

Organization and development of working instructions for maintenance of pumps of LLP «JV KazGerMunai»

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Abstract. The scientific article contains working instructional documents on the organization of maintenance of existing types of pumps at the oil field of LLP «JV Kazgermunai», consideration of their optimal ways and maintenance with the participation of specialists in the main types of pumps. A schedule of preliminary planning of pump maintenance works at the oil field has been drawn up and the term of pump maintenance for the current year has been approved. The main purpose of the scientific article is the formation of a system of uninterrupted operation at the enterprise with optimization of maintenance in order to form a stable functioning of pumps at the oil field is to reduce the volume of basic costs for pump repairs and increase production volumes at the oil field. The scientific article discusses maintenance work on 4 types of pumps at the oil field of LLP «JV Kazgermunai». The article presents the values of the failure rate for modern brands of pumps of four groups: submersible, for drainage and wastewater; domestic; cantilever; underwater - for obtaining artesian waters based on statistical processing of data on their operation. Having developed analytical and statistical models for assessing their reliability at the enterprise, the types of failures during their operation and their probabilities were determined. Information on malfunctions and failures of pumping units of water supply and sanitation systems under operating conditions for subsequent analysis and development of recommendations for the design and operation of hydraulic systems in order to determine reliability characteristics based on the processing of the database at the enterprise by methods of mathematical statistics. According to the results of the scientific analysis carried out at the enterprise, the main causes forming the base of failures of pumping equipment were identified, priority causes of their occurrence were identified and an analysis was carried out on their operational, structural or design errors. Reliability parameters for four groups of pumping equipment used at the enterprise were evaluated, their analysis was carried out, and a schedule and regulations for periodic maintenance were drawn up.

Keywords: pump, maintenance, oil refinery, types of pumps, repair, scheduled repair of pumps.

1. Introduction

LLP «JV Kazgermunai» is one of the largest companies in the field of oil production in Kazakhstan. The oil refining company carries out its activities for exploration, development, production and sale of hydrocarbon raw materials at the Akshabulak, Nuraly and Aksai fields of the South Turgai lowland in the Kyzylorda region of Kazakhstan.

The activities of a modern enterprise producing competitive products and services require the use of modern production equipment. Its presence and effective operation are the key to success in the market. Management of the maintenance and repair of pumps is aimed at the efficient use of the assets of the enterprise involved in its main activities. The solution to this problem is associated both with the problems of using complex equipment and with personnel management, providing material and technical resources, planning and monitoring the implementation of work to maintain these systems in working order. In addition, it is necessary to ensure the safety of the operation of the equipment, since violation of the established norms and rules for its use can lead to more serious consequences: accidents and man-made accidents. Therefore, the use of complex production technical and technological systems is often the object of strict state

technical control. In order to improve the Toir management mechanism, many enterprises use new management technologies, in connection with which the problems of the practical application of application software to automate repair management processes are becoming especially relevant. Today, a significant part of foreign software is available on the market of Kazakhstan, which allows you to automate the processes of pump maintenance management.

Maintenance and repair of pumping units must be carried out in accordance with the requirements of legislative, regulatory and technical acts of the Republic of Kazakhstan:

1. Labor Code of the Republic of Kazakhstan.

1. Law of the Republic of Kazakhstan «on Civil Protection»;

1. unified rules for the development of oil and gas fields of the Republic of Kazakhstan;

1. technical regulation «rules for ensuring industrial safety for hazardous production facilities of the oil and gas industry»;

- MEST 18322-78 «system of maintenance and repair of equipment. Terms and definitions».

- GOST 21623-76 «system of maintenance and repair of equipment. Indicators for assessing the suitability for repair. Terms and definitions».

- Location 50-609-30-87 offers. Operation and repair of equipment. The order of delivery for repair and acceptance for repair. General requirements.

- MEST 2.601-2013 «unified design documentation system. Operational documents».

- MEST 27.002-89 «reliability in technology. Basic concepts. Terms and definitions».

Table 1. Description of pumps at the enterprise «JV Kazgermunai» LLP

Description of pumps at the enterprise						El.engine description		
№	Pump type	Year of release	Q, M ³ /t	H, M	n, turnover / min	El.engine type	N, кВт	n, number of rounds / min
1	SP-95-4B	2007	95.0	40	3000	Phase asynchronous	3. 18.6	3000
2	SP-125-3A	2011	125	53	2900	-//-	26	2900
3	SP-30-8	2012	30	61	2900	DIN Nr.1.4301 AISI 304	W.- 7.5	2900
4	SP-17-5	2011	30	53	3000	DIN Nr.1.4301 AISI 304	W.- 7.5	3000

Table 2. Photo and description of operation of pumps used in a scientific article

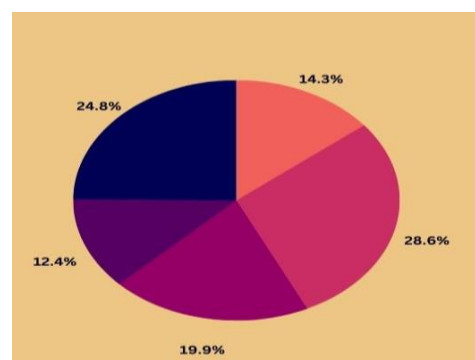
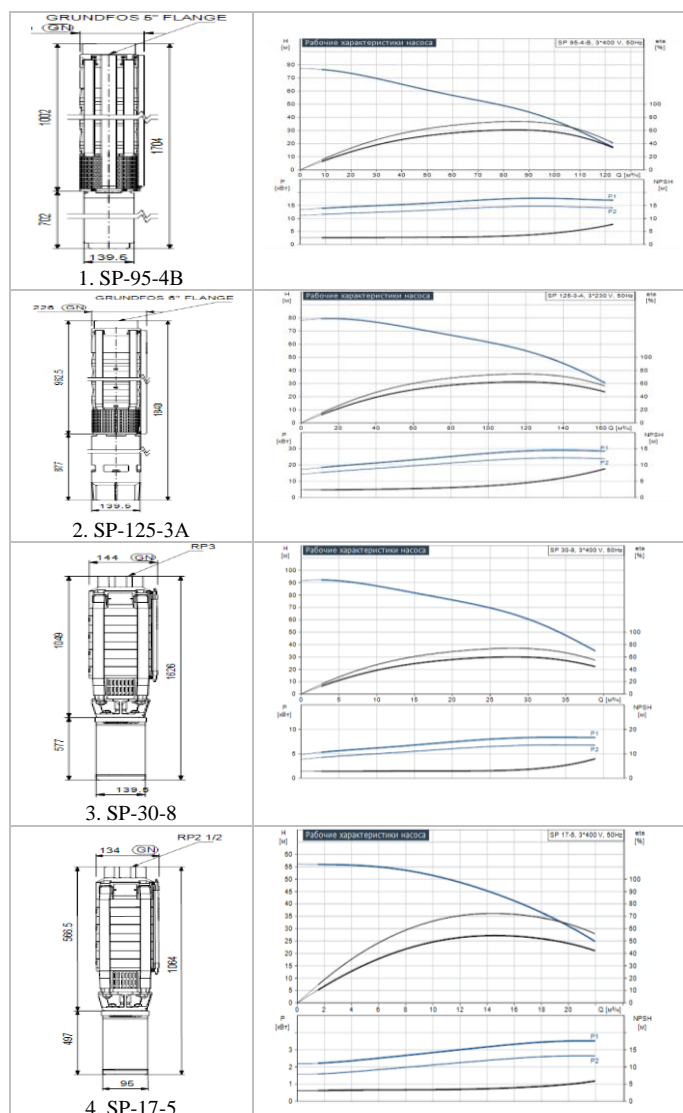


Figure 1. Percentage of possible failure values of pumps during operation

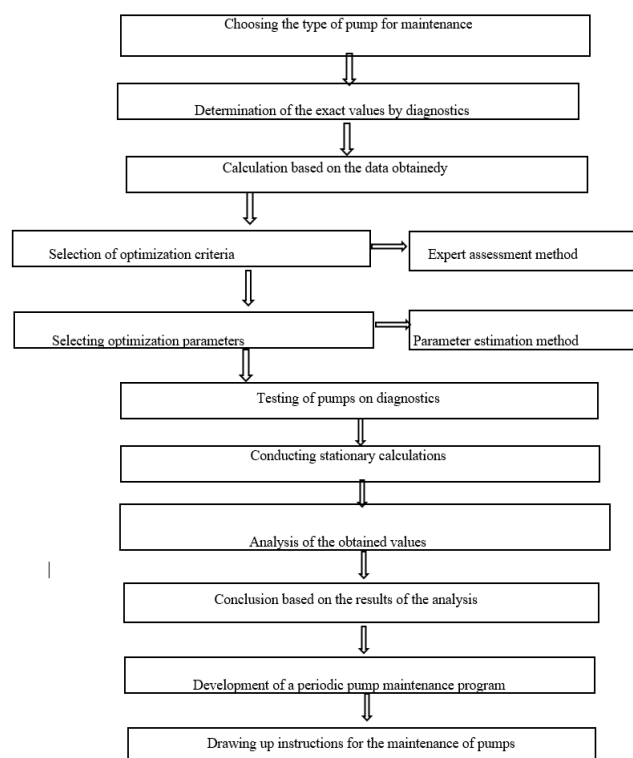


Figure 2. Methods and diagnostic observations carried out in order to assess the performance of pumps

A pump is a machine in which a mechanical transformation occurs drive energy into the hydraulic energy of the pumped fluid, due to which its flow is carried out. Pumps are used in a pumping unit consisting of one or more pumps and a drive motor connected to each other. The operation of the pump and pumping unit is characterized by a number of parameters, the most important of which are presented below. The main indicators are the so-called external characteristics that reflect the technological capabilities and energy needs of the machine.

Main parameters of the pump:

- pump Q supply (pump performance) is the amount of liquid that pumps the pump per unit of time. Measured in cubic meters per hour(m³/h) or liters per hour(l/h).

- pump Pressure is the actual mechanical work that is transmitted by the pumped liquid pump. In other words, the pressure is the height of the water column to which the pump can lift the liquid. The pump head is denoted by the letter h, measured in meters of water column (m).

- power is a complete increase in the energy obtained by all the flow in the pump per unit of time. Measured in kilowatts (kW).

The volume transfer value Q of pumps is calculated using the following formula:

$$Q(t) = \frac{n(t)}{N_0} \quad (1)$$

$$P(t) = \frac{N_{0i} - n(t)}{N_0} \quad (2)$$

Where: $Q(t)$ is the probability of rejection; $P(t)$ - the probability of working without giving up; $n(t)$ - T is the time-based waiver value; N_{0i} is a type of pumps of the same type in time.

№	List of periodic maintenance and maintenance works of pumps
1	<p>№1 maintenance (every 3 months) 4 times a year:</p> <ul style="list-style-type: none"> • Checking all parameters of pumps (pressure, flow, temperature, pressure in the compensation chamber, etc.), deviations caused by pipe clogging may be due to wear of the internal parts of the pump; • Checking for breakage and leakage of open external cables; • Electric motor maintenance: check the absence of damage, free rotation of the fan, check the centering of the shafts, check the insulation resistance, lubricate the bearing assemblies; • Checking oil seal on pumps; • Diagnostics of bearing condition; • Checking the centering of the pump couplings. <p>Checking the tightness of all fixing fittings, instrumental inspection of the relevance of the pump shafts and drive, alignment if necessary, checking the condition of the coupling, checking the condition of the oil, if necessary, add or replace again if the oil loses its physical and chemical properties or the operation of the separated motorhomes is completed);</p> <ul style="list-style-type: none"> • Check the connections for leakage of lubricating oil and refill if necessary; <p>Check for leaks through the main connections on the suction side and pump pumping side, through the shaft seals, from the bearing housings;</p> <ul style="list-style-type: none"> • Instrumental collection and analysis of systematic vibration indicators of the pump and electric motor, if necessary, elimination of the causes of increased vibration.
	<p>№2 maintenance (every 6 Months) 2 times a year</p> <ul style="list-style-type: none"> • Checking the tightness of the pump shafts and drive, if necessary, centering; • Electric motor maintenance: check the absence of damage, free rotation of the fan, check the centering of the shafts, check the insulation resistance, lubricate the bearing assemblies; • Connection maintenance; • Hydraulic fluid filling; • Checking the working condition of the emergency disconnection in order to verify its correct operation; • Check and tighten electrical connections, check for any signs of overheating.
3	<p>№3 maintenance (annual) once a year :</p> <ul style="list-style-type: none"> • Check the proper clearance of seals and connections; • Checking electrical connections and tightening of Tolar, checking for the absence of any signs of overheating; • Checking the fastening of all electrical connections; • Carry out the testing and confirmation of all pumps; • Check for wear, breakage and repair of all external cables on demand; • Checking the condition of quickly worn parts, assemblies, if necessary, replacement • Check for possible bearing runs, radial leaks, replace if the permissible parameters are exceeded; • Check the maximum radial stroke allowed by the shaft for Shaft concentration. Checking the presence of a shaft; • Check the oil viscosity and replace if necessary; • Checking the wear of mechanical peripheral seals and, if necessary, replacing them, monitoring the operation of sealing rings.

Figure 3. Schedule of periodic maintenance of pumps of LLP «JV KazGerMunai»

2. Materials and methods

2.1. Centrifugal pump maintenance instructions

1.General part.

1.1.the mechanic (Master) of the workshop is responsible for the operation of centrifugal pumps.

1.2.the workshop mechanic is responsible for timely and high-quality repairs in accordance with the schedule of planned and preventive repairs and filling out the watch log.

1.3.the operator is responsible for the operation of centrifugal pumps during shifts.

1.4.all centrifugal pumps must include the established passport form, repair, operation and operation logs of the clock, the schedule of the PPR and the plan of the room for burning pumps and pipelines.

1.5.all centrifugal pumps must be assigned a serial number. The number is attached to the pump housing and El.the engine is also in the pump starting device.

1.6. persons who have passed training courses and passed exams are allowed to service pumps.

2.preparation for launch.

2.1. pumps are clean and fit. Before starting, make sure that there are no foreign objects in the pump and El.engine. Check the El grounding.serviceability of the engine, pressure gauges.

2.2. check the presence of «traffic jams» in the pump (checked by turning the shaft to the coupling).

2.3. check if the seal is well filled.

2.4. check the presence and fixation of the clutch and fan fenders.engine.

3.starting the pump.

3.1. close the valve on the pressure pipe.

3.2. open the valve on the intake pipe.

3.3. Add email.make sure the engine and shaft are in the correct direction of rotation.

3.4. after rising from the pressure line of the pump in the pressure gauge,

slowly open the valve on the pressure pipe.

Note: in order to prevent the pump from overheating, it is not allowed to work on the injection pipe for a long time (more than five minutes) when the gate valve is closed.

4.pump operation.

4.1. monitor the bearing temperature and El temperature when the pump is running.engine.

4.2. monitor the condition of the gland (glands in Normal mode should not exceed 10-15 drops per minute).

4.3. observe the readings of the pressure gauges.

4.4. stop the pump if:

a) temperature El.the engine volume exceeds 80 CC;

B) there is a significant increase in the temperature of the pump housing compared to the temperature of the pumped liquid;

C) the bearing temperature exceeds 70 l c;

d) significant fluid leakage through the oil seal;

E) the appearance of a glandular or El fume.engine;

E) in the pump, clutch coupling and El.engine;

G) significant pressure drops during a closed shutter in the injection pipe.

5.stop the pump.

5.1. close the valve on the pump injection pipe.

5.2. shutdown El.engine.

5.3.in the cold season, in an unheated room, drain the water from the pump and pipe housing.

6.prohibited.

6.1. operation of the pump in the absence of a connecting coupling enclosure and an El Fan.engine.

6.2.in the absence of grounding, El.engine.

6.3. when the pump seal is defective.

6.4. with faulty pressure gauges.

6.5. clean and tighten the seal on the running pump.

Report all pump malfunctions to the mechanic and write in a journal.

3. Results and discussion

In order to form the activity of continuous operation of pumps during the operation process of the oil refinery enterprise LLP «JV Kazgermunai», it is necessary to optimize the

process of their maintenance and develop working instructions and regulations for them, which are used in the process of working with pumps for employees of the enterprise, specialists. In the scientific article, based on the data obtained on the research work carried out at the enterprise, a diagram of the main emerging deviations during the operation of pumps and their percentage in terms of the value of possible refusals was developed.

Maintenance of LLP «JV Kazgermunai» is a set of preventive measures aimed at ensuring the operability and safe operation of the pumping station. An important accompanying task is to identify possible problems in the form of defects or wear. And also-in the early stages of manifestation, which makes it possible to reduce the costs of their elimination.

According to the scientific article, the maintenance of pumps includes three main types of measures: checking the operability of equipment, mechanisms and devices, checking the optimality of working conditions, for example, a sufficient amount of lubricant, reliability of fastening, etc., cleaning technical devices, mechanisms and equipment.

When defects or defects are detected, a set of measures is developed to eliminate them. If necessary, as additional measures, the current repair and replacement of failed or worn parts and working units is carried out.

In this study on a scientific article, the main methods and types of diagnostic control were used in order to form their continuous operation, considering the process of their operation on 4 different types of pumps at this enterprise.

According to the research carried out at the oil refining enterprise of LLP «JV Kazgermunai», the parameters of the pumps during the main operation were determined and the corresponding calculations were carried out with the help of specialists of the enterprise.

The main result of the scientific research at the enterprise LLP «JV Kazgermunai» in the scientific article is the features of the main pumps used in oil refining, the timing schedule of their necessary maintenance and, in addition, the pumps performing the main work at the oil refining Enterprise, a regulatory regulation document has been developed considering international standards. Almost all the necessary information on the scientific article was provided by the company's engineers through information collected in regulatory journals and Diagnostic Research.

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«ҚазГерМұнай БК» ЖШС сорғыларға техникалық қызмет көрсетудің жұмыс нұсқаулығын ұйымдастыру және әзірлеу

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Андатпа. Ғылыми мақалада «Қазгермұнай БК» ЖШС мұнай кен орнындағы қолданыстағы сорғы түрлері оларға техникалық қызмет көрсетуді ұйымдастыру, олардың оңтайлы жолдарын қарастыру және сорғылардың негізгі түрлері

бойынша мамандардың қатысуымен техникалық қызмет көрсету бойынша жұмыстық нұсқаулық құжаттары жасалды. Мұнай кен орнындағы сорғылардың техникалық қызмет көрсету жұмыстары бойынша алдын-ала жоспарлау кестесі құрылды және ағымдағы жыл бойынша сорғылардың техникалық қызмет көрсету мерзімі бекітілді. Ғылыми мақаланың негізгі мақсаты мұнай кен орнындағы сорғылардың тұрақты түрде жұмыс жасауын қалыптастыру мақсатында техникалық қызмет көрсетуді оңтайландыра отырып кәсіпорындағы тоқтаусыз жұмыс жүйесін қалыптастыру сорғылардың жөндеу жұмыстарына кететін негізгі шығындардың көлемін азайту және мұнай кен орнындағы өндірістің көлемін арттыру болып табылады. Ғылыми мақаланың «Қазгермұнай БК» ЖШС мұнай кен орнындағы 4 сорғы түрлері бойынша техникалық қызмет көрсету жұмыстары қарастырылды. Кәсіпорындағы олардың сенімділігін бағалаудың аналитикалық және статистикалық модельдерін әзірлей отырып олардың жұмыс жасау кезіндегі істен шығу түрлері және олардың ықтималдылықтары анықталды. кәсіпорындағы мәліметтер базасын математикалық статистика әдістерімен өңдеу негізінде сенімділік сипаттамаларын анықтау мақсатында, гидравликалық жүйелерді жобалау және пайдалану бойынша ұсыныстарды кейіннен талдау және әзірлеу үшін пайдалану жағдайында сумен жабдықтау және су бұру жүйелерінің сорғы агрегаттарының істен шығуы және істен шығуы туралы ақпарат. Кәсіпорындағы жүргізілген ғылыми талдау нәтижелері бойынша сорғы жабдықтауының істен шығу базасын қалыптастыратын негізгі себептер анықталды, олардың пайда болуының басым себептері анықталды және олардың пайдалану, құрылымдық немесе жобалаушының қателіктері бойынша талдаулар жүзеге асырылды. Кәсіпорында қолданылатын сорғы жабдықтауының төрт тобы үшін сенімділік параметрлері бағаланды, оларға талдаулар жүргізілді сонымен қатар мерзімдік техникалық қызмет көрсету кестесі және регламенті жасалды.

Негізгі сөздер: сорғы, техникалық қызмет көрсету, мұнай өңдеу кәсіпорны, сорғы түрлері, жөндеу, сорғылардың жоспарлы түрдегі жөндеу кестесі.

Организация и разработка рабочей инструкции по техническому обслуживанию насосов ТОО «СП КазГерМунай»

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Аннотация. В научной статье составлены рабочие инструктивные документы по организации технического обслуживания существующих типов насосов на нефтяном месторождении ТОО «СП Казгермунай», рассмотрению их оптимальных путей и техническому обслуживанию с участием специалистов по основным видам насосов. Составлен график предварительного планирования работ по техническому обслуживанию насосов на нефтяном месторождении и утвержден срок технического обслуживания насосов по текущему году. Основная цель научной статьи формирования системы бесперебойной работы на предприятии с оптимизацией технического обслуживания с целью формирования устойчивого функционирования насосов на нефтяном месторождении заключается в снижении объемов основных затрат на ремонтные работы насосов и увеличении объемов производства на нефтяном месторождении. В научной статье рассмотрены работы по техническому обслуживанию по 4 видам насосов на нефтяном месторождении ТОО «СП Казгермунай». В статье приведены значения интенсивности отказов для современных марок насосов четырех групп: погружных, для отвода дренажных и сточных вод; бытовых; консольных; подводных - для получения артезианских вод на основе статистической обработки данных по их эксплуатации. Разработав аналитические и статистические модели оценки их надежности на предприятии, были определены виды отказов при их работе и их вероятности. Материалы и методы исследования - это информация о неисправностях и отказах насосных агрегатов систем водоснабжения и водоотведения в условиях эксплуатации для последующего анализа и разработки рекомендаций по проектированию и эксплуатации гидравлических систем с целью определения характеристик надежности на основе обработки базы данных на предприятии методами математической статистики. По результатам проведенного научного анализа на предприятии выявлены основные причины, формирующие базу отказов насосного оборудования, выявлены приоритетные причины их возникновения и осуществлен анализ по их эксплуатационным, структурным или конструкторским ошибкам. Были оценены параметры надежности для четырех групп применяемого на предприятии насосного оборудования, проведен их анализ, а также составлен график и регламент периодического технического обслуживания.

Ключевые слова: насос, техническое обслуживание, нефтеперерабатывающее предприятие, виды насосов, ремонт, плановый ремонт насосов.

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