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Технические характеристики на ЛИТИЙ-ИОННЫЕ АККУМУЛЯТОРНЫЕ СИСТЕМЫ для железнодорожного транспорта Ion-OnBoard Regen

Ion-OnBoard® Regen Li-ion for Rail

Battery system 792 V - 238 kW

Innovative battery system for regenerative energy storage for light rail rolling stock.

Ion-OnBoard® Regen Li-ion battery system 792 V - 238 kW battery unit has a nominal voltage of 790 V and is able to provide high discharge capability up to 238 kW in 30 s and store 214 kW of regen power in 10 s.

One battery system consists of:

- 20 **Modul'ion**®-12 (Mi 12-40.30 PFe) Super-Phosphate™ (SLFP) connected in series
- Power box equipped with a manual switch, contactor and fuses
- Liquid cooling system and, as an option, a BTMS ⁽¹⁾ for battery management

The **Modul'ion**®-12 and the power box are placed in a metallic box 'Medium' type.



Applications

- For light rail systems: trams, streetcars and tram-trains
- To supply autonomous traction power for catenary free
- To store kinetic braking energy (regenerative braking) and reuse it for autonomous traction
- To maintain power quality for the local distribution network

Features

- Quick and high recharge capabilities (e.g. regenerative braking application)
- High life cycle performance
- Light weight and compact design for rail applications
- Robust construction withstanding onboard vehicle shocks and vibrations
- Liquid cooled system

Benefits

- High rate charge and discharge capability for an always available system
- Easy installation (roof mounted assembly)
- Minimum maintenance
- Reduced CO₂ footprint and saved energy

⁽¹⁾ BTMS: Battery Thermal Management System

| Nominal characteristics | Values for 1 box |
|--|---------------------------------|
| Li-ion module | Modul'ion ®-12 40.30 PFe |
| Number of modules in series | 2 rows of 10 |
| Voltage (Min/Max) | 600 V – 924 V |
| Nominal voltage | 792 V |
| Rated capacity at C ₅ | 28 Ah |
| Rated energy at C ₅ | 22.1 kWh |
| Energy at C | 22 kWh |
| Mechanical characteristics | |
| Dimensions (without BTMS) L x W x H (mm) | 1,747 x 1,000 x 300 |
| Weight (without BTMS) (kg) | 503 |
| Cooling | Liquid cooled |
| Electrical characteristics at + 25°C | |
| Nominal continuous current/power in charge/discharge | 90 A/71 kW |
| Maximum pulse power: | |
| - in 10 s in charge | 270 A/214 kW |
| - in 30 s in discharge | 300 A/238 kW |
| Operating conditions | |
| Operating temperature | - 25°C to + 45°C (with BTMS) |
| Temperature for transport and storage | |
| - recommended | - 10°C to + 30°C |
| - possible | - 30°C to + 70°C |
| Maximum relative humidity | Up to 90% |
| Maximum sound power level | < or= 84.5 dB(A) |

* Typical values. To be sized according to customer load and cycle profile.

BMM ⁽²⁾ communication

- 2 power connections to railway equipment
- CAN Open bus communication protocol carrying:
 - State Of Charge (SOC)
 - State Of Health (SOH)
 - Alarms
 - Operating conditions (voltage, temperature)
 - Operating limits (maximum voltage and current values in charge and in discharge)
- CAN Black box registering alarms (overcurrent, overvoltage, high temperature) and the number of charge and discharge cycles

BTMS



| Electrical connections | |
|--------------------------------------|--------------------------------------|
| Data bus connection | CAN Open bus |
| Protection class for the battery box | IP 65 |
| Protection class for the BTMS | IP 20 |
| Fuse protection* | 200 A |
| Electrical power connection | Harting (HAN Modular) Pfisterer P2PS |
| Compliance to standards | |
| Cell safety | UL 1642 |
| Module safety | EN 50 178 / IEC 60 950 |
| Shock and vibration | IEC 61 373 Cat 1 Class B |
| Fire and smoke | EN 45545-3/NFPA 130/SMP 800 C |
| Electrical insulation | NF EN 50 124-1 |
| IP Protection | NF EN 60 529 |
| Electrical safety | NF EN 50 155 |
| E M C | NF EN 50 121-3-2 |
| Welding | EN 15 085 / EN ISO 13 918 |
| Transportation qualification | UN 3480 - Class 9 |

* Typical values. To be sized according to customer load and cycle profile.

| Cooling system | |
|----------------------------------|-------------------|
| Power | 6 kW |
| Concentration of ethylene glycol | 50% |
| Temperature control range | + 15°C to + 45°C |
| Filling capacities | 10 l |
| Operating weight | 145 kg |
| Dimensions L x W x H (mm) | 1,420 x 430 x 600 |

Battery box 'Medium' type

Different numbers of **Modul'ion**[®]-12 Power (Mi 12-40.30 PFe) can be configured in the same battery box 'Medium' type. Following characteristics are achieved:

| Number of modules MI 12-40.30 PFe | 2 X 9 | 2 X 8 |
|--------------------------------------|---------|----------|
| Nominal voltage | 713 V | 634 V |
| Maximum voltage | 832 V | 739 V |
| Minimum voltage | 540 V | 480 V |
| Rated energy at C ₅ | 19.9 kW | 17.7 kWh |

Safety

Safety driven design for cells, modules and systems guarantees safe behavior in case of abuse usage or component failure. This includes:

- Stringent design rules and qualification
- Implementation of redundant safety features
 - at cell level (e.g. shutdown effect separator and mechanical vent)
 - at module level (e.g. electronic board, voltage and temperature monitoring, balancing)
 - at battery level (e.g. electronic board, power switch and current sensor)

⁽²⁾ BMM: Battery Management Module



Ion-OnBoard® Regen Li-ion for Rail

Battery system 515 V - 218 kW

Innovative battery system for regenerative energy storage for light rail rolling stock.

Ion-OnBoard® Regen Li-ion battery system 515 V – 218 kW battery unit has a nominal voltage of 515 V and is able to provide high discharge capability up to 218 kW in 30 s and store 232 kW of regen power in 10 s.

One battery system consists of:

- 26 **Modul'ion**®-12 (Mi 12-20.60 PFe) Super-Phosphate™ (SLFP) connected in series
- Power box equipped with a manual switch, contactor and fuses
- Liquid cooling system and, as an option, a BTMS ⁽¹⁾ for battery management

The **Modul'ion**®-12 and the power box are placed in a metallic box 'Long' type.



Applications

- For light rail systems: trams, streetcars and tram-trains
- To supply autonomous traction power for catenary free
- To store kinetic braking energy (regenerative braking) and reuse it for autonomous traction
- To maintain power quality for the local distribution network

Features

- Quick and high recharge capabilities (e.g. regenerative braking application)
- High life cycle performance
- Light weight and compact design for rail applications
- Robust construction withstanding onboard vehicle shocks and vibrations
- Liquid cooled system

Benefits

- High rate charge and discharge capability for an always available system
- Easy installation (roof mounted assembly)
- Minimum maintenance
- Reduced CO₂ footprint and saved energy

⁽¹⁾ BTMS: Battery Thermal Management System

| Nominal characteristics | Values for 1 box |
|--|---------------------------------|
| Li-ion module | Modul'ion ®-12 20.60 PFe |
| Number of modules in series | 2 rows of 13 |
| Voltage (Min/Max) | 390 V – 601 V |
| Nominal voltage | 515 V |
| Rated capacity at C ₅ | 56 Ah |
| Rated energy at C ₅ | 28.8 kWh |
| Energy at C | 28.7 kWh |
| Mechanical characteristics | |
| Dimensions (without BTMS) L x W x H (mm) | 1,713 x 1,385 x 300 |
| Weight (without BTMS) (kg) | 621 |
| Cooling | Liquid cooled |
| Electrical characteristics at + 25°C | |
| Nominal continuous current/power in charge/discharge | 150 A*/77 kW |
| Maximum pulse power: | |
| - in 10 s in charge | 450 A/232 kW |
| - in 30 s in discharge | 424 A/218 kW |
| Operating conditions | |
| Operating temperature | - 25°C to + 45°C (with BTMS) |
| Temperature for transport and storage | |
| - recommended | - 10°C to + 30°C |
| - possible | - 30°C to + 70°C |
| Maximum relative humidity | Up to 90% |
| Maximum sound power level | < or= 84.5 dB(A) |

* Typical values. To be sized according to customer load and cycle profile

BMM ⁽²⁾ communication

- 2 power connections to railway equipment
- CAN Open bus communication protocol carrying:
 - State Of Charge (SOC)
 - State Of Health (SOH)
 - Alarms
 - Operating conditions (voltage, temperature)
 - Operating limits (maximum voltage and current values in charge and in discharge)
- CAN Black box registering alarms (overcurrent, overvoltage, high temperature) and the number of charge and discharge cycles

BTMS



Electrical connections

| | |
|--------------------------------------|----------------|
| Data bus connection | CAN Open bus |
| Protection class for the battery box | IP 65 |
| Protection class for the BTMS | IP 24 |
| Fuse protection* | 315 A |
| Electrical power connection | Pfisterer P2PS |

Compliance to standards

| | |
|------------------------------|-------------------------------|
| Cell safety | UL 1642 |
| Module safety | EN 50 178 / IEC 60 950 |
| Shock and vibration | IEC 61 373 Cat 1 Class B |
| Fire and smoke | EN 45543-3/NFPA 130/SMP 800 C |
| Electrical insulation | NF EN 50 124-1 |
| IP Protection | NF EN 60 529 |
| Electrical safety | NF EN 50 155 |
| E M C | NF EN 50 121-3-2 |
| Welding | AWS D 1.1 |
| Transportation qualification | UN 3480 - Class 9 |

* Typical values. To be sized according to customer load and cycle profile

Cooling system

| | |
|----------------------------------|-------------------|
| Power | 6 kW |
| Concentration of ethylene glycol | 50% |
| Temperature control range | + 15°C to + 45°C |
| Filling capacities | 10 l |
| Operating weight | 145 kg |
| Dimensions L x W x H (mm) | 1,420 x 430 x 600 |

Battery box 'Long' type

Different numbers of **Modul'ion**[®]-12 Power (Mi -12-20.60 PFe) can be configured in the same battery box 'Long' type. Following characteristics can be achieved:

| Number of modules MI 12 20-60 PFe | 2 X 12 | 2 X 11 |
|--------------------------------------|----------|----------|
| Nominal voltage | 475 V | 436 V |
| Maximum voltage | 554 V | 508 V |
| Minimum voltage | 360 V | 330 V |
| Rated energy at C ₅ | 26.6 kWh | 24.4 kWh |

Safety

Safety driven design for cells, modules and systems guarantees safe behavior in case of abuse usage or component failure. This includes:

- Stringent design rules and qualification
- Implementation of redundant safety features
 - at cell level (e.g. shutdown effect separator and mechanical vent)
 - at module level (e.g. electronic board, voltage and temperature monitoring, balancing)
 - at battery level (e.g. electronic board, power switch and current sensor)

⁽²⁾ BMM: Battery Management Module



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