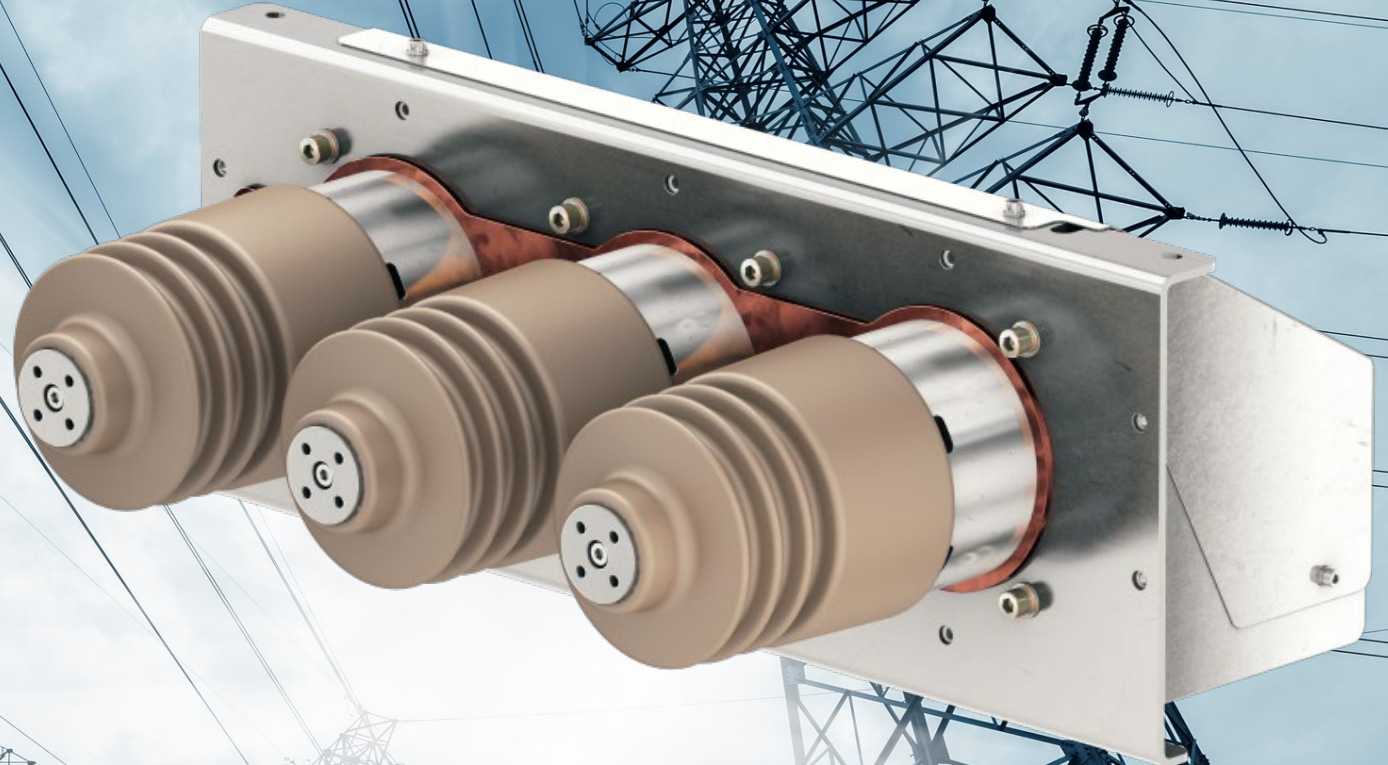


# SiQuench

The resettable  
Arc Quenching Device  
Launch



Mikko Manninen 09.03.2021

# Arc Flash

Phenomena



# Arc Protection AQ100 – SiQuench Launch Program 2021

## WELCOME

**Arc Flash : Uncontrolled  
release of energy, can be  
considered as an Explosion**

**Controlled** Arc has been used in several applications since 1809 after Arc lamp was invented. Almost 80 years later Arc welding was patented and today's infrastructure and our way of life has a lot to thank for that.

**Uncontrolled** Arc and its energy we want to limit with such inventions like Arc Flash relays and with Arc Quenching Devices – Safety matters

# Phenomena – High Pressure

- High Pressure from an Arc generates from two sources
- 1. Air expanding >1600 times
- 2. Copper expands by a factor of 67000 in vaporizing
- Shrapnel and molten metal explodes ~1000 km/hour

Imagine to compare with water boiling to steam - 1670 times more volume



# Phenomena – Intensive Light

- Arc Flash Contains UV and IR spectrum waves and may damage eyesight permanently
- causes inflammation of the cornea and can burn the retinas of the eyes
- Think about Arc welding without proper goggles. – splinters in the eyes all night and no sleep





## Phenomena – Sound waves and Hot temperatures

- Permanent hearing loss cause of high dB sound waves
- Arc flash ~4 times the temperature of the sun surface.
- 20000K, but special types of arcs can reach upto 50000K



# SiQuench

Arc Quenching Device

Part of the Arc Protection



# AQ 100 series (MV)

## MEDIUM VOLTAGE PRODUCTS



### AQ-110P CURRENT AND LIGHT POINT SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 12 light detectors and one light detecting fiber



### AQ-110F CURRENT AND FIBER SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 3 light detecting fibers



### AQ-102 FIBER SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110F or standalone for light only system

Up to 3 light detecting fibers



### AQ-101 POINT SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors and one light detecting fiber



### AQ-101S POINT SENSOR UNIT (double BB /duplex)

Light sensing unit for double busbar applications. Installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors



### AQ-101D POINT SENSOR UNIT

Din rail mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

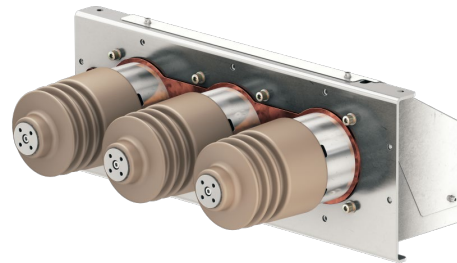
Up to 12 light detectors and one light detecting fiber



### AQ-103 POINT SENSOR UNIT

Flush mounted light sensing unit

Up to 14 light detectors and one light detecting fiber



### SiQuench AQD

Resettable AQD

Up to 24kV  
50kA 3sec.



# AQ 100 series (MV)

## Arc Relays with Current option

### MEDIUM VOLTAGE PRODUCTS



#### AQ-110P CURRENT AND LIGHT POINT SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 12 light detectors and one light detecting fiber



#### AQ-110F CURRENT AND FIBER SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 3 light detecting fibers



#### AQ-102 FIBER SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110F or standalone for light only system

Up to 3 light detecting fibers



#### AQ-101 POINT SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors and one light detecting fiber



#### AQ-101S POINT SENSOR UNIT (double BB /duplex)

Light sensing unit for double busbar applications. Installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors



#### AQ-101D POINT SENSOR UNIT

Din rail mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

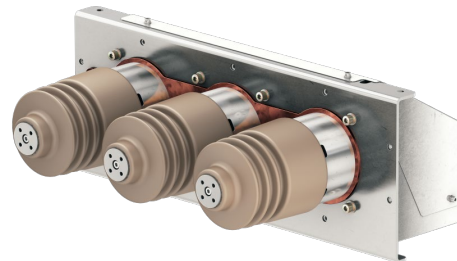
Up to 12 light detectors and one light detecting fiber



#### AQ-103 POINT SENSOR UNIT

Flush mounted light sensing unit

Up to 14 light detectors and one light detecting fiber



#### SiQuench AQD

Resettable AQD

Up to 24kV  
50kA 3sec.

# AQ 100 series (MV)

## Arc Relays with point sensor option



### MEDIUM VOLTAGE PRODUCTS



#### AQ-110P CURRENT AND LIGHT POINT SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 12 light detectors and one light detecting fiber



#### AQ-110F CURRENT AND FIBER SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 3 light detecting fibers



#### AQ-102 FIBER SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110F or standalone for light only system

Up to 3 light detecting fibers



#### AQ-101 POINT SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors and one light detecting fiber



#### AQ-101S POINT SENSOR UNIT (double BB /duplex)

Light sensing unit for double busbar applications. Installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors



#### AQ-101D POINT SENSOR UNIT

Din rail mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

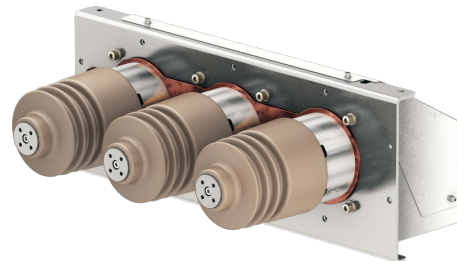
Up to 12 light detectors and one light detecting fiber



#### AQ-103 POINT SENSOR UNIT

Flush mounted light sensing unit

Up to 14 light detectors and one light detecting fiber



#### SiQuench AQD

Resettable AQD

Up to 24kV  
50kA 3sec.

# AQ 100 series (MV)

## Arc Relays with fiber sensor option



### MEDIUM VOLTAGE PRODUCTS



#### AQ-110P CURRENT AND LIGHT POINT SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 12 light detectors and one light detecting fiber



#### AQ-110F CURRENT AND FIBER SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 3 light detecting fibers



#### AQ-102 FIBER SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110F or standalone for light only system

Up to 3 light detecting fibers



#### AQ-101 POINT SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors and one light detecting fiber



#### AQ-101S POINT SENSOR UNIT (double BB /duplex)

Light sensing unit for double busbar applications. Installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors



#### AQ-101D POINT SENSOR UNIT

Din rail mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

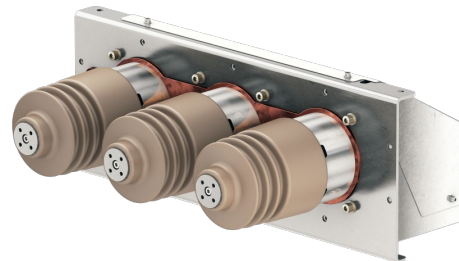
Up to 12 light detectors and one light detecting fiber



#### AQ-103 POINT SENSOR UNIT

Flush mounted light sensing unit

Up to 14 light detectors and one light detecting fiber



#### SiQuench AQD

Resettable AQD

Up to 24kV  
50kA 3sec.

# AQ 100 series (MV)

## Arc Quenching Unit

### MEDIUM VOLTAGE PRODUCTS



#### AQ-110P CURRENT AND LIGHT POINT SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 12 light detectors and one light detecting fiber



#### AQ-110F CURRENT AND FIBER SENSOR UNIT

Flush mounted current and light sensing main unit

4 current inputs, up to 3 light detecting fibers



#### AQ-102 FIBER SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110F or standalone for light only system

Up to 3 light detecting fibers



#### AQ-101 POINT SENSOR UNIT

Flush mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors and one light detecting fiber



#### AQ-101S POINT SENSOR UNIT (double BB /duplex)

Light sensing unit for double busbar applications. Installed as sub-unit to AQ-110P or standalone for light only system

Up to 12 light detectors



#### AQ-101D POINT SENSOR UNIT

Din rail mounted light sensing unit installed as sub-unit to AQ-110P or standalone for light only system

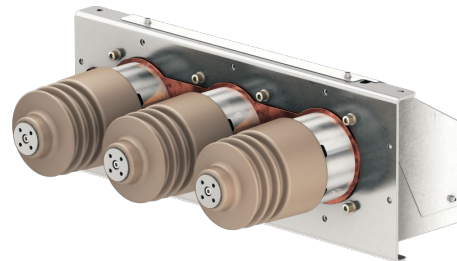
Up to 12 light detectors and one light detecting fiber



#### AQ-103 POINT SENSOR UNIT

Flush mounted light sensing unit

Up to 14 light detectors and one light detecting fiber

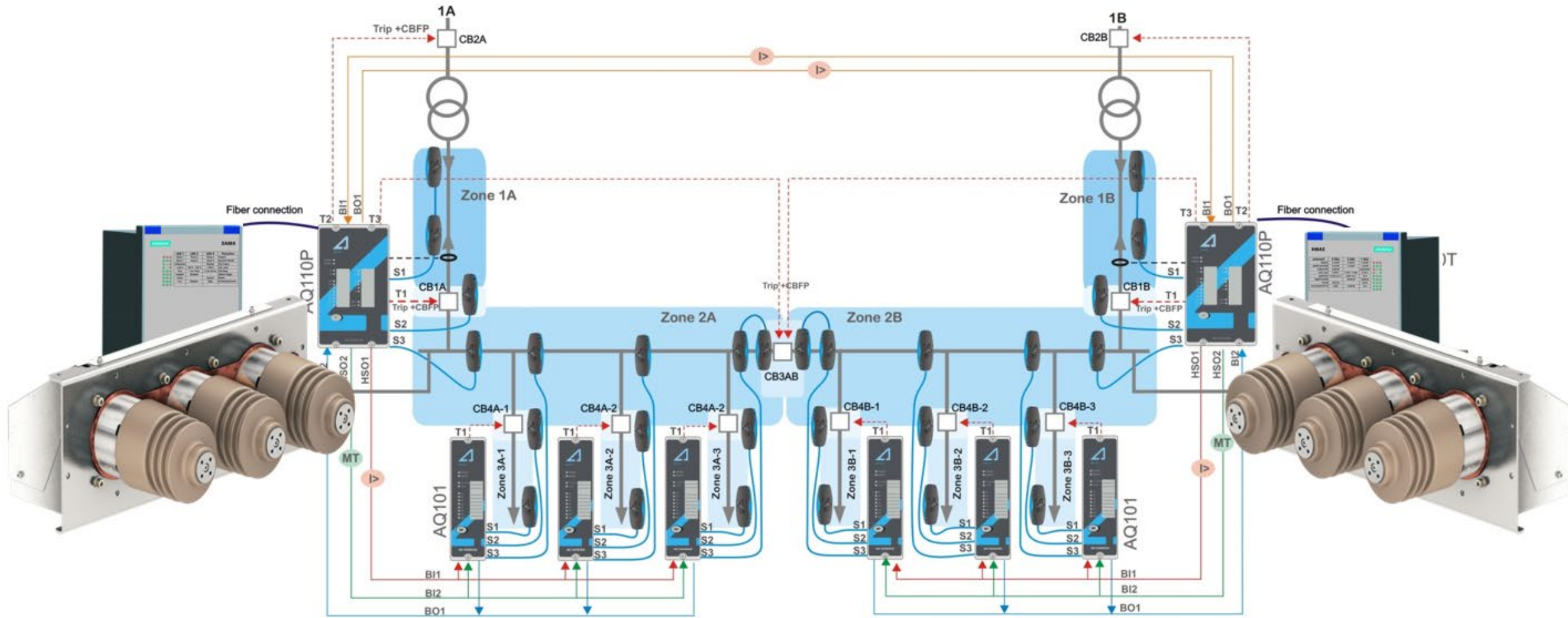


#### SiQuench AQD

Resettable AQD

Up to 24kV  
50kA 3sec.

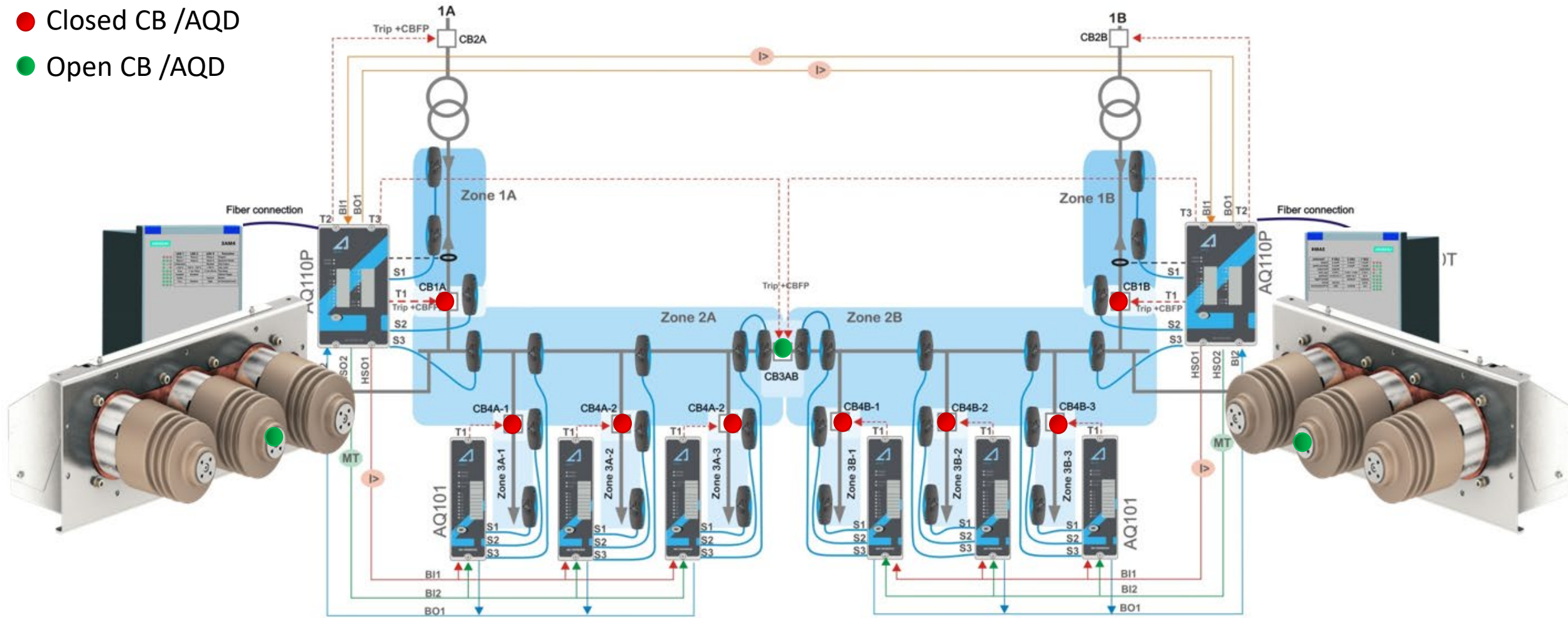
# SIQuench Arc Quenching Device



Full feeder selectivity

# SIQuench Arc Quenching Device

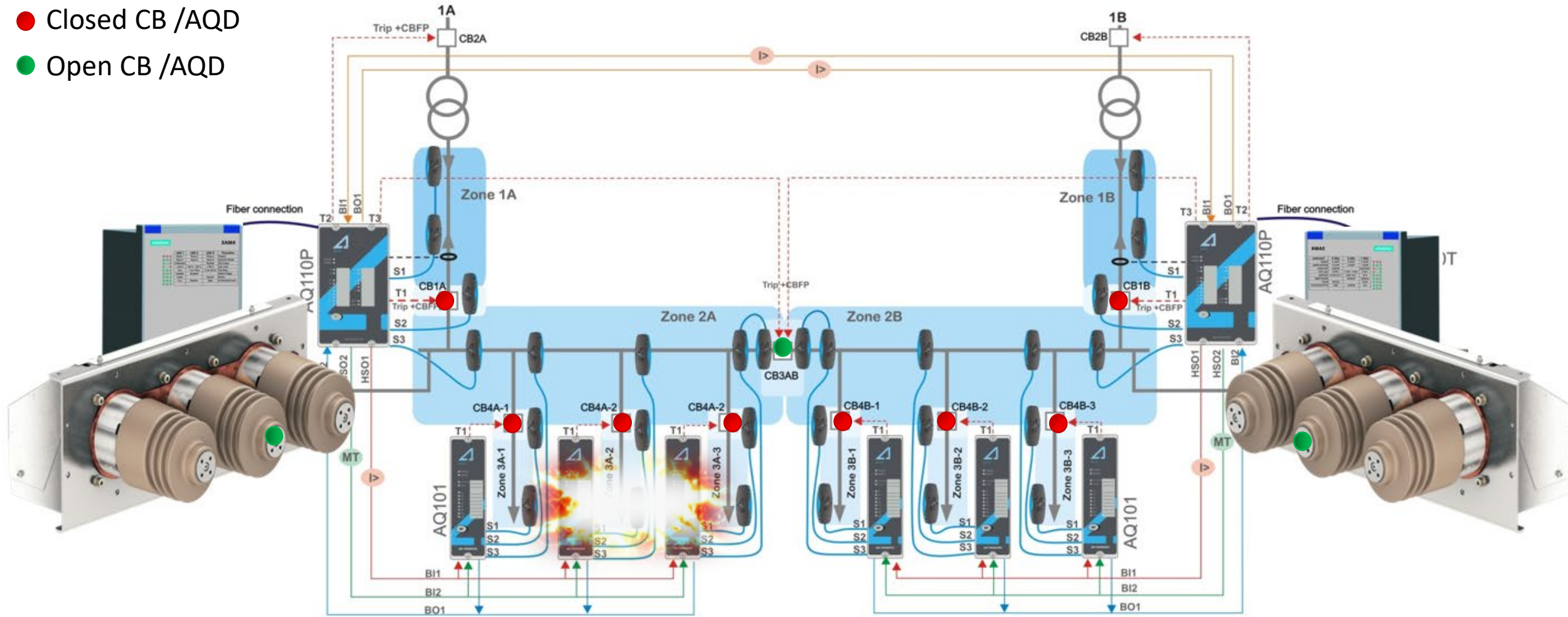
- Closed CB /AQD
- Open CB /AQD



Full feeder selectivity

# SIQuench Arc Quenching Device

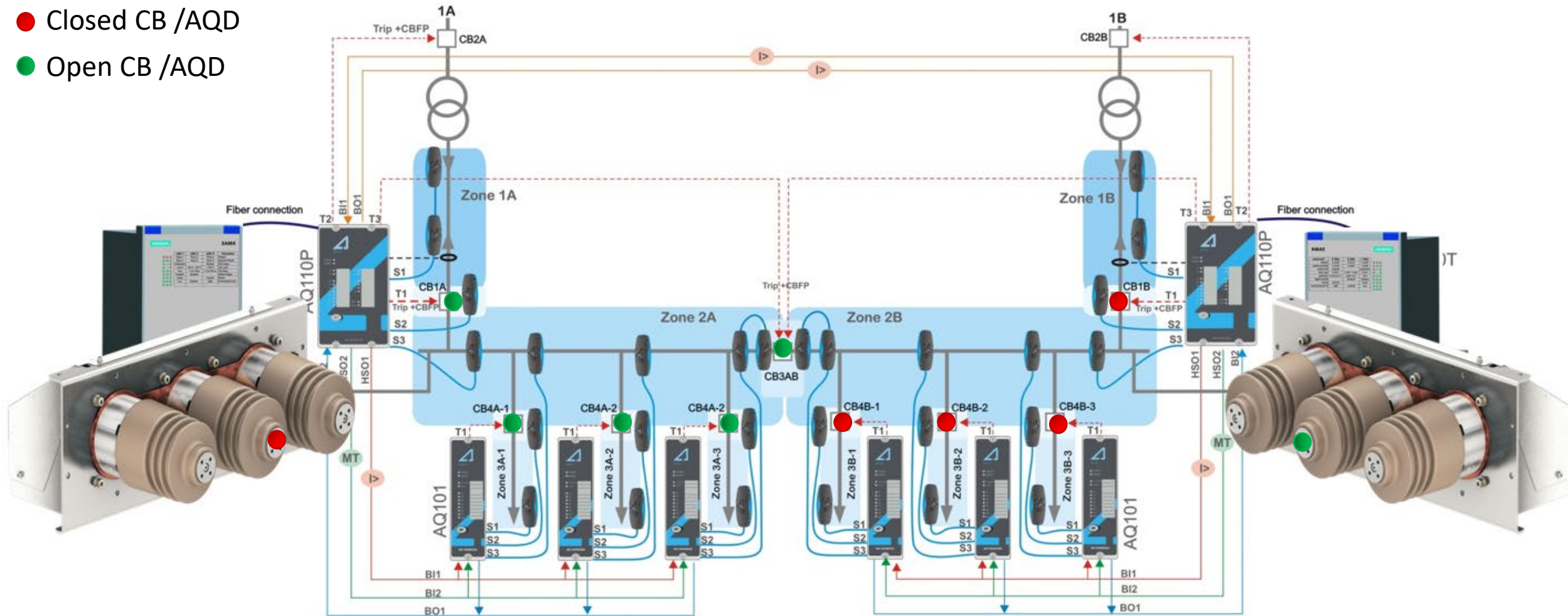
- Closed CB /AQD
- Open CB /AQD



Full feeder selectivity

# SIQuench Arc Quenching Device

- Closed CB /AQD
- Open CB /AQD

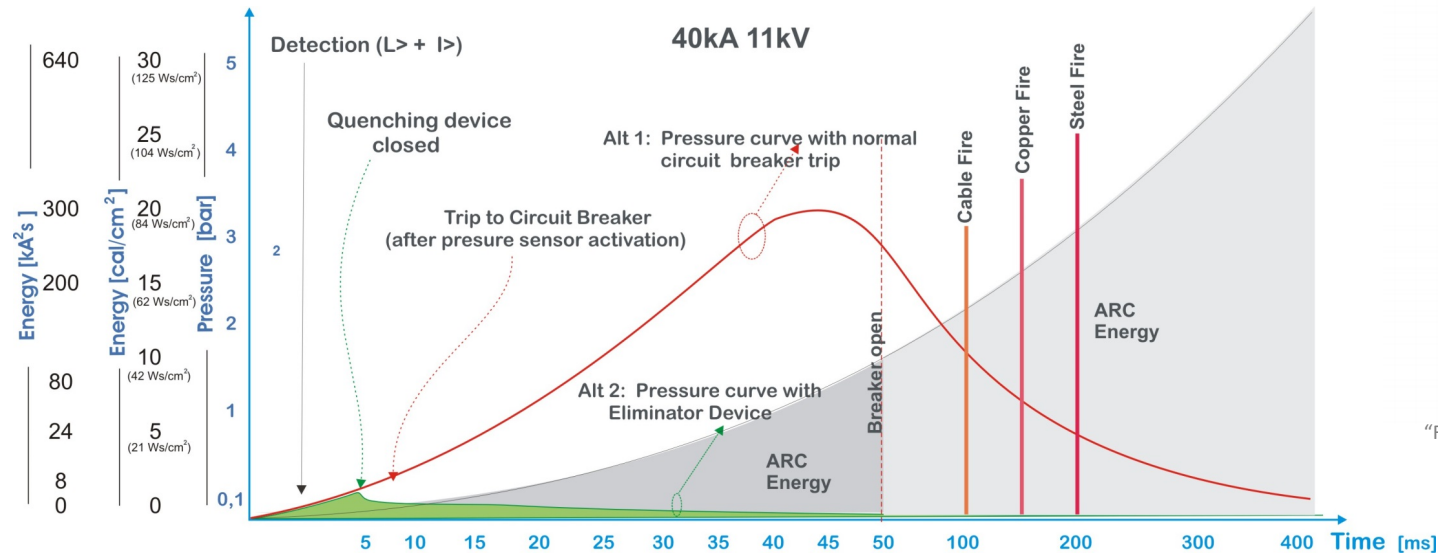
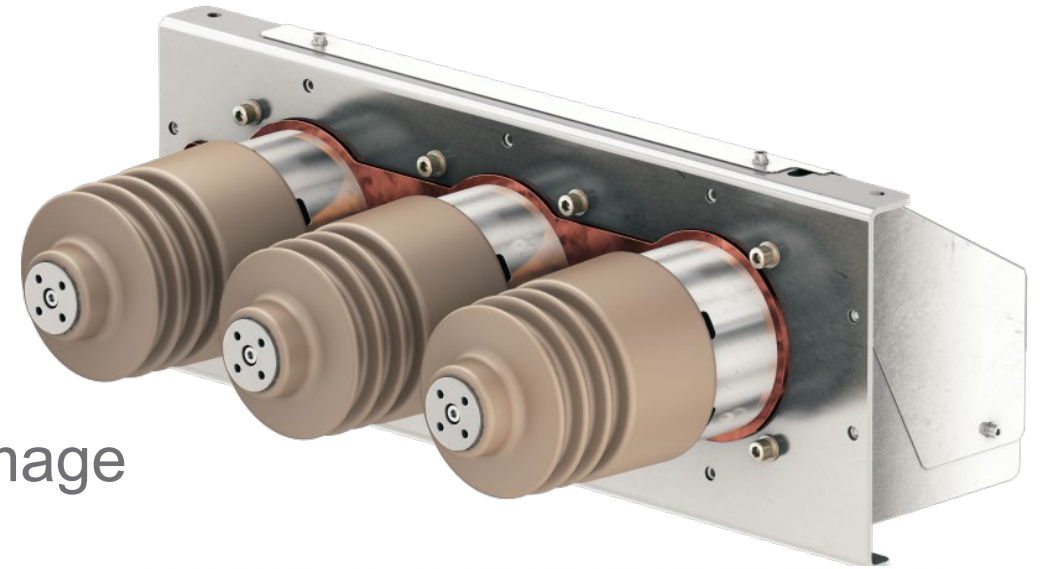


Full feeder selectivity



# SiQuench

- Minimize Arc fault Energy
- To maximize personnel safety
- To minimize downtime and equipment damage



**TABLE I**  
**MAXIMUM POWER IN THREE PHASE ARC, MW**

Bolted Fault kA	System Voltage, kV					
	0.48	2.4	4.2	7.2	13.2	34.5
1	0.42	2.0	3.6	6.3	11.4	29.8
2	0.83	4.2	7.2	12.5	22.8	59.6
3	1.25	6.2	10.8	18.7	34.8	91.0
5	2.08	10.3	18.0	31.2	57.1	149.2
10	4.15	20.8	36.0	62.3	114.2	295.5
15	6.23	31.1	54.0	93.4	171.3	447.7
20	8.3	41.5	72.0	120.5	228.3	596.7
30	12.5	62.2	108.0	186.8		
40	16.6	83.0	144.0			
50	20.8	103.8	180.0			

"From: IEEE Member Ralph H. Lee paper "The Other Electrical Hazard: Electric Arc Blast Burns"

# SiQuench Dimensions PMA210

## 3AM4132-1DA12-0AB2-Z

Arc quenching device (17,5kV)

Controller (trigger device) included

31,5 kA - 3s

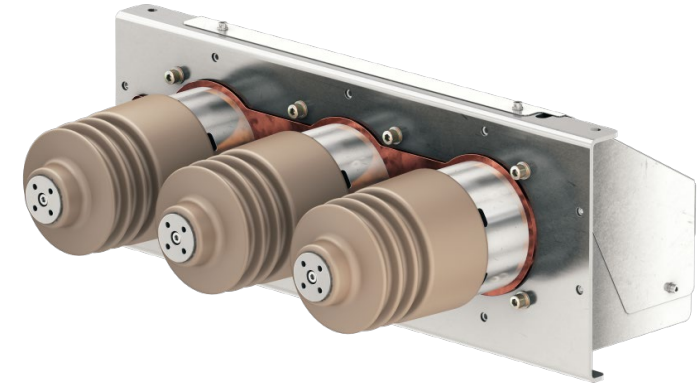
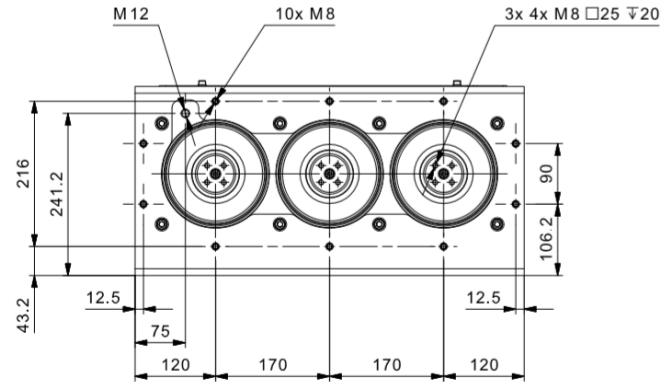
BIL: 95 kV

Phase conductor displacement: 170 mm, total width 580 mm

Reusable: 30 mechanical operations, 5 operations under fault current

Connection cables between trigger device and quenching device included

Auxiliary supply 110 - 250 Vac/dc



## 3AM4143-3DA12-0AB2-Z

Arc quenching device  
(24 kV)

Controller (trigger device) included

50 kA - 3s

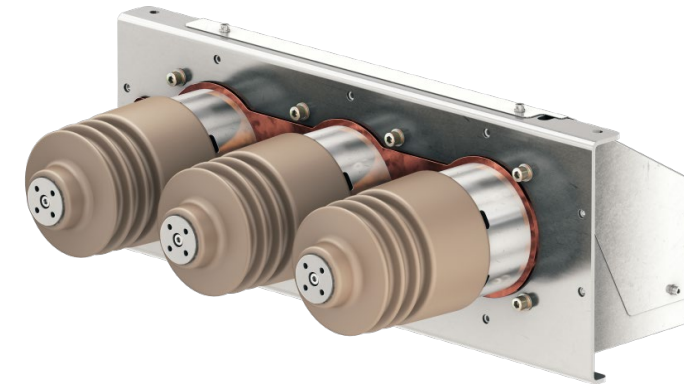
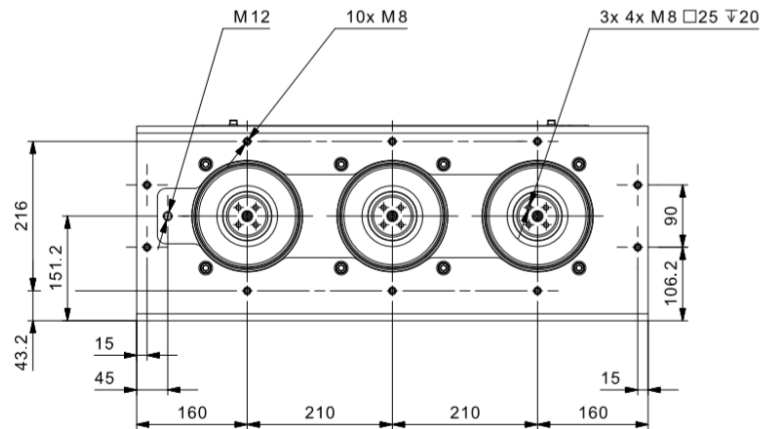
BIL: 125 kV

Phase conductor displacement: 210 mm, total width 740 mm

Reusable: 30 mechanical operations, 5 operations under fault current

Connection cables between trigger device and quenching device included

Auxiliary supply 110 - 250 Vac/dc



- Testing and commissioning can be fully done!

# MV and LV product selection

## AQ 01 Arc Light Sensor

### Sensitivity levels 8 / 25 / 50 kLux

- 3 wire (+24Vdc, Signal, Gnd)
- Current based information (2mA, 20mA)
- Maximum 3 sensors in line (up to 200m line)
- Snap-in cable connector for quick installation
- Shielded cable connection



# MV and LV product selection

## AQ 02 Arc Light and Pressure Sensor

- 3 wire (+24Vdc, Signal, Gnd)
- Current based information (2mA, 20mA)
- Maximum 3 sensors in line (up to 200m line)
- Snap-in cable connector for quick installation
- Shielded cable connection
- 1ms pick up for light and pressure (0,2bar increase)



# MV and LV product selection

## AQ06 / AQ07 / AQ08 Arc fiber loop sensor

- Plastic or multi core glass fiber
- Length 5 to 50m
- Self supervision
- Up to 125 °C / 257F
- Sensitivity 8...25kLux
- Can touch the live parts



### ARC QUENCHING

Typical protective equipment (PPE)



Level of damage



### ARC QUENCHING

Typical clearing time	<4 ms
Typical worst-case incident energy level (IEEE 1584)	>1 cal/cm <sup>2</sup>
Typical Personal Protective Equipment (PPE)	Category 1
Typical outage and repair time	Hour
Recommended	Fault current >10 kA and all important loads
Level of protection	<b>ULTIMATE</b>

### ARC FLASH RELAY

Typical protective equipment (PPE)



Level of damage



### ARC FLASH RELAY

Typical clearing time	50-80 ms
Typical worst-case incident energy level (IEEE 1584)	<10 cal/cm <sup>2</sup>
Typical Personal Protective Equipment (PPE)	Category 2
Typical outage and repair time	Hours
Recommended	Fault current <10 kA and non-important loads
Level of protection	<b>GOOD</b>

### CONVENTIONAL RELAY

Typical protective equipment (PPE)



Level of damage



### CONVENTIONAL RELAY

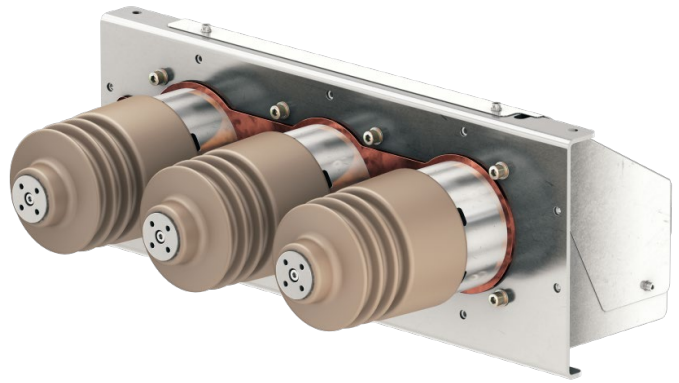
Typical clearing time	>500 ms
Typical worst-case incident energy level (IEEE 1584)	>40 cal/cm <sup>2</sup>
Typical Personal Protective Equipment (PPE)	Category 4
Typical outage and repair time	Days or weeks
Recommended	Never
Level of protection	<b>BAD</b>

# SiQuench

MV Arc Quenching Device



# Arcteq - SiQuench



2020



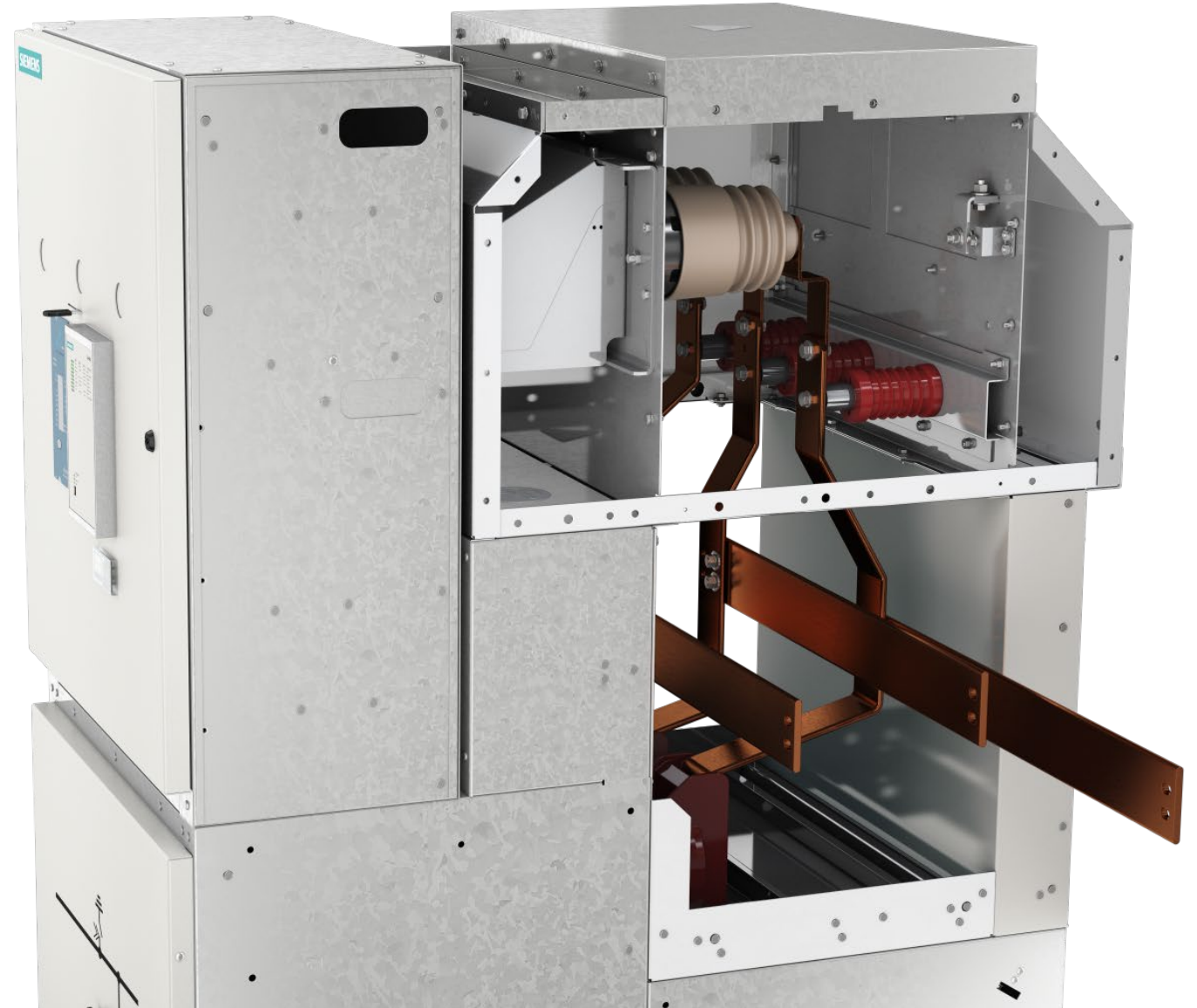
**ARCTEQ**<sup>®</sup>  
RELAYABLE POWER

**SIEMENS**  
*Ingenuity for life*

**ARCTEQ**<sup>®</sup>  
RELAYABLE POWER



# SiQuench Installation



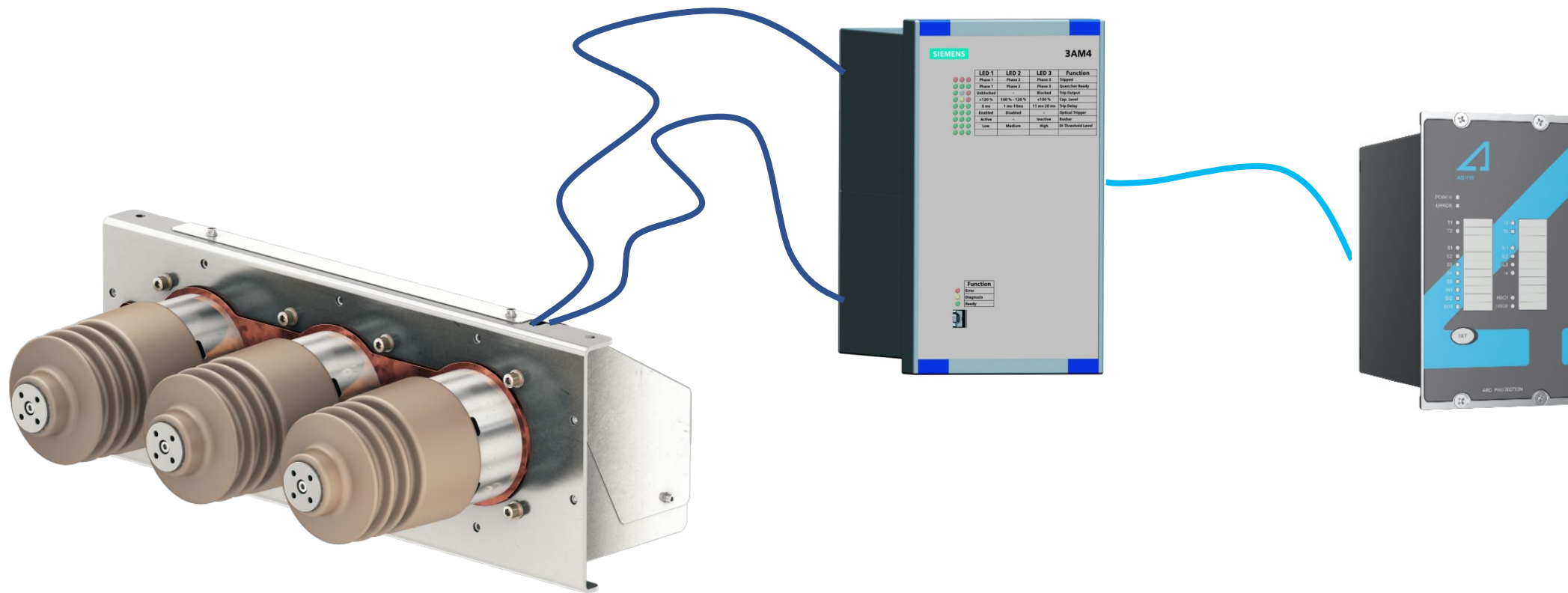
<https://www.youtube.com/watch?v=S3ID9khZf-M&t=91s>

Siemens SiQuench installation in NXAir Switchgear

# Siemens SIQuench

your natural choice!

# SiQuench Installation



# SiQuench Installation

## NEW BUILD

- For Any Metal Clad or Metal Enclosed Air insulated system up to 24kV
- Easy design for standard installation method
- Added value and performance for the switchgears

## RETROFIT

- For Any Metal Clad or Metal Enclosed Air insulated system up to 24kV
- Case by case installation method. On site designing may be necessary.
- Added value and performance for the switchgears



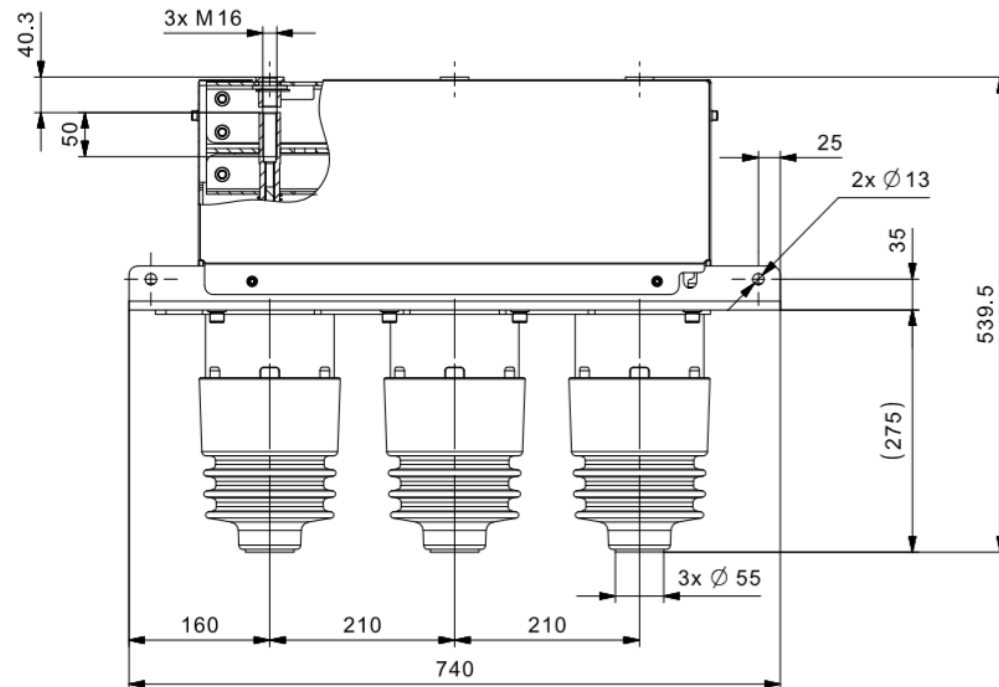
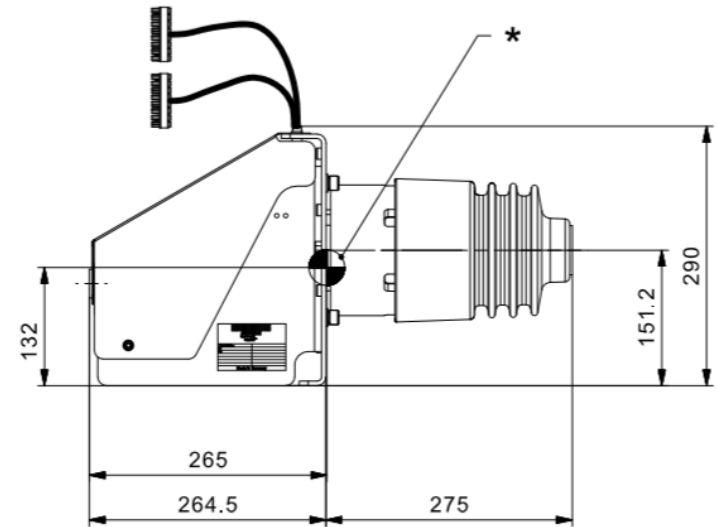
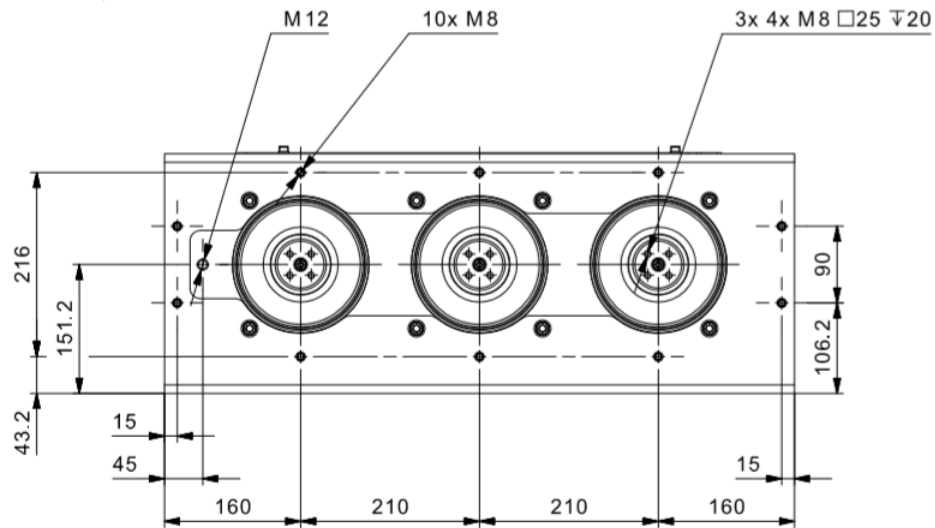
# SiQuench

Arc Quenching Device

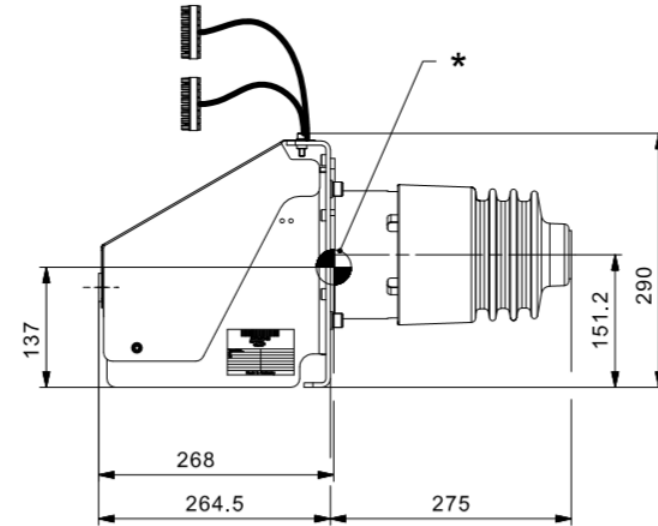
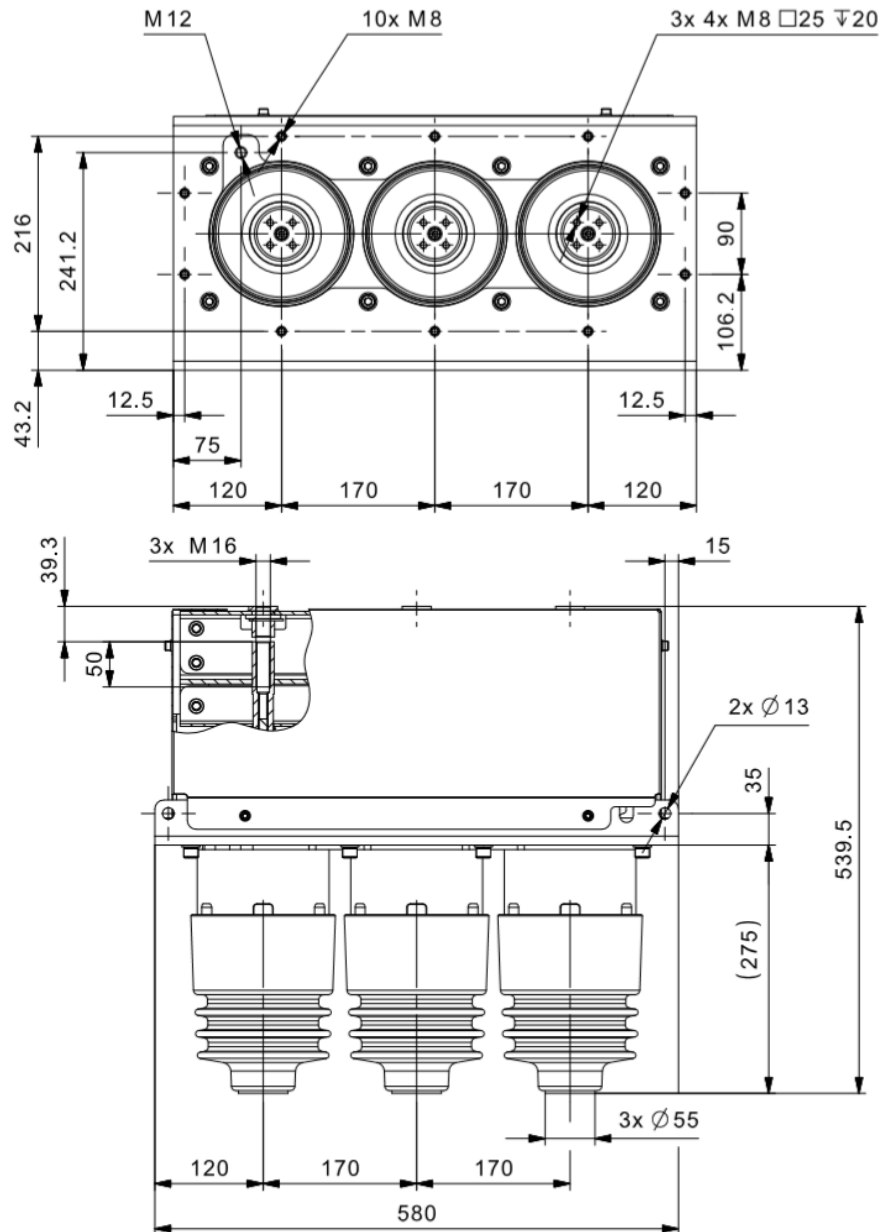
Mechanical and Technical



# SiQuench Dimensions PMA210



# SiQuench Dimensions PMA170



# SiQuench Installation

## Design

The SIQuench 3AM4 is a 3-pole switching device consisting of:

- High-voltage section
- Switching part

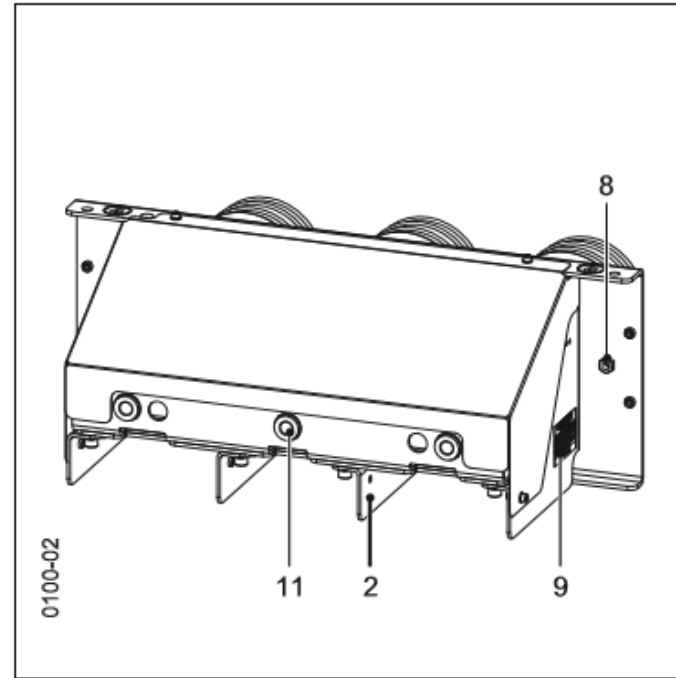
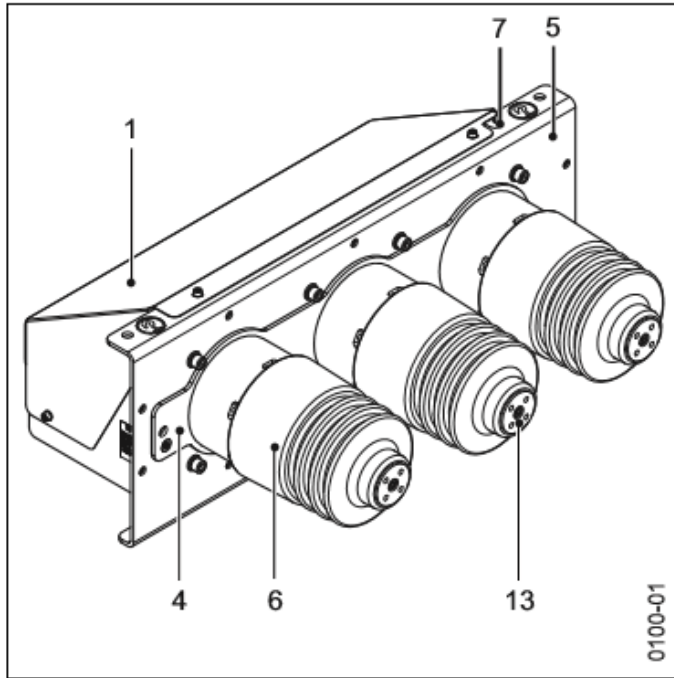


Fig. 1 Front view – high-voltage part

Fig. 2 Rear view – switching part

- 1 Cover
- 4 Earthing plate, short circuit connection
- 5 Base plate
- 6 Insulating housing
- 7 Cable outlet
- 13 High-voltage connection

- 2 Switching part
- 8 Earthing terminal
- 9 Name plate
- 11 Interface for clamping mechanism for switchgear

## High-voltage section

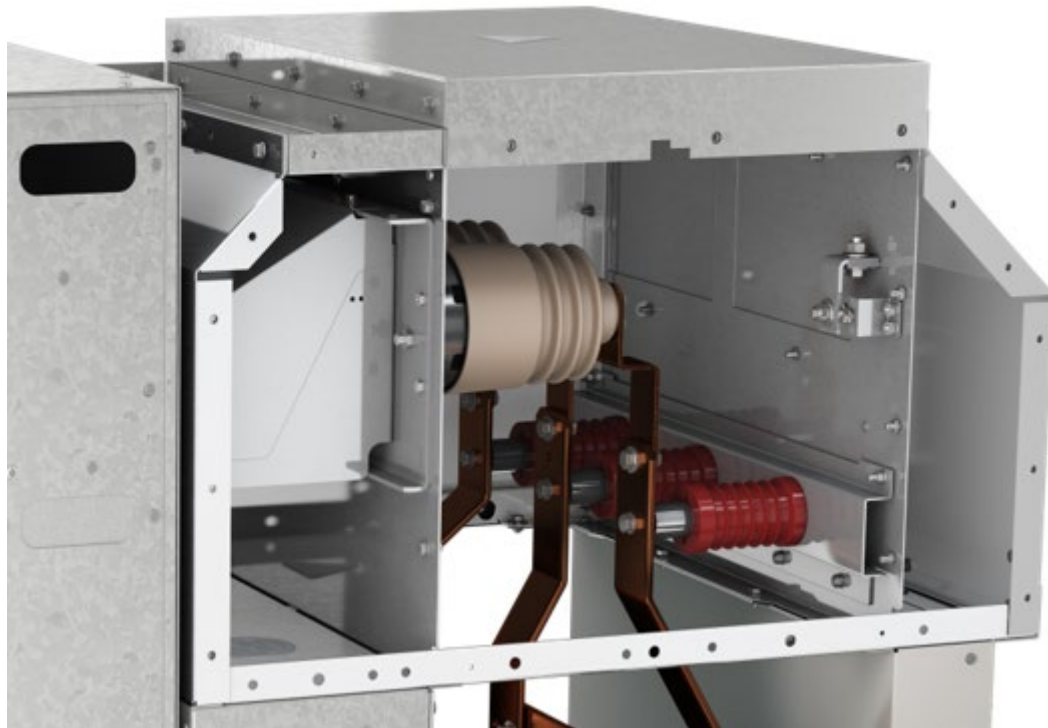
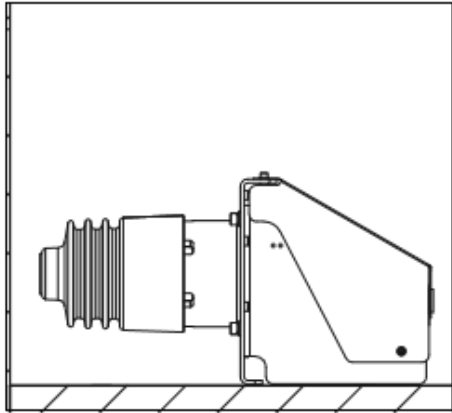
The high-voltage section consists of three poles with insulating housings (6) with short-circuit connection for connecting the conductor bars. The inner mechatronics for a pole consists of, for example, from position switch for signal "ready to shift", switching mechanism, contact and solenoid. The high-voltage section is connected to the switching part via the short circuit connection, earth plate and base plate.

## Switching part

The components of the switching part such as the position switch for oil leakage, contact rods and return mechanism are protected by a cover. On the back of the SIQuench 3AM4 are the interfaces for the clamping mechanism for the return of the individual movable contacts.



# SiQuench Installation



## Installation position

Observe the distances as per IEC 60071 insulation coordination or comply with the required leeway distances according to the national operational requirements.

## Installation position

The SIQuench 3AM4 recommended installation position is horizontally for the high-voltage connection!!!

also vertical installation is possible.

# SiQuench Installation

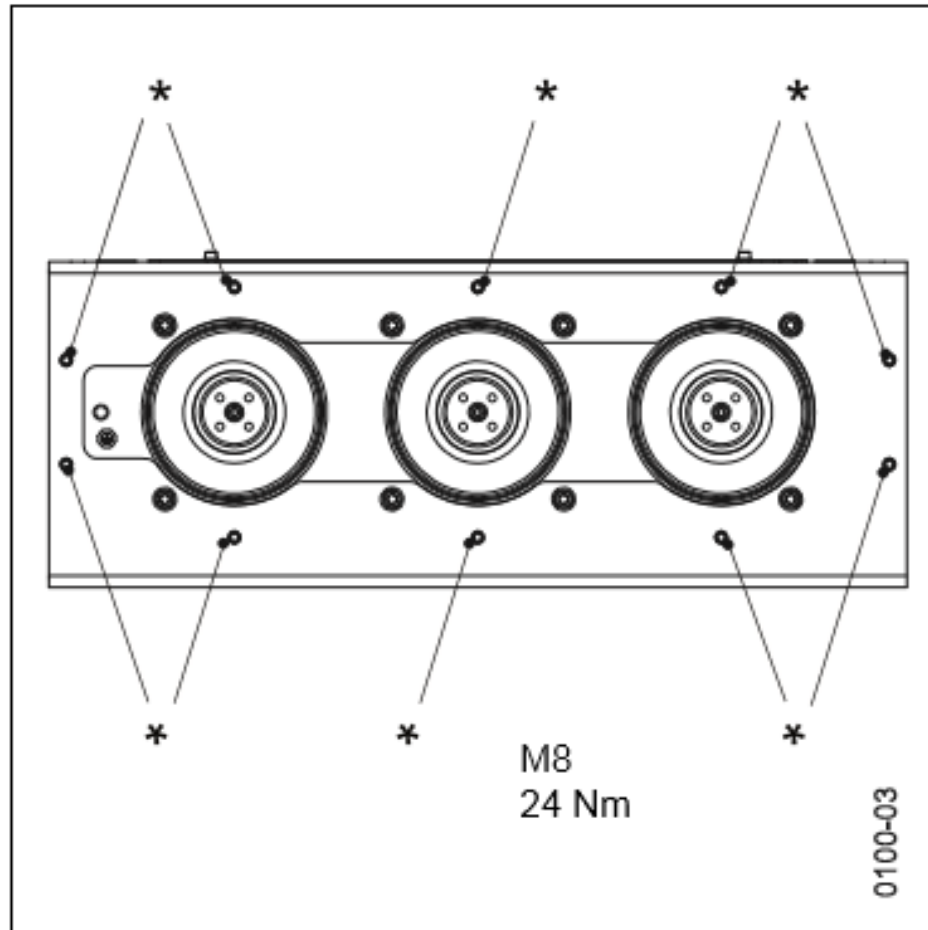


Fig. 14 Mounting points

Mount the SIQuench 3AM4 tension-free and torsion-free at the 10 specified mounting points (\*) on a frame, wall, or on a withdrawable part. Mounting screws M8 with fastening elements, (resistance 8.8 bolt strength), tightening torque 24 Nm

# SiQuench Installation

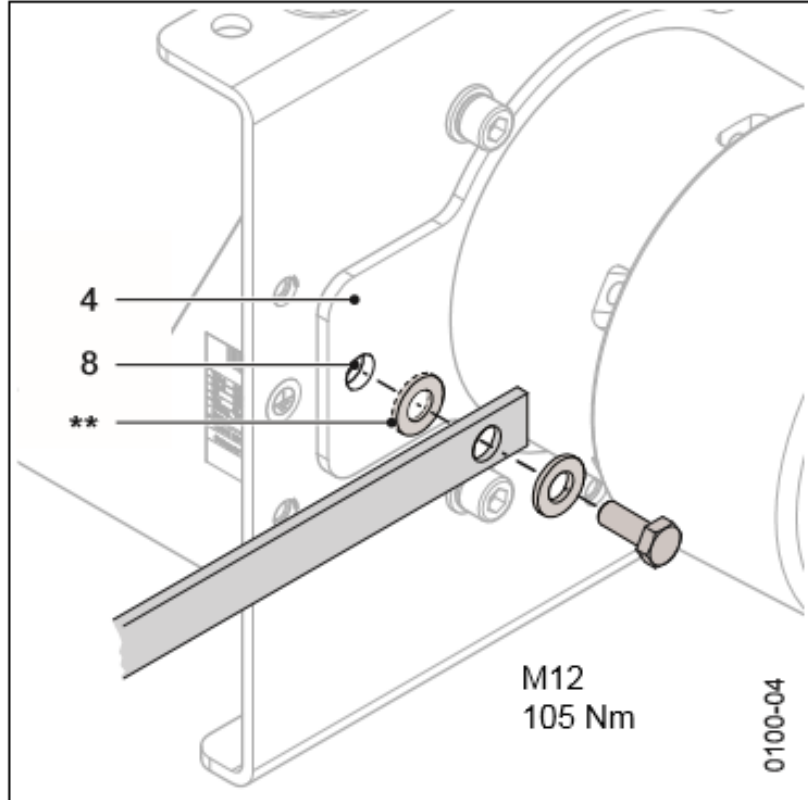


Fig. 15 Earthing terminal with earthing bar

- 4 Earthing plate
- ) 8 Earthing terminal

## Connecting to earth

- Dimension earthing for the complete short-circuit current.
- Select the cross-section of the earth bar so that the rated short-circuit current, with a maximum voltage drop of 3 V can be conducted to the provided earthing point (see IEC 62271-200). (40x10 Cu recommended)
- Observe the order of the fixing elements: Place the washer, ring-main cable of the earthing bar and contact washer (SN 70093) with the teeth facing the operating mechanism box under the bolt head. Fix M12 hexagonal bolt with the fixing elements to the earthing terminal (8) with 105 Nm.

- Consult Arcteq about all mechanical connection and together we can fit this into your systems.

# SiQuench Installation

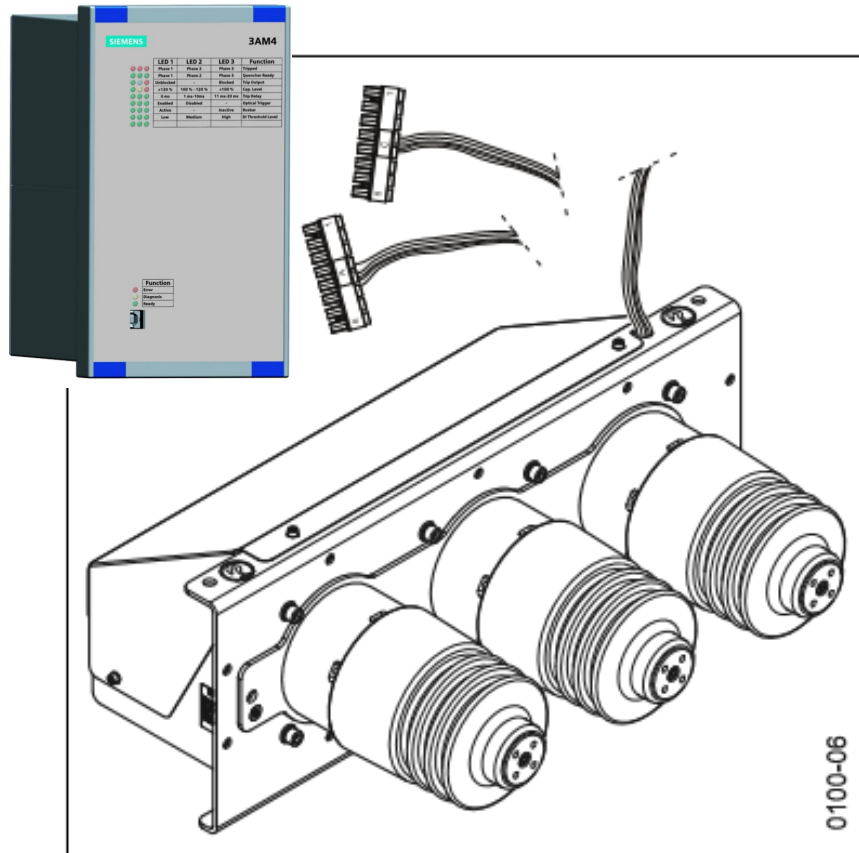


Fig. 16 Example – low-voltage cable harness with connectors

- 1 Cover
- 7 Cable outlet

Connecting the low voltage

Connect the SIQuench 3AM4 connecting leads to the customer's Door mounted SIQuench controller in such a way that safe operation as per supplied circuit diagram is guaranteed.

# SiQuench Arc quenching device (MV)

## PERSONNEL SAFETY

- Reduce risk of injury during operations and maintenance
- Protection active even in open door situation
- More comfortable personal protection equipment (PPE) requirements, typically category 1

## EQUIPMENT SAFETY

- Minimized damage to equipment
- Less repair costs
- Shorter power outages

## APPLICABLE FOR NEW OR RETROFIT INSTALLATION

- Applicable for most types of new air insulated switchgear configurations
- Can be easily build as retrofit installation to existing installations

## REDUCED TOTAL SWITCHGEAR AND BUILDING COST AND FOOTPRINT

- “Arc resistant” characteristics with metal clad switchgear designs
- Option to arc resistant switchgear applications
- No arc flash energy release beyond switchgear enclosure
- Minimized pressure effect

## DEPENDABILITY

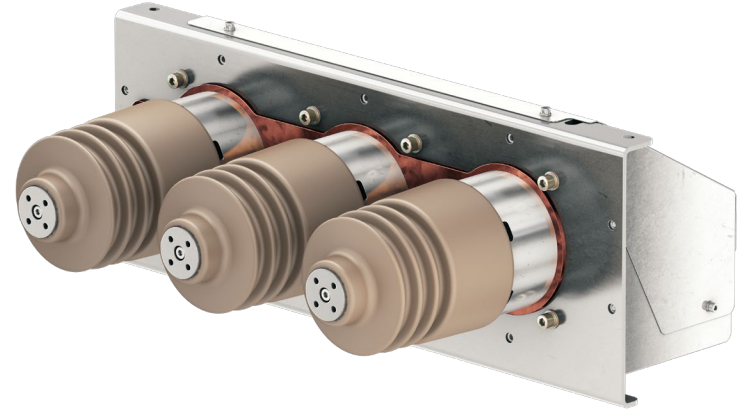
- Continuous self-supervision of the system
- Alarm on any erroneous condition
- Meets with highest EMC immunity requirements

SIQuench marketing

The background is a solid bright blue. On the right side, there are several white geometric shapes: a large diagonal line starting from the top right and extending towards the center, and two horizontal bars at the bottom right, one of which is partially cut off by the edge of the image.

# Marketing

- The Siemens SIQuench is sold through the Arcteq global sales network, for installation in any MV network substation/switchgear
- Two variants
  - SIQuench 3AM4132 up to 17,5 kV
  - SIQuench 3AM4143 up to 24 kV
- Pricing added to Arcteq pricelists 2021
- Please get in touch with your sales contact at Arcteq for any question you may have.



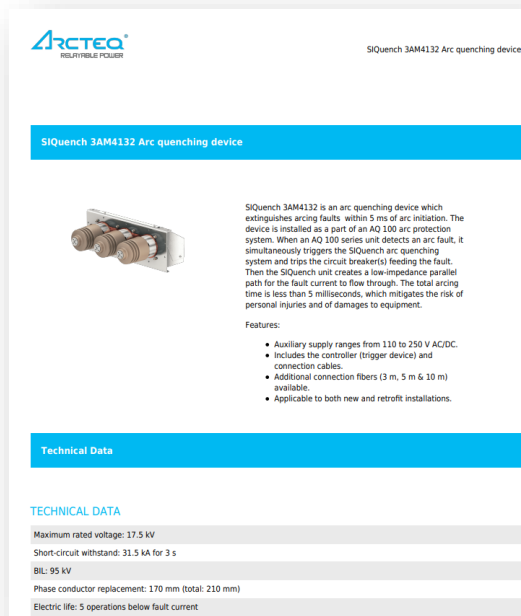
# SIQuench on Arcteq.fi web

Products and Services:

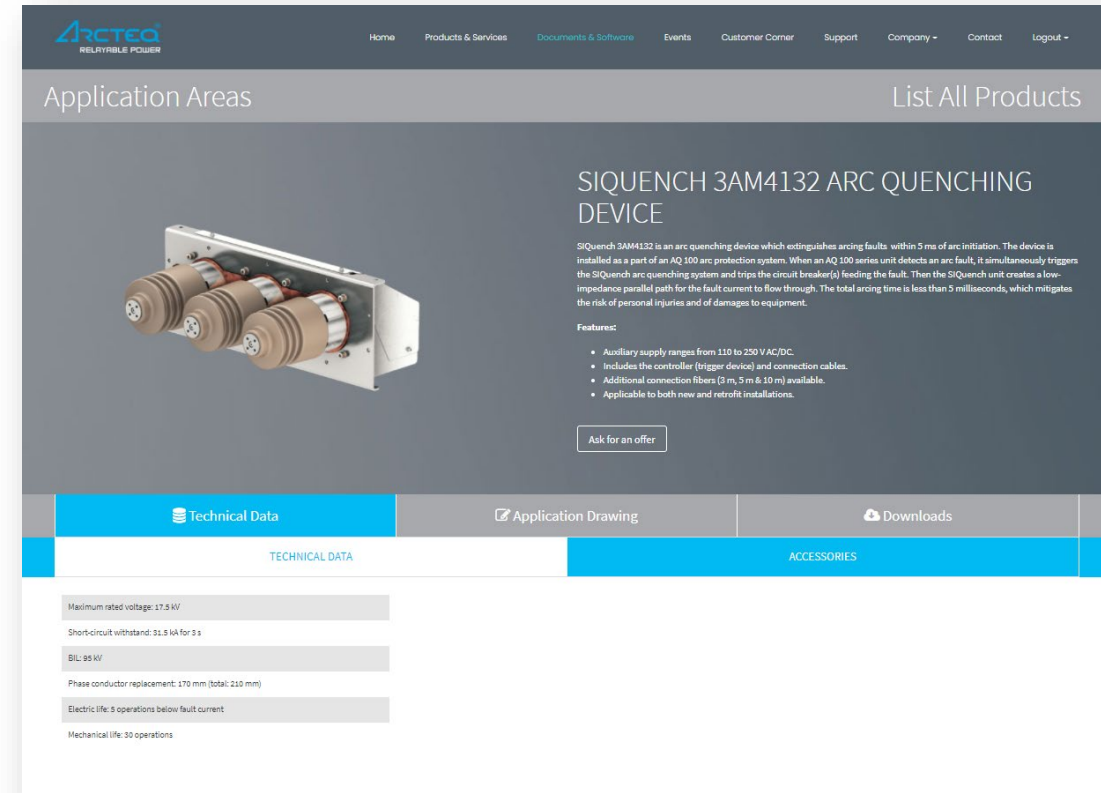
[SIQuench 3AM4132 Arc quenching device](#)

[SIQuench 3AM4143 Arc quenching device](#)

Datasheet available from product page  
(Create PDF button)



The screenshot shows a PDF document for the SIQuench 3AM4132 Arc quenching device. It features the Arcteq logo at the top left and the product name at the top right. Below the product name is a small image of the device. The main text describes the device's function: it extinguishes arcing faults within 5 ms of arc initiation by creating a low-impedance parallel path for the fault current. A 'Features' section lists: Auxiliary supply ranges from 110 to 250 V AC/DC; Includes the controller (trigger device) and connection cables; Additional connection fibers (3 m, 5 m & 10 m) available; and Applicable to both new and retrofit installations. A 'Technical Data' section is highlighted in blue, containing: Maximum rated voltage: 17.5 kV; Short-circuit withstand: 31.5 kA for 3 s; BIL: 95 kV; Phase conductor replacement: 170 mm (total: 210 mm); and Electric life: 5 operations below fault current.

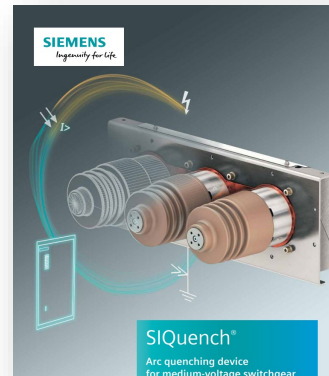


The screenshot shows the product page for the SIQuench 3AM4132 Arc Quenching Device on the Arcteq website. The page has a dark header with the Arcteq logo and navigation links. Below the header is a navigation bar with 'Application Areas' and 'List All Products'. The main content area features a large image of the device on the left and a text block on the right. The text block includes the product name, a detailed description of its function, and a 'Features' section with the same bullet points as the PDF. Below the text is an 'Ask for an offer' button. At the bottom of the page, there are three tabs: 'Technical Data', 'Application Drawing', and 'Downloads'. The 'Technical Data' tab is active, showing a table with the following specifications: Maximum rated voltage: 17.5 kV; Short-circuit withstand: 31.5 kA for 3 s; BIL: 95 kV; Phase conductor replacement: 170 mm (total: 210 mm); Electric life: 5 operations below fault current; and Mechanical life: 30 operations.

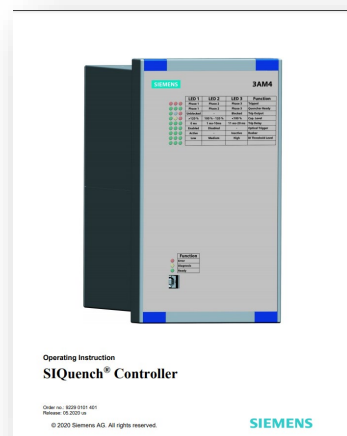


# SIQuench Documentation at <https://www.arcteq.fi/documents-and-software/>

## Brochure



## Instruction manuals



The screenshot shows the 'DOCUMENTS & SOFTWARE' page of the Arcteq website. The navigation bar includes links for Home, Products & Services, Documents & Software, Events, Customer Corner, Support, Company, Contact, and Logout. The main content area features a header with the text 'DOCUMENTS & SOFTWARE' over a background image of a terminal block. Below the header, there are two sections: 'Watch Arcteq Videos:' with a button for 'Arcteq Videos', and 'Arcteq Webinar Wednesday material available on YouTube:' with a button for 'Arcteq YouTube channel'. Further down, there is a section for 'Arcteq documents:' with two buttons: 'AQ 100 series' and 'AQivate Software'. The 'AQ 100 series' button is highlighted in blue and has a minus sign icon. Below it, the text 'Catalogues & Brochures' is followed by a list of documents: 'AQ-01 Technical Specification v1.3 (English)', 'AQ-02 Technical Specification v1.1 (English)', and 'AQ-100 Series ANSI product catalogue v1.1 (English)'. The 'AQivate Software' button is also highlighted in blue. Below it, there is a note: 'To download AQivate setting and configuration tool registration is required. Registration is required for enabling software's update notice feature.'



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