TR for said HR12 refrigerant. Furthermore, the stated variations remain observed as approximately linear. In other words the COP_{act} stays directly proportional to TR because of approximately linear relationship between the COP_{act} and TR.

Table 2. The COP_{act} of HR12 refrigerant at different TR

COP_{act}	2.251	2.167	2.19	2.22	2.08
TR	0.198	0.169	0.16	0.134	0.109

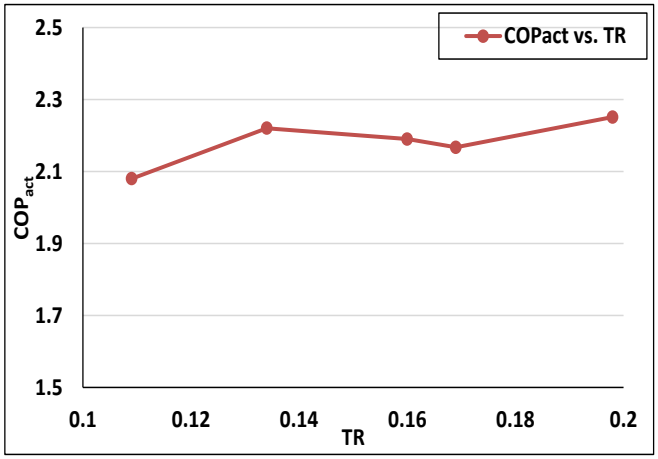

Figure 9. COP_{act} vs. TR with HR12 refrigerant

C. Variations of COP_{rel} with TR for HR12 Refrigerant

Table 3 précises the tabular inscriptions of the variations of COP_{rel} with TR for HR12 refrigerant. Figure 10 also demonstrates the graphical representation of the corresponding variations of COP_{rel} with TR for HR12 refrigerant. As expected, it stands observed (from both the stated table and figure) that the COP_{rel} decreases with the increase of TR for said HR12 refrigerant. Furthermore, the stated variations remain observed as approximately linear. In other words the COP_{rel} stays inversely proportional to TR because of approximately linear relationship between the COP_{rel} and TR.

Table 3. The COP_{rel} of HR12 refrigerant at different TR

COP_{rel}	0.24	0.27	0.28	0.35	0.41
TR	0.198	0.169	0.16	0.134	0.109

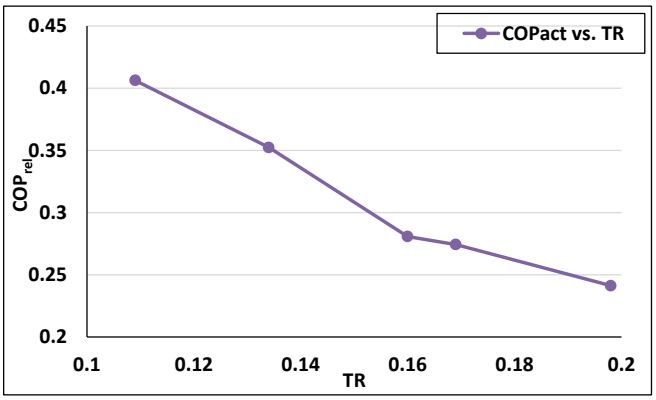

Figure 10. COP_{rel} vs. TR with HR12 refrigerant

V. CONCLUSION

Experimentations stand performed for investigating influence of HR12 refrigerant on system accomplishment with monitoring in terms of COP and TR. Temperature and pressure got measured by different temperature and pressure gauges mounted at several predetermined locations. Additionally, power consumption by refrigeration system also got measured from the installed energy meter readings. Altogether, it summarizes the tabular inscriptions of the variations of COP_{th}, COP_{act} and COP_{rel} with TR for HR12 refrigerant. Besides, it also demonstrates the graphical representation of the corresponding variations of COP_{th}, COP_{act} and COP_{rel} with TR for HR12 refrigerant. As expected, it stands observed (from both the stated table and figure) that both COP_{th} and COP_{act} increase with TR, however, the COP_{rel} decreases with the same for said HR12 refrigerant. Furthermore, the stated variations of COP_{th}, COP_{act} and COP_{rel} with TR remain observed as approximately linear, individually. That's why, both COP_{th} and COP_{act} remain directly proportional to TR, however, the COP_{rel} remains inversely proportional to the same on account of nearly linear relationship between the COP_{th}, COP_{act} and COP_{rel} with TR, exclusively.

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