A stationary diesel power plant is a backup power source for responsible consumers of electric energy – livestock complexes, farms, poultry farms and other agricultural facilities. The necessity and justification for the use of backup power at the facility, as well as the power of the station, are determined in a specific design. The choice of a site for the construction of a diesel power plant and the scheme for connecting the electric unit to the distribution networks of 0.38 kV of centralized power supply is decided on the basis of technical and economic indicators when designing a local reservation system. In agriculture, a diesel power plant with a capacity of 16-30 kW has become widespread. This capacity is usually sufficient for the backup power supply of responsible consumers.

Summing up, it should be noted that the appearance of diesel power plants has allowed us to solve many problems related to the power supply of both residential and industrial premises. Their high reliability, wear resistance and availability of the fuel used allows the units to be used in any climatic conditions and at facilities remote from the main networks.

1. Умбеткулов Е.К., Соколова И.С., Бердимурат А.Д. Резервные электрические станции. Конспект лекций для студентов специальности 5В081200 – «Энергообеспечение сельского хозяйства». [Electronic resource] – Mode of access: https://libr.aues.kz/facultet/102_EEF/134_Kafedra_elektricheskih_stantsiy_i_elektroenergeticheskih_sistem/579_Rezervnie_elektricheskie_stantsii/TMN2KUkagHxZJC6tbvwA5o4Qsf7I9X.pdf – Date of access: 04.05.2021.

UDC 621.313.13

MAINTENANCE AND TROUBLESHOOTING OF ELECTRIC MOTORS

Student – Litvinyuk D.M., 20 e,
Master Degree Student, APF
Scientific supervisor – Sysova N.V., senior teacher
EI «Belarusian state agrarian technical university»,
Minsk, the Republic of Belarus

Abstract. The article deals with the routine inspection and servicing of electric motors. Visual inspection, motor's windings test, brushes and commutator inspection, and vibration tests are described in the article.

Keywords: maintenance, bearings, lubrication, visual inspection, motor.

Introduction

Modern agriculture is heavily dependent on the use of electric motors to power vehicles, and electricity-powered machinery is becoming widely used in

agricultural applications. Electric motors help make daily operations in a timely and reliable manner. Correct installation, appropriate operation and periodic maintenance are important for an electric motor proper work. As such, it is critical to perform regular maintenance checks on and troubleshooting of electric motors to ensure their no-failure operation at peaks.

Main part

The key to minimizing motor problems is scheduled routine inspection and service or preventive maintenance. The frequency of routine service varies widely between applications. For a routine maintenance program to be effective it is important to make written records indicating date, items inspected, service performed and motor condition. Every time a specialist inspects the motors, replaces bearings, adjusts the belt tension, and so on, he should take notes of it. In addition, every time lubrication is added to the motor or bearings, it should be also notated. Such records help identify specific problems in each application and avoid breakdowns and production losses.

The routine inspection and servicing can generally be done without disconnecting or disassembling the motor. It involves the following factors: visual inspection, motor's windings test, brushes and commutator inspection, and vibration tests [1].

A quick visual inspection can reveal some important details about the electric motor. If the electric motor operates in a rugged environment, signs of corrosion or dirt will be seen. Serious corrosion may indicate internal deterioration and/or a need for external repainting. If dirt is build-up on individual components, it is necessary to wipe, brush, vacuum or blow accumulated dirt from the frame and air passages of the motor. Accumulation of dust and dirt can reduce ventilation and heat removal. Heat reduces insulation life and eventually causes motor failure. Excessive heat is both a cause of motor failure and a sign of other motor problems. They can be grouped as follows: wrong motor, severe duty, excessive friction, electrical overloads.

Visual inspection of relays and contacts can help to see whether they are dust-free and aren't rusted. While inspecting electric motors visually one should feel for air being discharged from the cooling air ports. If the flow is weak or unsteady, internal air passages are probably clogged. It is necessary to remove the motor from service and clean.

Noise indicates motor problems but ordinarily does not cause damage. Noise, however, is usually accompanied by vibration. Vibration can cause damage in several ways. It tends to shake windings loose and mechanically damages insulation by cracking, flaking or abrading the material. Embrittlement of lead wires from excessive movement and brush sparking at commutators or current collector rings also results from vibration. Finally, vibration can speed bearing failure. Whenever noise or vibration is found in an operating motor, the source should be quickly isolated and corrected.

Noise and vibrations can be caused by a misaligned motor shaft or can be transmitted to the motor from the driven machine or power transmission sys-

tem. They can also be the result of either electrical or mechanical unbalance in the motor. Electrical unbalance occurs when the magnetic attraction between stator and rotor is uneven around the periphery of the motor. This causes the shaft to deflect as it rotates creating a mechanical unbalance. Electrical unbalance usually indicates an electrical failure such as an open stator or rotor winding, an open bar or ring in squirrel cage motors or shorted field coils in synchronous motors. An uneven air gap, usually from badly worn sleeve bearings, also produces electrical unbalance. Sometimes, excessive vibrations are difficult to detect manually. A few tests, such as field vibration analysis that is conducted by mobile instruments that measure exact frequency and amplitude of vibrations, can help in detecting the exact cause of vibrations.

Except for expensive, high horsepower motors, routine inspections generally do not involve opening the motor to inspect the windings. Therefore, long motor life requires selection of the proper enclosure to protect the windings from excessive dirt, abrasives, moisture, oil and chemicals. When the need is indicated by severe operating conditions or a history of winding failures, routine testing can identify deteriorating insulation. The easiest field test that prevents the most failures is the ground-insulation test, usually 500 or 1000 volts, to the motor and measures the resistance of the insulation. Low readings may indicate a seriously reduced insulation condition caused by contamination from moisture, oil or conductive dirt or deterioration from age or excessive heat. Motors which have been flooded or which have low megger readings because of contamination by moisture, oil or conductive dust should be thoroughly cleaned and dried. The methods depend upon available equipment. Time to obtain acceptable megger readings varies from a couple hours to a few days[2].

It should be noted that brushes and commutators require more frequent routine inspection and service. Many factors are involved in brush and commutator problems. First consider external conditions that affect commutation. Frequent motor overloads, vibration and high humidity cause sparking. Extremely low humidity allows brushes to wear through the needed polished brown commutator surface film. Oil, paint, acid and other chemical vapours in the atmosphere contaminate brushes and the commutator surface. Always recheck for sparking after correcting one problem to see that it solved the total problem. Also remember that, after grinding the commutator and properly reseating the brushes, sparking will occur until the polished, brown surface reforms on the commutator.

Lubrication is essential for proper motor maintenance as it will affect the life, noise, speed, torque, grease migration out gassing, temperature and corrosion of the motor. Lubrication on a scheduled basis, in conformance with the manufacturer's recommendations, provides optimum bearing life [3].

The overall performance of electric motor bearings is dependent on their design and functionality. To maintain the operations of electrical equipment, tools, and appliances, it is necessary to check the condition of electric motor bearings. If sleeve bearings are now resisting or produce rasping or scraping

sounds whenever the shaft is rotated, then they may have already been seized and need lubricating them with oil. Ball bearings that have already worn, on the other hand, may possess a distinctive dry rolling sound when the shaft is moved. They can also manifest raspy feel and resistance when rotating the shaft. In this case, lubrication cannot fix them since the problem is already permanent. The only solution to these faulty bearings is to replace them fully.

Conclusion

Generally speaking, to ensure better maintenance of electric motors, all maintenance procedures and tests should be conducted systematically (at least every 6 months) in order to pinpoint potential problems and correct them before they result in undesired downtime. Proper preventive maintenance of motor reduces unplanned downtime, increases the life of electric motors, improves the motor efficiency and reduces energy consumption.

A checklist that focuses on examining and monitoring the motor and electrical wiring allows detecting and identifying potential problems that the motor may face and addressing these problems ahead of time. This will drastically bring down unexpected repair expenses.

1. Maintenance and Troubleshooting of Electric Motors [Electronic resource]. – Mode of access https://www.maintenanceworld.com/maintenance-and troubleshooting-of-electric-motors/ – Date of access: 06.04.2021

2. Motor Troubleshooting and Maintenance [Electronic resource]. – Mode of access: https://ru.scribd.com/document/28542166/Motor-Troubleshooting-and-Maintenance. – Date of access: 25.03.2021

3. Brush life in DC motors [Electronic resource]. – Mode of access: https://www.plantservices.com/articles/1997/001/ – Date of access: 25.03.2021

UDC 004:63

DIGITAL TECHNOLOGIES IN AGRICULTURE

Students – Guildyuk K.V., 46 ts, 1st year, TSF;
Daguil A.I., 46 ts, 1st year, TSF
Scientific supervisor – Liubochko I.A., senior teacher
EI «Belarusian State Agrarian Technical University», Minsk, the Republic of Belarus

Abstract. The article describes digital technologies in agriculture.

Keywords: digital technologies, agriculture, drone monitors, precision pruning.

In the not-too-distant future, our fields could be tilled, sown, tended and harvested entirely by fleets of co-operating autonomous machines by land and