

ISSN 2181-8622

Manufacturing technology problems



**Scientific and Technical Journal
Namangan Institute of
Engineering and Technology**

**Volume 8
Issue 2
2023**



UDK 621-314.212

CONTROL OF VIBRATION PARAMETERS ON THE TANK WALL OF OIL POWER TRANSFORMERS IN OPERATION

KADYROV HUSANKHON

Doctoral student of Fergana Polytechnic Institute
E-mail: xusanxonqodirov231@gmail.com, Phone.: (+99890) 231-3910

Abstract:

Objective. evaluation of dynamic viscosity of transformer oil according to vibration parameters under operational conditions.

Methods. vibration control, thermal image control, analytical analysis, correlation analysis methods were used.

Results. The dynamic viscosity of the transformer oil and the change value of the dynamic viscosity during the current repair interval were determined with the vibration parameter in the frequency range of 1 kHz to 10 kHz.

Conclusion. The experimental results of determining the oil viscosity by controlling the vibration parameters in the operational state of the oil power transformer were presented. According to the vibration parameters, the indicators of reduction of the dynamic viscosity from the nominal value are determined. During the current technical inspection of transformers, it was possible to determine the condition parameters in a short period of time and at low costs.

Keywords: Oil power transformer, drain, technical condition, diagnostics, method, faults, damage, vibrodiagnostics.

Introduction. To evaluate the technical condition of transformers, it is necessary to analyze the parameters of its elements: temperature, pressure, currents, noise level, vibration frequency, vibration speed, vibration acceleration [2]. Early detection of faults and their causes using diagnostic methods of transformers allows to reduce the cost of electrical equipment by 75%, losses caused by lack of power by 63% and save annual costs by 2% [3]. Today, in connection with the growing attention to saving energy and resources at the level of demand, the scientific researches being carried out to ensure the long-term operation of technological devices are aimed at identifying faults that have started in the transformer, extending its service life, and reducing repair costs. is being studied.

Evaluation of the technical condition of oil power transformers is divided into two groups[2]:

1. Assessment of the technical condition in the case of being disconnected from the network;

2. Evaluation of the technical condition in the state connected to the network (operation).

Technical diagnostics of individual elements of the transformer can be carried out without disassembling the transformer, or with partial or complete disassembly. Diagnostics with dissection includes the use of non-destructive and dimensional control methods and tools for the parameters of individual components and parts. To assess the technical condition without disassembling them, diagnostic indicators are used: temperature, pressure, leakage currents, noise level, vibration amplitude, vibration speed, vibration acceleration, etc. [1]. Shows the classification of the main damage of the power transformer.

In recent years, the method of vibration diagnostics has been developing in the assessment of the technical condition of oil power transformers. The existing sections of the method of vibration diagnostics allow to assess the technical condition of the mechanical part of oil power transformers. This vibration diagnosis method uses vibration

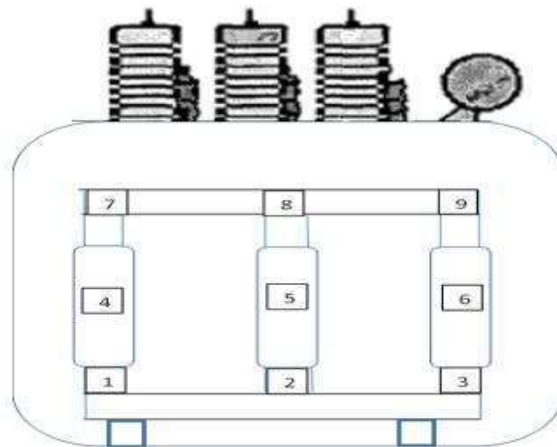
parameters with a frequency of up to 1 kHz. The results of the high-frequency vibration parameters at 1 KHz do not reflect the results of the mechanical part. Because at a frequency higher than 1 kHz, the effect of mechanical parts in the oscillating motion fades in the oil [3]. In order to increase the accuracy of assessing the technical condition of oil power transformers and to better study the factors that have a negative effect on the operational condition, it is desirable to control them at frequencies of 1 kHz and higher. Research shows that high-frequency vibration parameter values at 1 kHz reflect values arising from small damages. An increase in the particles in the transformer oil indicates that the quality index of the oil is decreasing.

Methods. Diagnostic methods, vibration control, thermal image control,

analytical analysis, and correlation analysis methods were used in the research process.

Research results and their discussion. When assessing the technical condition of an oil power transformer, it is appropriate to control its main structural elements and auxiliary elements. In order for the main components of oil-based power transformers to work in long-term operating conditions, it is necessary to have good quality indicators of oil. The use of the vibration control method in determining the technical condition of the oil in operational conditions allows for quick analysis.

In order to carry out vibration diagnostics of an oil transformer under operating conditions, we divide its tank surface into vertical and horizontal parts.



Picture 1. Installation points of sensors for monitoring vibration parameters on the surface of the transformer tank

When carrying out the research results, the vibration results are analyzed according to the frequency. We get the results of the vibration parameter up to 1kHz as values that are resolved in the active part of the transformer. In this case, it is appropriate to accept the values in the lower part. Because the vibration in the mechanical parts, that is, in the ferromagnetic core and coils, spreads to

the transformer tank through the base. It is desirable to take into account the value of the vibration parameters at values higher than 1 kHz at the surface of the tank. At high frequency, the vibration parameters of mechanical parts fade and reflect the vibration parameters of small particles. Small particles move along the entire tank along with the oil and create a vibration effect in the transformer tank. The moving

particles in the oil consist mainly of oil droplets and water droplets, and as its value increases, the values of the vibration parameters also increase.



Picture 2. Oil in operation has high frequency oscillations compared to power transformer oil

The impurities in the oil are considered as mechanical impurities. An increase in mechanical impurities means that the quality indicator of transformer oil is deteriorating. Monitoring the technical condition of the transformer elements in accordance with the frequency range, while recording the vibration parameters of oil power transformers and studying the

reasons for the formation of these parameter values.

According to the vibration parameters in the frequency range from 1 kHz to 10 kHz, the dynamic viscosity is studied in laboratory conditions by taking samples from the oil of each measuring transformer. The dynamic viscosity of the transformer oil was determined using the "Viscosometer" device.

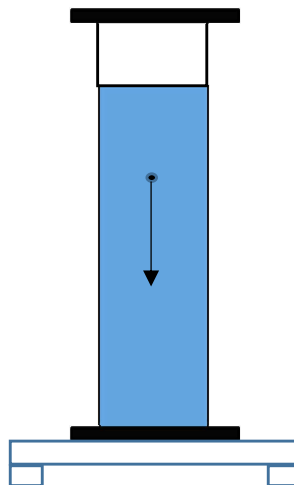


Figure 3. Capillary viscometer

The oil of each transformer whose vibration parameters were controlled was checked for its dynamic viscosity using a viscometer laboratory stand. As a result of these tests, the values of dynamic viscosity were studied according to the change of the temperature of the transformer oil in accordance with the results of the vibration

speed of the oil power transformer. Viscosity indicators of liquids change depending on its temperature. But the quality indicators of the liquid accelerate these value changes.

The results of determining the dynamic viscosity of the liquid in Figure 3 can be expressed by the following formula:

$$\eta = \frac{2(\rho_j + \rho_s)gr^2}{9v} \tag{1}$$

Here:

ρ_j – ball density, ρ_s – liquid density, r – the radius of the sphere, v – the ball's falling speed, g – acceleration of a body in free fall.

We can see the process of change of dynamic viscosity according to the vibration acceleration for the same temperature on the viscometer laboratory stand through the following characteristics.

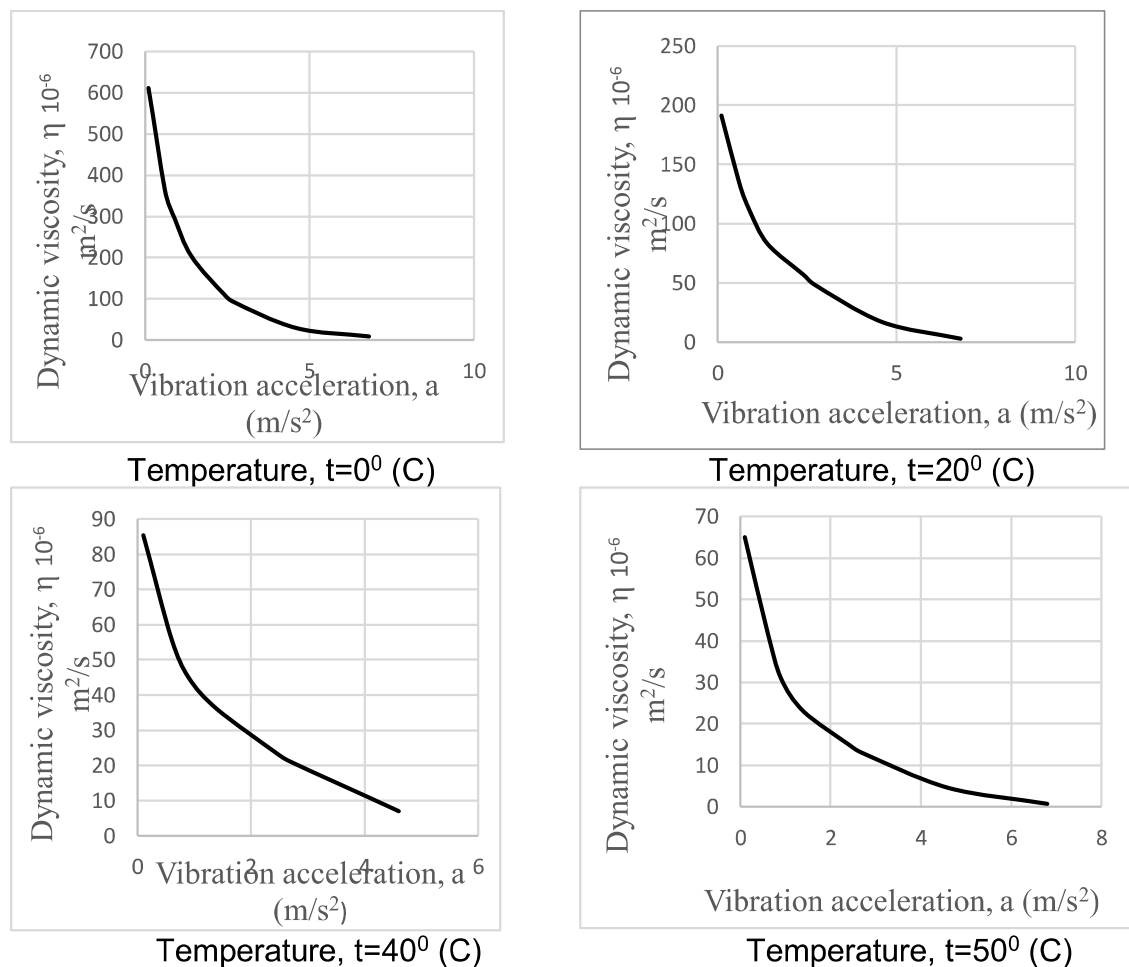


Figure 4. Characteristics of the results of the vibration acceleration of the transformer oil depending on the dynamic viscosity at different temperatures

According to the results of the research, table 1 was formed on the expression of the dynamic viscosity of the oil at different temperatures by the vibration parameters affecting the wall of the transformer tank according to the quality indicators.

Table 1

Temperature, t (c)	Vibration acceleration, a (m/s ²)							
	0,1	0,6	0,9	1,4	2,4	2,7	4,6	6,8
0	611.4	365.1	302.7	203.4	111,2	91.3	29.1	9.1
10	325.5	235.2	186.4	121.2	82.2	64.3	22.2	7.8
20	191.4	135.2	111,2	83.1	57.6	49.7	17.1	2.97
30	121.3	95,1	74,2	61.6	45.4	42.5	12.3	2.57
40	85.4	67.2	51.3	36.1	28.5	25.3	7.2	2.11
50	65.7	42,1	31.6	27.5	21.8	17.7	3.3	0.65
60	46.2	34.3	26.4	19.6	10.4	8.1	1,34	0.55

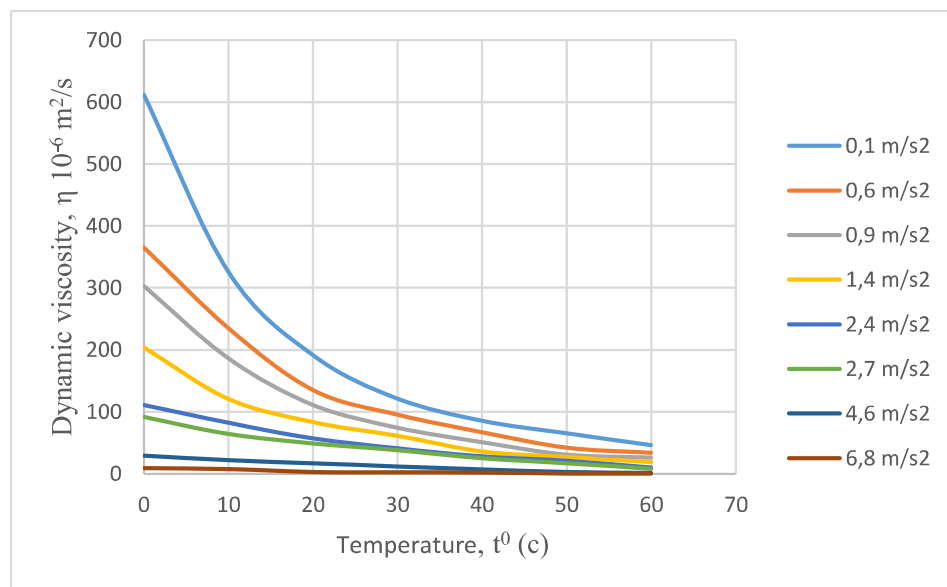


Figure 5. Characteristic of dependence of dynamic viscosity of transformer oil on vibration parametric and temperature

Based on the characteristics in Figure 5, we can clearly see the dynamic viscosity of the transformer oil at different temperatures and the vibration indicators affecting the tank wall.

Monitoring the dynamic viscosity values of oil power transformer oil under operational conditions allows them to accurately plan the maintenance costs and service plan of the maintenance personnel. It is possible to reduce the effect of factors such as load and external temperature

changes affecting the operation of oil power transformers.

By comparing the quality indicators of transformer oils with controlled vibration parameters, we can see the excess demand placed on the transformer during scheduled maintenance intervals. As an example, we can consider the graph of changes in the quality indicators of transformer oil during the current maintenance period of transformers, that is, six months of control.

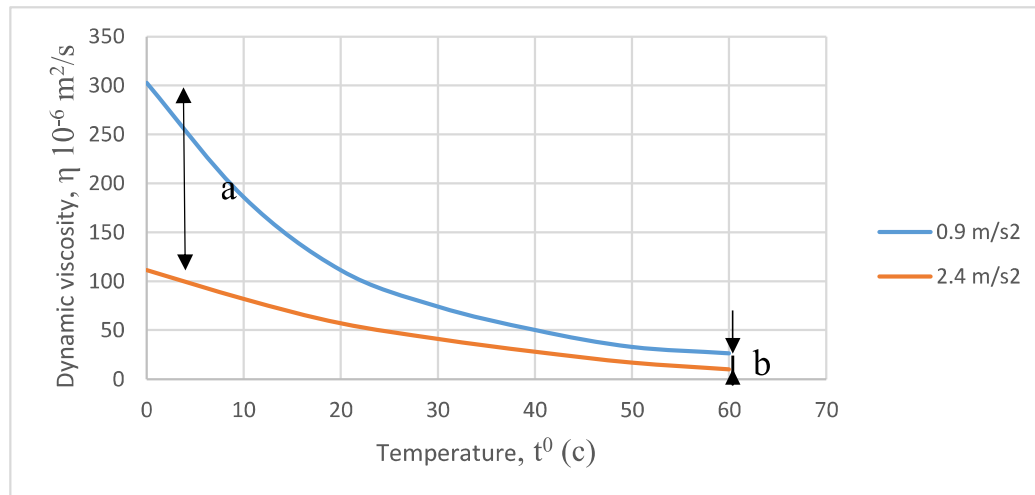


Figure 6. The difference in the change of the dynamic viscosity of the oil during the current maintenance interval

The quality indicator of the oil during the current repair period of the oil power transformer allows to determine whether the value of the change exceeds the demand for it. The b value in Fig. 6 is the $\Delta\eta$ value of the quality indicator of the transformer oil in the operational state over time between the first control and the second control.

$$\Delta\eta = \eta_2 - \eta_1 \quad (2)$$

Here:

η_1 – dynamic viscosity of the oil at the initial time;

η_2 – dynamic viscosity of oil over time.

It is recommended to control the load of the transformer taking into account the temperature of the external environment in accordance with the value of $\Delta\eta$ of the oil. The dynamic viscosity of the oil represents the ability to transfer the temperature of the transformer core to the external environment.

Summary. The experimental results of determining the oil viscosity by

controlling the vibration parameters in the operational state of the oil power transformer were presented. According to the vibration parameters, the indicators of reduction of the dynamic viscosity from the nominal value are determined. During the current technical inspection of transformers, it was possible to determine the condition parameters in a short period of time and at low costs.

References

- ГОСТ 1983-2015 Межгосударственный стандарт. Трансформаторы напряжения Общие технические условия// Москва Стандартинформ 2016.
- А.В.Тюрюмина, В.С.Секацкий, А.П.Батрак. Применение метода акустической эмиссии для диагностики силовых трансформаторов// Техническая физика завашишинские чтения- 2017. 293-296 с.
- А.Ю.Гурьянов. Современные методы диагностики силовых трансформаторов// Энергообеспечение, энергосбережение и эффективное использование энергии 310-312 с.
- D.T.Yusupov, X.M.Qodirov, N.U.Karimov. “Moyli kuch transformatorlari resurslarini vibrodiagnostika orqaliy tahlil qilish” nomli maqola Scientific-technical journal (STJ FerPI, ФарПИ ИТЖ, НТЖ ФерПИ, 2022, Т.26. спец. выпуск №9)

6. D.T.Yusupov, X.M.Qodirov, N.U.Karimov. Kuch transformator moyining dinamik qovushqoqligi 1 kHz dan yuqori chastotada tebranish tezlanishini ta'siri // Scientific-technical journal (STJ FerPI, ФарПИ ИТЖ, НТЖ ФерПИ, 2022, Т.26. спец.выпуск №9) 189-192 betlar

7. Юсупов Д.Т., Кадыров Х.М. Высокочастотный вибрационный контроль масляных силовых трансформаторов. Министерство науки и высшего образования Российской федерации министерство образования и науки республики Татарстан «Казанский государственный энергетический университет» актуальные вопросы прикладной физики и энергетики III международная научная конференция 27-28 октября 2022

8. D.T.Yusupov, X.M.Qodirov "Moyli kuch transformatorlarni teplovizion diagnostikasi" mavzusida // Navoiy bo'limi tashkil etilganligining 5-yilligiga bag'ishlangan "Fan, Ta'lim va ishlab chiqarishning integratsiyasi-rivojlanish vataraqiyot garovi" Xalqoro ilmiy amaliy koferensiyasi 2022 yil 9-10 iyun Navoiy shahri 195-198 betlar

9. D.T.Yusupov, X.M.Qodirov. Uzoq muddat ekspluatatsiya sharoitidagi moyli kuch transformatorlarida paydo bo'ladigan nosozliklarini vibratsion tahlil qilish// Oliy ta'lim muassasalarida raqobatbordosh kadrlar tayyorlashning zamonaviy integratsiyasini ta'minlash: muammolar va yechimlar" mavzusidagi Respublika miqyosidagi ilmiy-texnikaviy anjuman materaillar to'plami. – Qo'qon: TDTU QF 2022.247-249 betlar

10. D.T.Yusupov, X.M.Qodirov. Uzoq muddat ekspluatatsiyada bo'lgan moyli kuch transformator resurslarini tebranish tekshiruvi usullarda baholash// Qarshi muhandislik-iqtisodiyot institutida xorijiy oliy o'quv yurtlari olimlari ishtirokida "Energiya va resurslarni tejovchi innovatsion texnologiyalarni rivojlantirishning dolzarb muammolari" mavzusida Respublika ilmiy-amaliy konferensiyasiga teziz bilan qatnashildi. 2022-yil 23-24-sentabr 96-99 betlar.

METHODOLOGY FOR ASSESSING THE LEVEL OF TRAIN SAFETY

KHUDAYBERGANOV SAKIJAN

Associate professor of Tashkent State Transport University
E-mail: sakijan@mail.ru

ABDURAKHMANOV AZAM

Independent researcher of Tashkent State Transport University
E-mail: Azam4579494@mail.ru

KHUSENOV UTKIR

Assistant of Tashkent State Transport University
E-mail: otkirusenov@mail.ru

YUSUPOV AZIZJON

Senior lecturer of Tashkent State Transport University
E-mail: yusupovaziztosh@gmail.com

Abstract. The results of the analysis of the existing methods of train safety management show that these methods are not enough to solve the issues of economic traffic safety management. This means that there is a need to develop a methodology to improve the efficiency of traffic safety management. This article presents a newly developed new methodology for assessing the level of safety of train traffic, in which the formula for determining the level of safety of cargo transportation is developed taking into account the

CONTENTS

PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

N.Khalikova, S.Pulatova	
A research of consumer opinions in forming the important factors of fur garments.....	3
N.Khalikova, S.Pulatova	
Literary analysis new technologies of women's outer clothing from carakul....	9
Sh.Korabayev, H.Bobojanov, S.Matismailov, K.Akhmedov	
Study of aerodynamic characteristics of cotton fiber in separator of pneumo-mechanical spinning machine.....	14
Sh.Korabayev	
Research of the movement of fibers in the confusion between the air channel and the rotor in a pneumo-mechanical spinning machine.....	18
M.Mirsadikov, M.Mukimov, K.Kholikov, N.Karimov, Sh.Mamadjanov	
Analysis of technological parameters and physic-mechanical properties of interlock knitted fabric knitted from cotton-nitron yarn.....	23
M.Mirsadikov, M.Mukimov, K.Kholikov, N.Karimov	
Study of technological parameters and physical-mechanical properties of rib fabric knitted from spinning cotton-nitron yarn.....	32
N.Karimov	
Analytical calculation of the deformation state of the saw gin saw teeth bending under the action of a load.....	38
Z.Ahmedova, A.Khojiyev	
Analysis of headwear and beret in fashion.....	42
N.Khusanova, A.Khojiyev	
Creation of a new model of women's coat.....	51
M.Abdukarimova, R.Nuridinova, Sh.Mahsudov	
Method of designing special clothing based on approval of contamination assessment methodology.....	59
Sh.Isayev, M.Mamadaliyev, I.Muhsinov, M.Inamova, S.Egamov	
Practical and theoretical analysis of the results obtained in the process of cleaning cotton from impurities.....	67
GROWING, STORAGE, PROCESSING AND AGRICULTURAL PRODUCTS AND FOOD TECHNOLOGIES	
D.Saribaeva, O.Mallaboyev	
Scientific basis for the production technology of fruit lozenges (marshmallow)	74
R.Mohamed, K.Serkaev, D.Ramazonova, M.Samadiy	
Development of technology to incorporate dehydrated murunga leaf powder in paneer cheese.....	79
B.Adashev, D.Salikhanova, D.Ruzmetova, A.Abdurahimov, D.Sagdullaeva	
Indicators of blending of refined vegetable oils.....	87
O.Ergashev, A.Egamberdiev	
Choosing acceptable parameters for experiment on new energy-saving vacuum sublimation drying equipment.....	92

A.Eshonto'rayev, D.Sagdullayeva, D.Salihanova	
Determining the effectiveness of soaking almond kernels before processing..	97
CHEMICAL TECHNOLOGIES	
Sh.Kiyomov, A.Djalilov, R.Zayniyeva	
Adhesion of a thermoreactive epoxy waterful emulsion film former on metal..	102
A.Djalilov, Sh.Kiyomov	
Synthesis of a non-isocyanate urethane oligomer based on phthalic anhydride.....	107
T.Abdulxaev	
Water vapor adsorption isotherm on zeolite AgZSM-5.....	114
F.Juraboev, B.Tursunov, M.Togaeva	
Study of the catalytic synthesis of o-vinyl ether based on monoethanolamine and acetylene.....	120
S.Mardanov, Sh.Khamdamova	
Solubility of components in the system $\text{NaClO}_3 \text{ CO}(\text{NH}_2)_2\text{-NH}(\text{C}_2\text{H}_4\text{OH})_2 - \text{H}_2\text{O}$	124
D.Salikhanova, Z.Usmonova, M.Mamadjonova	
Technological basis of activated carbon production process through processing of plum seed waste.....	128
N.Alieva	
Analysis of the effect of adhesive substances on paper strength.....	134
Sh.Rahimjanova, A.Hudayberdiev	
Optimization of heating of mixtures of oil and gas condensate by hot flows of fractions in tubular heat exchangers.....	138
M.Mehmonkhanov, R.Paygamov, H.Bahronov, A.Abdikamalova, I.Eshmetov	
Binding materials for creating coal granules and their colloid-chemical characteristics.....	146
A.Khurmamatov, S.Boyturayev	
Analysis of oil dust released during processing of metal surfaces under laboratory conditions.....	152
M.Kalilayev, Sh.Bukhorov, A.Abdikamalova, I.Eshmetov, M.Khalilov.	
Study of foam formation in polymer solutions depending on the content and nature of surfactants.....	159
MECHANICS AND ENGINEERING	
Sh.Pozilov, O.Ishnazarov, R.Sultonov	
Frequency adjustment of well pumping equipment.....	167
H.Kadyrov	
Control of vibration parameters on the tank wall of oil power transformers in operation.....	179
S.Khudayberganov, A.Abdurakhmanov, U.Khusenov, A.Yusupov	
Methodology for assessing the level of train safety.....	185
Sh.Abdazimov, N.Muminjanova	
Use of integrated technologies in vocational education.....	189
M.Uzbekov, O.Bozarov, E.Begmatov, M.Begmatova	
Analytical analysis of the optimal dimensions and energy parameters of the impeller of a nozzle hydraulic turbine.....	196
B.Boynazarov, F.Nasretdinova, M.Uzbekov	

Analysis of solar energy devices.....	205
D.Mukhtarov, R.Rakhimov	
Determining comparative efficiency in composite film solar dryers.....	213
P.Matkarimov, D.Juraev, S.Usmonkhujayev	
Stress-strain state of soil dams under the action of static loads.....	221
A.Khayrullaev	
Microcontroller-based remote monitoring of overhead power lines.....	228
A.Mamaxonov, I.Xikmatillayev	
Design of a resource-efficient chain drive structure for the device drive that distributes the seed in the bunker to the linters.....	237
A.Yusufov	
Analysis of existing methods and approaches to the assessment of residual resources of traction rolling stock.....	243
A.Djuraev, F.Turaev	
Determination of the friction force between the composite feeding cylinder and the fiber rove.....	249
A.Kuziev	
Forecasting the prospective volume of cargo transportation for the development of the transport network.....	253
N.Pirmatov, A.Panoev	
Control of static and dynamic modes of asynchronous motor of fodder grinding devices.....	260
ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION	
K.Ismanova	
Systematic analysis of the state of control of the technological processes of underground leaching.....	267
K.Shokuchkorov, Y.Ruzmetov	
Analysis in solidworks software of the strengths generated in the underground part of the wagons as a result of the impact of force on the entire wheels of wagons.....	273
A.Yuldashev	
The processes of gradual modernization of the state administration system in uzbekistan over the years of independence.....	278
ECONOMICAL SCIENCES	
O.Khudayberdiev	
Fourth industrial revolution in the textile and garment manufacturing.....	287
N.Umarova	
Methodology for assesment of external factors affecting the financial security of building materials industry enterprises.....	293