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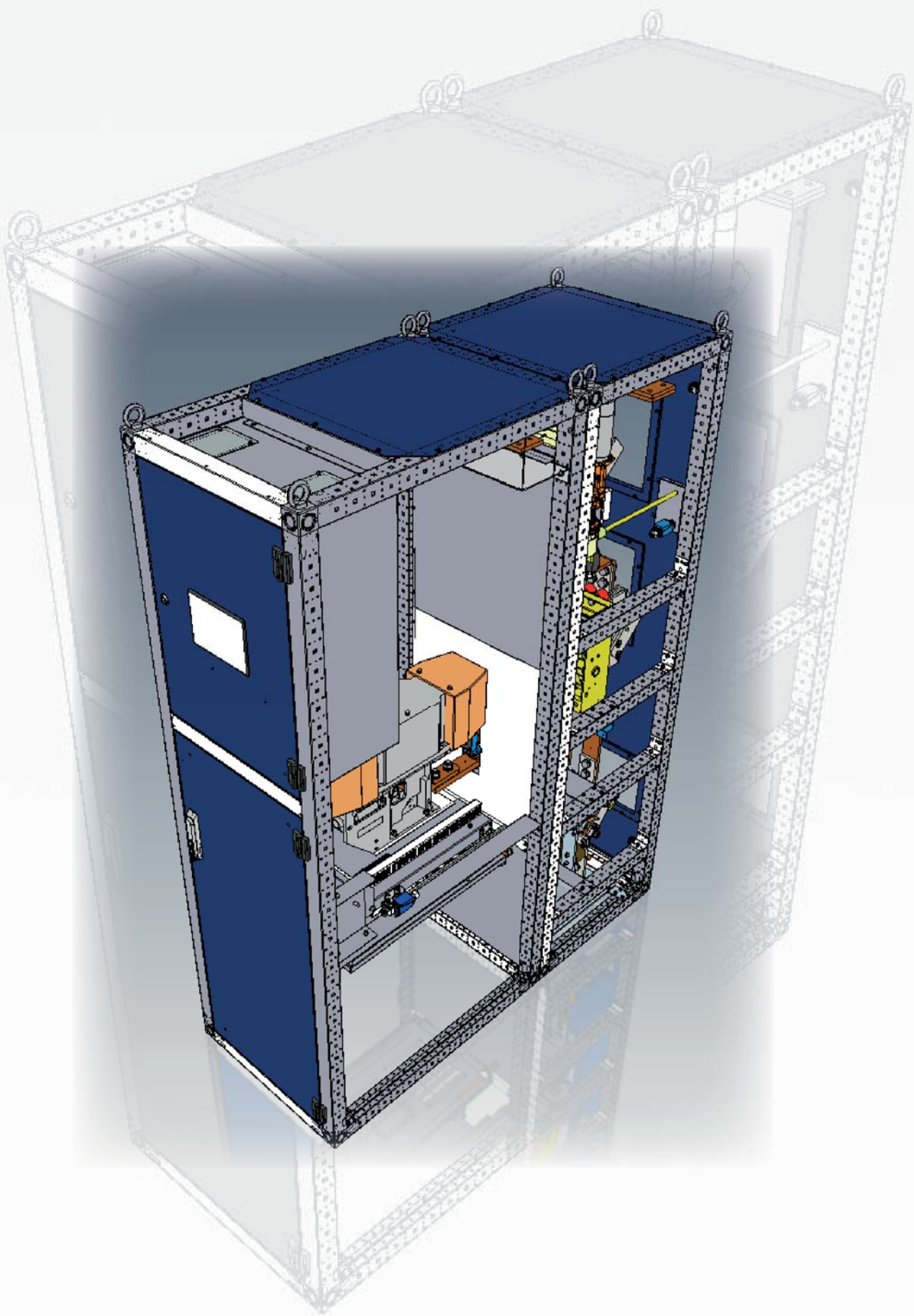


EZB 750L Cubicle Switchgear

Elektrizace železnic
Praha a. s.

EZB 750L Cubicle Switchgear

The EZB 750L is air-insulated cabinet type switchgear manufactured and delivered by Elektrizace železnic Praha a.s. (Railway Electrification Prague Inc.). This equipment has been designed for traction rectifier substations supplying city public transportation systems with traction supply system 750 V (600 V) DC. The switchgear is designed for positive pole distribution in traction supply system. It consists of single modules being mechanically and electrically interconnected. Each switchgear unit is invariably composed of two modules; by varying configuration of units, or (more precisely) single modules, individual functional units are formed, for example: traction feeder unit, rectifier unit. The traction feeder unit the switchgear consists of the EZB-DUR module and EZB-STC module. The traction rectifier unit the switchgear consists of the EZB-USM module and EZB-SIA module.

EZB-DUR Module + drawer

The EZB-DUR module fulfills a function of a traction feeder of contact line. The module cabinet is made as a welded self-supporting structure consisting of metal profiles with following overall dimensions:

- 600 × 900 × 2 000 mm (w × d × h) for nominal current up to 1 300 A (HSCB ARC 820)
- 600 × 1 100 × 2 000 mm (w × d × h) for nominal current > 1 300 A (HSCB UR, N-Rapid)

A manually operated drawer accommodating a high speed circuit-breaker (HSCB) is placed in the EZB-DUR module bottom part. Interior surfaces of cabinet walls are covered with GFRP (glass-fiber reinforced plastic) having a self-extinguishing feature, which protects the cabinet structure against electric and thermal effects of arcs resulting from the HSCB opening operation. The cabinet back wall (forming a junction to the EZB-STC module) contains holes, through which contact heads connecting the main and outgoing-feeder bus-bar system.

After manually operation with drawer must staff lock drawer in position pulled in/out with crow. Manually moving of drawer is possible only in distance of adjusted range of traversing. The drawer can contain, in addition to a HSCB, a sensor to measure the voltage and current, instruments to check the contact line isolation, contact heads to connect the positive pole power circuit, negative pole heads to measure the voltage, and heads to connect the drawer exposed conductive parts to protective earthing.

The drawer accommodating a HSCB has three functional modes:

- **operating mode**, when the HSCB is prepared to be switched on, or is on;
- **testing mode**, when the 750 V power circuit is opened, but the HSCB can perform closing operations, because operating circuits remain connected;
- **inspection mode**, when the HSCB can be repaired and measured, operating circuits are disconnected and the drawer is fully pulled out of the switchgear after mechanically removal of backstops.

In the top front part of the module is placed LV compartment for auxiliary circuits and control & command circuits which is placed in a separated space outside the main power circuit. In this LV compartment is placed a programmable logic controller (PLC), direct-current protection, and connecting and joining parts of auxiliary circuits. A touch display fulfilling an operating and visualization function for one unit of the switchgear (EZB-DUR + EZB-STC) is attached to the cabinet door. The measurement and control system integrated into individual units of the switchgear allows operating and controlling it locally, and in connection with the traction rectifier substation local control system, it allows remote and central controlling.

Measurement and Protection

In the positive pole switchgear, there is measured the voltage value on the output of each HSCB, current going from the traction feeder module to the contact line, and then is possible to measure current which is going through individual outgoing feeder cables. These values are subsequently displayed on the touch screen and in the remote and central control system. To check EDL (contact line isolation) the electrical resistance is measured based on outgoing-feeder voltage and outgoing- feeder current going via the EDL circuit (limiting resistance, fuse, contactor, current sensor). Based on such electric resistance, the system identifies, whether the contact line measured is in short circuit or is in operating condition.

In EZB-DUR module LV compartment is installed a digital direct-current protection, which protects the contact line. This digital protection provides protective functions such as overcurrent, short- circuit current, di/dt, undervoltage, and overvoltage protections. In addition, the EZB 750L switchgear can be equipped with a protection against any outgoing-feeder cables insulation damages and earth fault protection.

EZB-STC Module

The EZB-STC module is built as a self-supporting welded metal structure having following overall dimensions:

- 600 × 500 × 2 000 mm (w × d × h) for nominal current up to 1 300 A
- 600 × 600 × 2 000 mm (w × d × h) for nominal current > 1 300 A and two pole version (trolley bus)

It is to be fixed to the back part of the EZB-DUR module by bolts. Operators can access the module back part using the door. This door has a safety glass window enabling to check positions of disconnectors visually. The door is equipped with a door end position switch, which shuts down the traction feeder module, when the door is opened. The module includes strip conductors of the main (auxiliary) bus-bar, instruments such as a motor-operated load switch, auxiliary bus-bar disconnector, manually operated disconnectors of single outgoing-feeder cables, outgoing-feeder earthing switch, sensor measuring the output current generally, sensors measuring the output currents of single cables, sensor measuring the output voltage, instruments monitoring the outgoing-feeder cables condition, earth fault protection, and overvoltage protections.

EZB-USM Module

To the EZB 750 V DC switchgear, the EZB-USM cubicle-type

twelve-pulse (six-pulse) diode rectifier can be connected. The self-cooled rectifier nominal output current is 1 000 A - 4 000 A by default. The module cabinet is made as a welded self-supporting structure consisting of metal profiles with following overall dimensions:

- 1 000 × 900 × 2 000 mm (w × d × h) for nominal current up to 1 300 A
- 1 000 × 1 100 × 2 000 mm (w × d × h) for nominal current > 1 300 A

EZB-SIA Module

The EZB-SIA module is built as a self-supporting welded structure having following overall dimensions:

- 1 000 × 500 × 2 000 mm (w × d × h) for nominal current up to 1 300 A
- 1 000 × 600 × 2 000 mm (w × d × h) for nominal current > 1 300 A

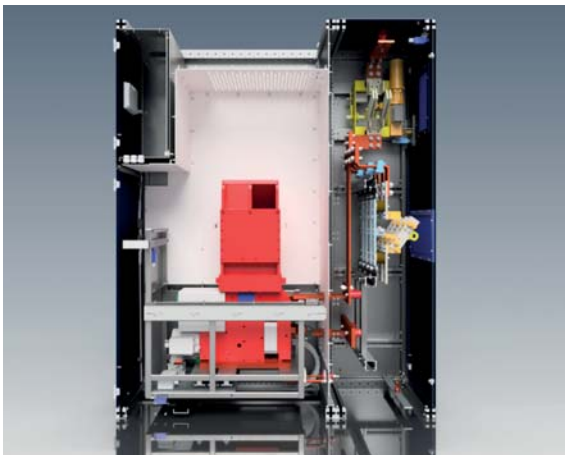
It is to be fixed to the EZB-USM module back part. This EZB-SIA module is used to distribute positive and negative poles of the rectifier via a single-pole or two-pole motor-driven disconnector. Thereafter, the positive pole distribution system is leading via the main bus-bar to EZB-STC modules to the contact heads, where the DUR drawer containing the HSCB is connected (see: EZB-DUR module + drawer). The negative pole is led to a jumper flag to connect return cables.

Conclusion

- all and any modules with type instrumentation have been tested in an authorized testing laboratory according to relevant standards,
- the EZB 750 V DC switchgear have been installed in traction rectifier substations of tram lines in Angers, Montpellier, Lyon, Le Havre (France), Rabat (Morocco), Rotterdam (Netherlands), Liberec Dolní Hanychov (Czech Republic), Ostrava Poruba (Czech Republic) and Praha Střešovice, Klárov (Czech Republic),
- the switchgear is supplied to a construction site as a compact equipment consisting of single modules so that overall connection and installation works are not time-consuming at all,
- enclosure of each unit as well as all switchgear meet, at least, requirements of IP 20 according to EN 50123-6 ed.2,
- dimensions of EZB-STC, EZB-SIA back modules may vary depending on instrumentation types used,
- when designing the structure and manufacturing the EZB 750L cubicle-type switchgear, especially provisions of following standards were fully satisfied: EN 50123-6 ed.2, EN 50 328, EN 50163 ed.2.

Table of Single Module Elementary Parameters

Parameters	EZB-DUR Module	EZB-STC Module	EZB-SIA Module	EZB-USM Module
nominal voltage	750 V DC	750 V DC	750 V DC	750 V DC
nominal auxiliary voltages	48 V DC, 110 V DC, 230 V AC	48 V DC, 110 V DC, 230 V AC	48 V DC, 110 V DC, 230 V AC	48 V DC, 110 V DC 230 V AC
nominal current of main bus-bars and main circuits [A]	2 000 - 4 000	2 000 - 4 000	2 000 - 4 000	2 000 - 4 000
nominal current of auxiliary bus-bar [A]	2 000	2 000	-	-
nominal current of circuit-breaker [A]	1 300 2 400 4 200	-	-	-
nominal current of disconnector [A]	-	2 000 - 4000	2 000 - 4 000	-
nominal short-time withstand current [A]	20 000	20 000	20 000	20 000
nominal ground fault current [A]	16 000	16 000	16 000	16 000
protection provided by enclosure	IP20/00	IP40/00	IP40/00	IP20/00
weight [kg]	210	160-240	190	270-350
operating temperature [°C]	-5 to +40	-5 to +40	-5 to +40	-5 to +40



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