ACADEMICIA
An International Multidisciplinary Research Journal
(Double Blind Refereed & Peer Reviewed Journal)

DOI: 10.5958/2249-7137.2021.01239.8

MODERNIZATION OF INDUSTRIAL COMPRESSORS BASED ON MODERN AUTOMATION TOOLS

Abduraxmonov Sultanali Mukkaramovich*; Sayitov Shavkatjon Samiddin ugli; Khasanov Ulugbek Shamilevich***; Karabayev Fazdindin Sirojitdinovich******

*Associate Professor,
Tashkent University of Information Technologies named after Muhammad al Khwarizmi,
UZBEKISTAN

**Assistant,
Fergana Polytechnic Institute,
UZBEKISTAN

***Master Student
Fergana Polytechnic Institute,
UZBEKISTAN

****Master Student,
Fergana Polytechnic Institute,
UZBEKISTAN

ABSTRACT

Modern compressors are built mainly by their computer-based automatic control systems that meet modern energy-saving requirements. Computer controls ensuring the safety of the equipment operation creates the conditions for saving energy.

KEYWORDS: *Electrical Energy, Computer Controls, Discrete Signals, Conversion Of Analog, Regulator, Compressor.*

INTRODUCTION

A compressor is an industrial equipment that is designed to compress gases, increase pressure and further supply compressed gas to the consumption of technological processes. The tasks in this case can be different from meeting the need for high-pressure compressed air to increasing the pressure in order to separate (dehumidify) the gas. Industrial compressors are used in many

industries and in various technological processes. Because the compressor is a rather complex and expensive equipment, with a large consumption of electrical energy [1].

Modern compressors are built mainly by their computer-based automatic control systems that meet modern energy-saving requirements. But many industrial enterprises use compressor machines built according to the projects of the 90s, which did not have computer control. Computer controls ensuring the safety of the equipment operation creates the conditions for saving energy.

Replacing these compressors with a new automated one requires a large financial cost. Therefore, the modernization of compressors based on elements of modern computer automation is relevant. We have developed modern automated control systems for compressor units based on multi-level automation systems built on the basis of industrial controllers, operator panels and operator workstations[2,3].

The constructed system is a two-level system consisting of a first-level system implemented on microprocessor-based meters-regulators, remote access modules, and a second-level system implemented on an industrial computer.

The first-level system includes:

- Subsystem for collecting, displaying and converting information; implementations of control actions.

The first of the subsystems performs: - collection, conversion of analog and discrete signals from the object; control of the reliability of the input analog information; - generates discrete signals (signs) of channel malfunction; measurement of input signals and output beyond the limits of the specified parameters.

- blocking the operation of the compressor according to certain parameters.

The second subsystem of the first level performs the calculation, checks for restrictions and implements the calculated control actions on the executive mechanisms of regulatory bodies.

The second-level system includes:

- subsystem for collecting and processing and storing information;

- subsystem for diagnostics of the state of the main equipment and situational control of the technical process;

- subsystem for adapting the coefficients of regulators and filtration coefficients;

The second-level information collection and processing subsystem collects analog and discrete information from the ADC and DAC modules, as well as information entered by the operator from the keyboard, filters and checks the reliability of the input information.

The subsystem of diagnostics of the state of the main equipment and situational control of the technological process of the second level is designed to recognize with a certain degree of confidence situations of shutdown of the main equipment and the state of the technological process with the issuance of recommendations on the virtual structure of the control circuits.

The subsystem of adjustment of coefficients of regulators on the basis of the analysis of dynamics of transients on channels:" the regulated variable - the position of the regulating body " carries out adjustment of tuning coefficients of regulators, and on the basis of the analysis of behavior of current values of analog parameters, carries out adjustment of coefficients of filtration.

The information representation subsystem is designed to implement a set of functions of the driver-operator dialogue with a personal computer. Information exchange between subsystems should be carried out through a system-wide information base. The operating mode of the system is continuous, three-shift.

The developed system is implemented for the modernization of the compressor 2VM2 .5-12/9.

Fig 1. Compressor 2VM2, 5-12 / 9

The compressor 2VM2. 5-12 / 9 is a horizontal, crosshead, piston compressor of two-stage compression, made on the opposite base M2, 5.

Complete set of the compressor 2VM2, 5-12/9 2VM-2,5-12/9 - all compressors are supplied with 2VM2. 5-12 / 9 electric motors, intermediate and end refrigerators.

Intermediate gas coolers are located above the compressor cylinders. The end gas cooler is installed on the foundation near the compressor. The 2VM air piston compressor with cylinder and oil seal lubrication is used in almost all industries where compressed air is not subject to strict cleanliness requirements. They are designed for the supply of compressed air as an energy carrier in construction works, coal and ore mining, tunneling, transportation of bulk products, in the drives of automation systems, pneumatic machines and equipment, etc.

Modular reciprocating air compressor units 2VM are mounted on a single supporting frame in factory readiness. The compressor 2VM2. 5-12 / 9 is driven by an asynchronous electric motor.

Technical characteristics of the compressor:

Compressible gas	Air	
Motor shaft speed, rpm	750	375
Capacity,	27	13,5
according to the suction conditions, m3 / min Initial	Atmospheric pressure	
pressure, atm Final	9	

pressure, atm	130	130
Flow rate ohl. water without end cooler (inlet +15°C), l / min Oil	96	
Amount of oil to be poured into the compressor frame, l Compressor	100	
weight, kg	3920	
Type	A2K 85/24-8/16 УХЛ4	
Power, kW	160/75	
Voltage, V Installation	380	
weight in the scope of delivery, kg	5000	
Overall dimensions of the installation, mm	3000×1485×2100	

The newly developed automated control system "Compressor" has special mnemonic circuits that control and control the operation of the compressor[4]:

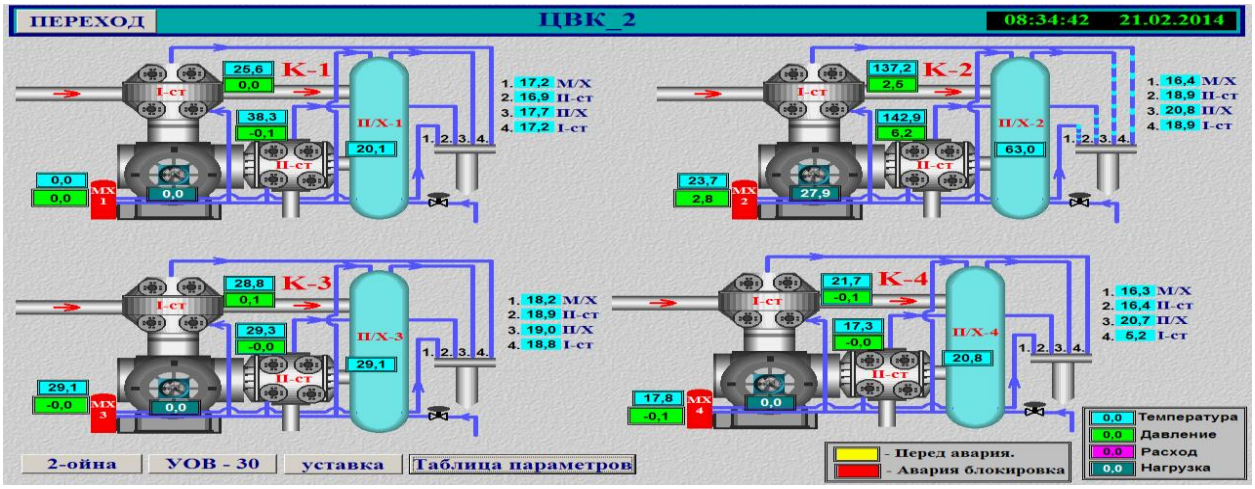


Fig. 2 The main mnemonic diagram.

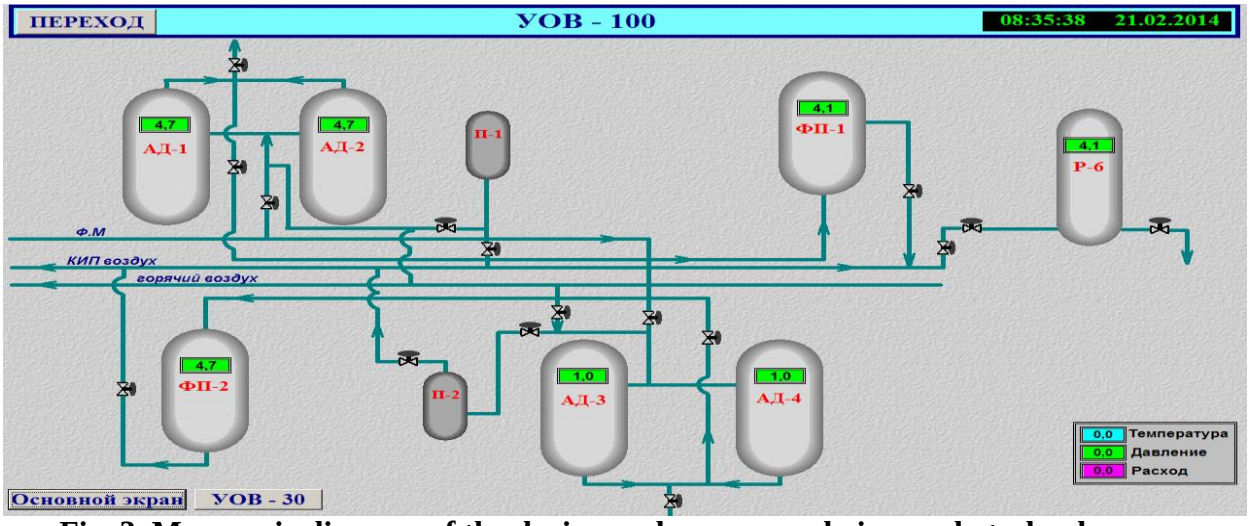
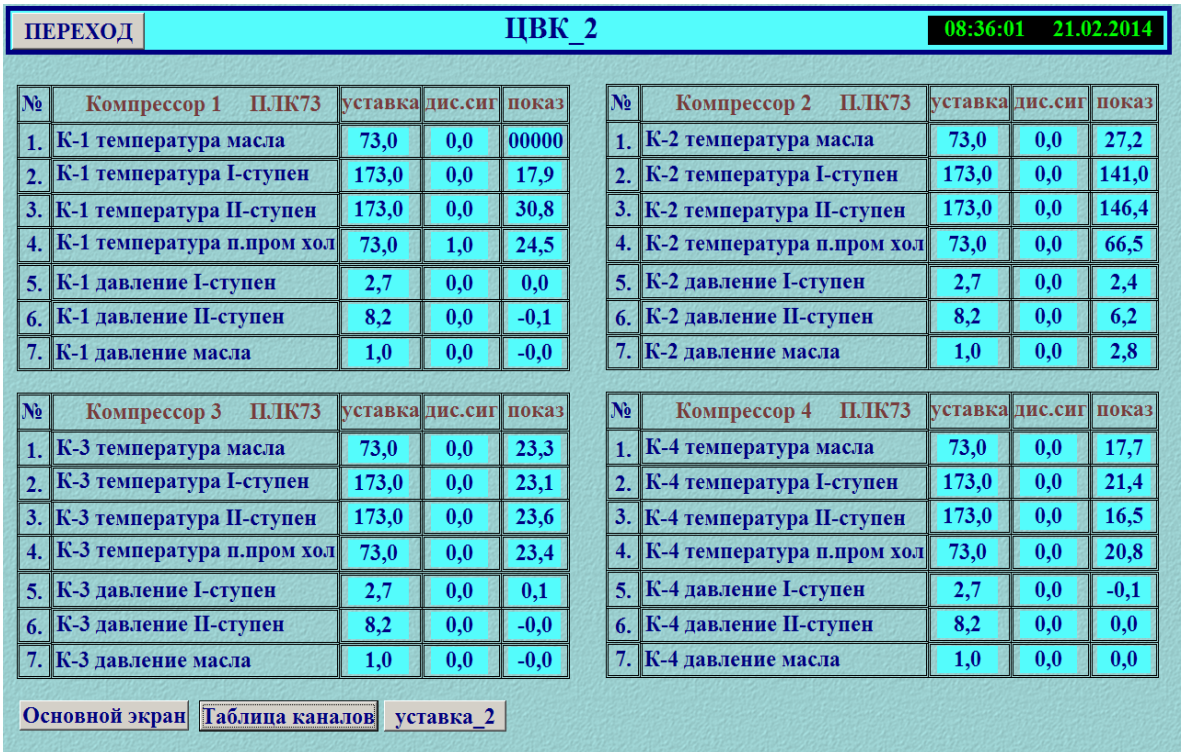


Fig. 3. Mnemonic diagram of the drying and compressed air supply technology.



ПЕРЕХОД ЦВК_2 08:36:01 21.02.2014

№	Компрессор 1 ПЛК73	уставка	дис.сиг	показ
1.	К-1 температура масла	73,0	0,0	00000
2.	К-1 температура I-ступен	173,0	0,0	17,9
3.	К-1 температура II-ступен	173,0	0,0	30,8
4.	К-1 температура п.пром хол	73,0	1,0	24,5
5.	К-1 давление I-ступен	2,7	0,0	0,0
6.	К-1 давление II-ступен	8,2	0,0	-0,1
7.	К-1 давление масла	1,0	0,0	-0,0

№	Компрессор 2 ПЛК73	уставка	дис.сиг	показ
1.	К-2 температура масла	73,0	0,0	27,2
2.	К-2 температура I-ступен	173,0	0,0	141,0
3.	К-2 температура II-ступен	173,0	0,0	146,4
4.	К-2 температура п.пром хол	73,0	0,0	66,5
5.	К-2 давление I-ступен	2,7	0,0	2,4
6.	К-2 давление II-ступен	8,2	0,0	6,2
7.	К-2 давление масла	1,0	0,0	2,8

№	Компрессор 3 ПЛК73	уставка	дис.сиг	показ
1.	К-3 температура масла	73,0	0,0	23,3
2.	К-3 температура I-ступен	173,0	0,0	23,1
3.	К-3 температура II-ступен	173,0	0,0	23,6
4.	К-3 температура п.пром хол	73,0	0,0	23,4
5.	К-3 давление I-ступен	2,7	0,0	0,1
6.	К-3 давление II-ступен	8,2	0,0	-0,0
7.	К-3 давление масла	1,0	0,0	-0,0

№	Компрессор 4 ПЛК73	уставка	дис.сиг	показ
1.	К-4 температура масла	73,0	0,0	17,7
2.	К-4 температура I-ступен	173,0	0,0	21,4
3.	К-4 температура II-ступен	173,0	0,0	16,5
4.	К-4 температура п.пром хол	73,0	0,0	20,8
5.	К-4 давление I-ступен	2,7	0,0	-0,1
6.	К-4 давление II-ступен	8,2	0,0	0,0
7.	К-4 давление масла	1,0	0,0	0,0

Основной экран Таблица каналов уставка_2

Fig. 4. Mnemonic display of technological parameters

CONCLUSION

We have developed a system that reduces the human impact on the operation of the compressor and optimizes the operation. The implementation of the system is achieved by saving electrical energy by 20 %.

The upper level of the automated control system "Compressor" is developed on the instrumental software package Trace Mode and is universal for use in other types of compressors.

REFERENCES:

1. Воронецкий А. В. Современные центробежные компрессоры. — М.: Премиум Инжиниринг, 2007. — 140 с

2. 2. Аллаяров О.Н., Сургучев А.В., Чеботарев С.М., ., Абдурахмонов С.М., Хен В.П. «Автоматизированная система управления технологическим процессом выпуска стеклопосуды на базе TRACE MODE».Журнал Приборы и системы. Управление, Контроль, Диагностика, 2003 г. (Россия)., №6,стр. 20-21.,

3. Аллаяров О.Н., Сургучев А.В., Абдурахмонов С.М., Хен В.П. «АСУТП станции защитных атмосфер» Журнал Приборы и системы. Управление, Контроль, Диагностика, 2003 г. (Россия), №8, стр. 15-16.

4. С.М. Абдурахмонов, Н.М. Жураев, З.Ш. Халилов. ИШЛАБ ЧИКАРИШ КОРХОНАЛАРИНИ ЗАМОНАВИЙ КУРИЛМАЛАР АСОСИДА МОДЕРНИЗАЦИЯЛАШ., МАШИНАСОЗЛИКДА ЗАМОНАВИЙ МАТЕРИАЛЛАР,

ТЕХНИКА ВА ТЕХНОЛОГИЯЛАР. Халкаро илмий- техникавий анжуман Туплами. Андижон, апрель, 2016. стр. 519-521

5. Khmonov S. M., Sayitov S. S. Smart traffic light technology //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 11. – С. 1309-1313.
6. Mukaramovich A. S., Samidinugli S. S., Anvarovich T. A. About automated measuring systems in the production of bulk products //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 10. – С. 1299-1304.
7. Хмадалиев Ў. А., Сайитов Ш. С. У. Контроллер заряда аккумуляторной батареи позволяющий уменьшить количество солнечных панелей //Universum: технические науки. – 2018. – №. 2 (47).
8. акимов М. Ф., Тожибоев А. К., Сайитов Ш. С. СПОСОБЫ ПОВЫШЕНИЯ ЭНЕРГЕТИЧЕСКОЙ ЭФФЕКТИВНОСТИ АВТОМАТИЗИРОВАННОЙ СОЛНЕЧНОЙ УСТАНОВКИ //Актуальная наука. – 2019. – №. 11. – С. 29-33.
9. Сайитов Ш. С. и др. НОВАЯ КОНСТРУКЦИЯ ДЛЯ ПАЙКИ ТЕРМИНАЛА СИСТЕМЫ ПОДОГРЕВА ЗАДНЕГО СТЕКЛА АВТОМОБИЛЯ //Актуальная наука. – 2019. – №. 9. – С. 22-27.
10. Mamasodikov Y., Qipchaqova G. M. Optical and radiation techniques operational control of the cocoon and their evaluation //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 5. – С. 1581-1590.