TracFeed® BCS

CHARGING STATIONS FOR ACCUMULATOR-POWERED TRACTION UNITS

English

TRACFEED® BCS: CHARGING STATIONS FOR ACCUMULATOR-POWERED TRACTION UNITS

Electric traction vehicles with accumulators as energy storage are increasingly replacing diesel traction. There is a complete solution for effective charging infrastructure.

Application

Accumulator electricle multiple units, also called as BEMU, and locomotives can run on electrified lines with as well as without overhead contact lines. However, the energy capacity of the accumulators limits the range of such vehicles from 50 km to 100 km, depending on the route profile, the number of stops, the driving speed, the comfort performance for heating/air conditioning and the operating concept. This means that charging stations will be required away from the electrified route network, for example at en route or at terminal stations.

The manufacturers Rail Power Systems GmbH (RPS) and F&S PROZESSAUTOMATION GmbH have jointly developed the concept for the TracFeed BCS Charging Stations (BCS – **B**EMU **C**harging **S**tation). It allows charging via the pantograph/overhead contact line interface in standstill and/or when driving.

TracFeed® BCS charging stations consist of the main components charging substation and overhead contact line system.

Charging substations 50 Hz

Concept

The charging substation (CSS) converts the electrical energy drawn from the state grid into the form required by the traction vehicles. In the case of the TracFeed® BCS CSS there is no frequency conversion. The output frequency corresponds to that of the supply network and is 50 Hz. In the Charging Station the voltage is transformed to the required level of 15 kV or 25 kV.

Components

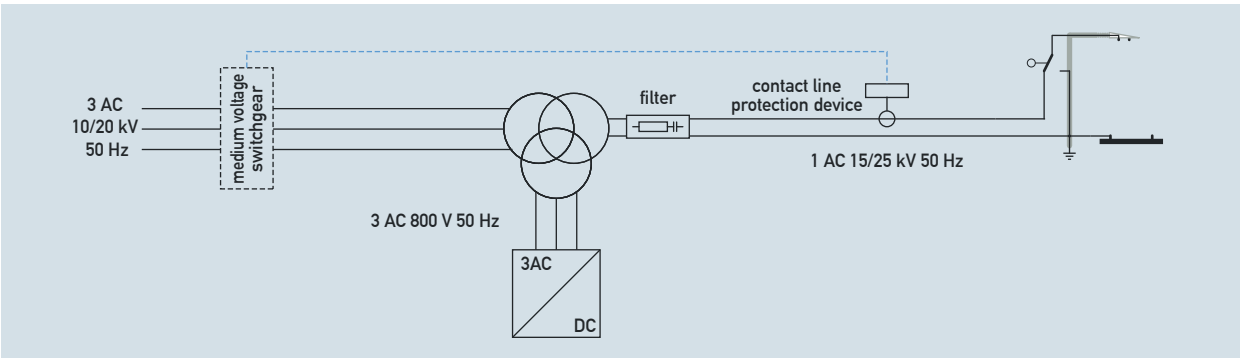
TracFeed® BCS CSS consits of the following components:

- Medium voltage switchgear
- Transformer
- Balancing converter
- Auxilliaries
- Protection and control system

The components are installed in a road transportable steel container, which enables pre-assembly and short erection times. The container effectively shields electromagnetic fields from inside. The CSS can be dismantled and/or transported to another location.

Medium-voltage switchgear

The medium-voltage switchgear is selected and configured according to the requirements of the local network operator. In the switchgear, two circuit breakers are arranged in series in the power line. All switching operations are carried out via the switchgear. One circuit breaker acts as a fallback level for the other. For this reason, there are no further switching devices in the power line.



Transformator

The transformer is designed as a three-winding transformer. The feeding power supply network (10 kV or 20 kV) is connected to the primary side. The balancing converter is connected to the second winding, which supplies the balancing reactive power and ensures symmetrical power drain from the supply network within its rated range. The contact line system of the charging station and the return circuit are connected directly to the third winding. The number of windings in this coil determines the contact line voltage. The charging power is transmitted with low losses via the transformer.

Balancing converter

A converter from the TIBS® power converter family from F&S PROZESSAUTOMATION GmbH is used as balancing converter. In contrast to purely passive systems, the balancing converter enables grid-related functions, some of which can be implemented after consultation with the grid operator. This includes:

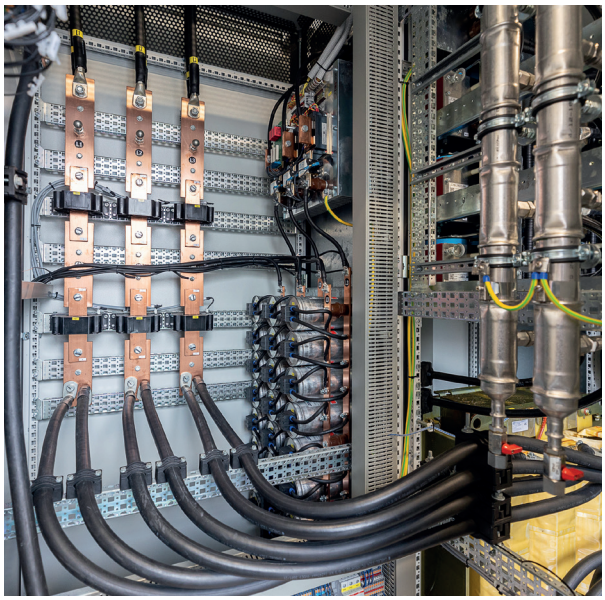
- Attenuation of high-frequency harmonics that can be excited from the vehicle converters such as four-quadrant converters (4QS) and auxiliary converters and transmitted directly into the power supply network via the transformer of the CSS
- Reactive power compensation/support
- Realization of Q(U) or Q(P) characteristics according to DKE AR-N 4110

The converters for the TracFeed® BCS CSS are configured with power ratings of 1,2 MVA and 2,0 MVA. The converter power corresponds to the maximum possible power per outgoing feeder or overhead contact line section.

Protection and control system

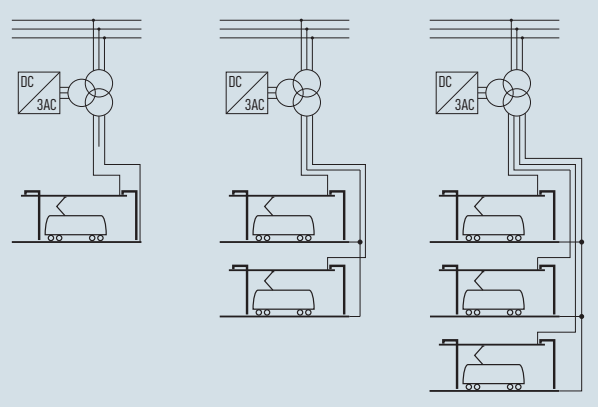
The CSS has a local control system and can be controlled on site. The system can be monitored via a remote maintenance access.

With an individually configured remote control system, the CSS can be integrated in an operator's control center and monitored and controlled from there.



Scalability

Based on the two converter sizes, up to three feeding circuits can be implemented by varying the contact-line-side transformer vector group. For the balancing converter, the operation of one deeding circuit is the determining load. If power is drawn from the other feeding circuits, the load on the symmetrical converter is lower. With three equally loads, the power draw is symmetrical without the converter intervening. This means that the total CSS power corresponds to up to three times the converter power. The contact-line-side circuit of the transformer must be selected accordingly and the transformer dimensioned for the total power. Furthermore, the up to three possible feeding sections of the CSS shall not be connected on the contact line side.



Overhead contat line installation

The overhead contact line installation is used to electrically contact the accumulator traction unit. If this is placed at platforms, the vehicles can start charging immediately after stopping at the platform.

If vehicles are only charged on standstill, the length of the overhead contact line is limited to the platform or the siding, with more than one vehicle being able to hold a section of overhead contact line. In this case, the use of a rigid overhead conductor rail, such as TracFeed® OSS, is recommended. Such a conductor rail can be limited to the length of the platform. This solution minimizes modifications in the existing railway infrastructure.

Solutions with catenary contact lines are conceivable for the construction of a few kilometers long overhead contact line island systems, in which the accumulator traction vehicles can also be charged while driving and the acceleration energy does not have to be taken from the accumulators.

Vehicle requirements

The use of the charging substations for 50 Hz requires appropriately configured vehicles. Vehicles that have been built for operation with an AC 25 kV 50 Hz electric traction power supply system can use the BCS charging substation without any mofifications.

Vehicles manufactured for an AC 15 kV 16,7 Hz electric traction power supply system must be modified. A test with the CSS pilot system demonstrated that software modifications in the vehicle control units are sufficient to upgrade the vehicle for operation with 50 Hz contact line frequency. Hardware changes are not necessary.

Compared to the costs for providing the usual contact line frequency of 16,7 Hz with a frequency converter, the additional costs for upgrading vehicles for 50 Hz are only a fraction of those for a 16,7 Hz substation.

The charging voltage and frequency must be taken into account when ordering the vehicles. An upgrade is technically possible in many cases.

Charging Substations for 16,7 Hz applications

For applications where a 50 Hz solution is out of the question, RPS and F&S offer solutions with frequency converters in the power ranges of 2,5 MVA, 5,0 MVA and 7,5 MVA. Examples are the charging substations for Schleswig-Holstein.

Applications

- Charging of accumulator-powered traction units in standstill and/or storage sidings
- Feeding of small overhead contact line installations
- Charging stations for electrical shunting locomotives on non-eletrified tracks
  - » industrial railways
  - » sidings/connection railways
  - » harbour railways

Keydata 50 Hz charging station

- Input
  - » 3 AC 10/20 kV 50 Hz
  - » 3 AC 400 V 50 Hz (for auxilliaries and control system)
  - » Grid connection conditions according to VDE AR-N 4110 will be met

- Output
  - » 1 AC 15 kV 50 Hz or
  - » 1 AC 25 kV 50 Hz

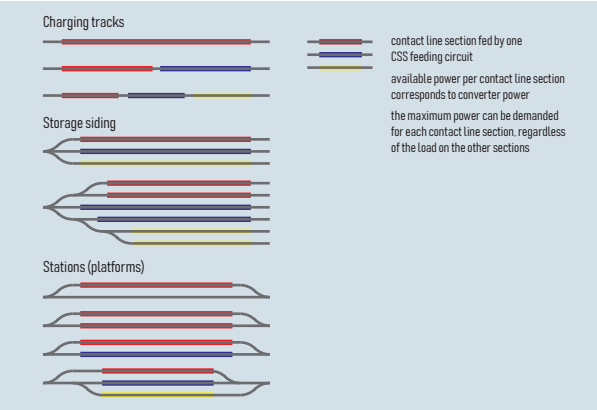
  according to EN 50163 and prTS 50729

- Power series (system performance)
  - » 1,2 MVA/2,4 MVA/3,6 MVA
  - » 2,0 MVA/4,0 MVA/6,0 MVA

- Balancing converter model series TIBS®
  - » 1,2 MVA or 2,0 MVA
  - » voltage level 825 V (low voltage)
  - » water cooled
  - » electronically switchable filters

- Building (up to 4 MVA system power)
  - » steel container, corrosion protected
  - » Painted in RAL colours, facing is possible
  - » accesses on one side
  - » cable entry from below
  - » dimensions (transport size, length x depth x height): 12,30 m x 3,30 m x 3,54 m , erected on site plus steps and ventilation dome
  - » total mass fully equipped: 24 ... 28 t

- Overhead contact line
  - » for charging at standstill:
    Rigid overhead conductor rail TracFeed® OSS
  - » for small overhead contact line installation:
    catenary overhead contact lines



Services

From the idea to implementation from a single source ...

- Advice and Planning
- Design and Manufacturing
- Onsite-installation (charging substation and overhead contact line)
- Comissioning
- Supervision and Remote control
- Maintenance

More information
www.bemu-cs.de

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