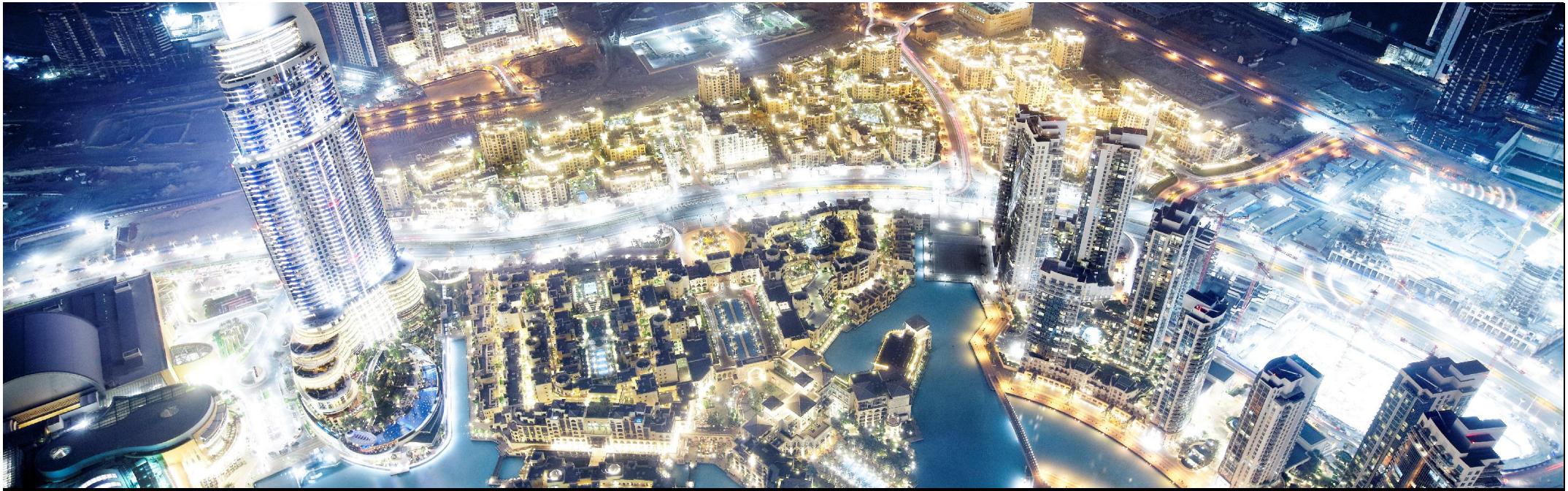


ABB Medium Voltage Days MEA 2016

Proactive safety
ABB medium-voltage switchgear

Power and productivity
for a better world™

Technical session
Title of presentation

- Speaker name — Martin Kropf
- Speaker title — Head of Local Product Marketing Apparatus
- Company name — ABB
- Location — Ratingen, Germany

Proactive safety
„Session statement“

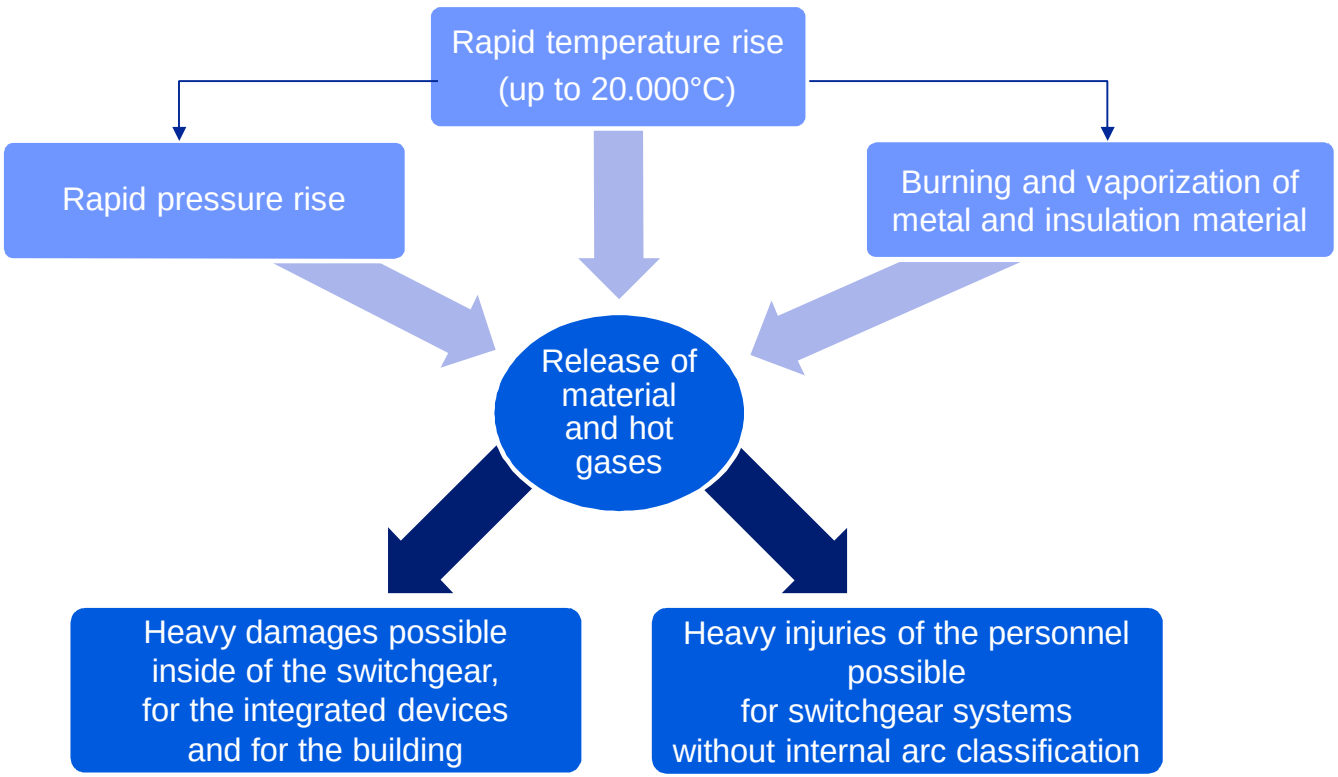
- Fortunately, flash-overs inside medium-voltage switchgear happen rarely, but they do occur for a number of different reasons.
- The consequences for your personnel, equipment and process may then be devastating.
- Please be welcome to a session discussing how to minimize the risks for and effects of internal arcs in switchgear, by effectively deploying both traditional and new innovative methods.

Internal arc faults
Reasons of formation

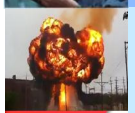
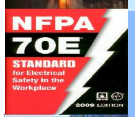


1. Human errors
2. Pollution
3. Bad connections
4. Mechanical faults
5. Animals
6. Defective devices

Internal arc faults
Impacts



Proactive safety
Motivation → WHY ?

	for the safety of personnel	Mandatory
	to prevent hazardous situations	Mandatory
	to be able to fulfill legal safety regulations & national standards, e.g. EN 61936-1	Mandatory
	to protect the building	Mandatory
	to protect the switchgear and the equipment	Optional
	to increase the process/system availability	Optional
	to secure the power delivery	Optional
	to save money	Optional

Switchgear with passive internal arc protection
Internal arc classification of medium-voltage switchgear

Video:
Internal arc test (IEC 62271-200) 50kA / 1s
Circuit-breaker compartment

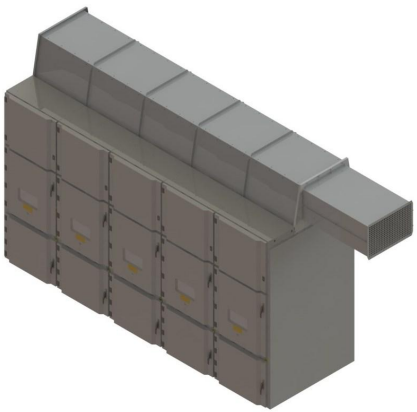
Front, rear and lateral accessibilty

Internal arc classification IAC AFLR according to the IEC 62271-200 Annex A (since 2003)

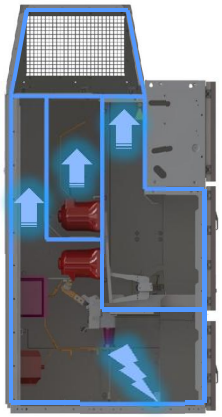
The switchgear must be in full accordance to all the five criteria:

1. The doors of the switchboard must remain closed and no opening of the cover panels must occur
2. Any part of the switchboard which may be hazardous for personnel must not be ejected
3. No holes must appear in the external housing of the switchboard in any parts accessible to personnel
4. The vertically and horizontally arranged fabric indicators placed outside the switchboard must not get burnt
5. All the switchboard earthing connections must remain effective

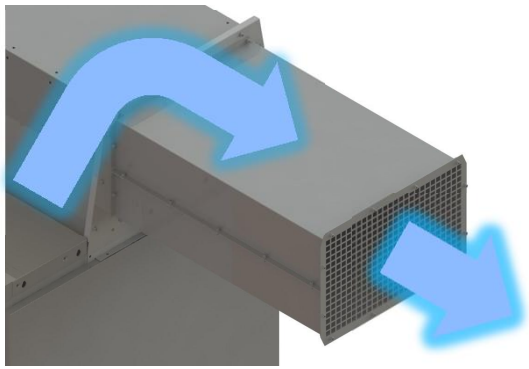
Switchgear with passive internal arc protection
Design of medium-voltage switchgear



Passive arc fault protection with gas ducts



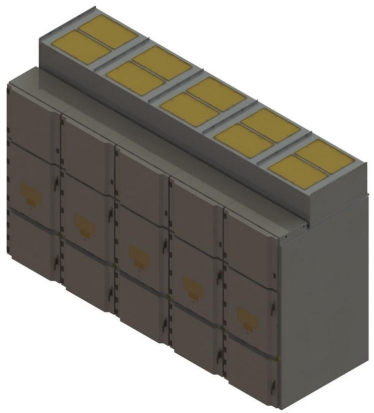
Separate functional compartments



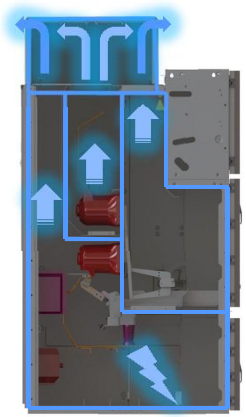
Gas duct to take away the hot gases out side the switchgear room

Switchgear with passive internal arc protection

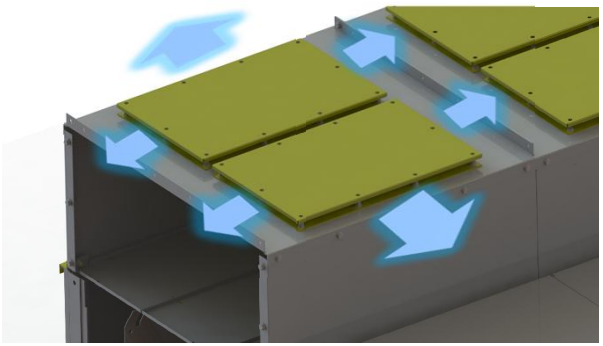
Design of medium-voltage switchgear



Passive arc fault protection with top chimney



Separate functional compartments

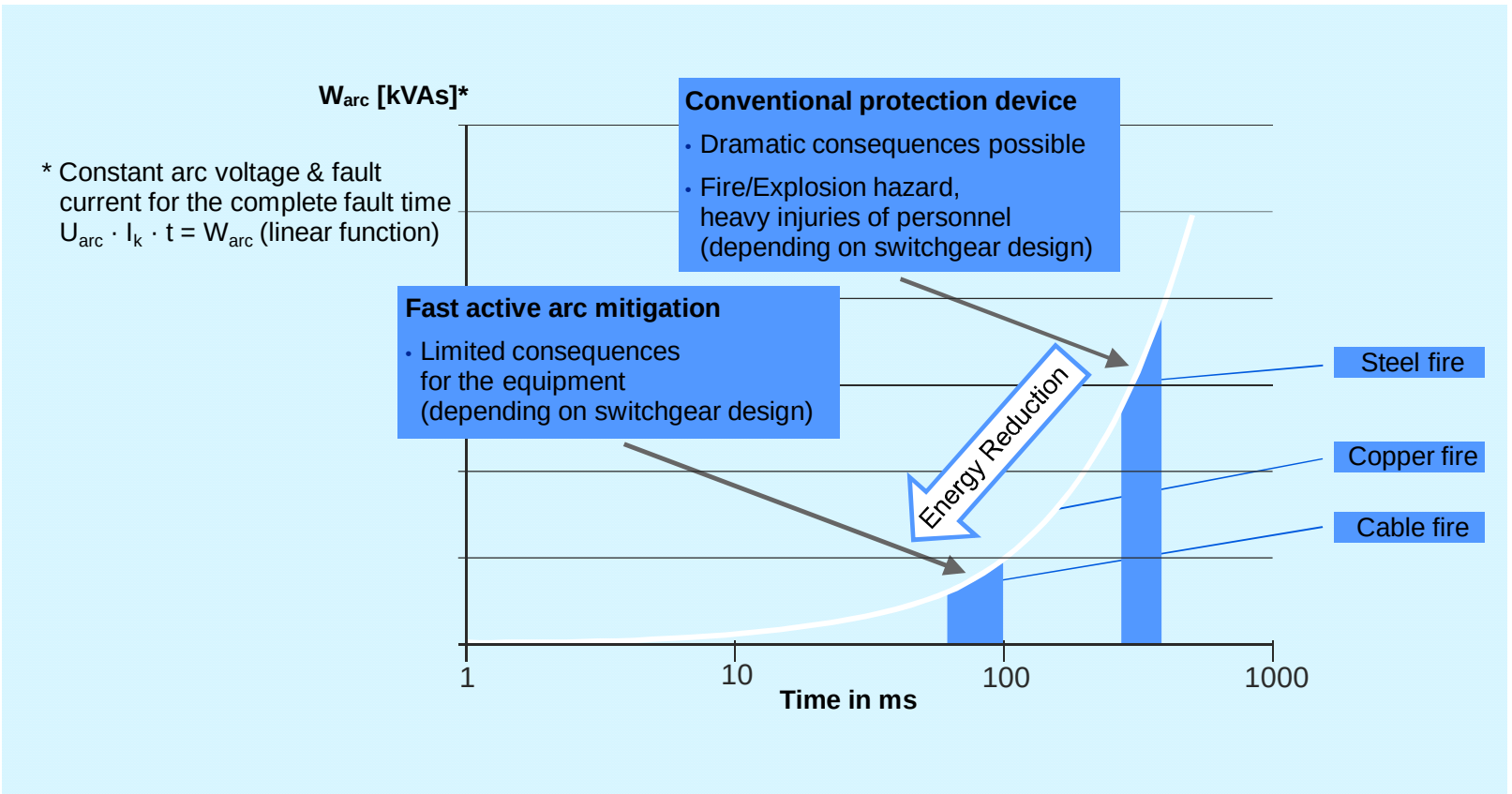


Top chimney to reduce the pressure and cool down the hot gases

Proactive safety
Switchgear with passive internal arc protection

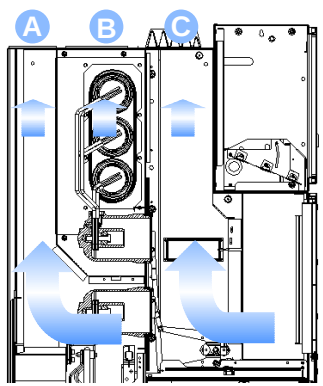
	**Ensures personnel safety under normal operating conditions**	**Mandatory**	✓
	**Prevents hazardous situations**	**Mandatory**	✓
	**Enables compliance to legal safety regulations & national standards, e.g. EN 61936-1**	**Mandatory**	✓
	**Protects the building**	**Mandatory**	✓

Protection systems for advanced protection
Fast active arc mitigation



Protection systems for advanced protection

Fast active arc mitigation with the I_{th}-Limiter

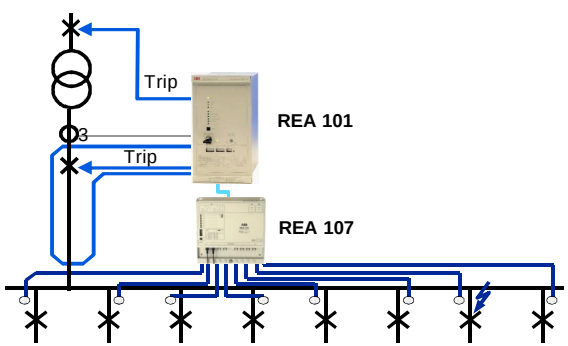


- Operates based on the indirect detection of overpressure
- Mounted on the pressure relief flaps
- Minimum time to clear the arc:
  70 ... 90 ms
  - 15 ms I_{th}-Limiter

    +
  - 40 … 60 ms
    Circuit-breaker operating time

    +
  - 10 … 15 ms
    Circuit-breaker clearing time

Protection systems for advanced protection
Fast active internal arc mitigation with REA System

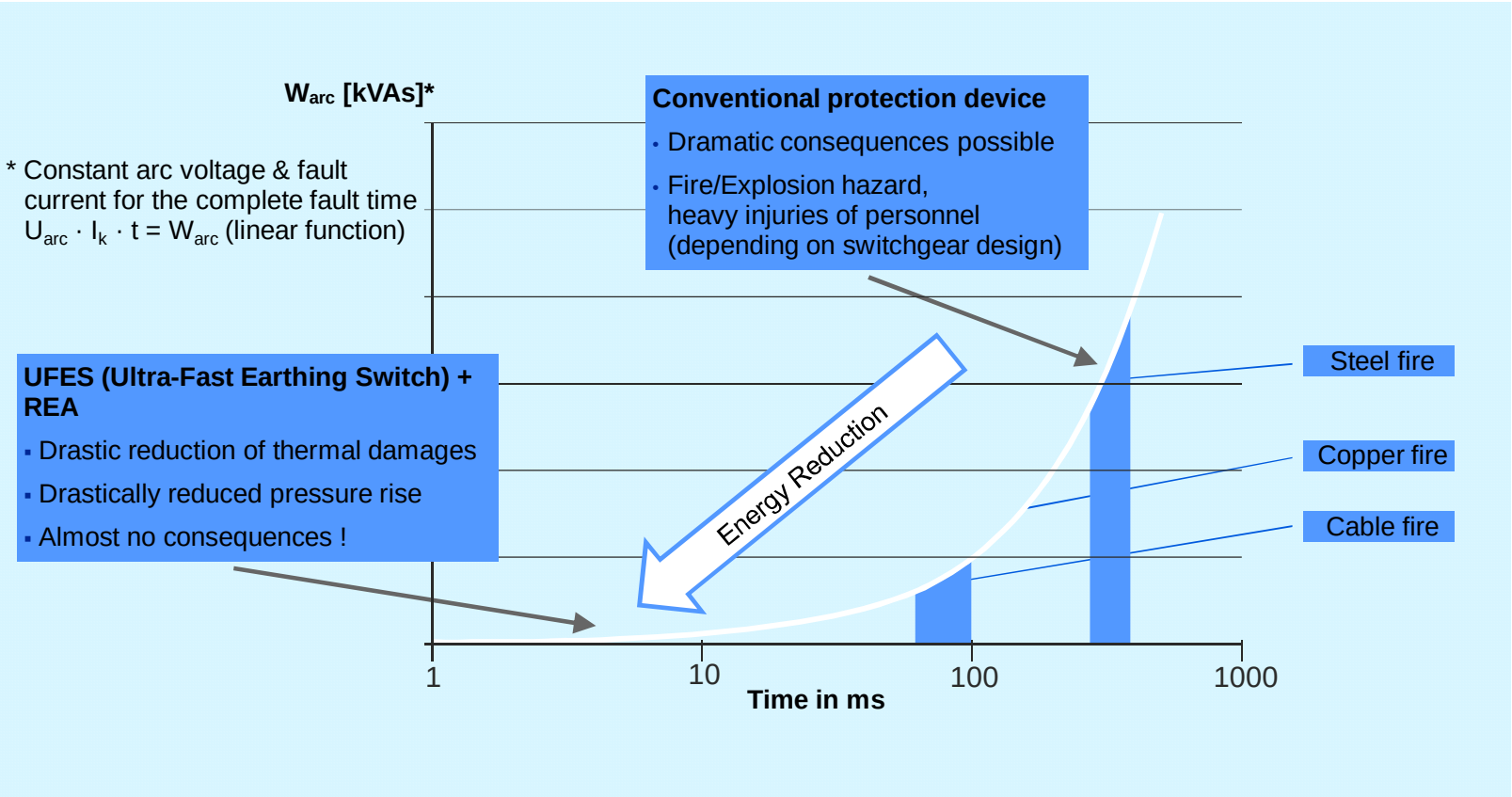


- Operates based on the detection of the light and current from arc
- Adjustable threshold levels
- Upgradable with UFES
- Minimum time to clear the arc: 60 … 80 ms
  - 2,5 ms REA
    +
  - 40 … 60 ms
    Circuit-breaker operating time
    +
  - 10 … 15 ms
    Circuit-breaker clearing time

Proactive safety
Active internal arc mitigation

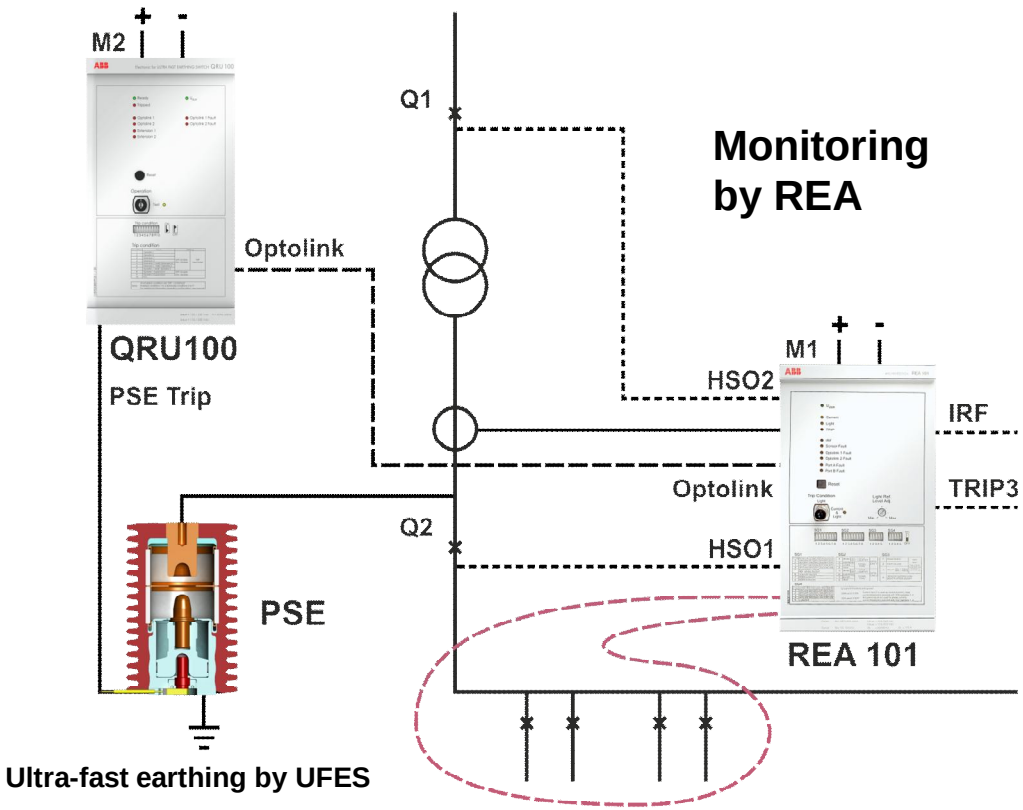
	Ensures personnel safety under normal operating conditions	Mandatory	✓
	Prevents hazardous situations	Mandatory	✓
	Enables compliance to legal safety regulations & national standards, e.g. EN 61936-1	Mandatory	✓
	Protects the building	Mandatory	✓
	**Reduces the damage of the switchgear to one compartment**	**Optional**	✓
	**Enables money savings**	**Optional**	✓

Protection systems for advanced protection
Ultra-Fast active internal arc mitigation & quenching



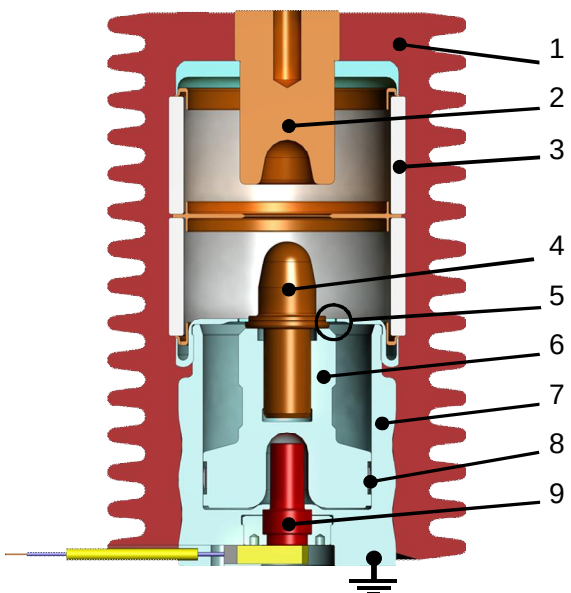
Protection systems for advanced protection

Example of an application UFES + REA



Ultra-Fast Earthing Switch type UFES
Primary switching element

Primary switching element – section view



1. Epoxy insulator
2. Fixed contact
3. Ceramic insulator
4. Moving contact pin
5. Rupture joint
6. Piston
7. Cylinder
8. Moving contact system
9. Micro gas generator

Primary switching element (PSE) type U1

- Vacuum interrupter and operating system integrated in one compact unit
- Fast and reliable micro gas generator operating mechanism
- Fast switching time of ~ 1.5 ms
- Easy handling
- Low-maintenance
- Flexible installation

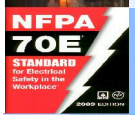
Protection systems for advanced protection
Combinable internal arc protection by ABB

Combinable arc protection
UFES + REA

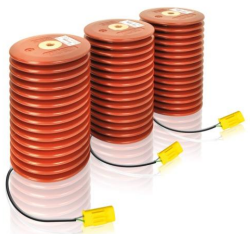
UFES (Ultra-Fast Earthing Switch) + REA

- Extinction of an internal arc in **less** than **4 ms** after its detection
- Versatile monitoring options with REA system:
  - Optical detection via line or lens sensors
  - Overcurrent detection
  - Selective protection
- Ultra-fast switching by UFES

Proactive Safety
Ultrafast active internal arc mitigation & quenching

	Ensures personnel safety under normal operating conditions **Enables personnel safety under maintenance conditions**	Mandatory **Optional**	✓ ✓
	Prevents hazardous situations	Mandatory	✓
	Enables compliance to legal safety regulations & national standards, e.g. EN 61936-1	Mandatory	✓
	Protects the building	Mandatory	✓
	**Minimization of pressure rise, gases and damages in the faulty compartment of the switchgear**	**Optional**	✓
	**Increases the process/system availability**	**Optional**	✓
	**Secures the electrical power delivery**	**Optional**	✓
	**Enables money savings**	**Optional**	✓

Proactive safety
References world wide, available for new and existing switchgear



- Overall more than 450 system sold world wide
  - Already successful tripping at customer site (Oil&Gas)!
- Available as option for new medium voltage switchgear
  - UniGear ZS1, up to 24 kV
- Available for retrofit application for already installed switchgear
  - First reference in the gulf currently under installation
- Available as loose component for OEM partners

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