**Deliverables:**

1. **Evaluation of current AC system performance based on the existing compressor performance** – **Include a table** like the table below:

|  |  |
| --- | --- |
| Overall isentropic efficiency | 0.6722 or 67.22% |
| COP | 4.11 |
| Energy cost ($/hour) | 0.2576 |
| Energy cost ($/month) | 61.82 |
| Capacity of the existing AC system (W) | 9876 |
| Your house size (ft2) | 830 |
| Capacity required for your house (W) | 6081 |

1. **Identification of Compressor Alternatives** – **Include a table** with the following information:

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1st alternative | 2nd alternative | Units |
| Manufacturer | Copeland | Copeland |  |
| Model number | ZP21kE-PFV | CP22K8ME |  |
| Refrigerant | R410A | R410A |  |
| Motor frequency | 60 | 60 | Hz |
| Motor phase (1 or 3) | 1 | 1 |  |
| Motor voltage | 208-230 | 208-230 | V |
| Performance @7°C/54°C rating conditions | | | |
| Capacity | 6213 | 6213 | W |
| Power | 2100 | 2100 | W |
| EER | 17.24 | 17.18 | Btu/h-W |
| Other specifications | | | |
| Overall length | 9.56 | 9.30 | In |
| Overall width | 9.56 | 9.09 | in |
| Overall height | 14.94 | 14.12 | In |
| RPM | 3500 | 3500 | RPM |

1. **Evaluations of Compressor Alternatives**
   1. **Mathematical Model of Compressor Capacity and Power** – **Include a table** like the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| Copeland Compressor Model ZP21kE-PFV: | | | |
| Coefficient # | Capacity Coefficients (W) | Power Coefficients (W) | Mass Flowrate Coefficient (g/s) |
| 0 | 9293.460431 | -11.64166785 | 165.7200568 |
| 1 | 206.9141431 | -14.20991885 | 2.653310094 |
| 2 | 163.3466375 | 24.22068232 | -0.8551055247 |
| 3 | 3.672799287 | -0.1159905293 | 0.03212726118 |
| 4 | 1.957443702 | 0.3229410557 | 0.002873563208 |
| 5 | -2.358658254 | -0.2410616324 | 0.008444636298 |
| 6 | 0.008241227732 | -0.0001343056965 | 7.57E-05 |
| 7 | -0.01308792094 | 0.001119644695 | -6.65E-05 |
| 8 | -0.01510579503 | -0.002063122392 | 1.41E-05 |
| 9 | 0.007534949734 | 0.001503874012 | -4.06E-05 |

|  |  |  |  |
| --- | --- | --- | --- |
| Copeland Compressor Model CP22K8ME-PFV: | | | |
| Coefficient # | Capacity Coefficients (W) | Power Coefficients (W) | Mass Flowrate Coefficient (g/s) |
| 0 | -3957.961381 | 2318.802413 | 104.5511514 |
| 1 | 1213.724604 | -34.26340731 | 13.07182007 |
| 2 | 256.6592867 | -25.18508254 | -2.001541182 |
| 3 | 5.913531234 | -0.4511599559 | 0.03815445222 |
| 4 | -13.25473112 | 0.8331550691 | -0.15083255 |
| 5 | -1.168179404 | 0.1648776491 | 0.04198394854 |
| 6 | 0.01720849503 | -0.003695735428 | 0.000200298596 |
| 7 | -0.03324154833 | 0.006614888271 | -0.000111599993 |
| 8 | 0.04853011721 | -0.004215340349 | 0.0006744688395 |
| 9 | -0.00329759596 | -0.0001600304257 | -0.0002345065605 |

* 1. **Model Validation – Include a table like the table below:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | At 7°C/54°C | | | At 7°C/38°C | | |
| ZP21K6E-PFV | Manufacturer’s value | Calculated Value | % Error | Manufacturer’s value | Calculated Value | % Error |
| Capacity (W) | 6213 | 6216 | 0.05425% | 8528 | 8508 | 0.2388% |
| Power (W) | 2100 | 2073 | 0.4624% | 1350 | 1357 | 0.5387% |
| Mass flowrate (g/s) | 38.93 | 38.75 | 1.268% | 44.23 | 44.25 | 0.04285% |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | At 7°C/54°C | | | At 7°C/38°C | | |
| CP22K8ME-PFV | Manufacturer’s value | Calculated Value | % Error | Manufacturer’s value | Calculated Value | % Error |
| Capacity (W) | 6213 | 6219 | 0.1031% | 8909 | 8776 | 1.489% |
| Power (W) | 2100 | 2081 | 0.8957 | 1690 | 1693 | 0.207% |
| Mass flowrate (g/s) | 40.82 | 40.57 | 0.6106% | 47.38 | 46.83 | 1.162% |

* 1. **Prediction of Compressor Performance at Typical Operating Conditions – Include a table like the table below:**

|  |  |  |
| --- | --- | --- |
| ZP21K6E-PFV | Pressure (kPa) | Temperature (°C) |
| Evaporator operating conditions | 933.2 | 5 |
| Condenser operating conditions | 2420 | 39.9 |
| Performance parameters at operating conditions | | |
| Actual capacity (W) | 3060 | |
| COP | 4.952 | |
| Power (W) | 617.8 | |
| Mass flowrate (g/s) | 14.85 | |
| Overall isentropic efficiency (%) | .6857 or 68.57% | |
| Energy cost ($/month) | $15.90 | |

|  |  |  |
| --- | --- | --- |
| CP22K8ME-PFV | Pressure (kPa) | Temperature (°C) |
| Evaporator operating conditions | 933.2 | 5 |
| Condenser operating conditions | 2420 | 39.9 |
| Performance parameters at operating conditions | | |
| Actual capacity (W) | 1789 | |
| COP | 1.173 | |
| Power (W) | 1525 | |
| Mass flowrate (g/s) | 11.16 | |
| Overall isentropic efficiency (%) | .2088 or 20.88% | |
| Energy cost ($/month) | $39.23 | |

1. **Final Compressor Selection and Supplier Information – Include a table with the following information for the selected compressor:**

|  |  |  |
| --- | --- | --- |
| Manufacturer | Copeland |  |
| Model number | ZP21K6E-PFV |  |
| Refrigerant | R410A |  |
| Motor frequency | 60 | Hz |
| Motor phases (1 or 3) | 1 |  |
| Motor voltage | 208-230 | V |
| Overall length, width & height | 9.56 x 9.56 x 14.94 | In |
| Performance @typical operating conditions (Pcond=2420 kPa and Tevap=5°C) | | |
| Capacity | 3060 | W |
| Power | 617.8 | W |
| Isentropic efficiency | 68.57% | % |
| Mass flowrate | 14.85 | g/s |
| COP | 4.952 |  |
| Expected energy cost | $15.90 | $/month |