A major application area of thermodynamics engineering

A major application country of thermodynamics is infrigidation, which is the transportation of heat from lower temperature part to a higher temperature one. The devices that produce infrigidation are called iceboxs, and the rhythms on which they operate are called infrigidation rhythms. The most often used infrigidation rhythm is a vapour-compression infrigidation rhythm in which the refrigerant is vaporized and compressed instead and is compressed in the vapour stage. There are figure of refrigerants which can be used in here, but the most normally used on a commercial graduated table is a R12 (used in this experiment every bit good) .

The thermodynamics of ideal vapour compaction rhythm can be analyzed on a temperature versus

information diagram as depicted in Figure 1. At point 1 in the diagram, the go arounding refrigerating en-

ters the compressor as a concentrated vapor. From point 1 to indicate 2, the vapor is isentropically

compressed (i. e. , compressed at changeless information) and exits the compressor as a superheated va-

pour. From point 2 to indicate 3, the superheated vapor travels through portion of the capacitor which removes the superheat by chilling the vapor. Between point 3 and point 4, the vapor travels through the balance of the capacitor and is condensed into a concentrated liquid. The condensation procedure occurs at basically changeless force per unit area.

Between points 4 and 5, the concentrated liquid refrigerant passes through the enlargement valve

(restricting device) and undergoes an disconnected lessening of force per unit area. This procedure consequences in the adia-

batic flash vaporization and auto-refrigeration of a part of the liquid (typically, less than half

of the liquid flashes) . The adiabatic flash vaporization procedure is isenthalpic (i. e. , occurs at con-

stant heat content) .

Figure 12 Temperature – Information diagram

1 World Wide Web. wikipedia. org/wiki/Refrigeration

2 hypertext transfer protocol: //upload. wikimedia. org/wikipedia/commons/f/f7/RefrigerationTS. png

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Between points 5 and 1, the cold and partly vaporized refrigerant travels through the spiral or tubings in the evaporator where it is wholly vaporized by the warm air (from the infinite being refrigerated) that a fan circulates across the spiral or tubings in the evaporator. The evaporator operates at basically changeless force per unit area. The ensuing concentrated refrigerating vapor returns to the compressor recess at point 1 to finish the thermodynamic rhythm.

The country under the procedure curve on T-s diagram represents the heat transportation for internally reversible procedures. The country under the procedure curve 5-1 represents the heat soaking up in the evaporator, the country under the procedure 2- 4 represents the heat rejection in the capacitor. In the ideal vapour compaction infrigidation rhythm all the heat losingss and breaks are being ignored, but in existent infrigidation rhythm, we need to take these losingss into consideration as they have been mentioned in this study subsequently.

The Hilton infrigidation research lab unit R714 is capable of following entities ;

i,· Investigation of the fluctuation in icebox " responsibility " or chilling ability for assorted condens-

ing temperature and the heat delivered to the chilling H2O with fluctuation in distilling

temperature. We can besides look into the fluctuation in infrigidation coefficient of per-

formance for the assorted condensation temperature.

i,· Investigation of the fluctuation in coefficient of public presentation based on electrical, shaft and

indicated power, finding of the overall heat transportation coefficient for the capacitor chilling spiral and public presentation of the thermostatic enlargement valve.

i,· Investigation of the heat delivered to the chilling $H2O$ with fluctuation in distilling tem-

perature, coefficient of public presentation as a heat pump for assorted distilling temperature,

every bit good as power input based on electrical, shaft and indicated power.

The of import facet of this study is to show the two Torahs of thermodynamics i. e.

foremost and 2nd jurisprudence of thermodynamics. The first jurisprudence is merely an look of the preservation of energy rule, and it asserts that energy is thermodynamic belongings.

$Q_{out} = W_{net} + Q_{in}$ Equation (1)

In this experiment the Qin is provided by input electromotive force, this input is used to make the net work done on the refrigerant by compressor and motor, and the consequence of this produces the heat which is being removed by the capacitor i. e. Qout.

The 2nd jurisprudence of thermodynamics asserts that energy has quality and measure, and existent procedures occur in the way of diminishing quality of energy.

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Aim ‘ s and aims: –

The Hilton infrigidation research lab unit R712 has been designed to let pupils to to the full look into the public presentation of a vapour compaction rhythm under assorted conditions of evaporator burden and capacitor force per unit area.

The chief aims of this research lab are listed below ;

i,· The presentation of application of the “ First and 2nd jurisprudence of thermodynamics ” .

i,· The debut of to infrigidation works and cipher the assorted coefficient of perform-

ance.

i,· Investigation of system losingss, this includes motor, compressor, evaporator and con-

denser losingss. These losingss (clash, heat losingss) occur merely in practical/commercial icebox, there are no losingss in ideal vapor compressor icebox.

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Apparatus

The figure shown below expressions like a infrigidation research lab unit R712 (non precisely it) and it consists of the undermentioned constituents ;

Figure 23 Refrigeration research lab unit

Panels: High quality glass reinforced plastic on which the undermentioned constituents are mounted. Refrigerant: R12

Digital Thermometer: A device that measures temperature.

Wattmeter: Allows measuring of the power input to either evaporator or motor. Voltage Controller: To change evaporator burden.

Variable Area Flow metres: Variable country types to indicator R12 and H2O flow rates. Pressure Gauges: To bespeak R12 force per unit area in evaporator and capacitor.

Spring Balance and Tachometer: These two together allow measuring of power required to drive the compressor.

Expansion Valve: Thermostatically controlled type i. e. restricting device. Evaporator: Electrically heated device i. e. heat money changer

Compressor: (Internally mounted) Twin cylinder belt goaded unit, along with spring balance force system.

Capacitor: A device or unit used to distill vapour into liquid. It is besides called heat money changer.

Motor: A machine that converts electricity into a mechanical gesture.

3 www. p-a-hilton. co. uk/English/Products/

Refrigeration__2_/refrigeration__2_. html

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Procedure4

In anterior executing an experiment the most of import things to make are, to mensurate the atmos-

pheric force per unit area, which would be added to the gage force per unit area to acquire an absolute force per unit area for both

capacitor and evaporator, and to equilibrate the two tips of the spring balance force, being applied

on the compressor. In failure to make these things would do a sufficient sum of mistake in the

concluding consequences.

In this experiment the capacitor force per unit area is being kept changeless i. e. 900KPa.

Step-1 Turn on the infrigidation works utilizing one of the control surfs, and puting the evaporator electromotive force i. e. 40 – 100 Vs, at the same clip equilibrating the two tips of compressor burden and put the capacitor force per unit area to 900KPa, utilizing rota-meter.

Step-2 Record the undermentioned values ; Evaporator Amps (1-2. 42A) , from wattmeter, compressor velocity utilizing tachometer, H_2O and refrigerating flow rate utilizing flow metre.

Step-3 Record the spring balance force, reading straight from the graduated table.

The hot H_2O is in the tubing is indicated by ruddy and cold H_2O is indicated by bluish mark in the infrigidation works.

Step-4 The flow rate is controlled by a choking device (valve) , the little alterations in gap and shuting the valve, consequence the capacitor force per unit area.

Step-5 The temperature values of the refrigerant at different phases in the whole rhythm at changeless force per unit area is given by temperature dialler. Now we had all the values we needed, now we changed evaporator Amps value, recorded remainder of the values as mentioned earlier and repeated the whole experiment for three to four times.

The Refrigeration Laboratory Unit has three controls. First a combined illumination circuit ledgeman and switch bends on both the compressor motor and the supply to the electrically heated evaporator. A combined variable country H_2O flow metre and valve allow control of the capacitor force per unit area and a panel mounted electromotive force accountant allows control of the evaporator burden from zero to full power.

Refrigerant R12 vapor is drawn into the compressor from the evaporator mounted on the forepart

of the panel. Work is done on the gas in the compressor and its force per unit area and temperature are raised. This hot, high force per unit area gas discharges from the compressor and flows into the panel

mounted H2O cooled capacitor, where heat is removed from it. This liquid so flows through

a thermostatic enlargement valve. Here it passes through a controlled opening, which allows its

force per unit area to fall from that of the capacitor to that of the evaporator. The refrigerant has a satu-

rated vapour stage at this point. The electromotive force across the warmer elements may be varied from nothing

to that of the brinies supply electromotive force by accommodation of a electromotive force accountant situated on the forepart

panel. Measurement of the power is carried out by a panel mounted digital wattmeter.

4 hypertext transfer protocol: //www. p-a-hilton. co. uk/R714-Edition-2-GREY. pdf

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Consequences

The observation tabular array below shows all the values of different constituents in the infrigidation works along with input indices and end product indices, heat content of the rhythm and losingss in the system.

The computations required to acquire those consequences (to finish the tabular array) are besides listed after this tabular array

below.

1 Condenser force per unit area (gage) Pc KNm-2 900 900 900

2 Evaporator force per unit area (gage) Pe KNm-2 -20 20 40

3 Condenser force per unit area (Abs) Pc KNm-2 1001. 663 1001. 663 1001. 663

4 Evaporator force per unit area (Abs) Pe KNm-2 81. 663 121. 663 141. 663

5 Compressor suction t1 0 C -23. 5 -22. 6 -5. 2

6 Compressor bringing t2 0 C 59. 9 68. 5 69. 4

7 Liquid go forthing capacitor t3 0 C 31. 6 34. 8 33. 8

8 Evaporator recess t4 0 C -32 -23. 6 -19. 1

9 Water recess t5 0 C 23. 8 21. 6 21. 4

10 Water mercantile establishment t6 0 C 41. 2 38. 6 39. 5

11 Water flow rate Mw g s-1 1. 5 5. 0 6. 0

12 R 12 Flow rate Mr g s-1 0. 7 1. 5 1. 9

13 Evaporator Volts Ve V 40 70 100

14 Evaporator Amps Ie I 1 A 1. 70 A 2. 42 A

15 Motor Volts Vm V 235 232 232

16 Motor Amps Im A 3. 6 3. 6 3. 6

17 Spring balance Force F N 5. 5 7. 5 8. 2

18 Compressor velocity North Carolina rpm 477 474 473

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19 Motor Speed = 3. 17 A- North Carolina Nm rpm 1512. 09 1502. 58 1449. 71

20 h1 KJ/Kg 340 345 360

21 h2 KJ/Kg 385 400 420

22 h3 KJ/Kg 225 240 250

23 h4 KJ/Kg 160 170 180

24 Qe, Elec = Ve A- Ie W 40 119 242

25 Qe, R 12 = Mr (h1 – h4) W 126 262. 50 342

26 Wc = 0. 0172A-FA-Nm W 143. 043 193. 832 204. 467

27 Power factor at shaft (power Wc) pf – 0. 43 0. 48 0. 52

28 Wm = Vm. Im. pf W 363. 78 400. 89 434. 31

29 W'c = Mr (h2 – h1) W 31. 5 82. 50 114. 0

30 Q cond = Mr (h2 – h3) W 112 240 323

31 Qw = Mw A- 4. 18 (t6 – t5) W 109. 09 376. 20 428. 87

32 CoPnet = Qe, Elec / Wm 0. 109 0. 296 0. 557

33 CoP R12 = (h1 – h4) / (h2 – h1) 4. 0 3. 1818 3. 00

34 t41 can be found by (t1 – t4) 0 C 8. 5 1. 00 13. 9

35 CoP (te-t2) = t41 / (t2-t41) 0. 165 0. 015 0. 250

36 Motor loss = Wc – Wm W -220. 73 -207. 06 -229. 84

37 Compressor loss = W'c-Wc W -111. 54 -110. 33 -90. 47

38 System loss = Qcond – Qw W 2. 91 -136. 20 -105. 87

39 System loss = Qe, R12 – Qe, Elec W 86 143. 50 100. 0

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Figure 3 A graph represents the relationship between net CoP and evaporator temperature

Figure 4 A comparing of different losingss of the system in one graph against Evaporator temperature

The fluctuation and entropy in the graphs is because of the hapless standardization and less

figure of perennial consequences (less trials provide less information) , and most of the recorded consequences are based on guessed values.

Calculations

To happen absolute force per unit area, we need an atmospheric and gauge force per unit area of the constituent.

Now for two single constituents,

i,· Condenser

As we know Patm = I? gh = 13600 kg/m3 A- 9. 81 m/s2 A- 762 A-10-3m

= 101. 663A-103 Kg / ms2 = 101. 663 KN/m2

Hence Pgauge, cond = 900 KN/m2

Pabs, cond = Patm + Pgauge, cond = 101. 663 + 900 = 1001. 663 KN/m2

i,· Evaporator

As Patm = I? gh = 13600 kg/m3 A- 9. 81 m/s2 A- 762 A-10-3m

= 101. 663A-103 Kg / ms2 = 101. 663 KN/m2

i. Pgauge, Evap = -20 KN/m2

Pabs, Evap = Patm + Pgauge, Evap

Therefore = 101. 663 + (-20) = 81. 663 KN/m2

two. Pgauge, Evap = 20 KN/m2

Pabs, Evap = Patm + Pgauge, Evap = 101. 663 + (20) = 121. 663 KN/m2

three. Pgauge, Evap = 40 KN/m2

Pabs, Evap = Patm + Pgauge, Evap

Therefore = 101. 663 + 40 = 141. 663 KN/m2

To happen Qw (Heat remotion from capacitor)

As we repeated the experiment three times, so H2O flow rate have three different values, hence we need to happen Qw at three points,

Qw = Mw A- 4. 18 (t6 – t5)

When Mw = 1. 5 gs-1, t6 = 41. 2 0C, t5 = 23. 8 0C

Qw = 1. 5 A-4. 18 (41. 2 – 23. 8) = 109. 098 W

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As Qw = Mw A- 4. 18 (t6 – t5)

When Mw = 5. 0 gs-1, t6 = 39. 6 0C, t5 = 21. 6 0C

So Qw = 5. 0 A-4. 18 (39. 6 – 21. 6) = 376. 2 W

Qw = Mw A- 4. 18 (t6 – t5)

When Mw = 6. 0 gs-1, t6 = 38. 5 0C, t5 = 21. 4 0C

Qw = 6. 0 A-4. 18 (38. 5 – 21. 4) = 428. 87 W

To happen Wc (work done by the compressor or a shaft loss)

The work done by the compressor depends on spring balance force and motor velocity, hence to acquire more work done out of the compressor we need to increase any of the above mentioned parametric quantities. Therefore

Wc = 0. 0172A-FA-Nm

i. Wc = 0. 0172A-5. 5A-1512. 09 = 143. 043 W

two. Wc = 0. 0172A-7. 5A-1502. 58 = 193. 832 W

three. Wc = 0. 0172A-8. 2A-1449. 71 = 204. 467 W

To happen Wm (work done by the motor on a shaft to revolve)

The work done by the motor is a merchandise of electromotive force provided, sum of current fluxing the motor and power factor of the shaft, which gives us the undermentioned values ;

Wm = Vm A- Im A- pf

i. Wm = 235 A- 3. 6 A- 0. 43 = 363. 78

two. Wm = 232 A- 3. 6 A- 0. 48 = 400. 89

three. Wm = 232 A- 3. 6 A- 0. 52 = 434. 31

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To happen CoPnet (Entire coefficient of public presentation of refrigerant)

CoPnet = Qe, Elec / Wm

By replacing different values of electric input heat energy (unreal input energy) and the work done by the motor, we get net coefficient of public presentation of the rhythm,

i. CoPnet = 40 / 363. 78 = 0. 109 = 11 %

two. CoPnet = 119 / 400. 89 = 0. 296 = 30 %

three. CoPnet = 242 / 434. 31 = 0. 557 = 56 %

To happen CoP (te-t2)

This is the coefficient of public presentation of ratio of temperature values at point 1-4 and difference of it, to the temperature of the refrigerant after compaction, so we get following

CoP (te-t2) = t41 / (t2-t41)

i. CoP (te-t2) = 13. 9 / (69. 4 – 13. 9) = 0. 250 = 25 %

two. CoP (te-t2) = 8. 5 / (59. 9 – 8. 5) = 0. 165 = 16 %

three. CoP (te-t2) = 1. 0 / (68. 5 – 1. 0) = 0. 015 = 1. 5 %

To happen Qe, R 12 (Heat remotion from Evaporator) The given equation is

aˆ¦

Qe, R 12 = Mr (h1 – h4)

By replacing different values of heat content, which we recorded from a force per unit area – heat content diagram, so we get

i. Qe, R 12 = 0. 7 (340 – 160) = 126. 0

two. Qe, R 12 = 1. 5 (345 – 170) = 262. 5

three. Qe, R 12 = 1. 9 (360 – 180) = 342. 0

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To happen W'c (Input work done or compressor work loss)

The input work done by the compressor can be calculated by happening flow rate of the refrigerating R12 and the difference of heat content of refrigerant before and after the compaction.

W'c = Mr (h2 – h1)

Substituting all three values of the above parametric quantities (variables) , we get

i. W'c = 0. 7 (385 – 340) = 31. 5

two. W'c = 1. 5 (400 – 345) = 82. 5

three. W'c = 1. 9 (420 – 360) = 114

To happen Q cond (Heat loss by the capacitor)

Similarly heat loss by the capacitor is a merchandise of refrigerating flow rate to the difference of enthalpy values of it, before come ining and go forthing the capacitor, we get

Q cond = Mr (h2 – h3)

Now, utilizing above stated equationaˆ¦

i. Q cond = 0. 7 (385 – 225) = 112

two. Q cond = 1. 5 (400 – 240) = 240

three. Q cond = 1. 9 (420 – 250) = 323

To happen CoPR12 (Coefficient of public presentation of refrigerant) CoP R12 = (h1 – h4) / (h2 – h1)

Coefficient of public presentation of refrigerant is a ratio of all the heat content values in the rhythm, here note that for ideal vapour – compaction infrigidation rhythm h3 = h4

Hence we get…

i. CoP R12 = (340 – 160) / (385 – 340) = 4. 00

two. CoP R12 = (345 – 170) / (400 – 345) = 3. 1818

three. CoP R12 = (360 – 180) / (420 – 360) = 3. 00

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System losingss

Motor loss = Wc – Wm

= 143. 043 – 363. 78 = -220. 75

= 193. 832 – 400. 89 = -207. 06

= 204. 467 – 434. 31 = -229. 84

Compressor loss = W’c-Wc

= 31. 5 – 143. 043 = -111. 54

= 82. 5 -193. 832 = -110. 33

= 114 – 204. 467 = -90. 47

System loss = Qcond – Qw

= 112 – 109. 09 = 2. 91

= 240 – 376. 20 = -136. 20

= 323 – 428. 87 = -105. 87

System loss = Qe, R12 – Qe, Elec

= 126 – 40 = 86. 00

= 262. 5 – 119 = 143. 50

= 342 – 242 = 100. 00

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Discussion of Consequences

The observation tabular array of consequences has been listed on page 8 – 9, and it is followed by all the computations required to finish the tabular array or to acquire the consequences.

The experiment has been repeated three times, so all the consequences (values have been listed three

times. In the computation subdivision the system losingss and heat energy are shown as negative val-

ues, it ' s because the work is done on the system and heat is being removed from that particu-

lar system, in this instance its capacitor. The positive values of system loss and heat energy

shows that heat is being add in the system and work is done by the system, and in this instance its

evaporator. The capacitor force per unit area i. e. 900 KPa, was non precisely 900 KPa. As we were set-

ting the force per unit area manually, so in the whole experiment the force per unit area was 900 KPa A± 10 % , it

was because of the fluctuation in the gage acerate leaf, so we assumed the considered force per unit area.

The compressor force per unit area applied by spring balance force, affected the work done of the com-

vasoconstrictor on the refrigerant R12, because to acquire an accurate compressor work done, the two tips

of the spring balance should be in balance (degree) , but during an experiment we were acquiring

random values (consequences) , so so I realised that something is incorrect, so I looked at all the

constituents of the infrigidation works, and I found that the two tips of the spring were non bal-

ance. Hence to acquire right consequences we had to remake the experiment. The throttling device or valve

has a immense impact on capacitor force per unit area, because by opening or shutting i. e. altering a flow

rate make a considerable sum of difference on capacitor force per unit area and evaporator tem-

perature.

Motor loss refers to the ingestion of electrical energy non converted to utile mechanical energy end product, but in this instance energy loss means less input energy to the compressor, which

means a refrigerant would be less compressed by a compressor, so less heat would be re-

moved by the capacitor, and even after go throughing through the valve the refrigerant would still

hold a high temperature and force per unit area, therefore less infrigidation would happen in a vapour com-

pression rhythm. Therefore we need to take into history power losingss in the electric motor.

In order to analyze this procedure more closely, infrigidation applied scientists use this force per unit area – en-

thalpy diagram shown in Figure 5. This diagram is a manner of depicting the liquid and gas

stage of a substance. Enthalpy can be thought of as the measure of heat in a given measure,

or mass of substance. The curving line is called the impregnation curve and it defines the

boundary of pure liquid and pure gas, or vapor. In the part marked vapour, its pure vapour. In the part it ‘ s pronounced liquid, it is a pure liquid. If the force per unit area rises so that we are

sing a part above the top of the curve, there is no differentiation between liquid and va-

pour. Above this force per unit area the gas can non be liquefied. This is called the Critical Pressure. In

the part underneath the curve, there is a mixture of liquid and vapor.

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3 2

4 1

Figure 65 Pressure – Heat content diagram

Evaporator Pressure line Condenser force per unit area line

phase (Not a consecutive line) Isobar Condensation phase

Zion valve R12 Evaporation procedure

5 hypertext transfer protocol: //www. mvsengineering. com/chapter18. pdf

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Isentropic Compression

R12 go throughing through Expan-

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At the recess of the compressor the temperature (t1) is the same as temperature of refrigerating R12 at the mercantile establishment of the evaporator. So we go directly from that temperature of left side of the day of reckoning (saturated liquid) to the right side of the day of reckoning (saturated vapour line) , and so following the temperature gradient line, we go down and enter the enthalpy value at that temperature and force per unit area. Similarly for the phase 2, we find h2 on x-axis.

When the refrigerant leaves the capacitor, it obtains a concentrated liquid stage (left side of the

day of reckoning) , so taking the mention of capacitor force per unit area line (ruddy line) , we take a consecutive line

analogue to the y-axis, and wherever it meets the x-axis gives a value of heat content (h3) at phase

three. In existent refrigerant works, enthalpy at phase 3 and phase 4 is non same, but for the interest

of computation we assume that it ' s an ideal status and heat content at these two points is same.

Trial 1

As Compressor suction = t1 = -23. 5 0C and condenser Pressure (Abs) = Pc =

1001. 663 KNm-2

Therefore the heat content h1 = 340 KJ/Kg

Compressor bringing = t2 = 59. 9 0C and Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2 Hence the heat content h2 = 385 KJ/Kg

Here Liquid go forthing capacitor = t3 = 31. 6 0C

And Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2 Hence the heat content h3 = 225 KJ/Kg

As mentioned earlier that h3 = h4 (Ideal status) Hence the heat content h4 = 225 KJ/Kg

But utilizing temperature at evaporator recess, t4 = -32 0C, we get Actual heat content value, h4 = 160 KJ/Kg

Trial 2

As Compressor suction = t1 = -22. 6 0C and condenser Pressure (Abs) = Pc =

1001. 663 KNm-2

Therefore the heat content h1 = 345 KJ/Kg (from above p-h diagram)

Compressor bringing = t2 = 68. 5 0C and Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2 Hence utilizing Figure 4, we get enthalpy h2 = 400 KJ/Kg

Here Liquid go forthing capacitor = t3 = 34. 8 0C

And Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2 Hence the heat content h3 = 240 KJ/Kg

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As mentioned earlier that h3 = h4 (Ideal status) Hence the heat content h4 = 240 KJ/Kg

But utilizing temperature at evaporator recess, t4 = -23. 6 0C, we get Actual heat content value utilizing figure 4, h4 = 170 KJ/Kg

Trial 3

As Compressor suction = t1 = -5. 2 0C and condenser Pressure (Abs) = Pc =

1001. 663 KNm-2

Therefore the heat content h1 = 360 KJ/Kg

Compressor bringing = t2 = 69. 4 0C and Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2 Hence the heat content h2 = 420 KJ/Kg

Here Liquid go forthing capacitor = t3 = 33. 8 0C

And Condenser Pressure (Abs) = Pc = 1001. 663 KNm-2, Evaporator Pressure = 40 KPa Hence the heat content h3 = 250 KJ/Kg

As mentioned earlier that h3 = h4 (Ideal status) Hence the heat content h4 = 250 KJ/Kg

But utilizing temperature at evaporator recess, t4 = -19. 1 0C, we get Actual heat content value at this phase, h4 = 180 KJ/Kg

6However the enlargement of the high force per unit area liquid, procedure 5 – 1 above is non reversible.

Notice that Expansion is a changeless heat content procedure. It is drawn as a perpendicular line on the P-h

diagram. No heat is absorbed or rejected during this enlargement, the liquid merely passes through

a valve, like H2O coming out of a pat. The difference is that because the liquid is saturated at

the start of enlargement by the terminal of the procedure it is partially vapour. Point 1 is inside the curve

and non on the curve as described in the Evaporation procedure. At point 4 it starts to distill

and this continues until point 5 when all the vapor has turned into liquid. Point 5 is saturated liquid. If more heat is removed, the liquid cools. It is so called sub-cooled liquid. Hence h4 is on a concentrated liquid line (left side of the day of reckoning) , and does non look in a vapour compaction rhythm, and this is the instance in all three trials.

6 hypertext transfer protocol: //www. alephzero. co. uk/ref/vapcom. htm # pH

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As there is no traveling portion in the whole infrigidation works apart from motor shaft of a compressor, so work done by them is zero, i. e. w = 0

So utilizing steady province energy equation, we get

W – Q = h2 – h1 Equation (2)

As W = 0, so equation (1) becomes

– Q = h2 – h1

Or Q = h1 – h2 Equation (3)

The coefficient of public presentation or COP (sometimes CP) , of a heat pump (i. e. icebox) is

the ratio of the alteration in heat at the " end product " (the heat reservoir of involvement) to the supplied

work. To find Cop value of infrigidation works every bit good as for the refrigerant is a good pattern, because this will exemplify that how much efficient of these two are.

7It takes a batch of heat to vaporize liquid. In other words a little sum of liquid circulating

in a icebox can execute a big sum of chilling. This is one ground why the vapor compaction rhythm is widely used. The infrigidation system can be little and compact. Besides

from a practical point of position heat exchange is much better when utilizing alteration of province –

vaporization and condensation. However the enlargement of the high force per unit area liquid, procedure 5 –

1 above is non reversible. And so the efficiency of this rhythm can ne'er even approach Carnot

efficiency.

7 hypertext transfer protocol: //www. alephzero. co. uk/ref/practcop. htm

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Decision

8The vapour-compression rhythm is used in most household iceboxs every bit good as in many

big commercial and industrial infrigidation systems but the efficiency of this rhythm can

ne'er even approach Carnot efficiency, because of its low coefficient of public presentation.

In the infrigidation works the operating parametric quantities can be varied by accommodation of capacitor chilling H_2O flow and electrically heated evaporator supply electromotive force. Components have a low

thermic mass ensuing in immediate response to command fluctuations and rapid stabilization.

Instrumentation includes all relevant temperatures, capacitor force per unit area, evaporator force per unit area,

refrigerant and chilling H_2O flow rates, evaporator and motor power, motor torsion and com-

vasoconstrictor velocity.

The most of constituents of infrigidation works used in this experiment (R712) are manually calibrated graduated tables (non digital) , and based on this hapless standardization all the recorded consequences are being guessed on the base of single judgement, which is incorrect most of the clip. Anyway a little sum of liquid circulating in a icebox can execute a big sum of chilling. This is one ground why the vapor compaction rhythm is widely used.

The heat content values which are being recorded straight from enthalpy – force per unit area diagram (Figure 4) , and based on how ill-defined that diagram is, I would state it is non a great beginning of information, but still we use this to happen heat content. The system (infrigidation works) has some losingss, which have described earlier in this study, this includes motor loss, capacitor and evaporator loss.

In decision, I would wish to state that by making this experiment I learnt a great sum of

cognition, about infrigidation works, and how it works, what sort of rhythm more frequently usage for

this, how much efficient is this and how to cipher the different losingss in this system. I would

state by understanding the operation of this little graduated table infrigidation works, I think I would be

able to run on an industrial graduated table infrigidation works, because the basic rule is same.

8 hypertext transfer protocol: //www. alephzero. co. uk/ref/vapcomcyc. htm

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