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Saving Electricity and Resources in Compressor Air Systems

Rasulova Mohigul Matyakub qizi

Bukhara state medical institute

Abstract: This article analyzes the operating modes of compressors operating under high pressure. The analysis of the work of several different systems of compressors was considered. Piston, screw and frequency converter driven screw compressors were analyzed.

Keywords: Compressed air, piston compressor, frequency converter, screw compressor, centralized system, asynchronous motor.

Saving energy in high-pressure compressed air systems is one of the most pressing challenges facing businesses today. In many enterprises, the energy consumption corresponding to the compressors reaches 25-30%, because the working body of the compressors still has a large power consumption, with an air production of several tens to hundreds of m^3/min consists of powerful piston and centrifugal blocks that are min.

Such working bodies were outdated both materially and morally a long time ago, and it became difficult to save electricity through them. The centralized delivery of compressed air, which all consumers receive from a common compressor, is already outdated. But it is still used in most enterprises.

At one time it was very useful to organize a centralized system, because it was problematic to organize anything else with the compressors of the time. In addition, the advantage of the centralized air system was that in case of repair or scheduled maintenance, there were always spare parts in the room where the compressor was located, which made it possible to produce the required amount of air without problems. In addition, it was convenient to monitor and store the compressor and devices installed in one place.

But the disadvantages that arise with a centralized air system wash away all its advantages. The sources of losses are:

- Continuous repair of piston compressors (scheduled repair as well);
- The number of technical service personnel;
- Organization of circulation of water supply for cooling;
- Wastes due to air leakage from pipes, etc.

There are also a number of other problems. For example, the possibility of freezing outside pipes in winter. Or the need to maintain a high general network pressure of compressed air for all consumers, including those that are not required.

In addition, another important problem is the differences between the performance of the compressor and the actual consumption of high-pressure air. This means that in some cases (weekends, night shifts, etc.) it is not necessary to use more powerful compressors.

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The first stage is the introduction of screw compressors to enterprises.

The widespread use of screw compressors in enterprises has led to the solution of many problems. Their widespread use has made it possible to switch to a decentralized compressed air system. The operation of the decentralized system consists in the fact that the need for compressed air is provided by separate screw compressors installed in the production facilities near the consumers.

The transition to a decentralized system has brought a number of important benefits. They made it possible to significantly reduce the length of the pipes. As a result, air losses due to air leakage in air ducts are reduced.

Figure 1. Low-power screw compressor with air collection tank.

The use of a screw compressor made it possible to connect the compressed air with the actual consumption of the consum er.

The operation of screw compressors does not require the constant supervision of technicians near them. Screw compressors do not require current maintenance, and their maintenance consists only of periodic replacement of spare parts. The maintenance time of a screw compressor is only a few hours, while the maintenance of a powerful reciprocating compressor takes 10 days or more.

Of course, a decentralized system has its drawbacks. For example, when a screw compressor breaks down, the question of backup air collection equipment immediately arises. Therefore, backup devices are necessary in any case.

However, installing and connecting a screw compressor does not present the same problems as reverse water cooling of a large capacity reciprocating compressor. Strong supports and foundations are not required to install the screw compressor, only a flat horizontal surface is sufficient.

Many businesses that have moved from a centralized to a decentralized system have already reaped significant economic benefits.

The second stage is application to the production of screw compressors with a frequency converter.

The next stage in the development of energy-saving technologies was the development of screw compressors with frequency converter drive in the mid-90s of the last century. A modern adjustable

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frequency drive consists of an asynchronous motor and a frequency converter. An electric motor converts electrical energy into mechanical energy and drives a pair of screws. A frequency converter drives an electric motor and converts alternating current from one frequency to another. It is called "variable frequency drive" and adjusts the speed of the motor by changing the frequency of the source voltage.

Figure 2. Medium power screw compressor.

The introduction of a frequency converter in compressor technology has a number of advantages over ordinary screw compressors.

- When starting an asynchronous electric motor of a conventional screw compressor, the starting current exceeds the nominal current several times, which leads to overloading of the network and limits the duration of the processing time. In frequency converter compressors, the start-up is smooth due to the frequency converter, and the voltage drop in the network is almost imperceptible.
- "Frequency converter" accuracy during operation keeps the required pressure with an accuracy of 0.01 MPa and immediately restores the pressure level when the pressure in the network changes.

For information, every 0.1 MPa of air pressure increases the electric energy consumption of the compressor by 6-8%.

- The production time of the compressor with a "frequency converter" corresponds to the demand for compressed air. As a result, electrical energy consumption is minimized during pure operation, when the asynchronous motor of a simple screw compressor consumes about 25-30% of its power.

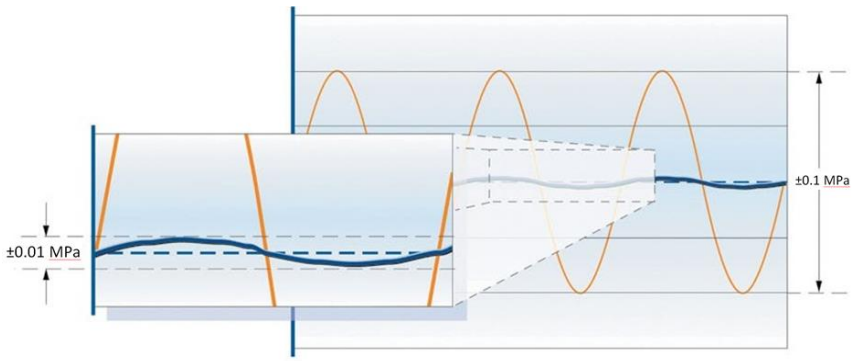

Figure 3. The frequency compressor maintains the required working pressure in the system with an accuracy of 0.01 MPa.

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And all these benefits are really earned. To clearly show the advantages of "variable frequency conversion" two graphs showing the total costs of producing compressed air over several years for a typical variable frequency compressor without variable frequency drive and a variable frequency drive combination are presented (Figure 4). It can be seen that during the operation of a compressor with a frequency converter, energy saving reaches 35%.

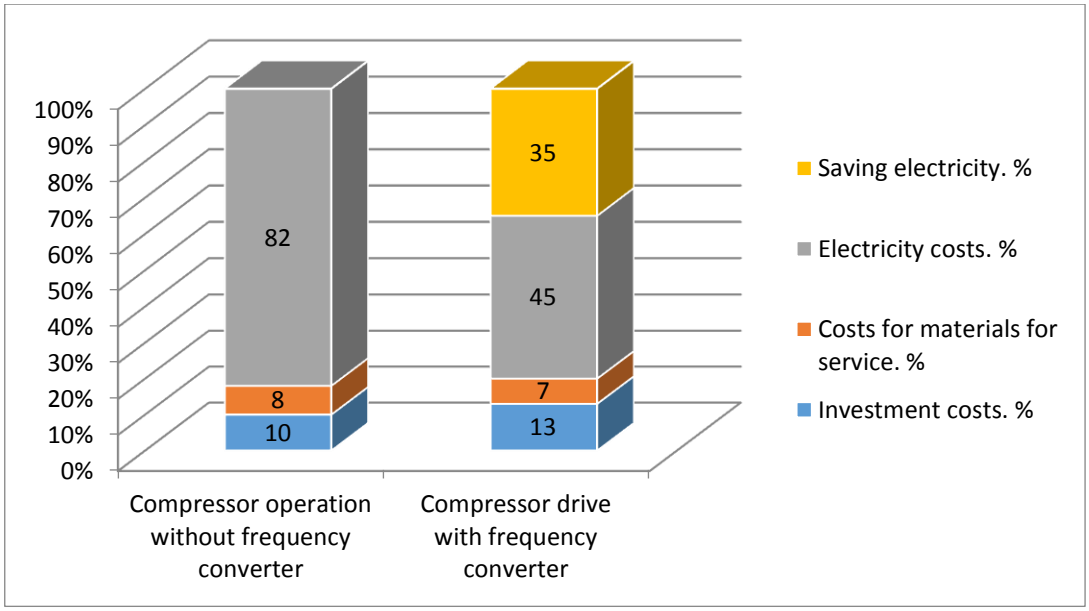

Figure 4. Comparison charts showing the advantages of using a variable frequency compressor.

References

1. Пластинин П.И. Поршневые компрессоры. Т.1 – М.: КолосС, 2006
2. Компрессорные машины. Страхович К.И., Френкель М.И., Кондряков И.К., Рис В.Ф. Москва. 1961
3. Воздушный компрессор "Komfort-1032". - Москва: Наука, 2009. - 595 с.
4. Рассел, Джесси Компрессор / Джесси Рассел. - М.: VSD, 2013. - 607 с.
5. Компрессоры: энергосбережение и надёжность. Журнал Компрессоры и пневматика. ugli Arzikulov X. M. SIQILGAN HAVO TIZIMLARIDA ENERGIYA TEJASH //Educational Research in Universal Sciences. – 2023. – Т. 2. – №. 14. – С. 620-625.