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Selections of Safety Relay Units for High-Voltage Electromotor While Developing Technogenic Deposits

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Abstract: In world practice electric motor of mining enterprise while developing technogenic deposits are subjected to failure due to winding overheating and rotor seizure. To prevent troubles automatic systems of safety relay units are usually applied with the setting value selection, but now there is no uniform approach for safety as well as statistic data of failure hazard and abnormal operation condition of elector motors. Existing calculation method of safety relay units and selection of performance data require complete and reliable manufacturer bench-mark data. Sometimes manual characteristics of the high-voltage electric motor of one type and brand can differ because of the different size of distance (up to hundredth millimeter) between a rotor and a winding. It results that electric motors can work with different performance data. Thus, it is desirable to make a setting choice for each high-voltage electric motor individually In this paper new graphic approach to a choice of best safety relay setting, connected with selection of the characteristic of the high-voltage electric motor which has been most approximated to its working value is offered.

Key words: The high-voltage electric motor · Oscillogram · Protective relaying · Characteristic · Sensitivity

INTRODUCTION

Annually total number of electric equipment breakdowns makes up 30- 35% damaged electric motors in the mining enterprises. There is a winding of the high-voltage electric motor, which is often (80- 85% of cases) faulty. Damage of high-voltage electric motors is caused by overloads on current. The increase in current in windings causes overheating- additional high temperature of elements and its design in comparison with an operating mode [1].

Recent years the majority of mining enterprise are equipped with digital devices of the safety relay, one of the advantages is possibility to record oscillograms. Using these oscillograms, it is possible to choose settings and to correct the characteristic of the high-voltage electric motor to prevent winding overheat and early faults of the high-voltage electric motor.

Methodology: Oscillograph is employed for starting oscillograms creation of electric motors for the purpose of identifying limit current characteristics.

Key Part: While carrying out the research recordings of starting oscillograms of the high-voltage electric motor workshop (draining, dressing factory) of Lebedinsk mining-and-processing plant, which is international supplier of iron concentrate, have been put down. At processing of starting oscillograms in Mathcad compared with the assigned characteristics of safety it was stated that in most cases the given parameters of overload protection are too high and do not provide the required protection of motor during start-up or overload. This selection of setting value is made averaged for all motors of this type, without their actuated mechanisms. The consequence is a reduction in protection sensitivity to emergency mode. Continuous operation of high-voltage electric motor in this mode leads to overheating,

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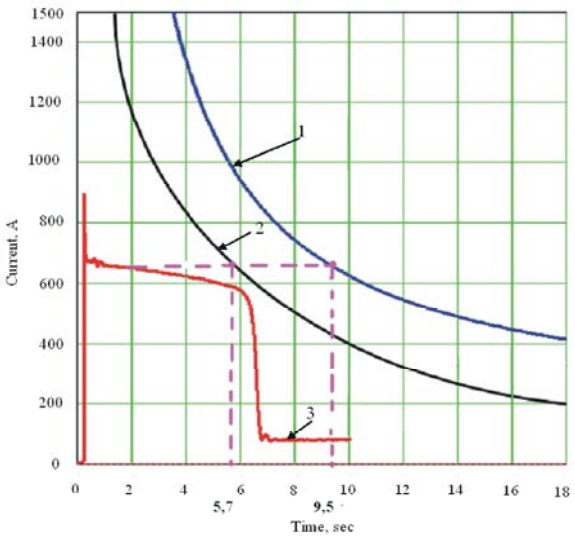

Fig. 1: Starting and protection performance of high-voltage electric motor air turbocharger: 1 – current characteristic; 2 – offered feature 3 – starting characteristic

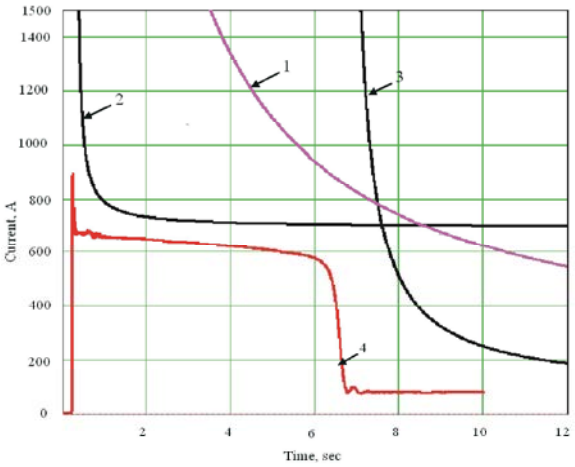

Fig. 2: Comparison of suggested current-time curve with existing protection
1- existing protection; 2 – suggested current-time curve # 1; 3- suggested feature # 2; 4 – starting feature

drying and lower dielectric isolation. The experimentally obtained data is when the temperature of the winding insulation is 8 °C the lifetime is reduced by 2 times [2].

The choice of parameters of protection operation for each high-voltage electric motor, taking into account its features has been made. Characteristics of high-voltage electric motor starter turbocharger and protection curves before and after applying this technique are shown in Fig. 1.

Figure 1 shows starting characteristic of normal operation mode of high-voltage electric motor, but while saving mode at 650 A setting value actuating will occur at 9.5 second, that results in overheating of the windings. We have proposed an approximate feature, which actuated at 5.7 seconds. It helps to prevent overheating and burning of the high-voltage motor.

During the investigation simultaneous use of several safety features was offered to employ on the modern digital relays (SEPAM production Schneider Electric). Comparison of the proposed time-current characteristics of the existing protection feature has been given on Fig. 2.

Figure 2 presents two suggested properties # 1 and # 2, which result to actuating of safety relay setting value how current so time of abnormal mode of high voltage electric motor. It helps to protect high voltage electric motor with higher reliability.

CONCLUSION

When comparing the proposed time-current characteristics with the existing protection feature the following conclusions can be made; obtained setting value have a higher coefficient of sensitivity and less delayed time compared with initial data, more reliable protection, more reliable protection against overload as well as delayed starting and rotor seizure are provided.

Findings: Suggested approach of feature selection when starting oscillograms of the high-voltage electric motor employed permits to select actuating parameters of protection relay which should protect the motor from rotor seizure and starter being delayed.

Combined usage of several interdependent properties allows to protect electro motors in all modes during starting up and then in operation conditions.

With the help of this method it is possible to choose protective properties for high voltage electric motor, taken into account all properties driven machinery.

The proposed approach of identifying the types of dependent characteristics and operation parameters can be used for any relay protection. This technique can also be used for motor protection relay for induction because their characteristics can be described mathematically and current-time curve can be constructed.

Thus, without investing additional funds in a change in the existing schemes of relay protection, a significant increase in its sensitivity can be achieved.

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