



MODULAR TRACTION SUBSTATIONS

■ CITY ELECTRIC TRANSPORT ■

BUILDING FUTURE **TOGETHER!**

Modular traction substation

Modular traction substation produced by «AVL Reach Limited» is an integrated solution for reliable power supply of electric transport network. We also provide equipment setup, commissioning and lifetime support.

Modular traction substation designed to form either portable or fixed electric power distribution point.

Application of modern equipment and advanced solutions in the field of electrical engineering, based on years of experience, ensures safety and reliability in equipment operation.

Modular traction substation belongs to 17.5 kV voltage class and is designed for operation in automatic, maintenance-free mode.

Modular traction substation is equipped with emergency lighting, heating, ventilation, air conditioning, security alarm and fire extinguishing systems.





Safety

High level of operational safety. Well thought interlocking system guarantee high operational safety standard.



Environmental compatibility

«AVL Reach Limited» uses materials with minimal impact on environment in its production. The materials are safe not only during operation, but also at the end of product life.



Mobility

Mobility with opportunity to be relocated by road and / or rail.



Advantages

- minimum preparation works on installation site;
- high readiness for commissioning;
- “plug-and-play” installation (simple connection of primary and secondary circuits);
- possibility to easily configure different circuits;
- protection against unauthorised intrusion and/or disassembling;
- ease of equipment access;
- compliance with international requirements and standards.



Operating conditions

- recommendations on equipment selection;
- designing;
- installation works;
- substation adjustment and commissioning;
- integrated tests;
- technical support;
- the Customer personnel training;
- after-sales services.

Design of modular traction substation

Modular traction substation can have include from one to three unified (single) module:

- single-unit – one unified module;
- two-unit – two unified modules;
- three-unit – three unified modules.

The number of cubicles in the modular traction substation is represented to suit standard network topology and can be adjusted to suit particular needs of the customer.

Modular traction substation is a functionally finished product with provision of power and auxiliary circuits connection points.

Modules are mechanically independent and can be installed in accordance with the design solution.

Reliable power supply is provided by power distribution equipment, automatically controlled by SCADA system.

Auxiliaries system provides operating voltage supply to all the systems.

Auxiliary system provides operating power supply to all vital systems. Each modules have robust structure, designed for electrical installations weight up to 22 tons. The modules are dust and moisture resistant with IP55 protection level in accordance with IEC 60529. Substation modules are lined with steel sheets with corrosion resistant and weatherproof coating. Floor, walls and roof are thermally insulated.

External materials are fire retardant with low smoke and halogen free emission.

All metal parts of the module are treated to avoid corrosion. Each module is equipped with ladders and drains. Substation is equipped fixtures for loading and unloading.

Each module is structurally divided into two compartments: transformer compartment and switchgear compartment. Each module has individual earthing point.



▲ Transformer compartment



▲ Switchgear compartment.
NEX Medium voltage switchgear



▲ Switchgear compartment. DC switchgear, rectifier, auxiliaries cabinet

Operating conditions

Modular traction substation operation is provided under the following climatic conditions:

- altitude up to 1000 m;
- ambient temperature operating limits:
 - upper - plus 45 °C;
 - lower – minus 40 °C.



Lighting system

Modular traction substation is equipped with a main and emergency lights system. Lighting is provided inside and outside modular traction substation.

Ventilation, air conditioning, heating systems

Modular traction substation is equipped with supply and exhaust ventilation, controlled by microclimate monitoring unit. Shutters for natural ventilation are installed. The shutters can be closed with electric drive. There is also a possibility of manual control. The shutters can be additionally closed with special louvers in cold season. Ventilation grids in operating position are dirt and insect resistant.



Air-conditioning system prevents moisture condensation during equipment cooling and heating cycles.

Outdoor air conditioner unit is installed outside on the narrow side of modular traction substation. Indoor unit is installed on the ceiling of switchgear compartment.

Combined operation of ventilation and air conditioning systems provides a constant temperature inside the module at wide range of external temperature fluctuations. In winter the specified air temperature range inside substation is provided by electric heating system.

Intruder alarm and fire extinguishing system

Modular traction substation is equipped with fire alarm system.



Fire-suppression system is located inside the module. Doors and gates are equipped with an emergency release locks.

Unauthorized intrusion inside the modular traction substation is prevented by utilisation of tamper-proof door hinges, heavy duty locks, reinforced structural elements of the shell and alarm system. Doors and gates are equipped with lugs for padlocks and seals.

Additional equipment

Power outlets are provided for power tools during assembly and maintenance works.

Modular traction substation is equipped with personal protective equipment storage and metering tools.

Technical details of modular traction substation

Name	Unit	Value
Rated voltage on HV side (IEC 62271-200)	kV	12; 17.5
Number of high voltage inputs 12 (17,5) kV	pc.	one/two/three
Number of traction transformers	pc.	one/two/three
Type of traction transformers	-	Dry (type of windings: cast resin, RESIBLOC®)
Rated power of traction transformer	kVA	1000; 1600
Rated voltage of traction network	V	600; 750; 1500
Rated current of outgoing feeders	A	1000; 2000
Number of rectifiers	pc.	one/two/three
Rectifier circuit	-	Bridge (6-12 pulse)
Connections diagram number (EN50328)	-	8-9-12
Rectifier duty class (EN50328)	-	VI
Rated current of busbars on HV side	A	up to 1250
Rated current of busbars on LV side	A	up to 4000
Short time thermal current on HV side	kA/3 s	25
Short time withstand current on HV side	kA	62.5
Short time withstand current on LV side	kA	80
Rated frequency	Hz	50
Rated voltage of secondary circuits	V	380 (415), 220 (240), 110, 24
Number of output feeders for: - 1-unit - 2-units - 3-units	pc.	1...3 3...5 5...8
Number of modules	pc.	one/two/three
Remote control system (SCADA)	-	yes
Overall dimensions of traction substation module frame (width x height x depth)	mm	10220x3230x3700
Approximate weight of modular traction substation with equipment	kg	up to 22000
Main standards	-	EN50123/IEC61992 EN50328

Customised design values can deviate from stated above to meet specific customer requirements .

Modular traction substation equipment

The following equipment is provided for installation in modular traction substation to maintaining power supply of city electric transport and rolling stock:

- NEX Medium voltage switchgear;
- Traction and auxiliaries transformers;
- Rectifier;
- DC switchgear;
- Negative busbar switchgear;
- Auxiliaries cabinet;
- Modular traction substation control cabinet;
- Protection relays blocks;
- Lighting system;
- Ventilation and air conditioning systems;
- Heating system;
- Fire extinguishing system and intruder alarm.



NEX Medium Voltage Switchgear

The diagram illustrates the electrical architecture of a NEX Medium Voltage Switchgear system, showing the flow of power from input cubicles through various transformers and switchgear to the final output lines.

Input and Distribution:

- Input Cubicle (Input 1) and Input Cubicle (Input 2):** These cubicles receive incoming power and contain circuit breakers, fuses, and monitoring devices (PA, PV, U).
- Outgoing Line Cubicle (Rectifier) and Outgoing Line Cubicle (Auxiliaries Transformer):** These cubicles handle the output from the input cubicles, featuring circuit breakers, fuses, and monitoring devices (PA, PV, U).
- Voltage Transformer Cubicle:** This cubicle is used for voltage monitoring and protection, containing a voltage transformer (VT) and monitoring devices (PA, PV, U).

Power Flow and Components:

- Traction Transformer:** The main power transformer for the system, connected to the outgoing line cubicles.
- Auxiliaries Transformer:** A smaller transformer used for auxiliary power, connected to the auxiliaries cabinet.
- Auxiliaries Cabinet, Integrated:** This cabinet houses the auxiliaries transformer and provides power to various systems:
 - Lighting System**
 - Air-conditioning System**
 - Electric Heating System**
 - Ventilation System**
 - Intruder Alarm System**
 - Fire Alarm System**
 - Control System of Modular Traction Substation**

Switchgear and Busbars:

- Negative Busbar Switchgear:** This switchgear handles the negative DC busbar, featuring a **Negative Busbar - Un** and four output lines (Line A, Line B, Line C, and Into Switchgear).
- Positive Busbar DC Switchgear:** This switchgear handles the positive DC busbar, featuring a **Line Operating Busbar +Un** and four output lines (Line A, Line B, Line C, and Reserve).

Monitoring and Protection:

- SMTN (traction network monitoring and protection system):** This system monitors the traction network for faults and provides protection.
- SCT (short-circuits tester):** This device is used to test the system for short-circuits.
- Un (DC rated voltage):** The system is rated for DC voltages of 600/750/1500 V.

Modular traction substation transportation and installation

Modular traction substation is designed to be transported on platforms by road and / or rail. The module design provides a number of fixture points for lifting devices attachments.

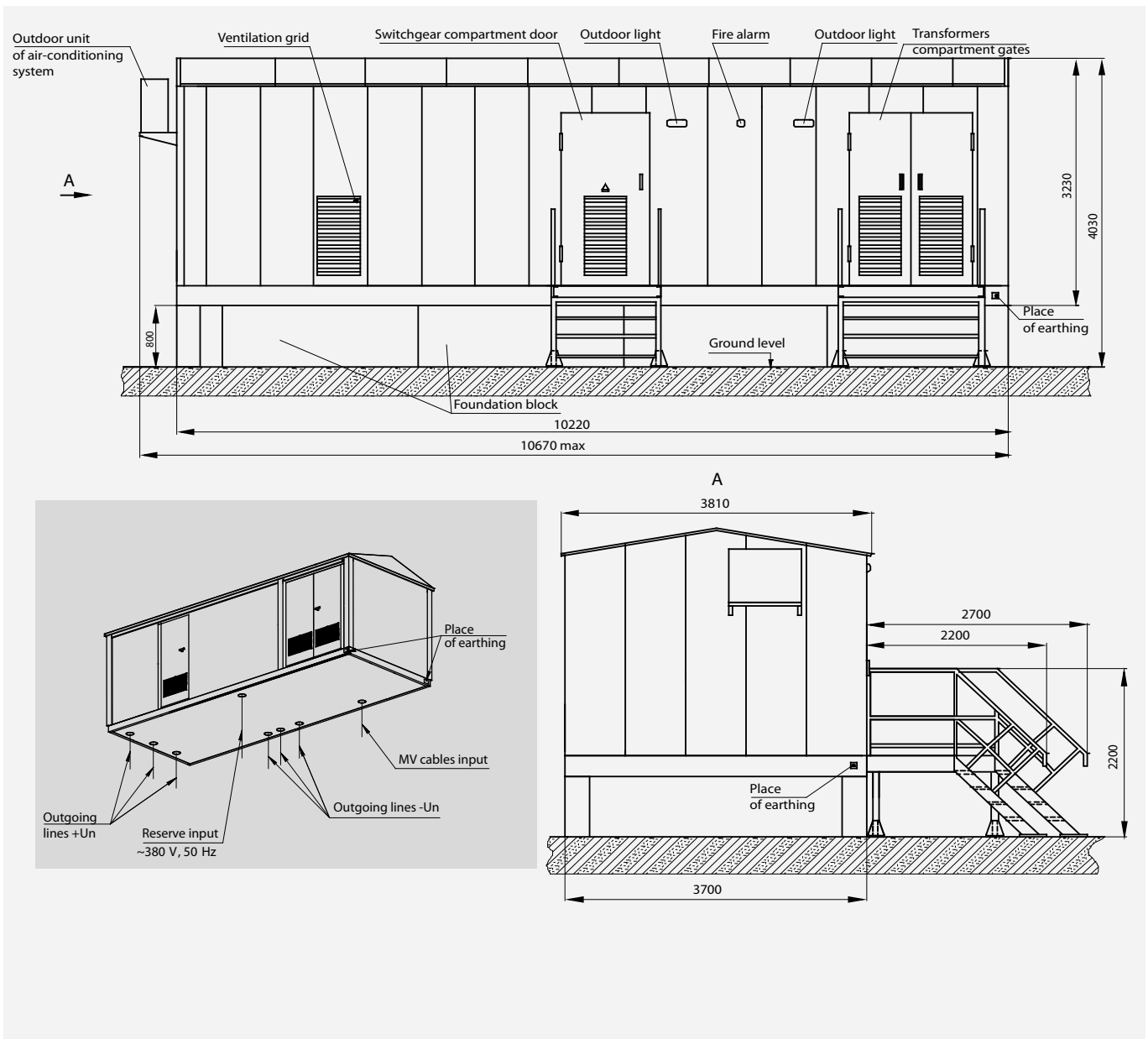
Internal cubicles are integral part of substation and permanently fixed. Ladders, drainage, air-conditioning system and outdoor unit are designed for independent transportation.

Modular traction substations are designed for installation on concrete slabs (reinforced concrete blocks or other foundation elements) allowing quick mounting / dismantling process and prompt relocation.

Mobile design significantly reduces time and effort required for modular traction substation commissioning and connection to the network.



Modular traction substations are equipped with footsteps with handrails for ease and safety of access.



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