ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Assessment of technical condition of electric motors at pumping stations

Rakhmatov A.D., Rakhimov J. J.

PhD, Tashkent institute of irrigation and agricultural mechanization engineers, Tashkent, Uzbekistan,
Researcher, Tashkent institute of irrigation and agricultural mechanization engineers, Tashkent, Uzbekistan

ABSTRACT: The article considers the assessment of the technical condition and the main factors of breakdown of electric motors in large pumping stations of the Republic of Uzbekistan.
The results of studies of the electric motors of the Jizzakh-1 pumping station are presented. The patterns of aging of the insulation of the electric motor and their service lives are determined. The obtained patterns valid for any electrical equipment and using the obtained expressions, their service life can be determined.

KEY WORDS: electric motor, insulation, the amount of rejections, service life, overheating temperature, damage, malfunction.

I.INTRODUCTION

At present, 60-65% of the electrical equipment of the pumping stations in the republic are exhausted.
Due to this, the incidence of NS electric motors increases. Their downtime is caused by internal defects, in addition to exploitation weariness. This means that in order to improve the reliability of electric engines, it is necessary to be aware of the detection in time and to carry out appropriate services and repairs. Due to the operation of electrical equipment, they gradually become absolute. The factory default values are changed .Initially, it decreases to the maximum permissible limit and then to a dangerous, emergency state. It is forbidden to use the electrical device which is on the dangerous for further operation. When the performance of an electrical device is within a certain critical size, it is usable and safe to use. [1].In the operation of pumping station, intermediate permissible limits are established so that the performance of the electric motor does not cross the hazardous boundary zone. [2].For example, if an electric motor has class. In insulation, it can withstand temperatures of up to 120℃, but that can cause irreversible insulation processes. For class A insulation electric vehicles widely used in agriculture and water management the allovable temperature is 70℃. Thus, for each critical parameter there are operating, permissible, and hazardous values. Operating value is always less than permissible value ($x_{op} < x_{per}$). In this zone there are nominal and current values as well. However, operating of the electrical equipment at permissible values will always continue with the risk of entering the hazard zone. Therefore, extra parameters should be controlled if the critical parameter of electric motor is closer to the permissible value.

II. SIGNIFICANCE OF THE SYSTEM

Currently energy companies are undergoing regular technical service and repairing electrical equipment based on the analysis results [3]. Here, the diagnosis of electrical equipment is carried out in the selected amount and intervals of time, specified in the regulatory and technical documentation. Repair and restoration of electrical equipment is determined according to its technical condition. As a result, the increasing malfunctioning of the electrical equipment will be eliminated in time, there will be no sudden downtime and the reliability is increases. A modern diagnostic monitoring and evaluation system of technical condition should be put into place to enhance such principle of exploitation. Different diagnostic and monitoring systems are used in the energy system, which may be [4].
Technological and exploitative monitoring. Here, the optimal performance of electrical equipment is monitored using local tools.
To turn down the object down on time in the case of an emergencies. Prevention of emergency plans and reduction of accidents.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Implementation of diagnostic of preventive monitoring system will help to prevent accidental situations and ensure reliable operation of electrical equipment. This prevents malfunctions to become accidents while the electrical equipment is operating.
Problems with short rotor asynchronous electric motor can be:
Stator wick insulation wear - 69%
Failure of bearings - 20%
Rotor and shaft failures - 5.5%
Gear box failure - 5%
Magnesium defect -0.5%
Problems with synchronous electric motor with short-circuit rotor can be:
Stator wick insulation wear - 45%
Failure of bearings - 10%
Rotor and shaft failures - 5%
Gear box failure - 5%
Magnesium defects -1.0%
Rotor control network contacts -34%.

III METHODOLOGY

The most common cause of electric motor wire insulation weariness and stator rotation failure. Synchronous engines also have a significant contribution to routers and steering systems (flanges and contact rings).
The electric motor heats up when it is in operation, which undergoes physical and chemical processes, especially, there is an overheating in the electrical parts causing mechanical damage to the insulation. Water molecules in the environment become insulated and penetrate through the cracks in the surface, causing the metal to break away from the insulation coating and to fall in the result of vibration. Dust and pollution in the air and chemically active gases accelerate this process [5].
There are several stages:
In the first step, the device becomes worn out by the effects of electricity, which increases energy losses.
In the second step, electrical elements become worn out by exposure to temperature, various dust and dampness, and by exposure to chemically active gases, which can also lead to increased impurities in the electric motor.
In the third stage, mechanical wear and tear are observed.
Electrical equipment deterioration can lead to malfunctions and may stop working.
For example, if the insulation resistance is 0.5 MOM, then the moisture content of the insulation of the electrical device is determined by the size of the absorbtion coefficient. The absorbtion coefficient Kabs should be as follow, $K_{abs} \geq 1.3$, otherwise the insulation will become wet and the electric motor will be dried. For a slow process, we will consider, for example, the model of the formation of the stop state of electrical equipment at the specified time in the depreciation of insulation. In the process, the parameter changes from the nominal to the permissible value. ($X_n < X < X_{pert}$) Insulation resistance varies under different internal and external influences. The new electric motor stator steppe insulation from the plant will be around 50 MOM. During the period of exploitation, this magnitude decreases. The probability that the electric motor will produce a suspension will consist of three zones.
1. Working zone
2. Permissible zone
3. Dangerous zone
The observed critical parameter will be in the working zone within a certain period of time. After the expiration of the service period or as a result of various external influences, a zone of wear begins on it. Here comes out of the allowable value of the critical parameter, and the probability of a stop of electrical equipment increases, or the probability of a suspension decreases. The connection between the change in the parameter and the probability of the operation of the electric device to the salt will be the parametric safety function of the object. With the passage of time in the exploitation of electric motors, the permissible or limit values of the critical parameter may change. And these dimensions may have an organizer of a random character .This means that in order to assess the probability of occurrence of cases or conditions caused by a gradual change in the premise parameter, we need to know the limit and permissible values of the parameter, the law of distribution of the parameter and the average square deviation of the parameter. The boundary and permissible values of the important parameters of the results of the research are given in the guidelines for its exploitation. If they are not, then the tests should be determined using physico-chemical methods.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Parameter distribution legitimacy will be normal, uniform, different-shaped and characteristic, and it will be difficult to determine. Usually normal distribution is accepted. The error in this can be up to 20% and will be enough in the security accounts. As a parameter of distribution law, mean square deviations are accepted. If the maximum Xmax and minimum Xmin dimension of the random parameter are known, then its average square deviation will be equal to:

$$\sigma = \frac{Xmax - Xmin}{2}$$

IV. RESEARCH RESULTS

Research shows that monitoring of electric motors can prevent problems in time. It reduces its current and capital repair costs by 60-70% [6]. The following parameters are controlled for the technical condition of electric motors:

Wonderland:

The moisture content of insulation is studied (Kabe 1.3).

Measure the resistance of wire phase (2%).

Measurement of dielectric losses of wick insulation is measured: tgb 4

Tested at high voltage insulated voltages: Usin = 1.8 Un

The box is opened and the insulation resistance between phase wires is measured:

R 0.5mOn

Synchronous engines measure rotor shaft insulation and dimension resistance.

The power supply is checked for correctness. The position of the bolts is measured by their density with the contact rings.

The results of voltage control in large engines are analyzed.

Salt is connected to the electric motor at nominal voltage.

The statistics of downtime on high-voltage cynic motors at the Jizzakh-1 pump station were observed in 2014-2019. The results are as follows (Table 1).

Table 1

№	DATE	Failure element
1.	20.01.2014	Phase insulation, stator helmets.
2.	30.07.2014	Inbound connection
3.	01.09.2014	Insulation of rotor rods
4.	20.11.2014	In conductor parts
5.	12.05.2015	Rotor Cantilever Cuffs and Brushes
6.	25.10.2015	Relays in control schema
7.	15.09.2016	Stator bed insulation is wet
8.	20.12.2016	Among the long packs of k.k.
9.	10.06.2017	Rotor brush insulation
10.	05.05.2018	The stator insulation is soaked
11.	20.09.2018	Failure in blocking gear
12.	10.04.2019	Rotor screws and bearings
13.	10.05.2019	The brushes are not broken
14.	15.07.2019	Stacking on the stator
15.	10.11.2019	The stator wick insulation is wet

Causes that synchronous engine fails.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Table 2

t / r	Damaged part	Number of damage, pcs	Injury%
1.	Insulation of stator rods	15	27
2.	Packing insulation	7	12
3.	Rotor insulation	5	9
4.	brushes and contact ring	8	15
5.	Wormwood	6	11
6.	bearings	9	17
7.	Val and other metal case	3	5,5
8.	Other problems	2	3,5
TOTAL:		55	100

- From the results, we can see that most electric insulation failures are caused by wear and tear. In this case, the source of the damage is not visible to the outside. It can only be detected in diagnostics and tests by technical means.
- The metal parts of the synchronous engine are broken down in different ways. The fastest insulation wears out. Depreciation rate depends on the engine performance. Under the influence of temperature, the wrapped paper will lose insulation elasticity and the engine will vibrate, causing the tabs to fall apart.
- As the temperature increases, the engine life will be reduced. The isolation of the electric motor becomes obsolete and becomes useless for expulsion, which is represented by exponential time, which is the length of service life of the engine.

$$t_{ec} = A_{iz} \exp(-\gamma\theta)$$

Here:
t_{ec} - insulation coating life, years
A_{iz}- a constant size that characterizes the service life of the insulating material
θ - temperature of the electric motor in the normal loading mode
γ - coefficient of reflection wear

This expression is true for any type of electrical device and varies in size. Proper operation of electric motors takes 8-10 years. In this case, the insulation class A is allowed to heat up to 70o C. It is recommended that the system be ventilated or otherwise cooled down to prevent overheating [7].

V. CONCLUSION AND FUTURE WORK

Among engine failures, the maximum stator insulation is 69%, rotor control system is 34%, and mechanical components are 20%.
Monitoring of the technical condition of the electric motors will eliminate defects in a timely manner, thus reducing the current repair costs by 60-70%.
The rate of wear of electric motor insulation is proportional to its load or temperature. Increasing temperatures will reduce the life of the electric motor. Proper engine rotation will increase the service life to 8-10 years.

REFERENCES

[1] Rakhmatov A., Toshpulatov N. Problems of energy supply in the pump station. // J: Irrigation and melioration. 2015 №1. 55-58th pages.
[2] Vasyuchenko P.V. Improving the reliability of electrical equipment through the use of diagnostic methods. // Energetic Energy, Energy Audit. 2014 . №5 (123), 27-34th pages
[3] Yeroshenko G.P, Kapykov B.R., Levin M.A.Problems of increasing the efficiency of the operation of agricultural electric drives. Uralsk: material form an international scientific and practical conference. 2003 , (0,15/0,1), 159-160th pages
[4] Levin M.A.Features of the operation of worn-out electrical equipment./ Problems of electric power industry, interuniversity scientific colllection:SGTU,2004. (0,25/0,25), 72-75th pages

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

[5] Kalykov B.R.Levin M.A.Agreement of the structure of the electric drive under operation conditions.Almaty.:"Agro-University",2004, (1,0/0,4), 20th page
[6] Levin M.A., Kalykov B.R.Choice of power reserve for asynchronous motor,/ Problems of electric power industry, interuniversity scientific collection; SGTU, 2004. (0,25/0,15), 235-237th pages
[7] Yeroshenko G.P., Levin M.A., KalykovB.R.Justification of the power reserve of synchronous electric motors/Mechanization and electrification of agriculture.2003. №3, (0,25/0,1), 22-23th pages