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# PROTECTION INSTALLATION FOR THE TRACTION ENGINES OF THE ELECTRICAL AND ELECTRICAL DIESEL LOCOMOTIVES

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This paper – work presents an installation for protection of the traction electric motors of the Electric Locomotives and Diesel Electric Locomotives.This instalation information abaut current performing the protections of the traction motors in programme logic, against slipping, gear damages, overload and shorteircuit.

Key words: installation for protection, traction electric motors, slipping, gearing

## 1. INTRODUCTION

There it is presented an installation that realizes the protection functions against skid of the non contact for the pinions, the excess load and shorting at the traction engines that equip the electrical and the electrical diesel circuits.

## 2. PRESENT STAGE

Now, the protection of the traction engines of the locomotives is made with electromechanical equipments and elements: electric maximal relays or tension maximal relays, antiskid centrals that use energy transformers. Even in the case where there are used electronic modules these fulfill simple comparison or temporization functions.

The electrical locomotives that are in exploitation in the country are provided with two types of skid protection installations:

- the locomotives manufactured after licence measure the difference between the currents of the traction engines and, when these ones exceed a fixed stage, they command the stopping of growing for the graduator and a easy stopping down and, if the difference persists in time, they command the descent of the graduator;

- the modernized locomotives of Siemens measure the rotative speed of all axles, and, in the case when the rotative speed of some axles exceeds with some stages the value of the least rotative speed, they selectively command, on each axle, the stopping down with air in two pressure stages, until the solving of the skid.

The skid detection at the electrical – diesel locomotives from the country is made through the measurement of the tension difference between the traction engines of each group. At this locomotive, the engines are registered two by two, within the framework of three groups. When this tension exceeds a fixed stage, there is ordered the tension reduction for the main generator and all the axles are easily stopped down.

The additional load and shorting protections are realized with maximal currents, respectively with impulse and shorting amplifiers.

The skid protection installations of the electrical locomotives based on the measuring of the difference of currents through engines and at the electrical diesel locomotives based on the measuring of the tensions difference on engines is characterized by a reduced efficiency due to the reduced number of electrical parameters that are registered and to the fact that the drive stages are fixed.

The skid protection installations that use the measurement of the rotative speeds have a good efficiency, but, due to the use of the rotative speed measuring heads mounted on each axle and to the stopping electric faucets, are characterized by a reduced efficiency and great maintenance costs.

Now, the locomotives are not provided with protections against skid for the traction engines' pinions, the coming out of this defect leading to the destruction of these engines.

The realization of the additional load protection of the traction engines with the help of the maximal relays is imprecise and it is exposed to errors due to the fact that they can be easily deregulated.

The shorting protection of the rectifying apparatus locomotives with the help of the shorting needs the use of a complex equipment for detection (pre - magnetization generator, trafo impulse) and foe execution (shorting), elements that cost and have a big gauge.

## 3. INSTALLATION DESCRIPTION

The installation proposes to use a numeric equipment that, on the basis of measurement of the electrical parameters of the traction engines (current and tension), should realize their protection and the protection of the locomotives against skid, of the additional load and of the shorting.

The installation is made up of the numeric system (1) that contains the central unit (2), provided with unvolatile memory (3) and real time watch (4) and that measures the electrical parameters of the traction engines with the help of the measuring heads (7) by means of the entrance interface (5) and generates commands for the protection of the engines and of the locomotives by the exit interface (6) towards the execution elements (8).

The displays (9), (10) situated in the drive posts display the information concerning the active protections and the value of the measured parameters.

The installation realizes the protection of the traction engines by measurement of the electrical measures that characterize their functioning, the realization of calculations on the basis of some appropriate models in order to determine other parameters necessary for their protection and the comparison with drive limit curves.

The central element of the installation is constituted by the numeric system (1) that contains a central unit (2) equipped with an unvolatile memory (3) and time real watch (4), an interface of analogical and numeric entrances (5) and an interface of numeric exists (6).

By means of the entrance interface (5) the system measures the tension and the currents of the traction engines with the help of the measuring heads (7) and receives other information concerning their functioning regime (degree of weakness of the field, regime of forced ventilation). It commands execution elements (8) by means of the exist interface (6) in the case when a protection actions.

The skid protection is realized by the calculation of the value for the rotative speeds of the engines, being known the tensions at their landmarks, the currents by inducts and excitations (taking into account the weakness stage of the field) and using the characteristics and the parameters determined within the framework of the tests realized upon the engines (the flux characteristic, the mechanical characteristics, etc.)

Having calculated the values of the rotative speeds there can be applied skid treatment algorithms similar to the ones that are used in the installations with taho – generators: the comparison with diagrams differentiated between the rotative speeds, function of minimal rotative speed (real speed) with more drive stages depending on the difference of the speeds or on the skid persistence time. The taken measures for solving the skid consisted in the stopping of the power growing and the command of some easy stopping, in the case when this does not disappears or has a raised level, the power reduction being commanded.

Compared to the classical system, of the electrical locomotive, which, in the case of skid persisting, commands the continuous descending of the power until its elimination, fact that substantially reduces the traction performances of the locomotive, the installation that makes the object of the investment descends the power, sep by step, waiting between them a sufficient time to detect the skid determination.

The installation permits the command of the selective stropping at the level of axle or bogie by the fact that it detects the motors that skids, fact that leads to the improvement of the traction performances in the skid regime.

The detection of the pinions' skid for the traction engines is made in the same manner as the skid protection. In the case of coming up of the skid there is detected a sudden supra rotative speed to very great values, the protection commanding the rapid exit from the traction regime.

The protection at additional load is realized in the most simple manner by the comparison of the currents by engines with a fixed stage (the principle of the maximal of current). The installation allows the protection at additional load by comparison of the currents with characteristics of action level, depending on the duration on which the current persists.

In the most complex manner the installation can function on the principle of the thermal image (terocopy ): knowing the evolution of the current by the engine and knowing its thermal time constants (heating / cooling with and without forced ventilation), there can be permanently calculated the supra temperature of the wrappings. This regime assures a superior net protection of the traction engines.

The shorting protection is realized by the detection with hard circuits of the currents' execution and by the action with circuits with short answer time (static relays).

The installation is provided with displays (9), (10) that are situated in the drive posts that should display the mechanical of the information concerning the values of the measured parameters, in order to prevent in the case of exceeds of some warning stages and to inform about the activated protection.

In revolatile memory (3) there are registered the information concerning the protections and the regimes in which this ones have acted, being also registered the time (hour and date) by its reading from the real time watch (4). By the analyses of the dates kept in memory there can be reconstituted the functioning regime of the locomotive.

By the extension of the number of numeric entrances of the interface of entrances, the installation can be coupled in order to register also the state of other signals from the locomotive (protections, signals), in order to realize some diagnose functions (display in the drive post and memory).

## 4. CONCLUSION

Protection of the locomotives traction motors by numerical systems using of more complex algorithms and leads to bettering of this function.

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**FIGURE 1**