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THE INFLUENCE OF THE STATIC CONVERTOR ON THE ELECTRICAL CIRCUITS OF A DIESEL LOCOMOTIVE 060 DA

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***Abstract**: Some elements concerning the influence of the tension static converters functioning upon both the equipment and the 2100 HP railway engine power circuit are briefly presented in this piece of work. It aims, in particular, the behavior of a high power static converter used on diesel-electric locomotive electric train heating.*
***Keywords**: locomotiva diesel-electica, convertor static, chopper, invertor.*

1. INTRODUCTION

After World War II, Diesel-electric locomotive experienced a great development. This was due to the need for a transport economic and technical innovations that took place after the war. Thus, in terms of transmission have been developed these types of diesel-electric locomotives:
- diesel-electric locomotive with DC – DC transmision.;
- diesel-electric locomotive with AC – DC transmision.;
- diesel-electric locomotive with AC – AC transmision.;

Drive diesel-electric locomotives DC - direct current (DC - DC) are equipped with electric generators and electric motors DC traction DC series excitationThese types of diesel-electric locomotives were the first occurred, they were still in operation.

Diesel-electric locomotives with AC transmission - current (AC - DC) are equipped with three-phase synchronous electric generators and electric motors to drive the DC series excitation.

Drive diesel-electric locomotives AC - alternating current (AC - AC) are relatively recent, with the development of power electronics, which are equipped with three-phase synchronous generators, power converters and static traction motors type asynchronously.

Because there are currently in use-generation diesel-electric locomotives old transmission DC - DC, to find their modernization by implementing modern equipment. One of these locomotives are diesel-electric locomotive 060 DA, which will be many years in service. At this locomotive were performed several upgrades, most is to replace old equipment with electronic equipment: static converters instead of rotating machinery, control equipment and digital signal instead of analog.

2. UPGRADES MADE TO THE DIESEL-ELECTRIC LOCOMOTIVE 060 DA

Upgrades made to the diesel-electric locomotive 060 DA were made according to the needs of the owner and were the replacement of equipment or installation of new equipment.

Thus, we have replaced:
- the old type Gauges Hasler speed with electronic speed measuring facility, which records data in a nonvolatile memory.
- rotary converter with a converter static for lighting;
- automatic voltage regulator with an analog type voltage regulator electronic type;
- the field regulator with an electronic;
- DC motors for auxiliary services with three-phase asynchronous;
- electropneumatic contactors with electromagnetic contactors.

New facilities were installed:
- the computer for signaling, control and diagnosis;
- static converter for electric train heating;
- chopper for start to diesel engine;
- static source for auxiliary services in the three-phase power.

The greatest achievement was but the transition from steam to electric heating heating of passenger trains hauled by diesel-electric locomotives type 060 Yes, by providing them with static power converters. These converters take part of diesel engine power in the form of electricity (characterized by a continuous current and voltage), cut the main generator, converts it into electrical energy (characterized by an alternating current and voltage) and sends wagons, which turns into heatStatic converter is a converter transformer without high (without galvanic separation). Solution to achieve this type of converter is using a high voltage chopper - containing type IGBT power transistors, power capacity and inductance.

Static converter, as well as any static converter is a range of sizes caraterizat electrical power input and output sizes (Fig. 1):

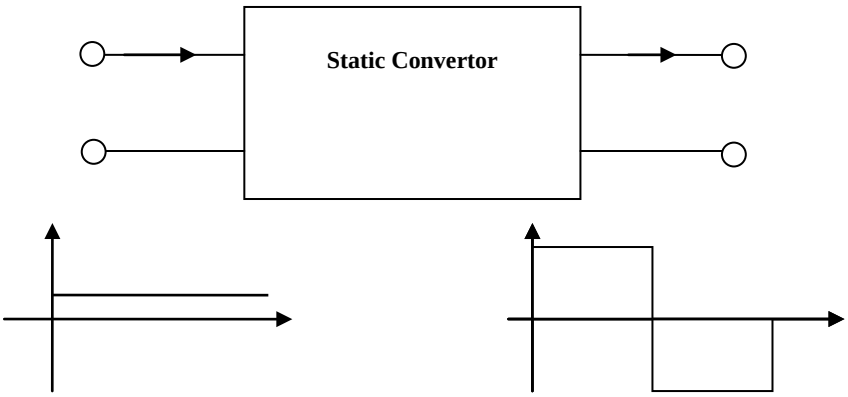

Fig. 1 Block diagram of static converter

U_1, I_1 – electrical input sizes;
U_2, I_2, f – electrical output sizes.

Technical characteristics of static converter used on diesel-electric locomotive 060 DA for electric train heating:

- current: I_2 = 267 A;
- voltage: U_2 = 1500 v c.a.;
- power P_2 = 400 KW.
- Input voltage (input convertor): U_1= 350 – 1000 Vc.c.;
- Input current: I_1= max. 1200 A;
- Output voltage: U_2 = 1200 – 1700 V c.a.;
- Output current: I_2 = max. 300 A;
- Output frecvence : f = 50 Hz;
- waveform output voltage: rectangular;
- electrical efficiency of the converter: $\eta > 0{,}98$;
- voltage control circuit: 170 Vc.c $^{(-30\ \%\ ;+25\ \%)}$;
- temperatura mediului ambiant: -35 ÷ +40 ^{0}C;
- humidity: < 90 % la 20 ^{0}C;
- dimensions of power electronics module: 1600x1000x400 mm;
- dimensions mode inductance: 700x800x300 mm;
- dimensions control unit, control and signaling (electronic block A1): 350x260x275 mm;
- weight power electronics module: 450 Kg;
- weight mode inductance: 200 Kg;
- weight control unit, control and signaling: 25 Kg.

3. Various problems encountered after upgrading diesel-electric locomotive 060 DA as a result of using static converters

Even if it is the greatest achievement of diesel-electric locomotive modernization type 060 DA converter installation with static heating and electric trains is the biggest problem of the locomotive, and this is largely due to lack of galvanic isolation of the static converter.

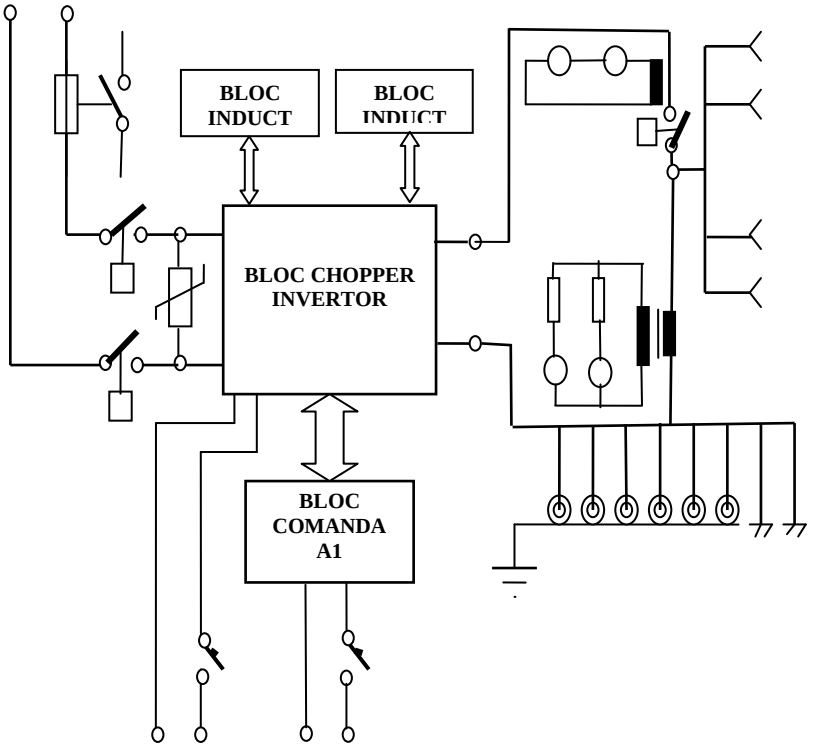

Fig. 2 Block diagram of the electrical installation of the static converter diesel-electric locomotive 060 DA

On locomotive is used to raise the DC voltage generator cut the main boost converter type without galvanic isolation, made after a special scheme with four inductors. DC bias is taken from the main generator and high boost converter using an inverter is converted to AC. In figure no. 2 can see the block diagram of the installation with static converter for electrical heating of trains. In diagram one can see various elements such as fuses, contactors, meters, etc..

Great problems arose after installing this plant is its aggressiveness in operation, from the various electrical insulating materials and special electric power machinery, electric motors and generator main traction. Tensions that arise due to lack of galvanic separation is dangerous both for electrical equipment, as well as for operators.

In this case there is only two solutions to remedy, namely:

- improving overall insulation of the locomotive power plant;
- use a converter with galvanic isolation.

We studied the static converter plant for train heating because it contains the most powerful static converter installed on diesel-electric locomotive 060 YES (400 kW).

4. CONCLUSIONS

Currently diesel-electric locomotive 060 DA suffered profound changes that have made it a modern locomotive equipped with the latest technologies.

Although technology brings great benefits AC, however, any implementation of it on a locomotive must be done carefully, taking into account the following:

- level of technology cost savings in maintenance cc as cc equipment are not sufficient to offset higher initial costs of the system;sistemele de c.a. nu furnizeaza inca o imbunatatire clara a fiabilitatii locomotivei;
- Facilities that do not improve the total efficiency of the locomotive;
- Equipment that tends higher electromagnetic interference with signal systems and traffic safety on the railway line;
- Equipment that has a greater mass. Small reduction in mass-cc engine can not compensate for the added weight of electronic equipment.

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