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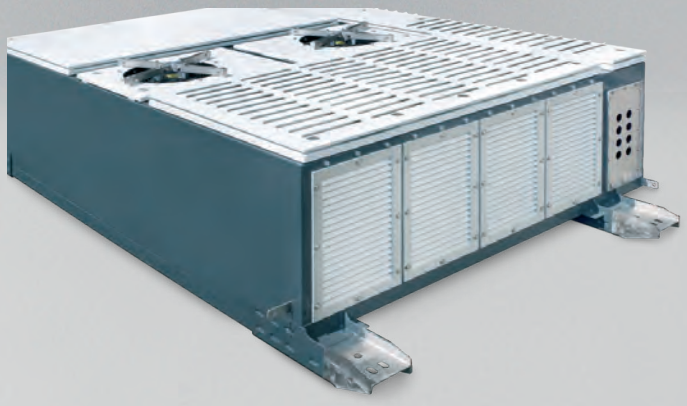


siemens.com/rail-electrification

Sitras HES

Hybrid energy storage system for rail vehicles

The Sitras® HES hybrid energy storage system will be used for rail vehicles and enables the storage of the braking energy and the operation without overhead contact line. It combines the advantages of powerful double-layer capacitors and traction batteries.

Due to its modular design Sitras HES can be adapted project specific to the according vehicle platform.

Features

- Energy saving up to 30 % of the supplied energy: e. g. up to 80 t less CO_2-emissions per year and tram
- Stabilizing the line voltage: Increasing the availability of rail vehicles by increasing the line voltage
- Sitras HES enables operation without overhead contact line
- Energy-efficient drive system for diesel multiple units and diesel shunting locomotives

Techical data double-layer capacitors *		
Usable energy content	[kWh]	project specific, e.g. 4,3
Maximum power	[kW]	project specific, e.g. 860
Range of operating voltage	[V]	190...720
Cooling		forced air cooling or water cooling

* other values on request

Techical data traction battery *		
Usable energy content	[kWh]	project specific, e.g. 45
Maximum power	[kW]	project specific, e.g. 300
Nominal voltage	[V]	project specific
Cooling		water cooling

* other values on request

Storage technologies

Modular design: From the energy storage module to a complete energy storage container

Double-layer capacitors

Double-layer capacitors feature a high level of efficiency, an extremely dynamic charge-transfer capacity, very high cycle strength and a long service life. They are also resistant to exhaustive discharge and maintenance-free.

The modular design results in a series of benefits:

- Scalability of the energy content for different rail vehicles
- High inherent safety of the modules
  - Internal voltage balancing function
  - Integrated monitoring circuits for voltage and temperature
  - Additional encapsulation against the environment in the case of a fault
  - Practical impossibility of damage caused by maintenance personnel
- Simple integration
  - into rail vehicles (electrical and mechanical)
  - within the cooling system
- Easy maintenance by replacing faulty modules

Traction battery

The used lithium ion cells feature following benefits:

- Constant voltage for the used operating range
- High power available for a short-time
- High energy content available
- Using the high energy content for operation without overhead contact line, specially in case of disturbances (e. g. obstacles, breakdown of external charging systems)
- Simple integration into rail vehicles (electrical and mechanical)

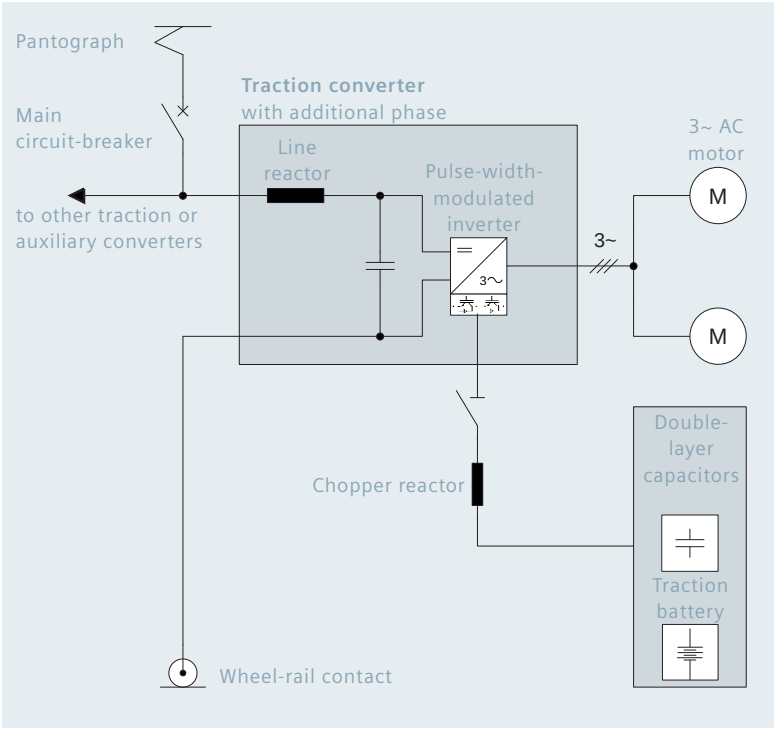
System design

The hybrid energy storage system can be integrated in new rail vehicles directly (integrated concept) or can be installed at existing rail vehicles additionally (independent concept).

Both storage technologies and both concepts for Sitras HES are approved according to “BOStrab” (German construction and operating code for tramways).

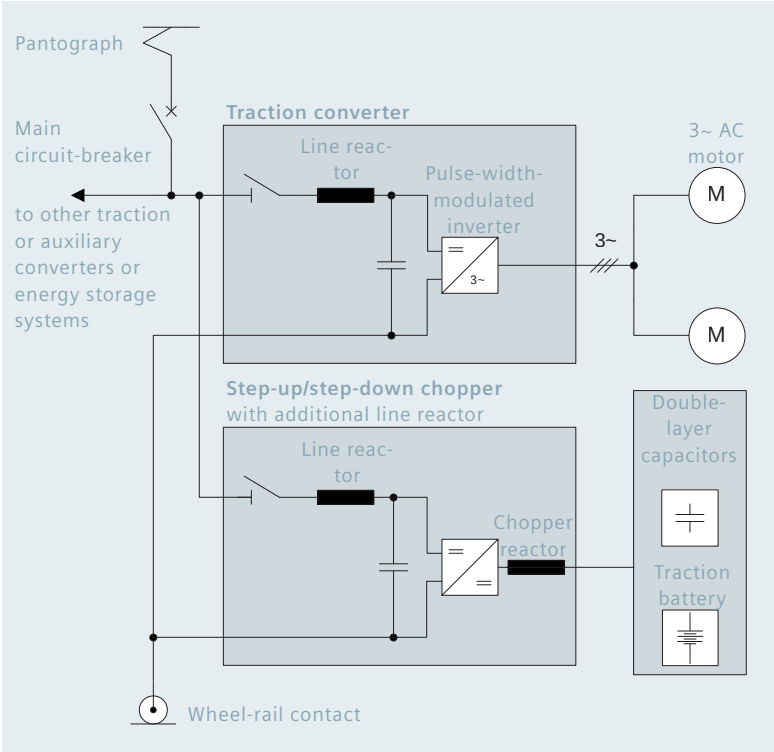
Integrated concept

- Phase module of the step-up/step-down chopper is integrated within the traction converter
- Electrical connection to the intermediate DC-link
- Closed-loop control embedded in the common control unit



Independent concept

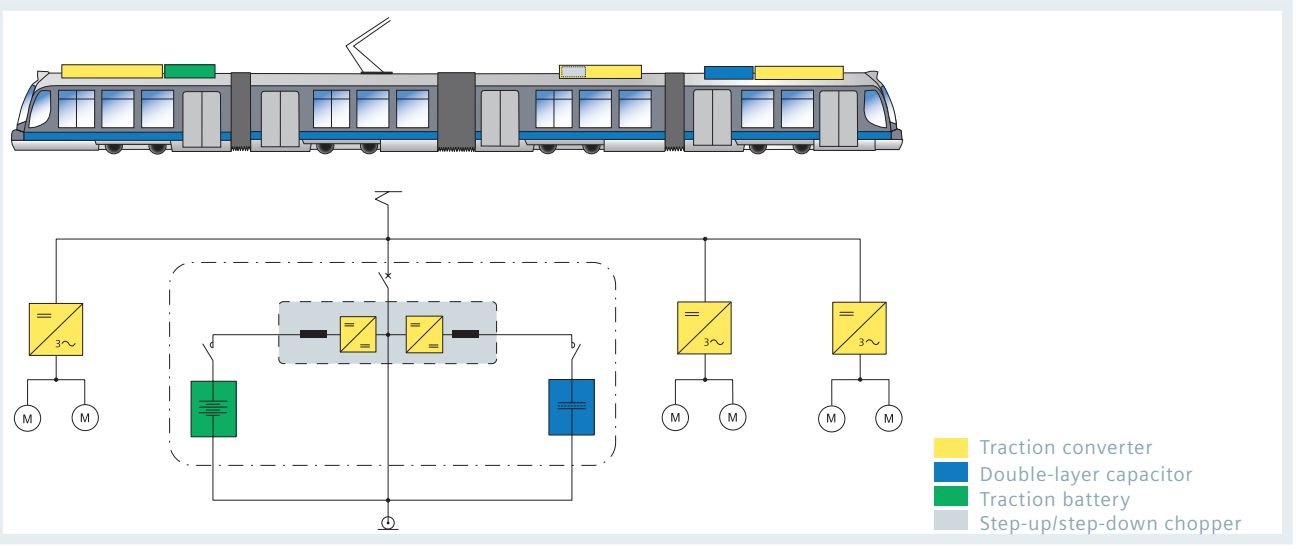
- Step-up/step-down chopper is an independent unit
- Electrical connection to the common feeding point of the rail vehicle
- Independent control unit
- Line reactor decouples the independent energy storage system



Application

Energy-efficient operation and operation without contact line – independent concept

- Step-up/step-down chopper connected via the line reactor to the feeding point
- Double-layer capacitors for high power requirements (traction)
- Traction battery for low power requirements (e. g. auxiliaries)
- Sitras HES installed on unused roof surfaces



The integrated concept is also possible for this application.

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