Vacuum Interrupters and Embedded Poles
Vacuum Interrupters and Embedded Poles
Core component in multiple indoor and outdoor applications

- Indoor and outdoor vacuum circuit-breakers
- Vacuum contactors
- Switch-disconnectors
- Railway switches
- Reclosers
- Capacitive switches
- Ring main units
- On-load tap changers
Vacuum Interrupters
Continous improvement for our common success

- Over 30 years of experience in vacuum technology
- Worldwide more than 3 million ABB vacuum interrupters in service
- Latest technologies for high quality mass-production
- Compact and robust design
- High reliability and electrical life time
- Small number of VIs cover the full MV range
  - High reliability of supply & short delivery times
- Focussed OEM approach for VIs & EPs
  - Technical & commercial on site support including certified test laboratories

Rated voltage:
... 36 / 40.5 kV

Rated current:
... 4,000 A

Rated short-circuit breaking current:
... 63 kA
Embedded Poles
Continuous improvement for our common success

- World wide more than 1 million Embedded Poles from ABB in service
- High dielectric strength without any further external measures
- Optimum protection of the vacuum interrupter from moisture, dust and external damage
- Suitable for different climatic conditions and altitude of site
- High reliability and long life
- Easy adaption on the circuit-breaker
- Maintenance-free
- High quality standard
- Shop Floor Control (SFC) – System enabled
- Efficient increase of the dielectric strength without usage of green-house gas

Rated voltage:
... 36 / 40.5 kV
Rated current:
... 3,150 A
Rated short-circuit breaking current:
... 50 kA
Rated lightning impulse withstand voltage:
... 200 kV
Embedded Poles PT
Continuous improvement for our common success

- New technology as invention for the future
- Environmental friendly in production, operation and disposal
- Requirements of IEC standards exceeded
- Improved low-temperature characteristics and enhanced mechanical strength
- High end production process
- High control of the production process

Rated voltage: ... 17.5 kV
Rated current: ... 2,500 A
Rated short-circuit breaking current: ... 40 kA
Circuit-breakers, contactors and cassettes
Circuit-breakers
eVD4: The Smart eVolution

- Measures current and voltage of phases
- Integrates protection and control units
- Communicates measurements and status of protections to control system
- Controls electrical accessories through protection unit

Since 1987, over 550,000 VD4 circuit-breakers have been successfully installed in a wide range of applications, worldwide.
Circuit-breakers
eVD4: Complete integration in a single device

- Measuring
- Protection and control
- Communication

Equipped with Relion® technology: protection and control unit RBX615 with IEC61850 and Goose
Circuit-breakers

eVD4: Reduce time from purchase to commissioning

Standard panel

Version with eVD4
Circuit-breakers
For any application

Vacuum circuit-breaker VD4-VM1
Rated voltage: … 36 / 40.5 kV
Rated current: … 4,000 A
Rated short-circuit breaking current: … 63 kA

SF$_6$ circuit-breaker HD4
Rated voltage: … 36 / 40.5 kV
Rated current: … 4,000 A
Rated short-circuit breaking current: … 50 kA

- Complete product range:
  - Vacuum and SF$_6$ breaking technology, fully interchangeable
  - Vacuum CB with magnetic or mechanical actuator
  - VD4-VM1 CB with embedded poles technology
- Complete range of accessories and interlocks
- Competitive product portfolio well positioned in the market
Circuit-breakers
VD4: the most utilized breaker in the world

- Rated voltage: … 36 / 40.5 kV
- Rated current: … 4,000 A
- Rated short-circuit breaking current: … 63 kA

- Use of established and innovative embedded pole solutions
- Reliable actuation for 30,000 CO operations
- Low inspection efforts in service and shortened maintenance time
- Maximum safety guaranteed through built-in range of interlocks to prevent dangerous operations
- Complete range of accessories and interlocks
Circuit-breakers
Vmax: The low end solution

- Vacuum interrupter technology
- Small, light and compact
- Developed for applications where space saving is a premium
- Based on freestanding vacuum interrupters and on moulded case design
- Applied in places where saving space is a must such as buildings and construction (e.g. Burj Khalifa)
Circuit-breakers
The circuit-breaker family for secondary distribution

Vacuum circuit-breaker VD4/R-S
Rated voltage: ...
… 24 kV
Rated current: ...
… 1,250 A
Rated short-circuit breaking current: ...
… 25 kA

SF₆ circuit-breaker HD4/R-S
Rated voltage: ...
… 36 kV
Rated current: ...
… 1,250 A
Rated short-circuit breaking current: ...
… 25 kA

- Vacuum or SF₆ breaking technology, fully inter-changeable
- Relays & current sensors on board, suitable also for installation in unmanned substations and without auxiliary power supply.
- Complete range of accessories and interlocks
- High reliability
- Used in secondary distribution applications such as the new Moscow race circuit
Contactors

V-Contact
VSC 7 / VSC 12
Rated voltage: ... 7.2 / ... 12 kV
Rated current: ... 400 A
... 100,000 CO AC3

Top class ABB technology

- VSC 7 / VSC 12:
  - OEM oriented contactor
  - Available in fixed and withdrawable version
  - Suitable for slimline & traditional type of panel
  - Magnetic actuator & extremely low power consumption
  - Contactor dedicated vacuum interrupters with high performance especially for switch of motors
  - Up to 1,000,000 operations
  - Maintenance-free
  - Electronic multi-voltage feeder
Cassettes / Enclosures

- Suitable for withdrawable circuit-breakers and contactors
- OEMs can add individually adapted components
- Making capacity earthing switch
- Maximum safety and high flexibility
- Type tested solution, ideal for retrofitting and revamping

PowerCube family:
- **PowerCube**
  - Rated voltage: … 36 kV
  - Rated current: … 4,000 A
  - Rated short-time current: … 50 kA

PowerCube family:
- **PowerBloc**
  - Rated voltage: … 40.5 kV
  - Rated current: … 5,000 A
  - Rated short-time current: … 50 kA
Fuses, Indoor Switches and VisiVolt™
Medium voltage fuses
Medium voltage fuses
Introduction

- ABB is a global manufacturer of both fuses and surge arresters.
- Surge arresters protect against overvoltages
- Fuses protect against overloads and/or overcurrents
- Sometimes we use combined fuse/surge arrester protection

Rated voltage:
... 36 kV
Rated current:
... 315 A
Rated short-circuit breaking current:
... 63 kA
Medium voltage fuses
Summary ABB current limiting fuses

Application of fuses in:
- Switches
- I_S-limiters
- Ring Main Units
- Contactors

Safety

- Unique design of ABB CEF/CMF family featuring: overload spots; a temperature released striker pin (TCU); and a secure and safe interruption process even in case of small overload currents
- Type tested (in scope of temperature rise and breaking performance) for application in SF6 RMU and air insulated panels
- Compliance to IEC 62271-105 fuse-switch (LBS) combination standard for full voltage ratings
- Lowest temperature during breaking and overload conditions
Medium voltage fuses
Summary ABB current limiting fuses

Application of fuses in:
- Switches
- Iₜ-limiters
- Ring Main Units
- Contactors

Performance
- High breaking capability up to 63 kA in minimum physical dimensions
- The fastest overload protection devices for high short-circuit currents, capable of limit prospective short circuit current thus protecting surrounding equipment from electrodynamics and heat stresses during short-circuit
Medium voltage fuses
Summary ABB current limiting fuses

Application of fuses in:
- Switches
- $I_\text{g}$-limiters
- Ring Main Units
- Contactors

Quality
- Recently modernized and automated production line
- Superior accuracy of TCC tolerance
  (+/- 10% vs. standard +/- 20%)
- Maintenance-free long service life and the most effective costs / results ratio
Medium voltage switches
ABB Indoor Switches
SFG/SHS2 Main Product Features

Rated voltage:
...24 kV
Rated current:
... 800 A
Rated short-circuit breaking current:
... 20 kA

- Switch-disconnector (Line-Open-Earth)
- It can be used in combination with fuses

SHS2
- Metallic separation between busbar and line areas
- Integrated front panel

SFG
- Epoxy cast resin enclosure
- Inspection window to see knife position

Three-position

Rated voltage:
... 24 kV
Rated current:
... 800 A
Rated short-circuit breaking current:
... 20 kA
ABB Indoor Switches
AM/NAL Main Product Features

AM:
Rated voltage: …24 kV
Rated current: … 630 A
Rated short-circuit breaking current: … 16 kA

NAL:
Rated voltage: …36 kV
Rated current: … 1250 A
Rated short-circuit breaking current: … 31.5 kA

AirSwitch
- Metallic separation between busbar and line areas
- Available as rotary isolator
- Integrated front panel

NAL/VR
- Class E3 for selected voltages
- ANSI/CSA/IEC tested
- 100 breaking operations tested at 630 A
- Arc quenching by means of air blast
ABB Indoor Switches
Main Product Advantages

Safety
- Earthed metallic separation between busbar and line areas (rotary type)
- Compliance to IEC 62271-105 fuse-switch combination standard
- Visible isolation with inspection windows to see the switch position (SFG)
- Integrated and free standing earthing switches with and without making capacity
- Interlocking devices
ABB Indoor Switches
Main Product Advantages

Performance

- Superior arc quenching technology by means of air pressure and gas blast combination
- Compact three positions (Line-Open-Earth) design (SFG / SHS2)
- Smart integration: Modular construction, compact size, easy installation, one switch – many applications
- High electrical and mechanical endurance

Quality

- Extremely durable and reliable actuator
- A life span of minimum 30 years, sealed for life, low maintenance costs
- Stringent testing of each unit, multi-standard worldwide use
Passive voltage indicator
VisiVolt™
VisiVolt™ – Passive Voltage Indicator
Main functions

- Warning function – increased safety
  - Higher level of safety of operating and servicing the system.

- Check of voltage status
  - Without using any additional equipment, the personnel can check the status of voltage presence.

- Confirming of equipment operation
  - At equipment with no visible gap (e.g. Sectos switch-disconnector) VisiVolt confirms the correct operation of the switch and disconnector.
VisiVolt™ – Passive Voltage Indicator

Advantages of VisiVolt™

Differentiating features of the product:

- Both indoor and outdoor application possibility
- Reflective display of good visibility under all lighting conditions (from dim indoor to bright outdoor)
- Large display size – visibility from long distance (e.g. on a pole mounted equipment)
- No electronic circuit – display element is the sensitive element
- All polymer components – no steel parts – no risk of corrosion
- Wide application range, easy installation, maintenance free
- Resistant to extreme operating conditions (salt fog, moisture, wind, solar radiation, high temperature)
Instrument Transformers and Sensors
LV Instrument Transformers

LV Instrument Transformers for various application:

- Medium / low voltage systems
- Cast resin / non casted / plastic housing/ thermoplastic rubber
- Open able (split core) / multi-ratio
- All electrical standards IEC, GOST, BS, AS, ANSI, CSA
- Electrical ratings provided as per individual client’s needs
- For primary and secondary distribution
- For AIS or GIS application
- High Voltage Dead Tank CBs, Power Transformers and Generators.

Ratings
Rated voltage: 0.6 kV
Rated current: 50,000 A
Frequency: 50 or 60 Hz
MV Instrument Transformers
Indoor

Ratings
Rated voltage:
... 40.5 kV
Rated current:
... 8,000 A
Rated short-circuit breaking current:
... 100 kA

MV Instrument Transformers used by leaders in Switchgear:

- Wide range of types fits to many various applications
- Electrical ratings provided as per individual client’s needs.
- Electrical standards IEC, ANSI, DIN, BS, GOST, CSA
- Many metrology certificates & approvals available.
- Leading in branch delivery performance
- Engineering and Customers Service are one phone call away
MV Electronic Instrument Transformers
Sensors

Ratings
Rated voltage: … 24 kV
Rated current: … 3 200 A
Rated short-circuit breaking current: … 40 kA / 3s

Sensors advanced technology for Integrated Solution:

- Flexibility and design process simplification
  - Wide performance range
  - Smaller size
  - Reduced weight
- High safety by default
  - Safe output signals
  - Reduced risk of accident (open secondaries, ferroresonance and saturation free)
- Design freedom
  - Integrated solutions
  - Plug and play connections
  - Mistake prove design
MV Instrument Transformers
Outdoor

Ratings
Rated voltage:
... 52 kV
Rated current:
... 2 500 A
Rated short-circuit breaking current:
... 100 kA

MV Instrument Transformers for outdoor conditions:

- Wide range of types fits to many various applications
- Electrical ratings provided as per individual client’s needs.
- Many metrology certificates & approvals available.
- Basic Impulse Level (BIL): up to 250 kV
- Typically used in large industrial plants with substation for primary revenue metering & relaying
- Products accepted by all end customers
VT Guard: smart solution for everyone

- Effective ferroresonance damping due to low resistance
- No thermal hazard to VT (real thermal protection)
- Non-sensitive to natural network asymmetry
- Small size (DIN – rail mounted)
Outdoor breakers & railway products
Outdoor apparatus

- Complete range of MV outdoor products, e.g.:
  - Circuit-breakers and reclosers
  - Sectionalizers and switches
  - Air switch disconnectors
  - SF₆ switch disconnectors
  - Fuses and cutouts

- Innovative combination of vacuum technology and magnetic actuation in circuit-breakers and reclosers
- Excellent materials for outdoor applications
Railway breaker
Solution for maintenance-free railway applications

- Complete range of railway products, e.g.:
  - Outdoor single or two phase circuit-breaker
  - Outdoor single or two phase Load break switch
  - AC circuit-breaker for rolling stock

- Especially suited for low space requirements
- Vacuum interrupter technology combined with electronic controlled operation and magnetic actuator
- Used in outdoor modules or any other OEM equipment
- Easy and fast installation
Ring Main Units
Ring Main Units
From basic RMU applications to advanced switchgears in one standardized range

- SafeRing / SafePlus / SafeLink
  - ... 40.5 kV / ... 630 A / ... 21 kA
- Standardized configurations available
- Available with load break switch, fuse combination or ABB vacuum interrupter
  - Completely sealed system
- Arc suppressor available
- Highest degree of personal safety
- Compact & robust solution
- Minimal maintenance
- Extensible on request
  - Standardized tools available for easy documentation access
Capacitive switches and surge arresters
Capacitive switch – PS Range
Switching capacitors in distribution systems

Ratings
Up to 36 kV
PS15, 200 A
PS15, 400 A
PS17, 400 A
PS25, 200 A
PS36, 300 A

- 15 kV → 36 kV
- ABB vacuum interrupter technology
- Lightweight
- Storage and transportation made easier
- Magnetic actuator – 50,000+ close-open operations
- Mechanical or electrical latching
- Maintenance-free
Capacitive switch – PS Range
Switching capacitors in distribution systems

- Control circuit
  - Nominal voltage: 120 V AC/DC and 240 V AC
  - Nominal open/close times: < 100ms
  - Nominal current: 10 A
- Switch status option
  - Voltage free contact
- Type tested to ANSI C37.66
Surge arresters

Lovos
280 - 1000 V @ 62 Hz
5 or 10 kA
25/40 kA @ 8/20 µs

Polim-family
Rated voltage:
... 44 kV
10 kA @ 8/20 µs
100 kA @ 4/10 µs

Overvoltage protection for high availability and safety
- Protection of installations to increase reliability and safety
- Wide range of surge protection for nearly every application
- Focus on technical customer support
- For indoor and outdoor installation
UFES™
Ultra-Fast Earthing Switch
Ultra-Fast Earthing Switch type UFES
The new active internal arc protection by ABB

- The new Ultra-Fast Earthing Switch type UFES

- Active internal arc protection in addition to available passive protection applicable for nearly all short-circuit proof, air-insulated switchgear

- Highest possible protection for switchgear in regard to the hazardous impacts caused by an internal arc
Ultra-Fast Earthing Switch type UFES
S³ – Speed, Safety, Savings

- **Speed** – A question of (Operation-) time
  Nearly immediate extinction of an internal arc by fastest intervention of the Ultra-Fast Earthing Switch.

- **Safety** – Greatly enhanced protection for personnel, switchgear and the environment
  A drastically reduced internal arc duration ensures minimized pressure and temperature rise. This leads, as a consequence, to minimal impacts at the fault location.

- **Savings** – The “insurance” for your switchgear
  Greatly increased system and process availability in combination with drastically reduced repair costs.
Ultra-Fast Earthing Switch type UFES
Applicable for highest requirements

Maximum rated voltage:
Ur = 40.5 kV → Ik = 40 kA (3s)

Maximum rated short-time withstand current for medium voltage:
Ik = 50 kA (3s), 63 kA (1s) → Ur = 17.5 kV

Maximum rated short-time withstand current for low voltage:
Ik = 100 kA (0.5s) → Ur = 1.4 kV
Ultra-Fast Earthing Switch type UFES
Available as … loose components

**UFES-kit-1** as OEM product, consisting of:

- Electronic detection and tripping unit type QRU1
- 1 set (3 off) Tripping cables (10 m) with special plug for PSE and electronic
- 3 Primary switching elements (PSE)
Ultra-Fast Earthing Switch type UFES
Available as … loose components

**UFES-Kit-100** as OEM product, consisting of:

- Electronic tripping unit type QRU100
- 1 set (3 off) Tripping cables (10 m) with special plug for PSE and electronic
- 3 Primary switching elements (PSE)

* For extension of existing or new REA arc protection systems
Ultra-Fast Earthing Switch type UFES
Available as … ABB Service retrofit solution

Service-Box

Service-Box
(Illustration: Side-mounted)

Draw-out unit

Draw-out technology
Ultra-Fast Earthing Switch type UFES
Available for … ABB switchgear (AIS)

UFES in UniGear – Top-Box installation

UFES in UniGear - Installation in cable compartment
Iₚ-limiter
The world’s fastest limiting switching device
**Iₚ-limiter**

*The world’s fastest limiting switching device*

- Reduces substation cost
- Solves short-circuit problems in new substations and substation extensions
- Optimum solution for interconnection of switchgears and substations
- In most cases the only technical solution
- Reliability and function proofed in thousands of installations
- Worldwide in service
- The peak short-circuit current will never be reached
- The short-circuit current is limited at the very first current rise
## I_S-limiter – Product Overview

### Applications

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**I⁰ₘ-limiter**

**Breaking of a short-circuit current with I⁰ₘ-limiter**

\[ i_1 + i_2 = i \]

*without I⁰ₘ-limiter*

\[ 250 \text{ kA} \]

*with I⁰ₘ-limiter*

\[ 125 \text{ kA} \]

\[ 50 \text{ kA} \times \chi \times \sqrt{2} \]

Current curve at the short-circuit location
Power and productivity for a better world™