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Modular concept of auxiliary converters for diesel electric locomotives

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Abstract

Nowadays almost every modern diesel electric locomotive includes auxiliary converters. Auxiliary converters and drives are an integral part of the main traction drives. Auxiliary converters provides cooling of main drives, traction motors, diesel engine, charging the vehicle's batteries and feeding of control circuits in entire locomotive. Auxiliary converters for diesel electric locomotives consists of inverters, chargers, alternator exciters and DC/DC converters of different voltage levels. Due the fact of the equal working principles of individual converters groups, certain amount of power classes has been designed and developed. Also for these groups of converters has been developed universal parameterized control software. The main advantage of parameterization and power classes for individual converters groups is simple design. This feature simply allows to build up complete auxiliary converter for a specific customer application. It is also possible to design and integrate smart converters, which automatically set correct required parameters in locomotive immediately after connecting.

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Keywords: Auxiliary converter; charger; exciter; inverter; CAN bus

1. Introduction

Rail transport is in term of economic and environmental increasingly important. For more attractive rail transport is necessary to continuously improve the quality, effectiveness and performance by using a driving railway vehicles such as electric and diesel-electric.

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Increasing these parameters bring with it a requirement for more powerful and efficient electric locomotives equipment. Part of the electric equipment are auxiliary converters too. Without auxiliary converters railway vehicle is not operable. Auxiliary converters and drives are inseparable part of the main traction drives.

2. Auxiliary converters for diesel electric locomotives

Diesel-electric locomotives are the basis for independent traction. The source of energy in these locomotives is the diesel engine. The mechanical energy is converted into electricity by using electric rotating machines (synchronous generators). Subsequently, the electrical energy is used for traction power and ensuring the tractive power of locomotive. The auxiliary converters are very essential in this process. They provide power supply and regulation of auxiliary circuits which are an inseparable part of the locomotive. These circuits include power supply of the compressor, cooling of the traction motors, cooling of the diesel engine, power supplying of the air-condition and finally charging of the vehicle battery. Without auxiliary converters, the locomotive would not be able to work. Respectively it would be able to work only in a limited mode and time. All converters are located inside the rack.

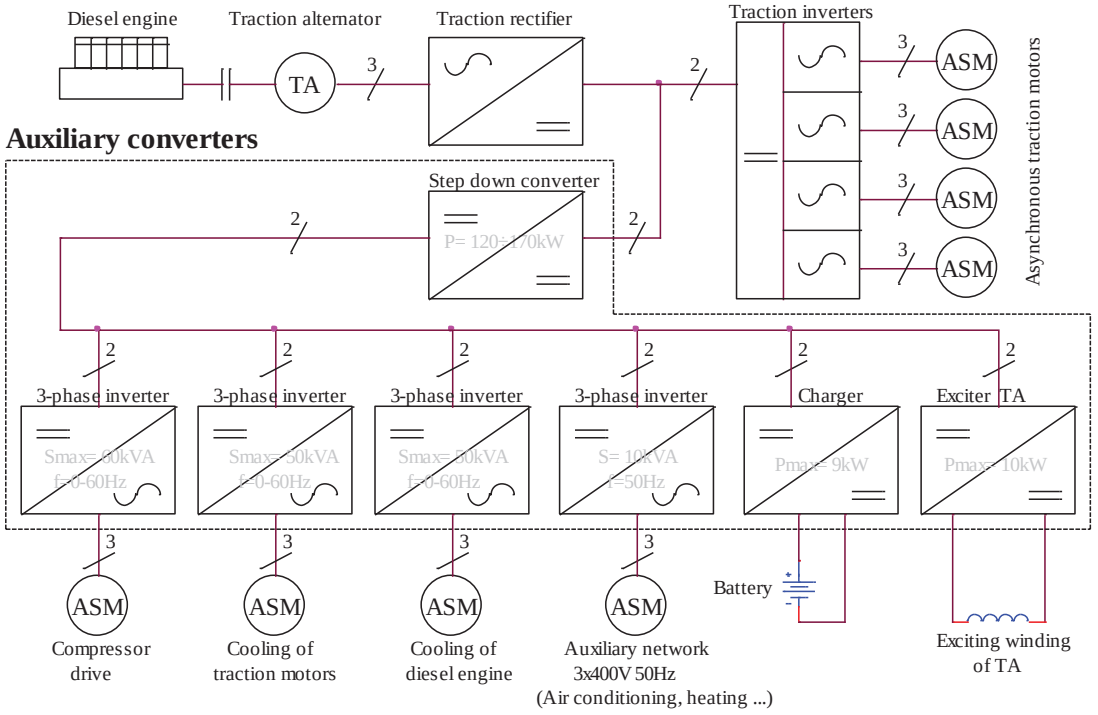

Fig. 1. modular topology of auxiliary converter.

3. Battery chargers

The charger of traction battery is often designed with topology of a half-bridge converter or a full-bridge converter (Fig. 2). The charger is a static converter with a voltage DC link circuit designed for converting an DC input voltage to a DC output voltage with galvanic isolation. The main function of the charger is to transfer voltage and current to a level suitable for battery charging and to stabilize it at this level. The power transformer provides galvanic isolation between input and output of the charger. The secondary voltage transformer is rectified and filtered by output LC filter. Usually the charger has two outputs. Normally one is for connecting the battery and the other to connect locomotive loads. This way optimum battery charging mode is ensured and the impact of loads on the charging process is excluded.