TABLE OF CONTENTS

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Automatic Evacuation Supply Device – 2nd generation
Technical specification

Remark

Replaces / Mod.	Basis Drawing	No Pg.	Format
		13	A4

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DOCUMENT HISTORY

Version	Date	Status, description of changes
0	14-04-14	Initial version
1 to 2	--	see previous document versions
3	15-06-13	PF9100298382 – Added chapter on battery cables. Added note on phases used for battery charger supply.
4	16-07-01	PF9100327926 – Added requirement for warning label on chapter 2.14. PF9100326973 – Added requirement to compliance to IEC/EN 61439-1:2011. Added requirement concerning residual voltage in chapter 2.14
5	16-08-05	Corrected code reference on document history Ae 04
6	19-01-19	MX7X-2919 Added minimum cross section on the input and output power terminals MX7X-2913 Added ID for the battery cable sets, battery boxes without cables and combination AESD 1+3 KVA and battery box 12/20 Ah in a single box.
7	19-03-19	MX7X-2975 Improved description of battery testing. Added state machine. SC1-1451 Added mechanical sketches in chapter 2.8. in replacement of M 41325210/11/12/13
8	19-05-09	MX7X-3091 Added CCQL version AESD (no 48V plug) and battery cable sets IDs SC1-1612 Changed SH to SHE and resized the device principle architecture. MX7X-3108 remove AESD application to specific machines and ACVF
9	19-07-08	SC1-1612 Update the principle architecture with a clearer figure (a Visio object) in chapter 1. MX7X-3125 Remove S5500 in the abbreviation table in chapter 1. Change the "section and isolate" in chapter 2.4 to "isolation". Change the "L3" in chapter 2.5 to "L2". Change INVERTER state to OFF in the state machine 2nd state. Update the description of KEF in chapter 2.7.
10	19-08-15	MX7X-3151 Update JH open transitions in state machine MX7X-3155 Introduce RT12120H to chapter 2.2 battery bank
11	20-07-17	SC1-2493 Add AESD label requirements in chapter 2.13.2 SC1-2666 Add Short circuit protection requirement for L1S, L2S, NS in chapter 2.9.3
12	20-09-04	MX7X-3259 Add EN81-77 requirement in chapter 4.2 MX7X-3276 Add BAT_OK signal to toggle every 12h if battery not OK in §2.3. Add requirements of load inrush current and 3 attempts before overcurrent protection in §2.5. MX7X-3307 Add the new MCB in §1 the device principle architecture.
13	21-04-25	SC1-3404 Change supply arrangement for providing an option to deliver AESD with and without batteries in F3 – EMD New chapter 2.13.3 update AESD Technical Spec (Q-doc) prescribing a label with different battery arrangements and a field to mark the one applicable for a certain installation.
14	22-01-15	SC1-3655 Chapter 2.1: 1KVA is supplied permanently and 1.5KVA peak 2 seconds in a single phase output. Chapter 2.5: the supply of lift control requires 2.5A (1KVA permanently, and 1.5KVA peak 2 seconds)

1 Scope of Document

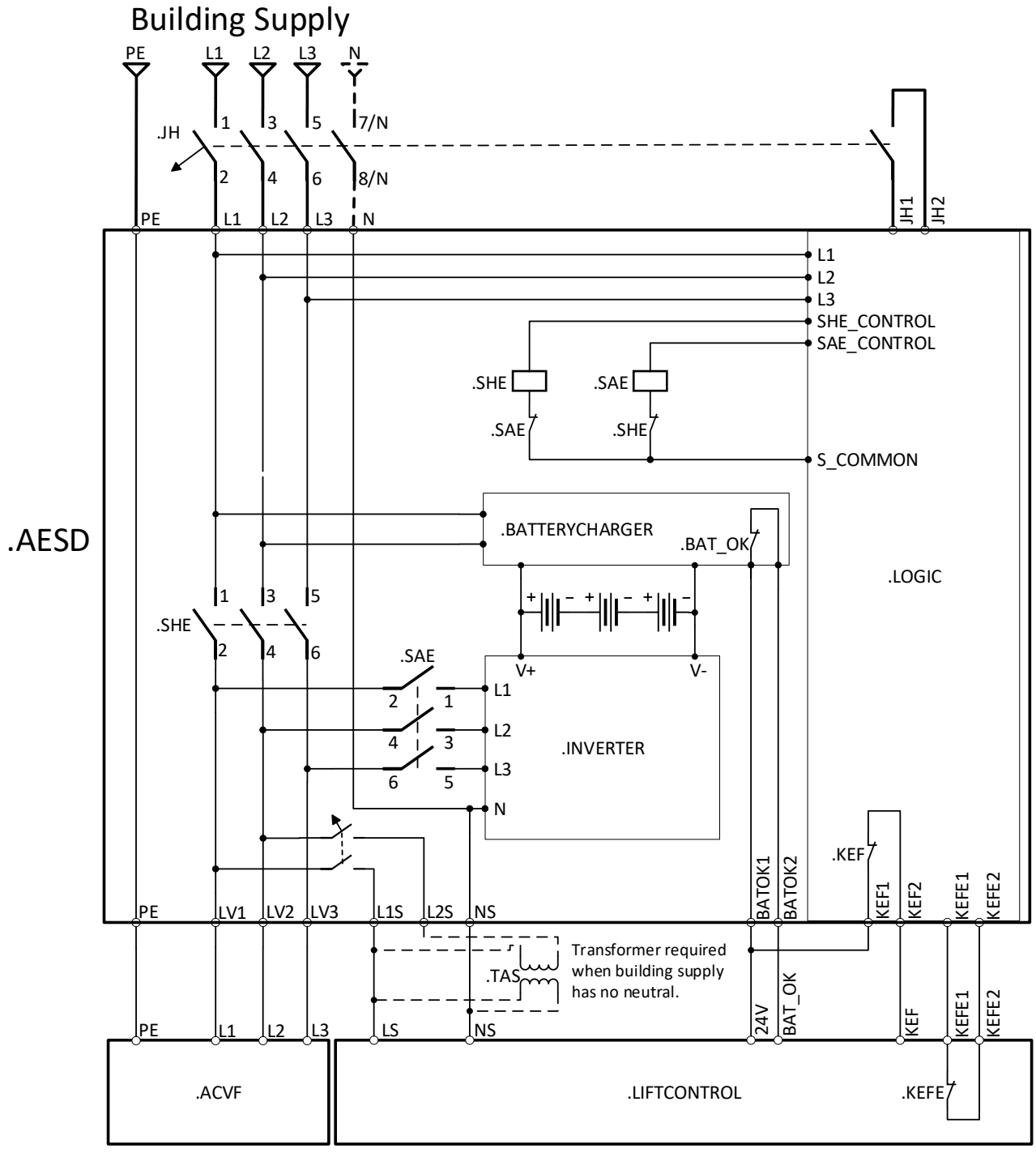
This document defines the minimal requirements for 2nd generation of the Automatic Evacuation Supply Device.

Following Schindler abbreviations are used in this document:

Abbr.	Definition	unit
AES	Automatic Evacuation System	
AED	Automatic Evacuation Supply Device (specification object)	
UC1_AED	Rated AED device output voltage	V
UC1_AED_max	Maximum allowed AED device phase-phase output voltage	V
UC1_AED_min	Minimum allowed AED device phase-phase output voltage	V

Automatic evacuation supply device is a component designed to supply the lift in absence of mains power allowing the passengers to be automatically rescued to a floor and released from the car.
The main goal of an automatic evacuation system is to prevent passengers to be trapped inside the lift car until the responsible for the lift evacuation arrives to the building. The system must be ready to operate at the moment it is required. Due to these two facts, design emphasis had to be given on the device reliability and maintainability.

The automatic evacuation supply device (AESD), part of the automatic evacuation system, is basically a 3-phase short interruption power supply (SIPS), provided in scalable ranges of power and energy output. It contains a suitable battery bank for energy storage, the battery charger, a three-phase inverter, a transfer switch and control logic. The concept requires one automatic evacuation device per lift and the device principle architecture can be seen on the figure below:



2 Component Specification

2.1 Scaling

The device is supplied in two power ranges: 3+1 and 6+1 kVA. From this total power:

- 1 kVA is supplied permanently and 1.5KVA peak 2 seconds in a single-phase output, taken from:
  - Inverter L2 phase and neutral, when the control is fed with 230 V from terminals L1S and NS

- Inverter L1 and L2 phases, when the control is fed with 400 V from terminals L1S and L2S via a transformer.
- The remaining power in a three phase 3x400 VAC output, equally balanced through the three phases L1, L2 and L3.

2.2 Battery bank

The battery bank is composed of 6 units of 12 V maintenance free lead-acid batteries with different capacities, calculated to provide the required device autonomy, with different machines and evacuation distances.
The autonomy calculation is NOT based on the supply of the rated power during the whole time. It is calculated based on a worst-case load cycle. According to device power rating, the required battery capacities are:

Device Rating (kVA)	Battery Capacities (Ah)
3+1	12 and 20
6+1	20 and 30

The batteries are not supplied with the device. As a reference, the battery types considered on the autonomy calculation are:

- 12 Ah – Types:
  - RT12120L-F2 of SHENZEN RITAR Power Co., Ltd. [CN]
  - RT12120H-F2 of SHENZEN RITAR Power Co., Ltd. [CN]
  - NP 12-12 from YUASA BATTERY (EUROPE) GMBH [DE]
- 20 Ah – Types:
  - RT12220H of SHENZEN RITAR Power Co., Ltd. [CN]
  - NP 18-12 from YUASA BATTERY (EUROPE) GMBH [DE]
- 30 Ah – Type:
  - RA 12-33 of SHENZEN RITAR Power Co., Ltd. [CN]

The batteries used with the device had an operating temperature range of 0 to 50 °C for charging and 0 to 60 °C for discharging.

2.3 Battery charger

The device contains a battery charger and floater circuit, with adequate output to charge and keep floating the corresponding battery bank. Its input power is taken from 2 phases of the input supply (which two been left to supplier's discretion) and could vary from 342 (380 – 10%) to 528 V (480 + 10%). Input frequency can be 50 or 60 Hz, +/-2 Hz, depending on the country of installation.
The preferred solution is a battery charger that requires no adjustment concerning the input voltage range, but input voltage selection by tap changing (380/400/415/440/460/480 V) is acceptable, if the wide range above could not be met in a cost-effective way.
A dry contact output (BAT_OK) should be available in a plug or pair of screw terminals.
This contact shall be open, reporting battery not OK, when:

- Battery is defective
- Batteries do not reach float charging status after 12 hours of charging
- AESD internal failure lead to battery charger not supplied

BAT_OK signals shall not be made inactive until AESD checks the battery status after enter floating.
AESD shall evaluate this signal every 12 hours. If battery is not OK, close this contact (BAT_OK active) for 20 seconds and then open it to report battery not OK. If battery is OK, then keep BAT_OK contact closed.
In any other condition the contact shall be closed (BAT_OK active).
The battery charger should be designed to assure the charging of a battery from the state it turns the BAT_OK signal till the full loaded state in 12 hours maximum.

2.4 Battery cables

Separate ID (see chapter 5) are given to the kits containing the cables that connect the batteries between themselves and to the AESD device. Those cables shall have adequate isolation, and be terminated in a way they correctly connect to the different batteries – see below:

- 12 Ah – 6.3 x 0.8 mm Fast-on
- 20 Ah – M5 screw, requiring an eyelet terminal with a 5.5 mm hole
- 30 Ah – M6 screw, requiring an eyelet terminal with a 6.5 mm hole

Those cables are supplied independently, or as part of some ID (see chapter 5).

Below is the detail spec on cable set:

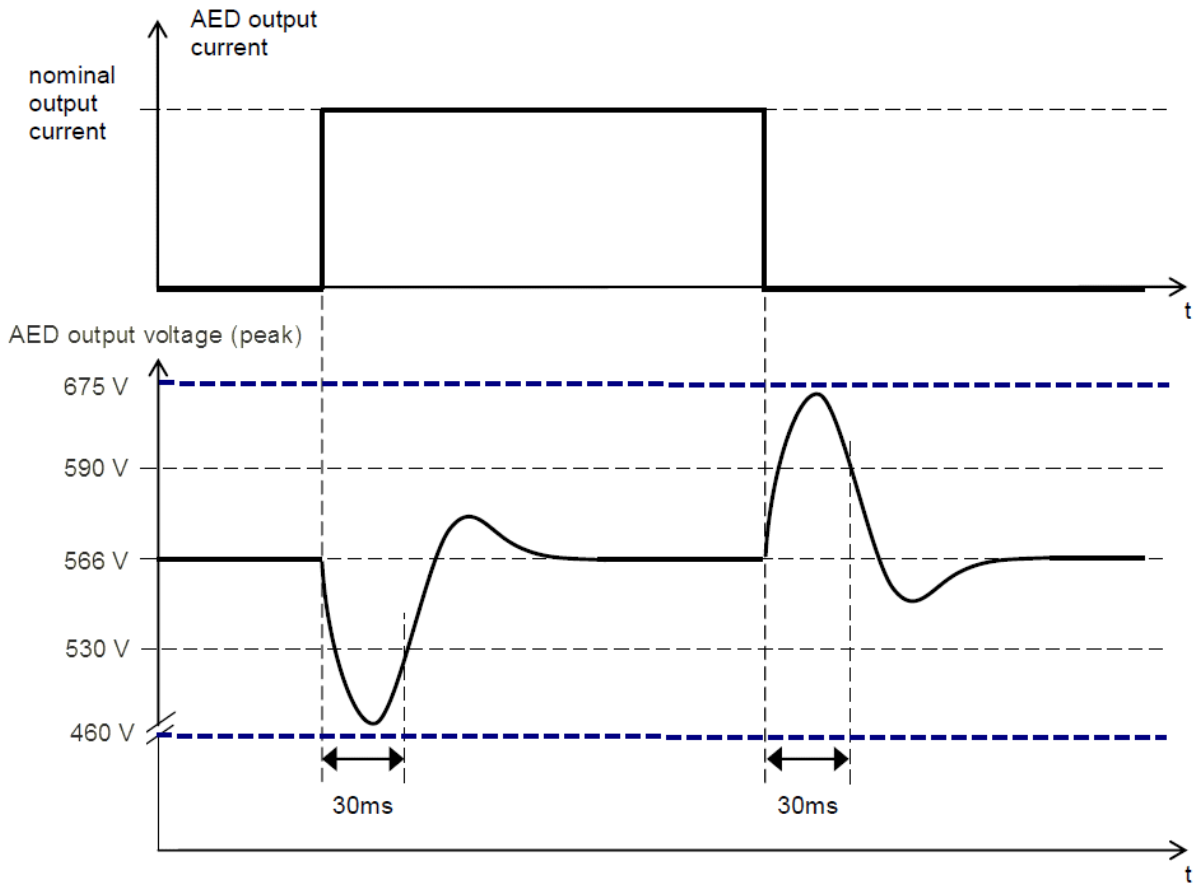
Cables set ID (Description)	Wire Links between Battery					Cable between AESD and Battery Box					PE wire between AESD and Battery Box		
	Qty	Section mm²	Length mm	Marking From	Marking To	Qty	Section mm²	Length mm	Marking From	Marking To	Qty	Section mm²	Length mm
59715540 (AESD 4 kVA Battery cable set 12 Ah)	3	6	240	+	-	1	6	1338	FU2-1	DC72V	1	6	900
	1	6	500	+	-		1.5	665		KA1-2			
	1	6	500	+	-	1	6	1680	C-	DC0V			
		1.5	100		DC48V	1	1.5	1585	FU1-1	DC48V			
59715541 (AESD 4 kVA Battery cable set 20 Ah)	5	10	240	+	-	1	10	1300	FU2-1	DC72V	1	10	900
							1.5	630		KA1-2			
						1	10	1650	C-	DC0V			
						1	6	1550	FU1-1	DC48V			
57644450 (AESD 4kVA Battery cable set 12Ah no 48V plug)	3	6	240	+	-	1	6	1338	DC72V	FU2-1	1	6	900
							1.5	615	DY2 DY2-1				
	2	6	500	+	-		1.5	615	DY2 DY2-2	FU2-3			
							6	1680	DC0V				
57644451 (AESD 4kVA Battery cable set 20Ah no 48V plug)	5	10	240	+	-	1	10	1338	DC72V	FU2-1	1	10	900
							1.5	615	DY2 DY2-1				
							1.5	615	DY2 DY2-2	FU2-3			
							10	1680	DC0V				
59715537 (AESD 7 kVA Battery cable set 20 Ah)	5	35	250	+	-	1	35	2000	FU2-1	DC72V	1	16	1200
							1.5	420		KA1-2			
						1	35	2200	C-	DC0V			
						1	6	2200	FU1-2	DC48V			
59715542 (AESD 7 kVA Battery cable set 30 Ah)	5	35	250	+	-	1	35	2000	FU2-1	DC72V	1	16	1200
							1.5	420		KA1-2			
						1	35	2200	C-	DC0V			
						1	6	2200	FU1-2	DC48V			

2.5 Inverter

The device contains an inverter, which provides a three-phase + neutral supply with 50 or 60 Hz output, rated 400 V, from the energy stored on the battery bank. The frequency of the inverter output is not required to be the same of the device supply.
Load regulation of the voltage output should be +/- 10%.
Maximum output voltage difference between phases with balanced load is 3%.
Due to the nature of the voltage supervision present on the ACVF device, and the different tolerances applied by this supervision when the lift is in standstill or traveling, the output peak voltage shall be maintained between the following values:

- 530 and 590 V peak when the lift is standstill – static load
- 460 and 675 V peak when the lift is moving – load varying dynamically

Inverter output voltage regulator is required to re-enter the 530 to 590 peak output voltage ranges within 30ms after a sudden load variation from 0 to 100% of the rated capacity in the three-phase output (see picture).



Additional 3 terminals (L1S, L2S and NS) are required for the control supply with 230 or 400 VAC. The control supply voltage is taken between the L1 and neutral (230V) or L1 and L2 (400V) – see principle schema. From L1S-N or L1S-L2S terminals (but not from both pairs at the same time), the supply of the lift control requires 2.5A (1kVA permanently, and 1.5KVA peak 2 seconds) to be available, and that condition should not disturb the inverter operation.
Additional load capacitance of 1 µF per phase should not harm the inverter operation.
Minimum requirement for the inverter output waveform is a quasi-sinusoidal waveform, with maximum total harmonic distortion of 35%.

The inverter output protection shall not be triggered by the load inrush current, that can reach 120A for up to 40 ms on 1 phase. The inverter shall allow 3 attempts until it's completely blocked by its over-current protection.

2.6 Transfer switch

This part is made of a pair of electrically interlocked contactors. One of them (SHE), rated on the lift input current, switches off the lift power input from the mains. The other one (SAE), rated on the maximum inverter output current, connect the inverter output to the lift power input. Ratings are according to the table below:

Device rating (kVA)	SHE AC-1 Rating (A)	SAE AC-1 Rating (A)
3+1	80	12
6+1	150	18

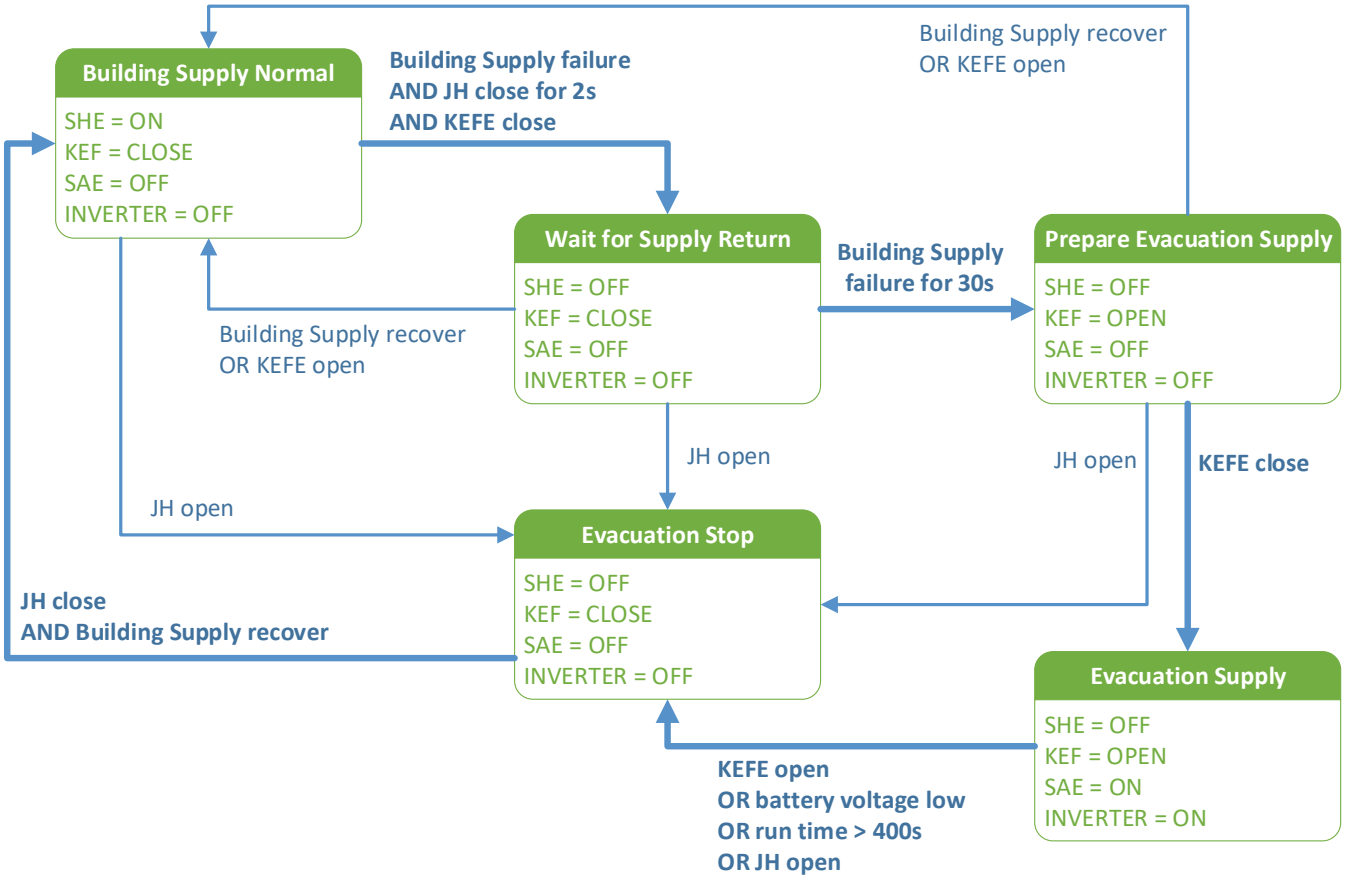
2.7 Control logic

AESD contains a logic circuit, scheduled to detect the failure on the lift mains (any phase with less than 90% of its rated voltage) and control the inverter and transfer switch.

Apart from the mains voltage detection, it has two other inputs:

- An input (JH), where a dry NO contact from the main switch is inserted. It is intended to discriminate a power failure from a voluntary interruption by the lift main switch. When the contact is closed, the mains switch is closed, and the power failure is not a voluntary one.
- An input (KEFE) where a dry contact from the lift control is inserted. It is intended to authorize the logic to switch the inverter and SAE contactors off and SHE contactor on after the evacuation process has been finished. When it is closed, the evacuation process is finished. This input shall be monitored minimum every 100ms by AESD.

The logic circuit also provides the lift control with one dry contact output (KEF) intended to inform the lift control that it will be powered by the AESD inverter soon. After open, SAE contactor will be closed, and INVERTER will start softly.
The process of the logic operation is described on the state machine below:



2.8 Enclosure

AESD is a self-contained device, to be installed in the elevator shaft or machine room wall, enclosed in two protection boxes, both rated IP21. The first box (AESD box) houses the battery charger, inverter, transfer switch and control logic. The second box (battery box) houses the battery bank.
These two boxes are mounted to the wall adjacent to each other, with the battery box installed either on right or left side to the AESD box.

Both boxes shall have cable openings on both sides, closed during transportation by removable sheets.

When installed side by side, one opening of the battery box will match with one of the openings of the AESD box, and from by them the connection of the battery bank with the device is done. The opposite opening of the AESD box is then used for cable entrance from building supply, ACVF and lift control.

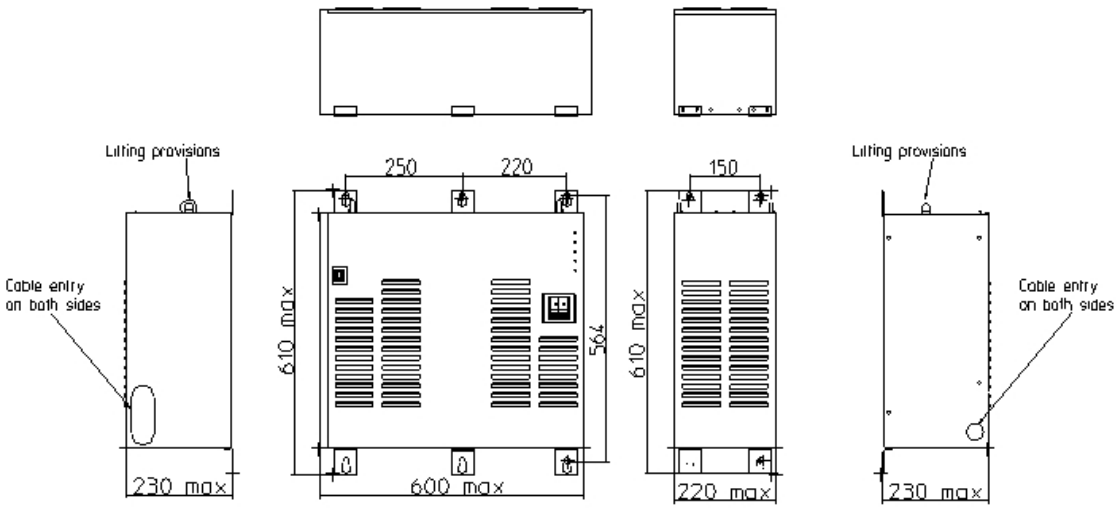
Both boxes shall have front covers, kept in place by non-losable screws. Cover shall have a secure cord in order it cannot fall down the shaft when removed.
Maximum dimension of the boxes, including the wall mounting brackets, as function of their capacity are:

Box	Maximum Width (mm)	Maximum Height (mm)	Maximum Depth (mm)
Inverter 3+1 kVA	600	610	230
Inverter 6+1 kVA	1000	1000	230
Battery box 12/20 Ah	220	610	230
Battery box 20/30 Ah	250	1000	230

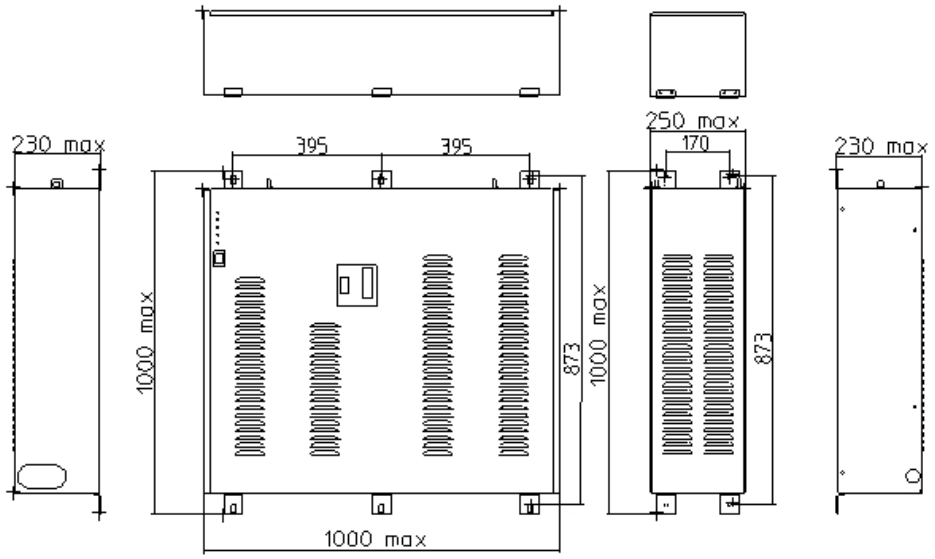
Device should be supplied with adequate lifting provisions (eyelets or hooks).

Adequate plugs and screws for concrete or brick wall mounting should be part of the AESD supply.

Battery box design shall assure the batteries are kept within its maximum operating temperature (see chapter 2.2) when the device is installed in ambient at any temperature within the application range (see chapter 4.1), If for this assurance openings are required in the box, they shall be made in a way they do not violate the required IP21 protection and shall be in a way they are not blocked when the battery box is installed besides the inverter box.
Sketches below give indication on enclosure construction:



AESD 3+1 kVA Battery box 12/20 Ah



AESD 6+1 kVA Battery box 20/30 Ah

2.9 Interfaces

2.9.1 To the building supply

- Screw or cage-clamp terminals, marked L1, L2, L3, N and PE. N terminal shall be of color blue and PE terminal of color yellow/green. L1, L2, L3 terminals are of any other color. Those terminals shall be adequate for cables from 4 to 35 mm² in 4 kVA units and from 6 to 50 mm² in 7 kVA units.
- Two screw or cage-clamp terminals for the mains switch auxiliary contact, rated 0.5-2.5 mm², marked JH1 and JH2

2.9.2 To the ACVF

- Screw or cage-clamp terminals, marked LV1, LV2, LV3, and PE. PE terminal shall be of color yellow/green. LV1, LV2, LV3 terminals are of any other color. Those terminals shall be adequate for cables from 4 to 35 mm² in 4 kVA units and from 6 to 50 mm² in 7 kVA units.

2.9.3 To the lift control

- Three screw or cage-clamp terminals, with 2.5 mm² ratings, marked L1S, L2S and NS
    - L1S and L2S lines shall have a protection device which limits the current in L1S, L2S, and NS wires to 10 A (Table 6 of IEC 60204-1). NS wire shall not be interrupted by this protection.
- Two screw or cage-clamp terminals for the KEF output, rated 1.5 mm², marked KEF1 and KEF2
- Two screw or cage-clamp terminals for the KEFE input, rated 1.5 mm², marked KEFE1 and KEFE2
- Two screw or cage-clamp terminals for the BAT_OK output, rated 1.5 mm², marked BATOK1 and BATOK2

2.9.4 To the mounting wall

- AESD - At least six mounting holes, accessible without opening the device box, for the wall fixation using screws and plugs supplied with the device.
- Battery boxes - At least four mounting holes, accessible without opening the device box, for the wall fixation using screws and plugs supplied with the device.

2.10 Additional Requirements

2.10.1 Product documentation

A manual in English should be supplied with each device unit. Its minimal contents are:

- Device electrical circuit (electronic circuits inside PCBs are not required)
- Information on function of any indication (LED, display, etc.) and adjustment (potentiometer, jumper, tap, etc.) available for field operation
- Maintenance instructions
- Basic troubleshooting

2.10.2 Drill template

Paper templates to allow the position of the mounting holes to be marked on the wall without the usage of the device itself shall be part of the supply of each device. Separate templates can be provided for inverter and battery boxes.

2.10.3 Maintainability

Replacement of part inside the device is not foreseen. In case of a device failure, the whole device is to be replaced.

2.10.4 Standby power consumption

Device power consumption at standstill (batteries fully charged, no evacuation in progress) should be limited to 50 W.

2.11 EMC compliance

Device, as part of the lift system, is subject to EMC codes EN12015:2004 and 12016:2004. In EU, it should also comply with EMC directive 2004/108/EC and should carry the CE conformity mark.

2.12 Testing Requirements

Device should be designed to require minimum field testing for commissioning. If any, prescriptions must be included on the product manual.

2.13 Regulatory Requirements

2.13.1 Regulation Compliance

Device should comply with Low Voltage Directive 2014/35/EU. The compliance to this directive can be presumed if the device is compliant to EN or IEC 61439-1:2011 (Low voltage switchgear and control gear assemblies - Part 1 (General rules). This compliance shall be declared on the device documentation.
UL/CSA code compliance is not required.
According assessment from CQC, the device itself is not required to have China compulsory certification (CCC), but some internal components (e.g. contactors) could be subject to it.

2.13.2 Label Requirements

Each AESD device shall be identified with a unique label. And with below requirements:
(1) Label shall be contained these contents listed in below table at least; Where there is (*) in Value column, it can be defined by supplier.
(2) The font size shall be no less than 10pt. and for all English characters, font shall be “Arial”. For all simplified Chinese characters, font shall be “宋体”;
(3) Marking color shall be Black, background color shall be White;
(4) Label material shall be PVC and pasted well with self-adhesive on its rear side before each delivery;

Contents of AESD label

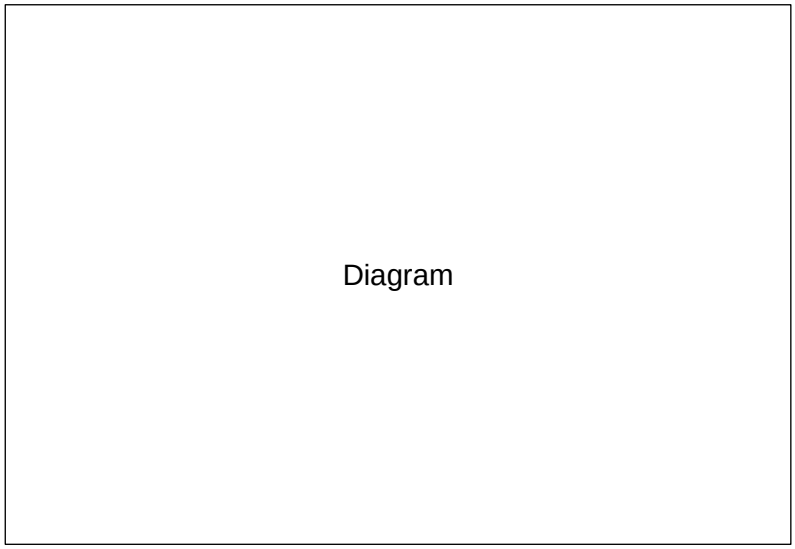
Item	Content	Value	Item	Content	Value
a)	型号 Type:	When application in China, Value is ◆ CO MX 7 if CO MX 7.02; ◆ CO SC 1 if CO SC1 When other areas except China, Value is ■ Control System	j)	制造单位 Manufacturer:	*
b)	规格 Model:	*	k)	制造日期 Date: (YYYY-MM-DD)	*
c)	产品编号 SN: (Serial Number)	*	l)	版本 Version:	*
d)	额定功率 Power:	3 kVA+1 kVA; or 6 kVA+1 kVA	m)	IP 等级 IP Class:	*
e)	输入电压 Input Voltage:	342-528 VAC	n)	环境温度 Ambient Temperature:	*
f)	输入电流 Input Current:	*	o)	重量 Weight:	*
g)	相线 Phase Line：	*	p)	产品 ID:	*
h)	频率 Frequency:	50 Hz or 60 Hz	q)	CE 标识 CE mark:	☒ Yes ☐ No
i)	输出电压 Output Voltage:	*			

2.13.3 Battery Arrangements Label

AESD battery boxes 59715538 and 59715539 shall be added a label to show the possible battery arrangements and respective connections, and with below requirements:
(1) The check box ( ) shall be left empty when the battery box is delivered to KW stock. The check box ( ) shall be marked with the correct battery type when the battery box is delivered to a commission.
(2) The diagram shall be clearly showing the battery arrangements and respective connections, and Should be consistent with the corresponding battery box instructions
(3) The label shall remain visible after the batteries are installed.
(4) Other requirements same as **2.13.2 Label Requirements** (2) (3) (4).

Battery Arrangements Label proposal, it can be defined by supplier

( ) 6 x 12 V/12 Ah batteries, Schindler ID 57659983
( ) 6 x 12 V/20 Ah batteries, Schindler ID 57659984
( ) 6 x 12 V/30 Ah batteries, Schindler ID 57659985



2.14 Special requirements from other codes

Device internal wiring not related to ground connections shall not be made with green or green/yellow wires, which are reserved for ground wires.
The graphical symbol IEC 60417-5036 (see below) shall be present on the device cover, warning about the risk of electric shock (EN 81-20:2014 clause 5.10.1.2.1)

Live parts having a residual voltage greater than 60 V after the supply has been disconnected shall be discharged to 60 V or less within a time of 5 s after disconnection of the supply voltage provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60 µC or less.
Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure containing the capacitances (IEC 60204-1 clause 6.2.4, invoked by EN 81-20:2014 clause 5.10.1.2.4).
In this case, the design shall assure a discharge time smaller than 5 minutes, to prevent disturbances to maintenance operations.

3 Ecological Requirements

3.1 Legal and other Requirements

3.1.1 Schindler internal rules

Hazardous substances

- Device shall not contain any of the substances listed in Schindler's "List of prohibited hazardous substances" (EJ 41100161)
- It shall also have minimal amounts of the substances listed in Schindler's "List of hazardous substances to be avoided" (EJ 41100162)

- A “Supplier declaration on hazardous substances”, following Schindler template, shall be submitted with the competent people signatures

4 Environment

4.1 Temperature, Humidity

- Operation temperature (temperature of the cooling air around the device) from 0 to 40 ºC
- Transport and storage temperature from -25 to 70 ºC
- Humidity up to 95%, non-condensing.

4.2 Vibration

- Device must comply with transport vibration conditions according Schindler's test specification EQ 41009002.
- Device must comply with seismic conditions according to EN81-77 category 1 and 2.

5 Schindler ID numbers

ID number	Description	Equivalence
59711481	AESD 2.0 3+1 kVA 80A	
57641948	AESD 2.0 3+1 kVA 80A no 48V plug	
59711482	AESD 2.0 6+1 kVA 150A	
59711483	Battery box 12/20 Ah (with battery cables 12 and 20 Ah)	59715538+59715540+59715541
59711484	Battery box 20/30 Ah (with battery cables 20 and 30 Ah)	59715539+59715537+59715542
59715538	Battery box 12/20 Ah w/o battery cable	
59715539	Battery box 20/30 Ah w/o battery cable	
59715540	AESD 4 kVA Battery cable set 12 Ah	
59715541	AESD 4 kVA Battery cable set 20 Ah	
57644450	AESD 4kVA Battery cable set 12Ah no 48V plug	
57644451	AESD 4kVA Battery cable set 20Ah no 48V plug	
59715537	AESD 7 kVA Battery cable set 20 Ah	
59715542	AESD 7 kVA Battery cable set 30 Ah	
59715543	Pack AESD 3+1 kVA + Battery box 12/20 Ah	59711481+59715538