\[ D = 1.04685 \times 219.1 \]
\[ D = 229.365 \text{ mm} \]
\[ \delta = \frac{D - d}{2} = \frac{229.365 - 219.16}{2} = 5.1025 \text{ mm} \]

\( \delta \): Thickness of insulation (mm)

\[ \Rightarrow \delta_{tt} = 5.1025 \times 8 = 40.82 \text{ mm} \]

\( \delta_{tt} \): Thickness of insulation after calculator (mm)

Because insulation of PU foam follows standard, so I select thickness PU: 50 mm

3. Calculation electrical system
3.1 Interview about electrical equipment
3.1.1 Control equipment

To do the task of control, open the machine in the circuit, people use many various electrical appliances

3.1.2 Aptomat (MCCB)

For occasional interruptions in the circuit, people use the aptomat. The aptomat consists of a system of contacts with arc cutters, automatic parts, circuit breaker to protect overload and short circuit. Electric circuit breaker according to the maximum current. When the current exceeds the value, it will cut off the circuit to protect the device.

Aptomati is used to close, disconnect the circuit and protect the device in case of overload.

Automatic open or close (aptomat)

3.1.3 Thermal Relay protects over current and overheat (OCR)

Thermal relay used to protect overcurrent or overheat. When the current is too large

or for some reason the motor winding temperature is too high. Thermal relay to circuit
Motor protection compressor.

Thermal relay can put into or outside compressor. Where to place outside: For overcurrent protection, it is usually fitted with a light switch. Some small air conditioners are available position the internal thermal relay at the top of the compressor.

Thermal relay in compressor

1- Plug, 2- Clip connection; 3- Contacts; 4- Terminal 5- Contact point; 6- Bimetallic structure; 7- Transistor; 8- body; 9- screw
Thermal relays and circuits

The basic element of the thermal relay is a bimetallic structure consisting of two different metals. In essence, they have different thermal expansion coefficients and are welded together. Bimetallic is heating with a resistor has the current flowing through the protective circuit. When working vases usually the heat dissipation in this resistor is not sufficient to deform the deformed bimetallic structure. When the lineThe power goes beyond the bimetallic radius and is bent, resulting in the circuit of the open protection device

3.1.4 Contactor and intermediate relay

Contactor and intermediate relays are used to switch off circuits. Structure

These include the following main components:

1. Completed suction
2. Magnetic circuit
3. Dynamic parts (armature)
4. Contact system (usually closed and usually open)

Contactor

It is important to note that the normally open contacts of the device only close when the coil is electrically charged in contrast the normally closed contacts will open when the coil is electrically closed when the power fails.

The system of contacts is structured differently and is usually galvanized to ensure continuitygood exposure. Large-clamped gear units with arc cutters are also available
Secondary contact to close the control circuit.

3.1.5. Relay of pressure protection and thermostat
To protect the compressor when the oil pressure and suction pressure are low, the pressure of the head is too high. We use oil pressure relays (OP), low pressure relays (LPs), and high pressure relays (HP). When one of the above events occurs, the pressure relays will interrupt the coil circuit and the compressor to stop the machine.

Below they are the structure and working principle of the pressure relays

3.1.6 Oil Pressure Relay

![Diagram of Oil Pressure Relay]

1- Phản từ cảm biến áp suất đầu; 2- Phản tử cảm biến áp suất hút; 3- Cơ cấu điều chỉnh; 4- Căn điều chỉnh; 5-

Figure 10.5 Oil Pressure Relay

The compressor oil pressure must be maintained at a higher value than the suction pressure of the machine to ensure the flow in the lubrication system and the reduction of load of the compressor. When working the oil pressure relays will compare oil pressure and internal pressure compressors should also be referred to as pressure relays. So when the output pressure is too low, the mode lubrication is not guaranteed, can not control the load reduction mechanism.

Low oil pressure may be due to the following reasons:
- Oil pump is broken
- Lack of lubricating oil.
- oil filters, oil pipes;
- Put too much oil on the oil.

Figure 10-5 shows the external and internal components of the oil pressure relays.

The oil pressure protection relay takes the signal of the oil pressure and compressor cacti pressure. ElementThe oil pressure sensor "OIL" (1) at the bottom of the relay is connected to the oil pump head and the part the low pressure sensor "LP" (2) is connected to the compressor cacti. If the oil pressure differential compared to the pressure in cacte deltap = pd - po is less than the set value before being maintained for a certain period of time, the control circuit acts to stop the compressor. When the deltap is small the current will pass through the time relay (or bi-metal-laden drying circuit). After a certain delay, the time relays (or structurebimetallic circuit breaker) line break control starter to start from the compressorMinimum allowable differential pressure can be adjusted through the structureclockwise increase the allowable pressure difference, meaning increasing the pressure of the oil. At the same time, the compressor can work. The pressure difference is fixed at 0.2 bar.

3.1.7 Relay high pressure HP và relay low pressure LP

High pressure relays and low pressure relays come in two different types:

* A combination of two relays
* Different types of relays

Figure 10-6, the pairs of HP and LP combination relays are fully independent of each other, each with its own LP is usually located on the left, while Hp is located on the right. Can distinguish LP and HP according to the temperature values set on the ladder, avoiding confusion.

Figure 10-7 shows high and low pressure relays.

High pressure relays are used to protect the compressor when the pressure is higher than the set pressure. It will work before the safety valve opens. The thrust is fed to the stacked box at the bottom of the relay, the pressure signal is shifted to the mechanical signal and transferred.

Translates the contact system, through which the circuit breaker starts from the compressor.
Figure 10-6: Low and high pressure relays

The set point of the high pressure relays is 18.5 kG/cm² lower than that of the safety valve 19.5kG/cm². This setting can be adjusted via the "A" screw. Working pressure difference: Adjustable by screw "B". When turning the screws "A" and "B" the pressure indicator moves on the pressure indicator.

a- High pressure relays  b- Low pressure relays

Figure 10-7: Low and high pressure relays

After the pressure has occurred and the process has been completed, the reset button should be pressed for trouble-free startup similar to HP, the LP Low Pressure Relay is used to automatically open the compressor, in cold running systems. When the chiller room temperature is reached, the solenoid valve stops. The refrigerant is supplied to the indoor unit, the machine performs gas extraction on the container and the pressure on the suction head is reduced below the set value, the pressure relays stop the machine. When the room temperature is high, the refrigerant is forced into the evaporator and the
pressure is drawn up and over the set value, the low pressure relays are automatically closed for the engine.

3.1.9 Relay of water pressure (WP) and flow (Flow Switch)  
To protect the compressor when the pump coolers condensate and pump heat, compressed pressure is not good (pressure drop, water shortage ..) people use pressure relays water and flow relays.

Water pressure relays act like other pressure relays, when the water pressure is low, no

Ensure the cooling condition of the condenser or compressor, the relay will disconnect the coil from the compressor to stop the machine. Thus the water pressure relays receive the pressure signal pushing head of the water pump.

In contrast the flow relays take the signal of the flow. When water flows through the relay contact open contact, normal operation system. When no water flow, the contact of the flow relay closed, and the coil winding startup and stops.

3.1.10 Symbols on the drawing  
To facilitate reading the drawing of the circuit, see Figure 10-10 below. Introduce some conventional symbols of the electrical equipment of the circuits of refrigeration systems. This is symbols commonly used for refrigeration circuits are now commonplace used.

On the other hand to avoid confusion when explaining the operation principle of the circuit We denote the "1" for the normally closed contact and the "2" for the contact usually open.
Compressor controls CP III

1. Outline of Functions

* The MYPRO-CP III is a dedicated controller for MYCOM screw compressor units. It consists of a back-lit, 4-line liquid crystal display (LCD) capable of showing 40 alpha-numeric characters, a ten key control panel and a plus function, 16 analog input connections, sixteen digital input and output (electrical signal) connections and an RS-485 Communications port.

* The 4-line, 40-character display allows indication of all measured values and simultaneous display of measured and set values is available using the key pad, ESC, DELETE, TAB, ENTER, and keys.

* Automatic compressor start/stop, remote start/stop and manual start/stop can be performed with this controller. In the
case of automatic remote start/stop operation, it is possible to change various set values via the communications port. Automatic capacity control of the compressor is available using the pressure regulator function, the electrical current limiter function and the slide valve positioner function of the controller.

Based on the data provided by various sensors, abnormal oil pressure drop, abnormal high pressure, excessively high temperature, overcurrent and filter clogging can be detected and an appropriate alarm issued. In addition to the above, an historical record of six previous alarm situations can be displayed.

3.1.12 Inverter

- Inverter is a device that can change the frequency of the grid voltage to change the motor speed, and the power grid frequency of Vietnam is 50Hz.

The operating principle of the inverter

- First, the 1-phase or 3-phase AC power is rectified and filtered into a flat one-way source. This stage is done by rectifier bridge diode and capacitor. As a result, the cosphi power factor of the inverter system is independent of load and has a value of at least 0.96. This DC voltage is converted (inverted) into a symmetrical three-phase alternating current. This stage is now implemented through the IGBT (isolated gate insulated transistor) by pulse width modulation (PWM). Thanks to advances in microprocessor technology and current semiconductor technology, pulse-shift frequencies can reach the ultrasonic frequency range to reduce engine noise and reduce losses on the engine iron core.

- The three-phase AC system at the output can change the amplitude and frequency values depending on the controller. In theory, between frequency and voltage there is a certain rule depending on the control mode. For constant load, the voltage-frequency ratio is constant. However, with the pump and fan loads, this rule is a function of level 4. Voltage is the quadratic function of frequency. This generates a momentary characteristic of the speed corresponding to the
requirement of the pump / fan load, since the torque itself is also the second function of the voltage.

- Power conversion efficiency of the inverter is very high because of the use of power semiconductor components manufactured by modern technology. Consequently, energy consumption is approximately equal to the energy required by the system.

- In addition, today's inverter has integrated many different types of control suitable for most different types of load. Today, the inverter has a built-in PID and is suitable for a variety of communication standards, which are suitable for control and monitoring in SCADA systems.

The benefits of using inverter.

- Inverter can change the motor speed easily, so the starting current of the motor will not exceed 1.5 times the traditional starting current with star-delta, (4 ~ 6) times the rated current.

- Thanks to the easy change of speed, it is possible to save power for regular loads without running at full capacity.

- Can help the engine run faster, usually 54-60Hz, normal is 1500v / p with 50Hz, when the inverter is 1800v / p with 60Hz, to increase the output of the machine, increase the speed. Ventilation fans.

- Inverters have electronic over current protection, high voltage protection and low voltage, creating a safety system when operating.

- The low-speed startup process allows the engine to carry large loads without sudden startup, to avoid damage to the mechanical parts, bearing, and longer engine life.

- Due to the principle of inverting conversion through diode and capacitor, the cosphi coefficient is at least 0.96, the reactive power from the motor is very low, almost ignored, thereby reducing the significant current in Reduce the cost of installing capacitor banks, minimizing line losses.
3.1.13 Liquid level regulating valves PMFL / FMFH and SV

For modulating liquid level control in refrigeration, freezing and air conditioning plant, and a system comprising a liquid level regulating valve type PMFL or PMFH, controlled by a pilot valve type SV valve, is used.

PMFL and SV systems are used on the evaporator side. PMFH and SV systems are used on the condenser side. The system is suitable for use with ammonia or fluorinated refrigerants. PMFL and PMFH can be used in liquid lines to or from

• evaporators
• separators
• intermediate coolers
• condensers
• receivers

Modulating liquid level provides liquid injection that is proportional to the actual capacity. This gives a constant amount of flashgas, thus ensuring stable regulation and economic operation because variations in pressure and temperature are held to a minimum.

6: Seal plug
2: Valve spindle
* Valve seat
19: Valve body
19a: Channel in valve body
20: Bottom cover
23: Main spring
24: Servo piston
24a: Channel in servo piston
30: Top cover
30a.b.c. Channels in top cover
Valve cone
Supplementary spring
Manometer connection

Spindle cap
Setting spindle
Pilot connection

When the liquid level inside the float drops, the float orifice opens. This relieves the higher pressure, $p_s$, acting on the servo piston to the low pressure side causing the PMFL to open.

Variations in liquid level will result in variations in pressure over the piston and variation in the amount of liquid injected. It is important to choose the correct spring set when designing the plant.

3.1.14 AKS 38

Introduction

AKS 38 is an electro-mechanical float switch designed to provide a reliable, electromechanical response to liquid level changes. The simple and basic design ensures long lifetime performance and reliable operation for many applications. AKS 38 can control liquid level in vessels and accumulators or can be used as a low/high level safety alarm.
3.2. Calculation select electrical equipment

**Base on data of pump (see 1.6, 1.7), we have shaft capacity of pump:**

- Pump 1 and Pump 3: $P=37 \text{ kW}$, factor $\eta = 0.926$
- Pump 2 and Pump 4: $P=15 \text{ kW}$, factor $\eta = 0.919$
- Fan 1 and Fan 3: $P=11 \text{ kW}$, factor $\eta = 0.9$

Absorbed power of pump 1 (37 kW) is:

$$P_{TT} = \frac{P}{\eta}$$

In which:
- $P_{TT}:[(kW)]$ Absorbed power
- $P:[37(kW)]$ Shaft capacity of pump
- Factor $\eta = 0.926$ : Capacity factor of shaft motor

We have:

$$P_{TT} = \frac{37}{0.926} = 39.96 \text{ kW}$$

Current intensity is:

$$I_{TT} = \frac{P_{TT}}{\sqrt{3} \times U \times \cos \varphi}$$

In which:
- $I_{TT}:[(A)]$ Current intensity
- $P_{TT}:[39.96(kW)]$ Absorbed power
- $U:[0.38(kV)]$ Voltage
- $\cos \varphi = 0.9$

We have:

$$I_{TT} = \frac{39.96}{\sqrt{3} \times 0.38 \times 0.9} = 67.46 \text{ A}$$

Calculation Current intensity is:

$$I = I_{TT} \times 1.4$$
In which:

$I_{TT}$: [67.46(A)] Current intensity

$I$: [(A)] Current intensity to select electrical equipment

We have:

$I = I_{TT} \times 1.4 = 67.46 \times 1.4 = 94.44$ (A)

We select star delta startingso we have current intensity to MC, MD, MS

Current intensity of contactor MC, MD

$I_{MC} = I_{MD} = I = 67.46$ (A)

Current intensity of contactor MS

$I_{MS} = \frac{I}{\sqrt{3}} = \frac{67.46}{\sqrt{3}} \approx 38.9$ (A)

Conclusion: From data above we select electrical equipment:

- Overload Model: TH-N120KPA (34-100A) (see index 1.15)
- MCCB Model: NF125-CW (80AF/63AT) (see index 1.13)
- MCCB Model for 2 pump: NF250-CW (200AF/175AT) (see index 1.13)
- Contactor MC and MD: S-N 80CX (see index 1.14)
- Contactor: S-N35CX (see index 1.14)
- Electric Wires of contactor MS is: 10x1Cx3 (see index 1.12)
- Electric Wires of contactor MD and MC is: 25x1Cx3 (see index 1.12)
- Electric Wires of MCCB is: 35x1Cx3 (see index 1.12)
- Electric Wires of MCCB for two pump: 95x1Cx3 (see index 1.12)
Calculation like above, I make table select electric wires, electrical equipment for dynamic circuit: (see index1.12, 1.13, 1.14, 1.15)

<table>
<thead>
<tr>
<th>STT</th>
<th>Position</th>
<th>MCCB</th>
<th>OCR</th>
<th>MS</th>
<th>MC &amp; MD wires</th>
<th>wires MC</th>
<th>wires MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pump 1</td>
<td>80AF/63AT NF125-CW</td>
<td>TH-N120KPA 34-100A</td>
<td>S-N35 CX</td>
<td>S-N80CX</td>
<td>10x1Cx3</td>
<td>25x1Cx3</td>
</tr>
<tr>
<td>2</td>
<td>Pump 2</td>
<td>80AF/63AT NF125-CW</td>
<td>TH-N120KPA 34-100A</td>
<td>S-N35 CX</td>
<td>S-N80CX</td>
<td>10x1Cx3</td>
<td>25x1Cx3</td>
</tr>
<tr>
<td>3</td>
<td>Pump 3</td>
<td>40AF/32AT NF63-CW</td>
<td>TH-N20TAK PCX 18-40A</td>
<td>S-N18 CX</td>
<td>S-N25CX</td>
<td>2.5x1Cx3</td>
<td>6x1Cx3</td>
</tr>
<tr>
<td>4</td>
<td>Pump 4</td>
<td>40AF/32AT NF63-CW</td>
<td>TH-N20TAK PCX 18-40A</td>
<td>S-N18 CX</td>
<td>S-N25CX</td>
<td>2.5x1Cx3</td>
<td>6x1Cx3</td>
</tr>
<tr>
<td>5</td>
<td>Wire pump 1 &amp; 2</td>
<td>200AF/175AT NF250-CW</td>
<td>TH-N20TAK PCX 18-40A</td>
<td>S-N16 CX</td>
<td>S-N22CX</td>
<td>2.5x1Cx3</td>
<td>4x1Cx3</td>
</tr>
<tr>
<td>6</td>
<td>Wire pump 3 &amp; 4</td>
<td>100AF/80AT NF125-CW</td>
<td>TH-N20TAK PCX 18-40A</td>
<td>S-N16 CX</td>
<td>S-N22CX</td>
<td>2.5x1Cx3</td>
<td>4x1Cx3</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>8</th>
<th>Fan 2</th>
<th>30AF/20AT NF30-CS</th>
<th>TH-N20TAK PCX 18-40A</th>
<th>S-N16 CX</th>
<th>S-N22CX</th>
<th>2.5x1Cx3</th>
<th>4x1Cx3</th>
<th>6x1Cx3</th>
</tr>
</thead>
</table>

168
3.3. Calculation select electrical equipment of Ethylene glycol solution system

**Base on data of pump (see 1.6, 1.7), we have shaft capacity of pump:**

+ Pump 1 (quality : 3) : P=15 kW, \( \eta = 0.912 \)
+ Pump 2 (quality : 3) : P=30 kW, \( \eta = 0.923 \)

- **Calculation select electrical wires and electrical equipment:**

  Absorbed power of pump 1 (15 kW) is:

  \[
P_{TT} = \frac{P}{\eta}
  \]

  In which:
  - \( P_{TT} \): [(kW)] Absorbed power
  - \( P \): [15(kW)] Shaft capacity of pump
  - Factor \( \eta = 0.912 \) : Capacity factor of shaft motor

  We have:

  \[
P_{TT} = \frac{P}{\eta} = \frac{15}{0.912} = 16.447 \text{ kW}
  \]

  Current intensity is:

  \[
  I = \frac{P}{\sqrt{3} \times U \times \cos \varphi}
  \]

  In which:
  - \( I_{TT} \): [(A)] Current intensity
  - \( P_{TT} \): [16.447(kW)] Absorbed power
  - \( U \): [0.38(kV)] Voltage
  - \( \cos \varphi = 0.9 \)

  We have:

  \[
  I = \frac{P}{\sqrt{3} \times U \times \cos \varphi} = \frac{16.447}{\sqrt{3} \times 0.38 \times 0.9} = 27.7658 \text{ A}
  \]
Select electrical equipment:

Calculation Current intensity is:

\[ I = I_{TT} \times 1.4 \]

In which:

\( I_{TT} \): Current intensity
\( I \): Current intensity to select electrical equipment

We have:

\[ I = I_{TT} \times 1.4 = 27.7658 \times 1.4 = 38.872 \ (A) \]

We select star delta starting so we have current intensity to MC, MD, MS

Current intensity of contactor MC, MD:

\[ I_{MC} = I_{MD} = I = 27.7658 \ (A) \]

Current intensity of contactor MS:

\[ I_{MS} = \frac{I}{\sqrt{3}} = \frac{27.7658}{\sqrt{3}} \approx 16.0306 \ (A) \]

Conclusion: From data above we select electrical equipment:

- Overload Model : TH-N20TAKPCX (18-40A) (see index 1.15)
- MCCB Model : NF125-CW (125AF/50AT) (see index 1.13)
- Contactor MC and MD : S-N 25CX (see index 1.14)
- Contactor MS : S-N20CX (see index 1.14)
- Electric Wires of contactor MS is : 2.5x1Cx3 (see index 1.12)
- Electric Wires of contactor MD and MC : 6x1Cx3 (see index 1.12)
- Electric Wires of MCCB For two pump : 16x1cx3 (see index 1.12)
Calculation like above, I make table select electric wires, electrical equipment for dynamic circuit:

<table>
<thead>
<tr>
<th>ST</th>
<th>Position</th>
<th>MCCB</th>
<th>OCR</th>
<th>MS</th>
<th>MC &amp; MD</th>
<th>wires MS</th>
<th>wires MC</th>
<th>wires MC &amp; CB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pump 1 (15kw)</td>
<td>125AF/50AT NF125-CW</td>
<td>TH-N20TAKP 18-40A</td>
<td>S-N20CX</td>
<td>S-N25CX</td>
<td>2.5x1C x3</td>
<td>6x1Cx3</td>
<td>16x1Cx3</td>
</tr>
<tr>
<td>2</td>
<td>Pump 2 (30kW)</td>
<td>160AF/125AT NF160-SW</td>
<td>TH-N60TAKP 54-105A</td>
<td>S-N35CX</td>
<td>S-N65CX</td>
<td>10x1C x3</td>
<td>16x1C x3</td>
<td>35x1Cx3</td>
</tr>
</tbody>
</table>

3.4. Calculation select electrical equipment compressor, condenser, oil pump.
Follow datumpump, fan, compressorwe have shaft capacity of pump, fan, compressor:

+ Water pump : P=7.5 kW , \( \eta = 0.88 \)
+ Oil pump : P=1.98 kW , \( \eta = 0.815 \)
+ Fan : P=45 kW , \( \eta = 0.926 \)
+ Compressor : P=386 kW , \( \eta = 0.95 \)

Calculation select electrical wires and electrical equipment:

- We calculation for fan:
Absorbed power of fan (45 kW) is:

\[
P_{TT} = \frac{P}{\eta}
\]

In which:
- \( P_{TT} \text{[(kW)] Absorbed power} \)
- \( P \text{[45(kW)] Shaft capacity of pump} \)
- Factor \( \eta = 0.926 \) : Capacity factor of shaft motor

We have:
\[ P_{TT} = \frac{P}{\eta} = \frac{45}{0.926} = 48.596 \, kW \]

Current intensity is:

\[ I = \frac{P}{\sqrt{3} \times U \times \cos \phi} \]

In which:
\( I_{TT} \) : [A] Current intensity
\( P_{TT} \) : [48.596 (kW)] Absorbed power
\( U \) : [0.38 (kV)] Voltage
\( \cos \phi = 0.9 \)

We have:
\[ I = \frac{P}{\sqrt{3} \times U \times \cos \phi} = \frac{45.596}{\sqrt{3} \times 0.38 \times 0.9} = 82.038 \, A \]

**Select electrical equipment:**

Calculation Current intensity is:
\[ I_{TT} = I \times 1.4 \]

In which:
\( I_{TT} \) : [82.038 (A)] Current intensity
\( I \) : [(A)] Current intensity to select electrical equipment

We have:
\[ I = I_{TT} \times 1.4 = 82.038 \times 1.4 = 114.853 \, (A) \]

We select star delta startingso we have current intensity to MC, MD, MS

Current intensity of contactor MC, MD:
\[ I_{MC} = I_{MD} = I = 82.038 \, (A) \]

Current intensity of contactor MS:
\[ I_{MS} = \frac{I}{\sqrt{3}} = \frac{82.038}{\sqrt{3}} = 47.365 \, (A) \]
**Conclusion:** From data above we select electrical equipment:

- Overload Model: TH-N20TAKPCX (18-40A) (see index 1.15)
- MCCB Model: NF125-CW (125AF/100AT) (see index 1.13)
- Contactor MC and MD: S-N 80CX (see index 1.14)
- Contactor MS: S-N50CX (see index 1.14)
- Electric Wires of contactor MS is: 10x1Cx3 (see index 1.12)
- Electric Wires of contactor MD and MC: 25x1Cx3 (see index 1.12)
- Electric Wires of MCCB: 50x1Cx3 (see index 1.12)

Only Fan star delta starting, but water pump, oil pump and compressor we select Soft start

*Calculation like above, I make table select electric wires, electrical equipment for dynamic circuit:* (see index 1.12, 1.13, 1.14, 1.15)

<table>
<thead>
<tr>
<th>STT</th>
<th>Position</th>
<th>MCCB</th>
<th>OCR</th>
<th>MS</th>
<th>MC &amp; MD</th>
<th>wiresMS</th>
<th>wiresMC MD</th>
<th>wiresM CCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water pump</td>
<td>30AF/20AT</td>
<td>TH-N20KPCX 0.2</td>
<td>S-N10CX</td>
<td>S-N18CX</td>
<td>1.5x1Cx3</td>
<td>2.5x1Cx3</td>
<td>4x1Cx3</td>
</tr>
<tr>
<td></td>
<td>(4kw)</td>
<td>NF30-CS</td>
<td>22A</td>
<td>CX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fan</td>
<td>125AF/100AT</td>
<td>TH-N120TAKPCX 85</td>
<td>S-N50CX</td>
<td>S-N80CX</td>
<td>10x1Cx3</td>
<td>25x1Cx3</td>
<td>50x1Cx3</td>
</tr>
<tr>
<td></td>
<td>(15kw)</td>
<td>NF125-CW</td>
<td>150A</td>
<td>CX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil Pump</td>
<td>30AF/3AT</td>
<td>TH-N12KPCX 0.1</td>
<td>S-N10CX</td>
<td></td>
<td>2.5x1Cx3</td>
<td>2.5x1Cx3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.98kw)</td>
<td>NF30-Cs</td>
<td>13A</td>
<td>CX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressor or (386kW)</td>
<td>NF1250-SDW</td>
<td>S-N800</td>
<td>350x1C x3</td>
<td>350x1C x3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------</td>
<td>------------</td>
<td>--------</td>
<td>----------</td>
<td>----------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.5 Calculator inverter

We have capacity of pump

- Pump for cooling tower
  + Pump 1 and 3 : P=37 kW
  + Pump 2 and 4 : P=15 kW
- Pump of ethylene glycol solution from tank to PHE : P=15 kW
- Pump of ethylene glycol solution from tank to Load : P=30 kW
- Compressor : P=386 kW
- Fan : P=45 kW

Capacity select inverter of equipment:

\[ P_{INV} = P \times 1.1 \]

In which:
- \( P_{INV} \) [\( (kW) \)] Inverter capacity
- \( P \) [\( 37(kW) \)] Motor power of pump
- 1.1 : Safe factor

We select inverter for pump 1 and 3 (P=37 kW):

\[ P_{INV} = P \times 1.1 \]

\[ = 37 \times 1.1 = 40.7 \text{ (kW)} \]

Based index 2.18. We select inverter: FR-470-45K

We select inverter for pump 2 and 4 (P=15 kW):

\[ P_{INV} = P \times 1.1 \]

\[ = 15 \times 1.1 = 16.5 \text{ (kW)} \]

Based index 2.18. We select inverter: FR-470-18.5K
Same as above, I have table select inverter:

<table>
<thead>
<tr>
<th>STT</th>
<th>Position</th>
<th>Pump 1 and 2 P=37kW (Cooling Tower)</th>
<th>Pump 3 and 4 P=15kW (Cooling Tower)</th>
<th>Pump 15 kW</th>
<th>Pump 30 kW</th>
<th>Máy nén 386 kW</th>
<th>Quạt 45 kW</th>
</tr>
</thead>
</table>

4. Calculate about economy for cooling system

4.1 Comparison about economy for compressors at evaporating temperature -8°C and -10°C

<table>
<thead>
<tr>
<th>STT</th>
<th>Evaporating Temperature ( °C )</th>
<th>Model</th>
<th>Cooling capacity (kw)</th>
<th>Absorbed power (kw)</th>
<th>Drive shaft speed (min-1)</th>
<th>COP</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8</td>
<td>N250M**-L</td>
<td>1602.9</td>
<td>381.8</td>
<td>3320</td>
<td>4.2</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>N250M**-M</td>
<td>1607.5</td>
<td>382.4</td>
<td>3350</td>
<td>4.2</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>-8</td>
<td>N250M**-H</td>
<td>1604.3</td>
<td>422.3</td>
<td>3370</td>
<td>3.8</td>
<td>90.48</td>
</tr>
<tr>
<td>4</td>
<td>-10</td>
<td>N250L**-L</td>
<td>1637.7</td>
<td>421</td>
<td>3100</td>
<td>3.89</td>
<td>92.62</td>
</tr>
<tr>
<td>5</td>
<td>-10</td>
<td>N250L**-M</td>
<td>1636.7</td>
<td>413.1</td>
<td>3110</td>
<td>3.96</td>
<td>94.29</td>
</tr>
<tr>
<td>6</td>
<td>-10</td>
<td>N250L**-H</td>
<td>1634</td>
<td>447.9</td>
<td>3125</td>
<td>3.65</td>
<td>86.9</td>
</tr>
</tbody>
</table>

We calculate cost electric in one year and 3 years: (we take Model N250M**-L and N250L**-L)

We take average electric cost per hour: 1800 dong / kw

The factory work 24h in day and 365 days: