Technical guide
Protection medium voltage-2016

Medium Voltage technical guide
2018

Technical Application Papers No. 15
The MV/LV transformer substations
(passive users)

Prefabricated metal-enclosed and metal-clad switchgear

Frequency and switchgear functions

Frequency

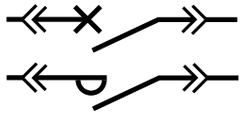
Two frequencies are usually used throughout the world:

A short list could be summarized as follows, knowing some countries use both frequencies in different networks:

- 50 Hz in Europe – Africa – Asia - Oceania – South of South America except countries mentioned for 60Hz.
- 60 Hz in North America – North of South America – Kingdom of Saudi Arabia – Philippines –Taiwan – South Korea - South of Japan.

Switchgear functions

The following table describes the different switching and protecting functions met in MV networks and their associated schema.

Designation and symbol	Function	Current switching	
		Operating current	Fault current
Disconnector 	Isolates		
Earthing switch 	Connects to the earth		(short-circuit making capacity)
Load break switch 	Switches loads	•	
Disconnecting switch 	Switches Isolates	•	
Circuit-breaker 	Switches Protects	•	•
Contactor 	Switches loads	•	
Withdrawable contactor 	Switches Isolates if withdrawn	•	
Fuse 	Protects Does not isolate		• (once)
Withdrawable devices 	See associated function	See associated function	See associated function

Selection of switching devices

There are three main types of electric circuit
opening and closing devices
which are used in medium voltage networks.

Circuit-breakers

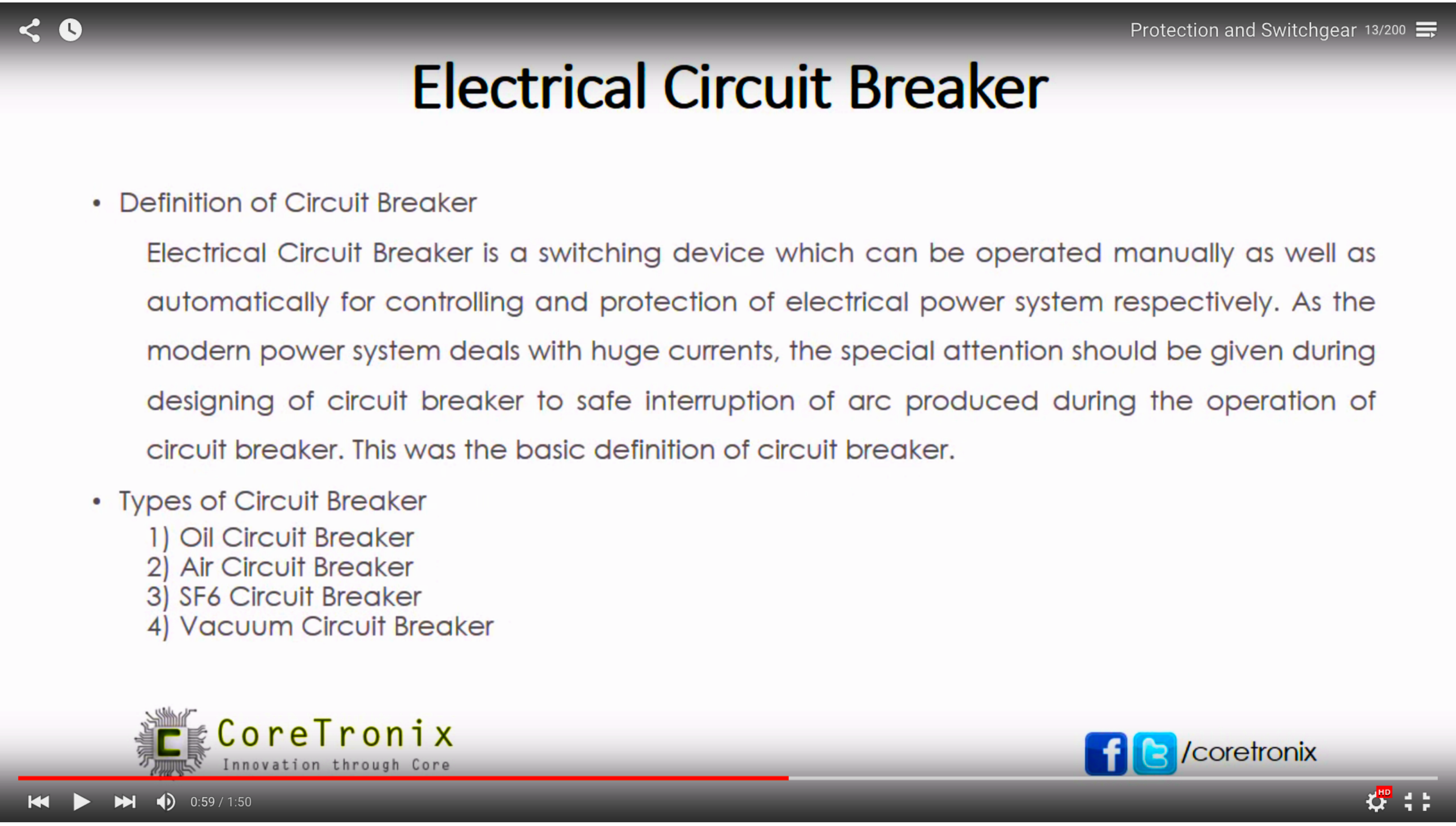
Switch-disconnector

Selection of switching devices

Contactor

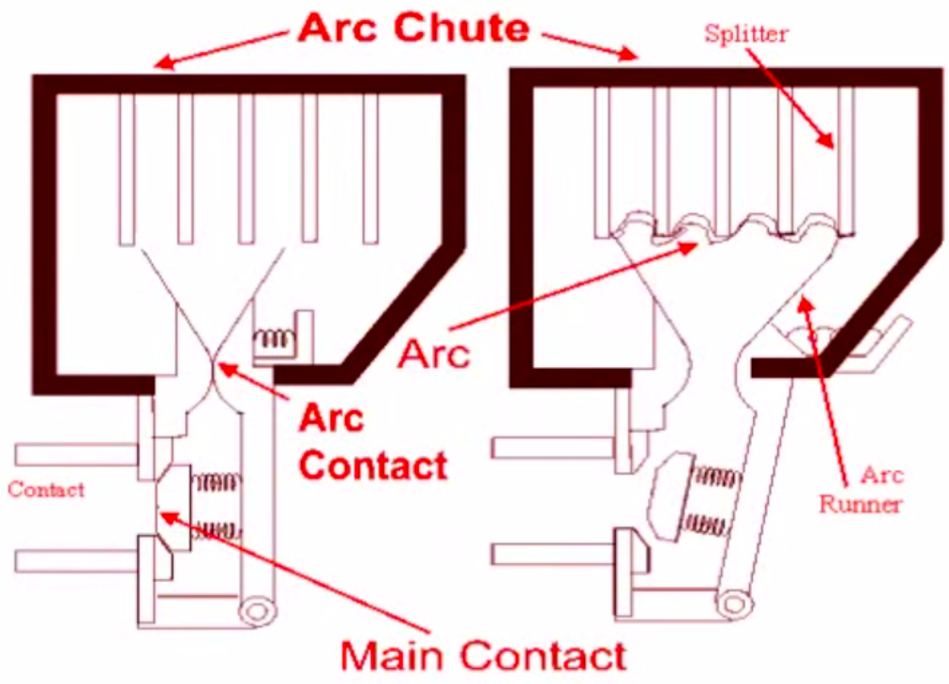
סיכום מפסיקי זרם

מסרט ב youtube

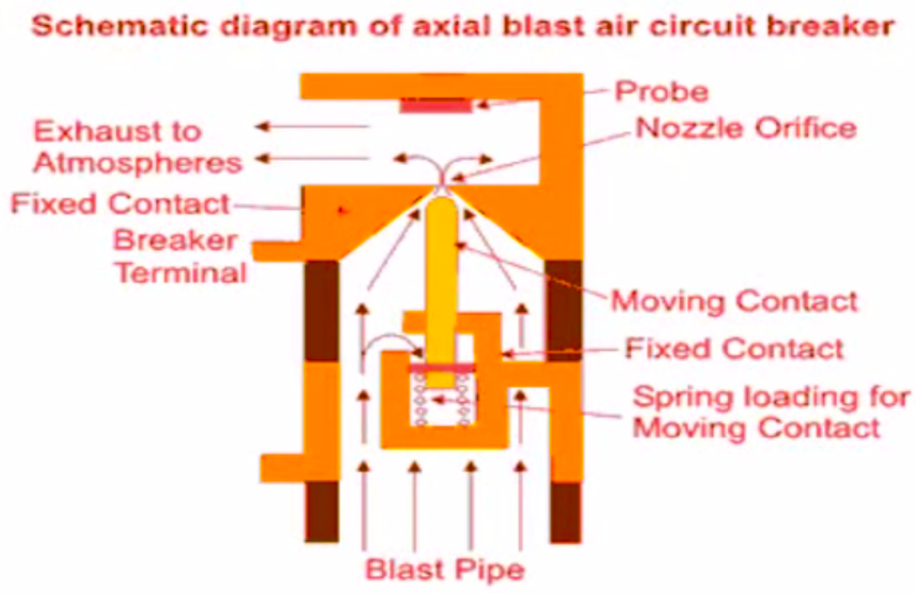


Types of Air Circuit Breaker

1) Plain air circuit breaker



2) Air blast Circuit Breaker

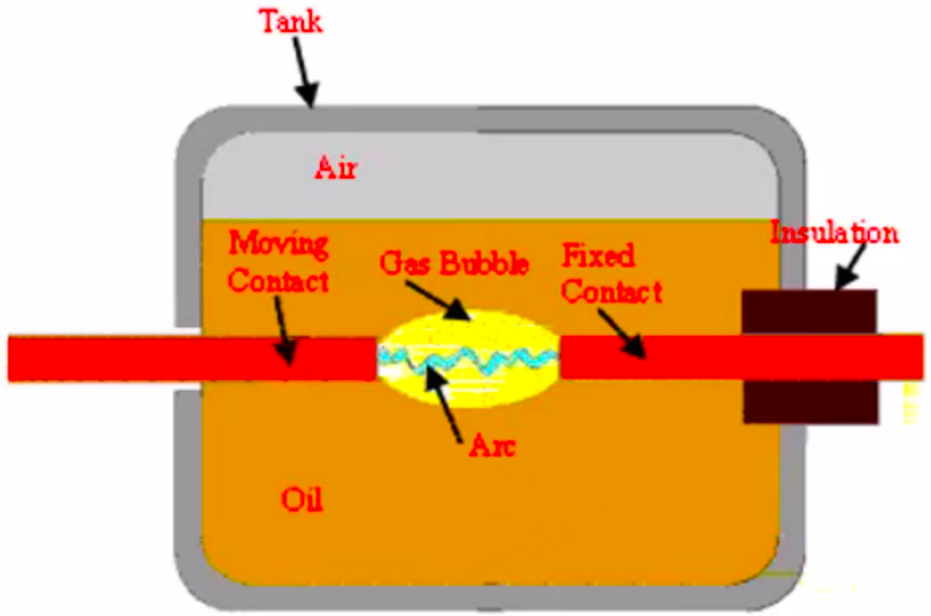


CoreTronix
Innovation through Core

/coretronix

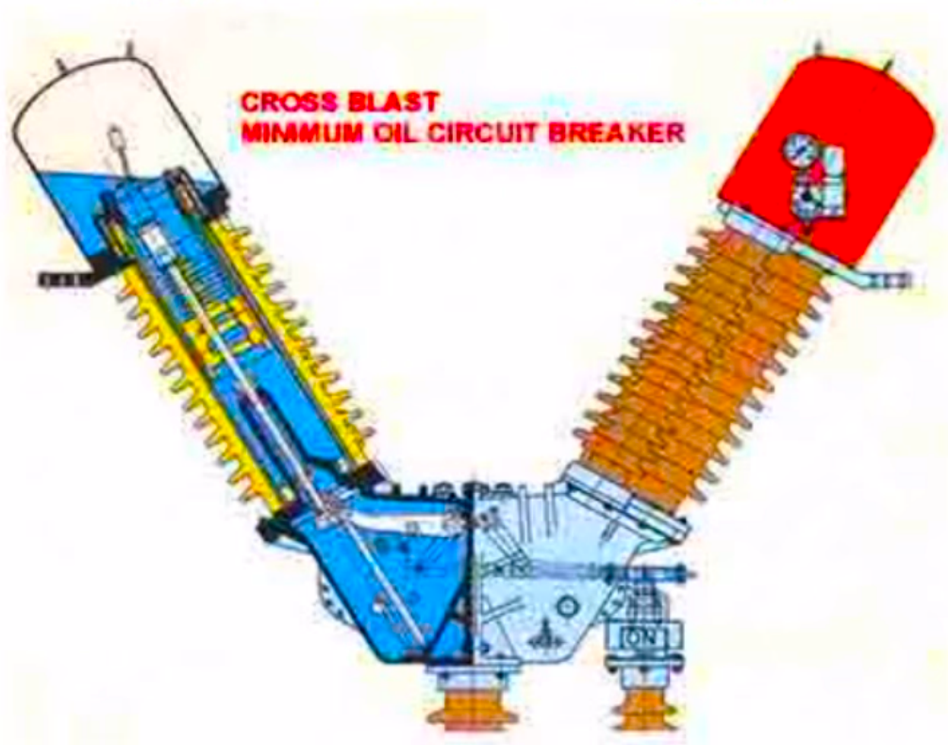
Types of oil circuit breakers

Bulk Oil Circuit Breaker or BOCB

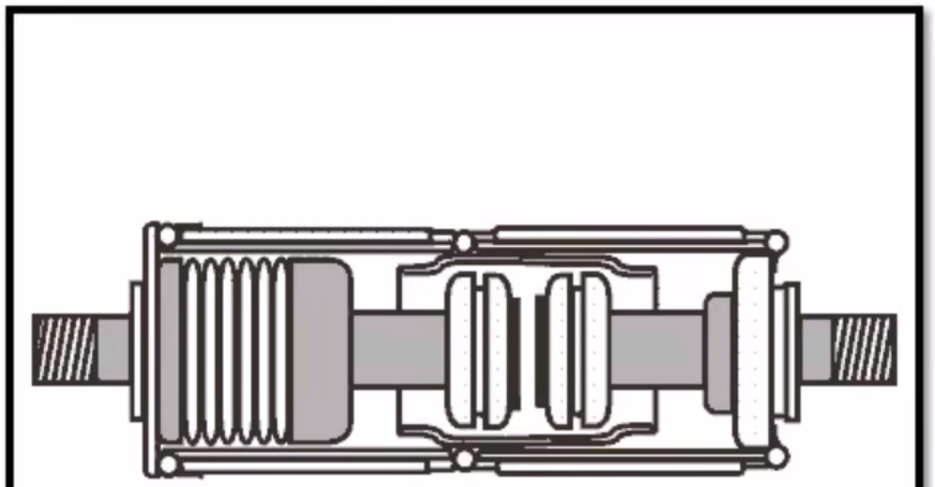


Conceptual view of Bulk Oil Circuit Breaker

Minimum Oil Circuit Breaker



Vacuum Circuit Breaker



Cross section of Vacuum Interrupter

SF6 Circuit Breaker

Sr No	Switchgear Equipment	Function
1.	Fuse	To Protect circuit against over current and short circuit currents.
2.	Circuit breaker	To make or break the circuit manually or remotely under normal condition and automatically under fault condition.
3.	Isolator	To disconnect the part of the system for maintenance from live circuit under no current condition.
4.	Earthing Switch	To discharge the voltage on the line (due to charges of line capacitance to earth) after disconnecting line from live section.
5.	Light using arrester	To divert high voltage surge towards the earth, due to lighting stroke or switching surges.
6.	Current transformer	To stepping down the magnitude of current for measurement, protection and control.
7.	Potential transformer	To stepping down the magnitude of line voltage for measurement, protection and control.
8.	Relay	To disconnect the abnormally operating part so as to prevent the subsequent faults e.g. Overload protection of a machine protects the machine and prevent insulation failure.

Types and Operation of SF6 Circuit Breaker

Under Electrical Switchgear

This page is all about:

SF_6 Circuit Breaker

Disadvantages of SF_6 CB

Types of SF_6 Circuit Breaker

Working of SF_6 Circuit Breaker

https://www.electrical4u.com/types-and-operation-of-sf6-circuit-breaker/

Table2. *Comparison of the SF6 And Vacuum Technologies In Relation To Operational Aspects*

Criteria	SF6 Breaker	Vacuum Circuit Breaker
Summated current cumulative	10-50 times rated short circuit current	30-100 times rated short circuit current
Breaking current capacity of interrupter	5000-10000 times	10000-20000 times
Mechanical operating life	5000-20000 C-O operations	10000-30000 C-O operations
No operation before maintenance	5000-20000 C-O operations	10000-30000 C-O operations
Time interval between servicing Mechanism	5-10 years	5-10 years
Outlay for maintenance	Labour cost High, Material cost Low	Labour cost Low, Material cost High
Reliability	High	High
Dielectric withstand strength of the contact gap	High	Very high

Table3. *Comparison of the SF6 And Vacuum Switching Technologies In Relation To Switching Applications*

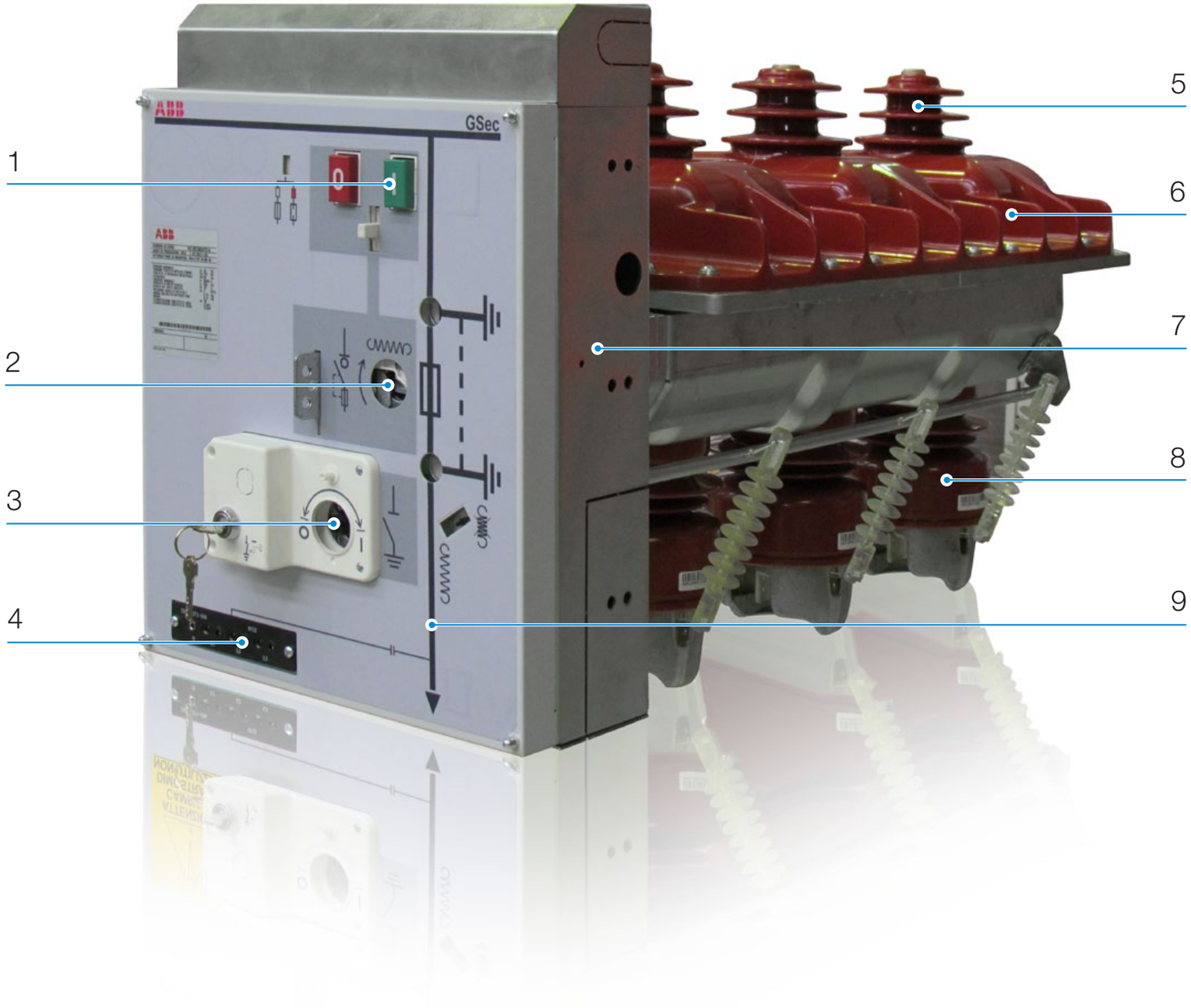
Criteria	SF6 Circuit Breaker	Vacuum Circuit Breaker
Switching of Short circuit current with High DC component	Well suited	Well suited
Switching of Short circuit current with High RRV	Well suited under certain conditions (RRV>1-2 kV per Milli seconds	Very well suited
Switching of transformers	Well suited.	Well suited
Switching of reactors	Well suited	Well suited. Steps to be taken when current <600A. to avoid over voltage due to current chopping
Switching of capacitors	Well suited. Re-strike free	Well suited. Re-strike free
Switching of capacitors back to back	Suited. In some cases current limiting reactors required to limit inrush current	Suited. In some cases current limiting reactors required to limit inrush current
Switching of arc furnace	Suitable for limited operation	Well suited. Steps to be taken to limit over voltage.

Non-inductive current and voltage sensors

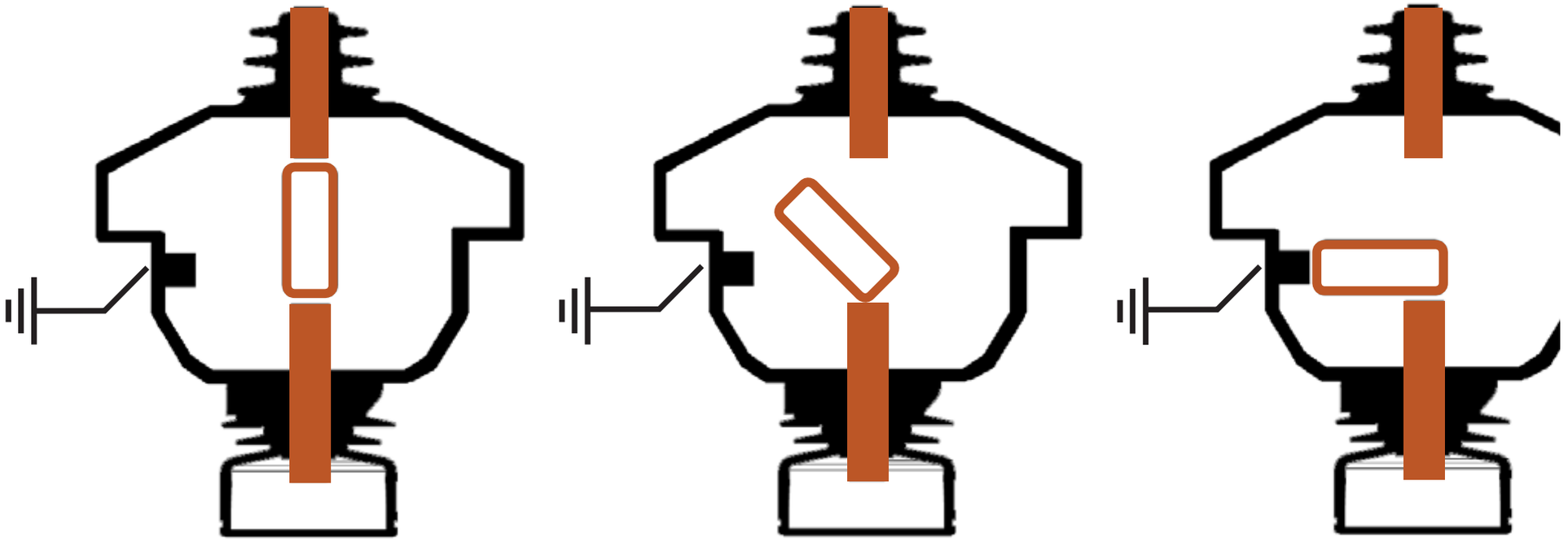
Since the power aborbed by the devices connected to the secondary circuit is extremely limited,
it is no longer necessary to have magnetic circuits for the coupling between the primary and secondary circuit.

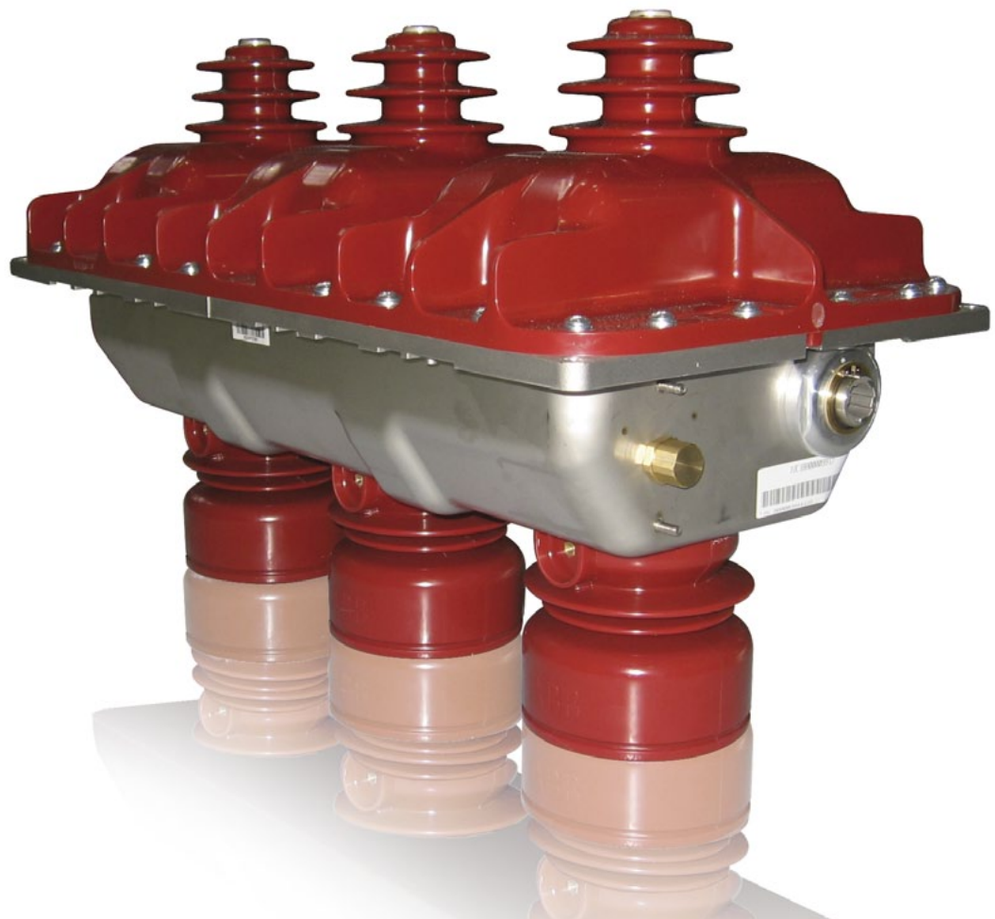
Current sensors or air CTs (Rogowsky coils)
and **voltage sensors (voltage dividers)**
have therefore been developed, which eliminate the negative as- pects of the inductive type of transformers (hysteresis cycle).

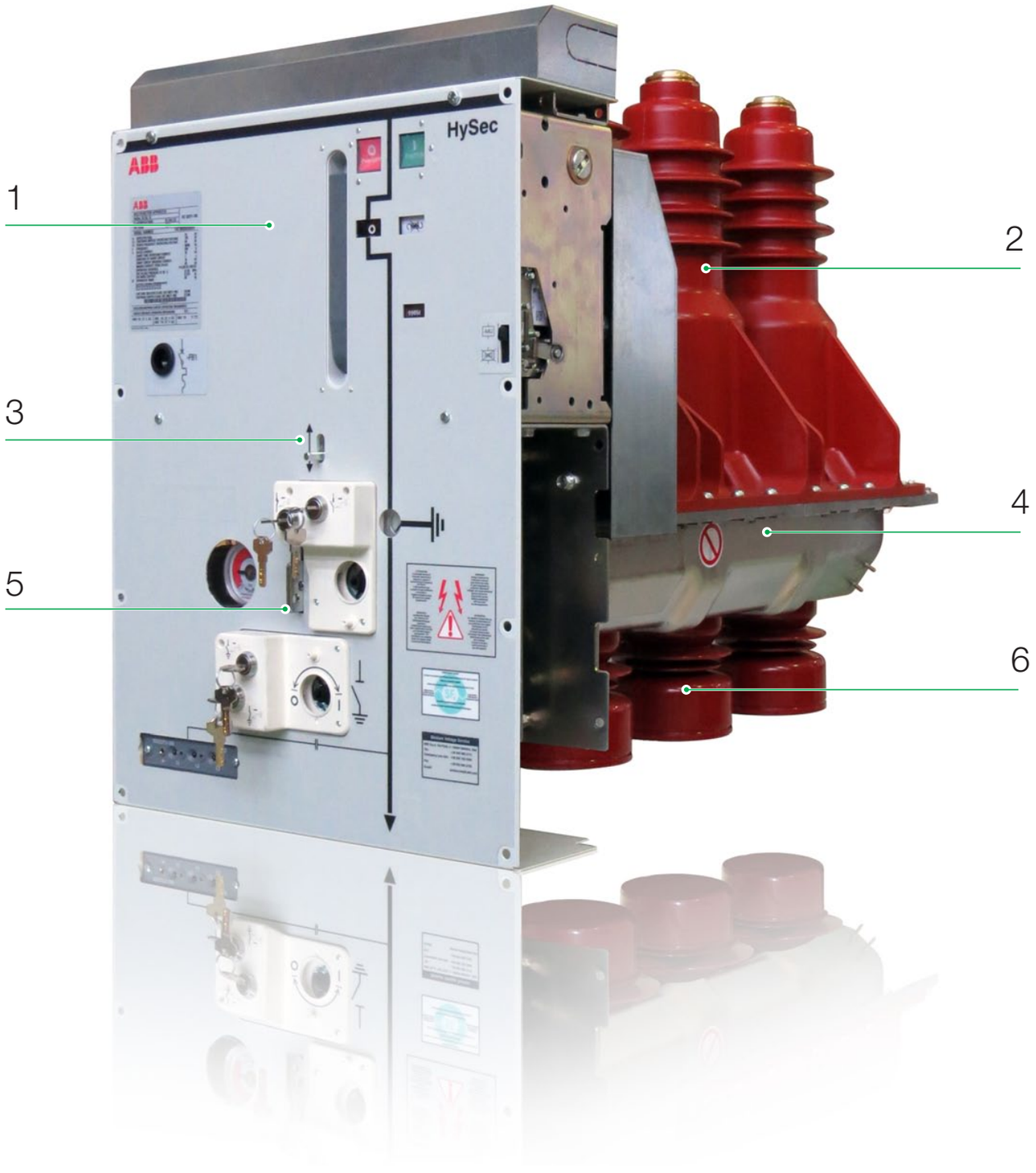
Combined current – voltage sensors



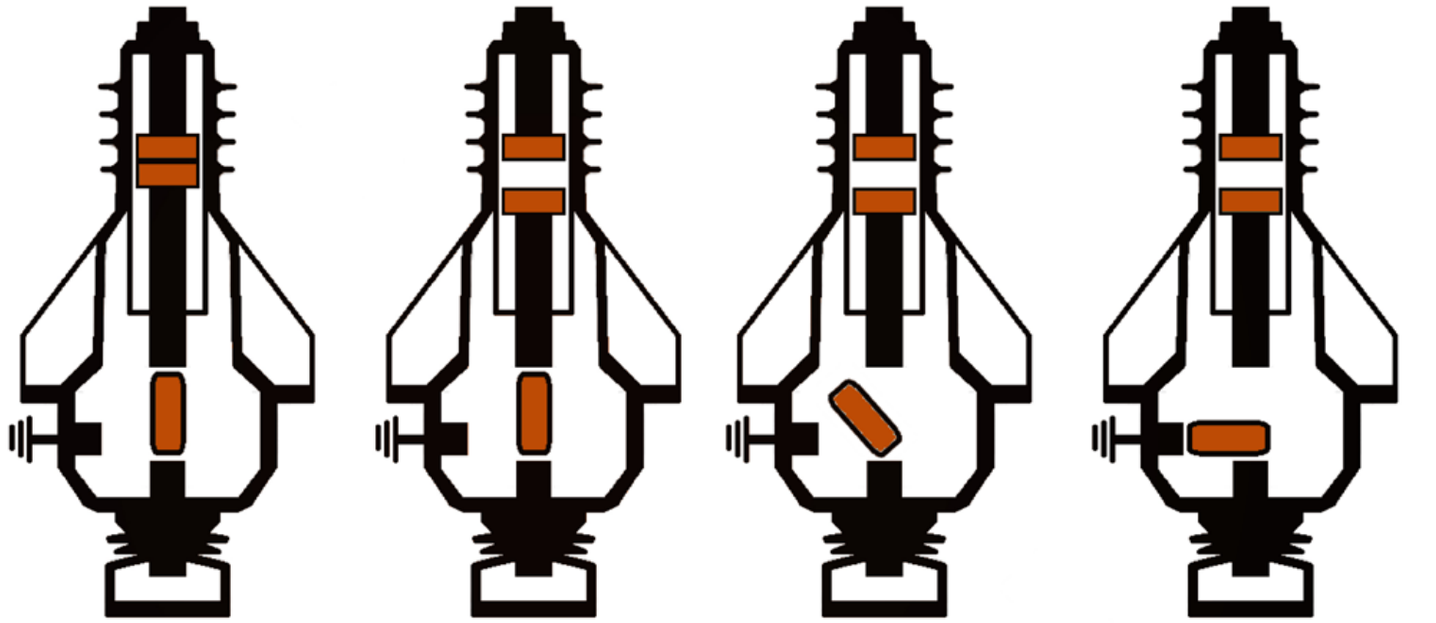
1 Opening and closing push-buttons
2. Connection for the line operating lever
3. Connection for the earth operating lever
4. Voltage signalling lamps (if applicable)
5. Top insulators
6. Enclosure (power part)
7. Housing of the operating mechanism
8. Bottom insulators
9. Mimic diagram

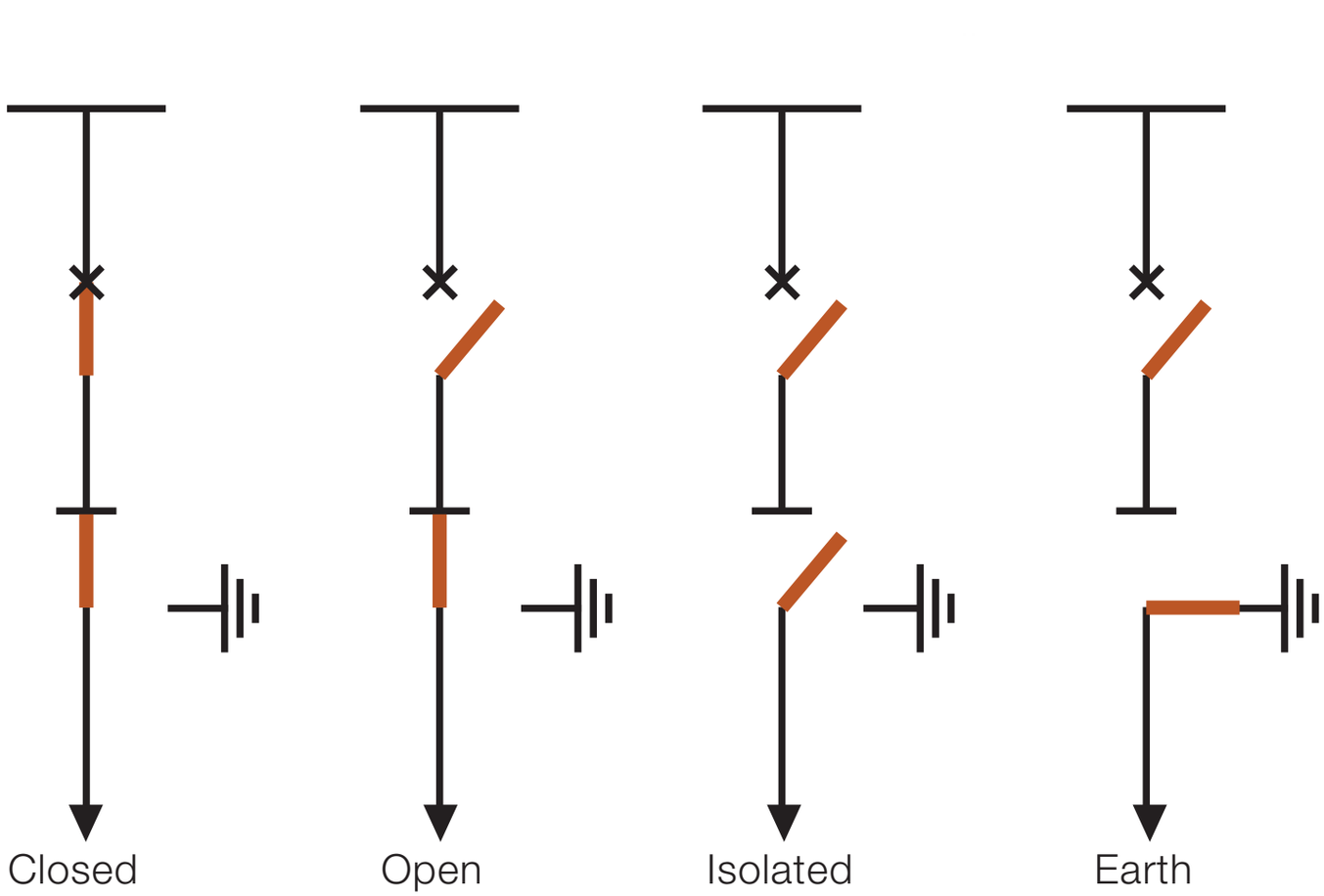

Line
Open
Earth





1. Operating mechanism of the the interrupting part
2. Resin housing of the interrupting part
3. Mechanical interlock between feeder disconnector and earthing switch
4. Lower part in stainless steel
5. Operating mechanism of the line disconnector and the earthing switch
6. Lower isolators with integrated capacitive sockets




Closed
Open
Isolated
Earth

Vacuum circuit-breakers VD4/R-Sec
(with REF601 relay and current sensors)

Gas circuit-breakers HD4/R-Sec
(with REF601 relay and current sensors)

ABB circuit-breakers of the VD4/R and HD4/R

series with lateral operating mechanisms have been designed specifically for use in secondary distribution switchgear and are used in MV/LV transformer substations in the industrial sector in general and in the service sector.
The use of **vacuum circuit- breakers** provides particular advantages in power systems where required frequent operations are required with normal operating currents.
VD4/R vacuum circuit-breakers provide high operating reliability and a long life.

The HD4/R medium voltage **gas circuit-breaker** uses SF6 gas to extinguish the electric arc and as the insulating medium. This circuit-breaker too, like the previous one, is built using the separate pole technique. Its construction is compact, sturdy and lightweight and is a lifetime sealed pressure system (IEC 62271-1).

Comparison of the SF6 And Vacuum Switching Technologies In Relation To Switching Applications

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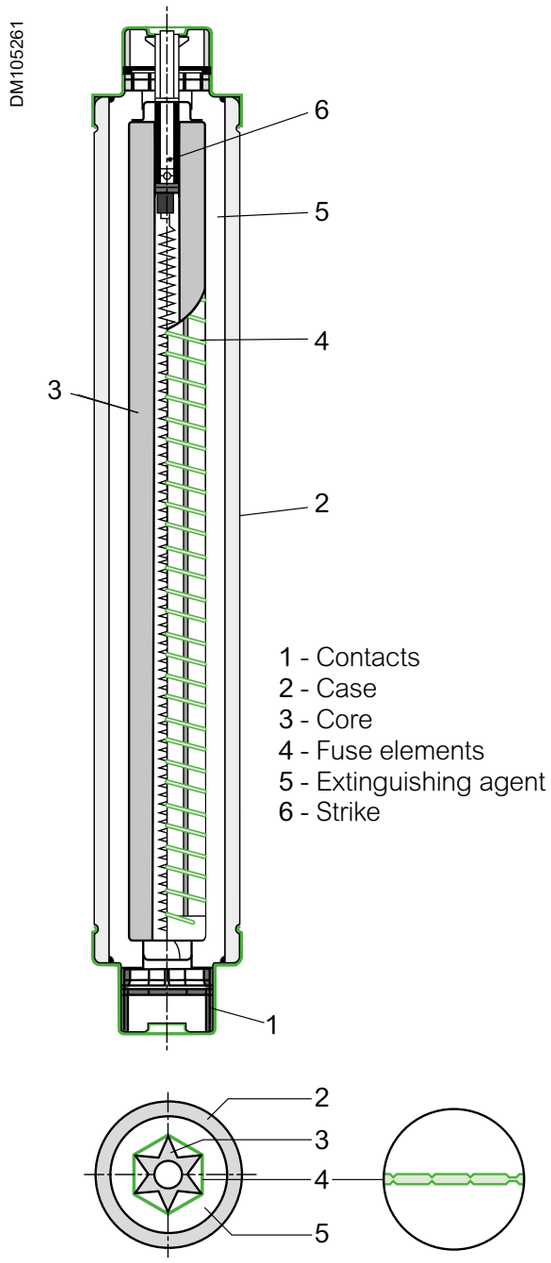
Current-limiting fuses

Introduction
Characteristics

DM105261



Introduction

MV current-limiting fuses are primarily used to protect transformers, and also motors, capacitors and other loads.

Characteristics

Ratings of the fuse-base

- Rated voltage
- Rated current
- Rated insulation level (power-frequency, dry, wet and impulse withstand voltages)

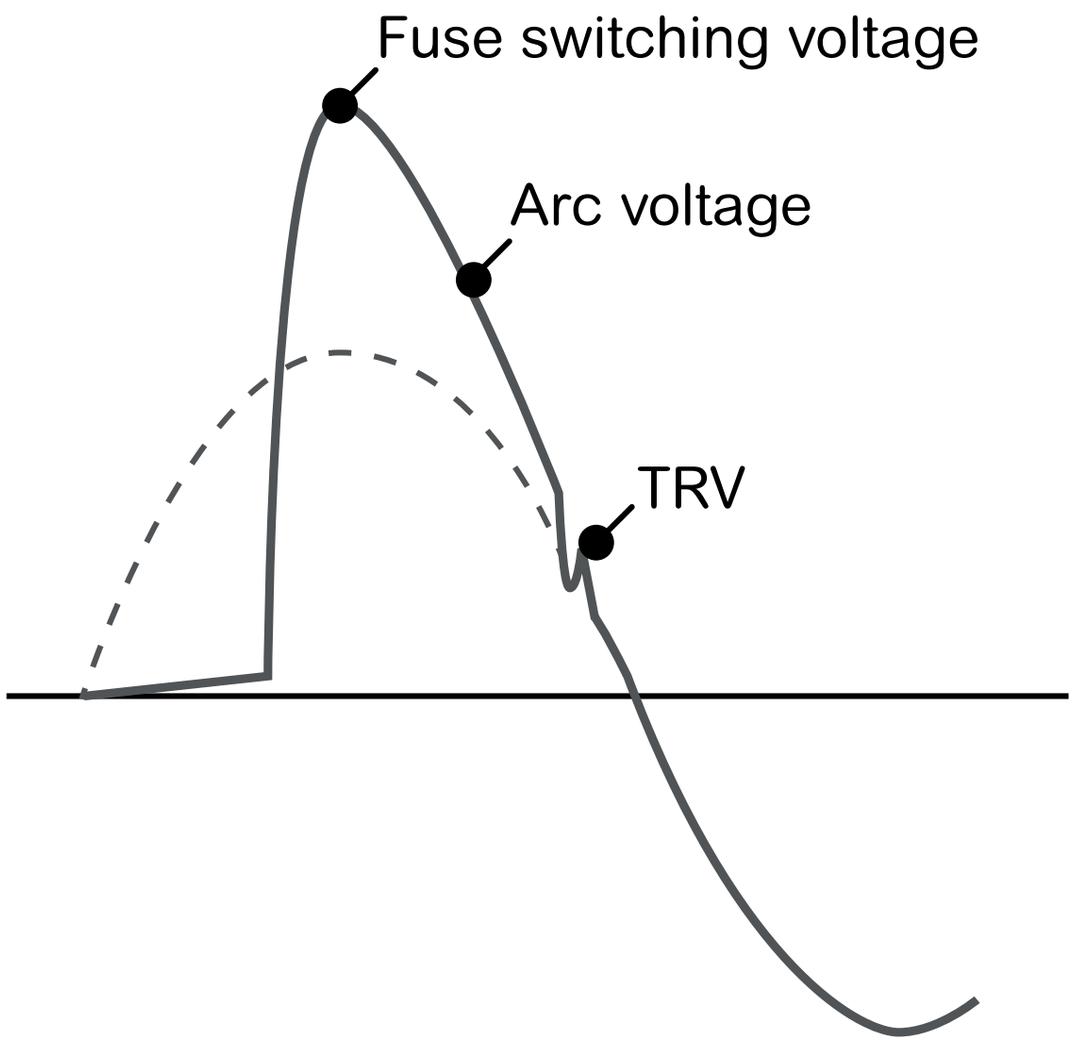
Ratings of the fuse-link

- Rated voltage
- Rated current
- Rated maximum breaking current
- Rated frequency
- Rated minimum breaking current for Back-Up fuses.
- Rated TRV

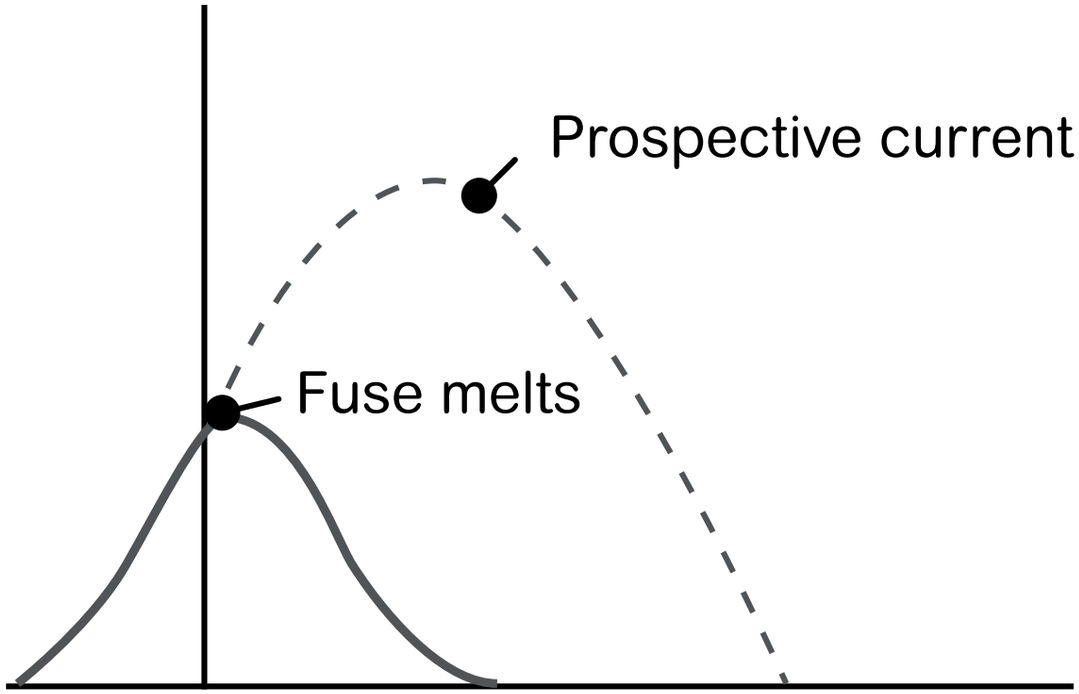
Characteristics of the fuse-link

- Temperature rise
- Class
- Switching voltages
- Time-current characteristics
- Cut-off characteristics
- I^2t characteristics
- Mechanical characteristics of the strikers
- Maximum application temperature

Voltage across the fuse

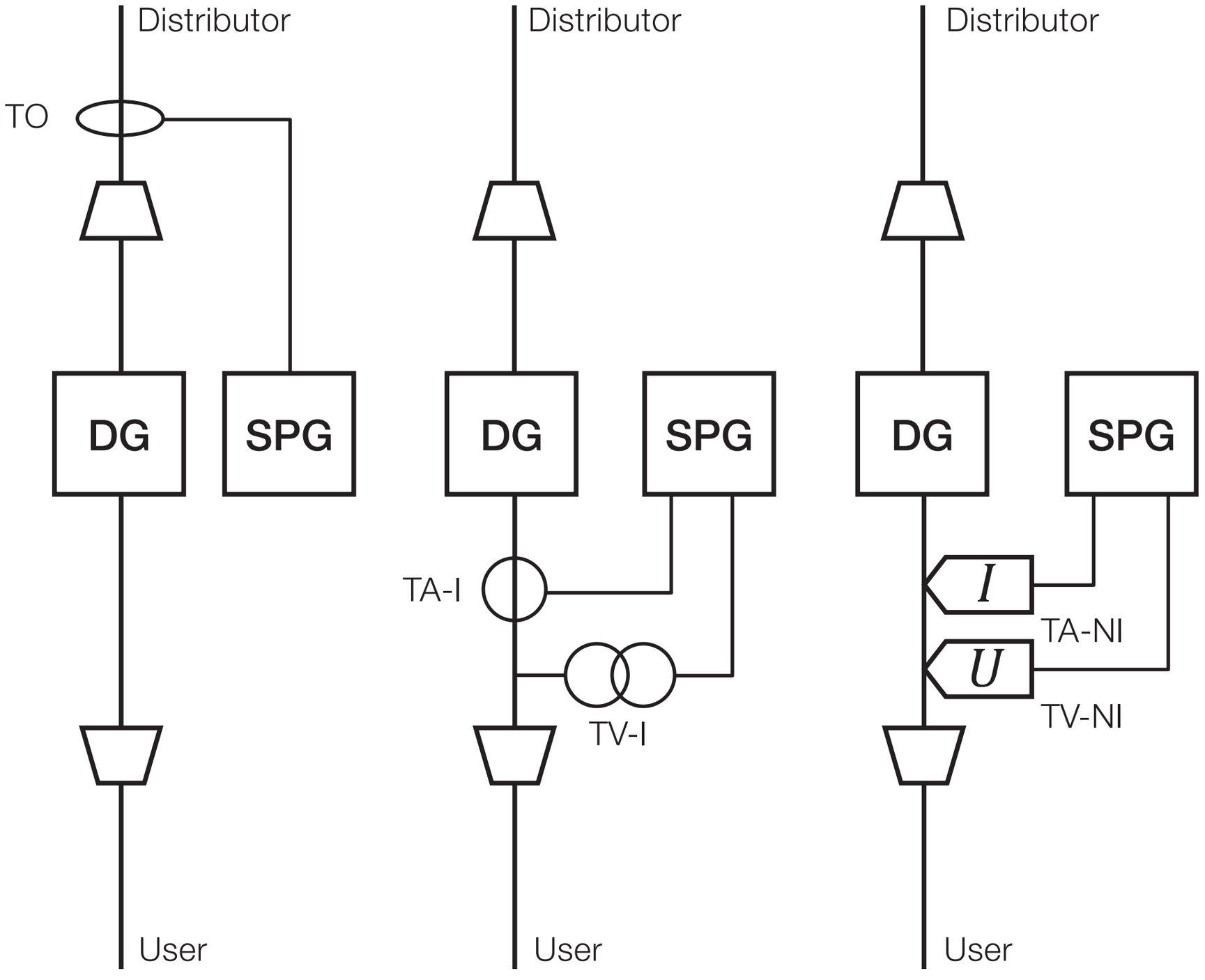


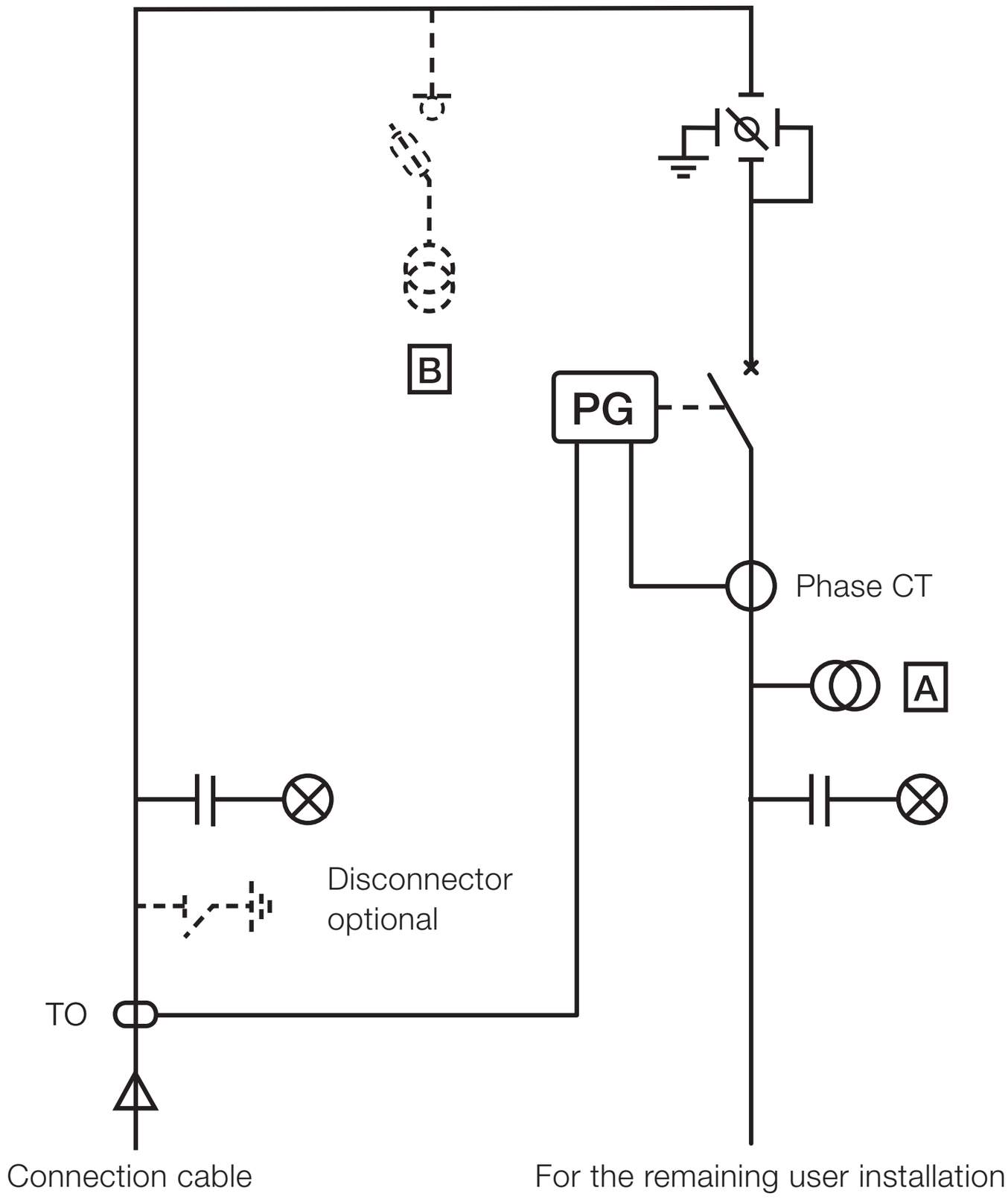
Current through the fuse



High current interruption for current limiting fuse

6. Diagram of user system for connection and MV switchgear




B
PG
Phase CT
A
Disconnector
optional
TO
Connection cable
For the remaining user installation