Power Technology Products for all applications – Make your choice
Agenda

- Vacuum Interrupters and Embedded Poles
- Circuit-breakers, contactors and cassettes
- Fuses, Indoor Switches and VisiVolt™
  - Medium voltage fuses
  - Medium voltage switches
  - Passive voltage indicator VisiVolt™
- Instrument Transformers and Sensors
- Outdoor breakers & railway products
- Ring Main Units
- Capacitive switches and surge arresters
- UFES™ Ultra-Fast Earthing Switch
- $I_s$-limiter
  The world’s fastest limiting switching device
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
- Focused 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 of ABB's Embedded Poles 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 altitudes 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

Vacuum circuit-breaker eVD4
Rated voltage: … 17.5 kV
Rated current: … 2,500 A
Rated short-circuit breaking current: … 40 kA

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

Current and voltage sensor in each pole

HMI (panel interface)
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

SF₆ 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 SF₆ 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

- 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

Rated voltage:
- ... 36 / 40.5 kV

Rated current:
- ... 4,000 A

Rated short-circuit breaking current:
- ... 63 kA
Circuit-breakers
Vmax: The low end solution

Vacuum circuit-breaker Vmax
Rated voltage: ... 17.5 kV
Rated current: ... 1,250 A
Rated short-circuit breaking current: ... 31.5 kA

- Vacuum interrupter technology
- Small, lightweight 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 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

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
Contactors

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 switching of motors
  - Up to 1,000,000 mechanical operations
  - Maintenance-free
  - Electronic multi-voltage feeder
Cassettes / Enclosures

The efficient interface to OEMs installation

- 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 combined fuse/surge arrester protection is used

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
- $I_g$-limiters
- Ring Main Units
- Contactors
- Air-insulated switchgear

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 SF$_6$ 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
- \( I_\text{g} \)-limiters
- Ring Main Units
- Contactors
- Air-insulated switchgear

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
- Air-insulated switchgear

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

- Switch-disconnector (Line-Open-Earth)
- 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 switch

Rated voltage:
...24 kV

Rated current:
... 800 A

Rated short-circuit breaking current:
... 20 kA
ABBB 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 possible
- Reflective display of good visibility at 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
- Openable (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 hotline
MV Electronic Instrument Transformers

Sensors

Ratings

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

Advanced Sensor 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)
- Freedom of Design
  - Integrated solutions
  - Plug and play connections
  - Mistake prove design
MV Instrument Transformers Outdoor

Ratings
Rated voltage:
... 52 kV
Rated current:
... 2500 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 Pro
Smart solution

- Efficient feroresonance damping
- Heat losses/radiation close to zero
- Low resistance secures efficient reaction and damping function
- Adjustable time delay and threshold voltage
- Status can be checked by IED (option with diagnostic)
- One product configuration is suitable for more secondary voltages
- Compact dimensions and easy assembly
Outdoor breakers & railway products
Outdoor apparatus

- Complete range of MV outdoor products, e.g.:
  - Circuit-breakers and reclosers
  - Sectionalizers and switches
  - Air switch disconnectors
  - SF$_6$ 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 electronically controlled operation and magnetic actuator
- Used in outdoor modules or any other OEM equipment
- Easy and fast installation
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

- 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

Ratings
Up to 36 kV
PS15, 200 A
PS15, 400 A
PS17, 400 A
PS25, 200 A
PS36, 300 A
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: < 100 ms
  - Nominal current: 10 A
- Switch status option
  - Voltage free contact
- Type tested to ANSI C37.66
Surge arresters

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
Ultra-Fast Earthing Switch type UFES
The active internal arc protection by ABB

- The Ultra-Fast Earthing Switch type UFES
- Active internal arc 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

UFES with electronic tripping unit type QRU100
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:
$U_r = 40.5 \text{kV} \Rightarrow I_k = 40 \text{kA (3s)}$

Maximum rated short-time withstand current for medium voltage:
$I_k = 50 \text{kA (3s)}, 63 \text{kA (1s)} \Rightarrow U_r = 17.5 \text{kV}$

Maximum rated short-time withstand current for low voltage:
$I_k = 100 \text{kA (0.5s)} \Rightarrow U_r = 1.4 \text{kV}$
ABB offers the Ultra-Fast Earthing Switch via different sales channels and for several applications:

- ABB Switchgear
  - UFES is offered as an option for Unigear ZS1, e.g.:
    - Top box assembly
    - Installation in the cable compartment
- Service / Retrofit
  - A service box or service truck can be used to increase the protection level of an existing switchgear
- Sales of loose components to OEM partners
$I_s$-limiter
The world’s fastest limiting switching device
I$_S$-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
### Iₜ-limiter – Product Overview

**Applications**

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- IPP’s
- Biomass

- Utilities

- Pulp & Paper
- Refineries
- Sugar / Ethanol
- Mining Extraction
- Oil Extraction
- Cement Industry
- Steel & Aluminum Mills
- Test Labs
- Ships
**I_S-limiter**

Breaking of a short-circuit current with I_S-limiter

\[ i = i_1 + i_2 \]

\[ i_1 = 50 \text{ kA} \]

\[ i_2 = 50 \text{ kA} \]

\[ i = I_k \]

\[ I_k = 50 \text{ kA} \]

\[ I_k \text{ perm.} = 50 \text{ kA} \]

\[ 125 \text{ kA} \]

\[ 250 \text{ kA} \]

Current curve at the short-circuit location
Conclusions

- Reduces costs of switchgear installations
- Solves short-circuit problems in new and extended systems
- Optimum solution for interconnection of switchgears
- Tried and tested in thousands of installations
- In service worldwide
- The short-circuit is limited at the first current rise
- The peak short-circuit current cannot be reached
Substation Automation and Protection
Relion®
REJ603 – self powered relay for wide range ct’s

- Self powered IED
  - Overcurrent protection
  - Earth fault protection
  - Inrush detector
- Suitable for all usual sensitive trip coils (100 mJ)
- Operation area 8 – 448 A by use of 5 special set of CTs
- Touch-Display as an option
Relion® 605 Series
REJ603 – Selfpowered Relay for conv. ct‘s

- Selfpowered relay for conv. Ct‘s
  - Overcurrent
  - Earthfault
  - Inrush blocking
  - Thermal protection
- Suitable for low power trip coils (100mJ)
- Integrated mechanical trip indication with manual reset
- Optional power supply via USB-serviceport
- Optional add. power supply for 24 – 240V AC / DC
Relion® 605 Series
REF601 - simple distribution networks

- Basic protection relays
  - Feeder protection REF601/REJ601
  - Motor protection REM601

- 2-row text-display
- With or without control function
- Optional serial port
- Parameterization via PCM600 (serial port required)
Relion®
615 series – simple distribution grid applications

- Protection and control devices
  - Feeder protection REF615
  - Line differential protection RED615
  - Motor protection REM615
  - Transformer Differential protection RET615
  - Voltage protection/Voltage Controller REU615
  - Capacitor Bank Protection REV615

- Control of 4 switching devices
- Full graphics- or 4-row text-display
- Arc protection with 3 sensors (not in RED)
- Programming via SFC
- Full GOOSE-performance (IEC 61850)
- Up to 8 analog inputs from CT/VT or Sensors (Sensors with REF, RED and REM)
Relion®
620 series – enhanced distribution grid applications

- Protection and control devices
  - Feeder protection REF620
  - Motor protection REM620
  - Transformer differential protection RET620
- Control of 8 switching devices
- Full graphics-display (2 pages)
- Arc protection with 3 sensors
- Programming via SFC
- Full GOOSE-performance (IEC 61850)
- Up to 32 binary inputs, 18 binary outputs
- Up to 8 analog inputs from CT/VT or Sensors (Sensors with REF only)
- Optional RTD/ mA modules in REM, RET
- 8 programmable function keys
Relion®
630 series – complex distribution grid applications

- Combined protection and control units
  - Feeder protection REF630
  - Motor protection REM630
  - Transformer differential protection RET630
  - Generator protection REG630
- Control of up to eight switches
- Single line diagram
- Five free programable push buttons
- Ereignisgesteuerte Anzeigefunktionen
- Full GOOSE performance (IEC 61850)
- RTD/mA Module
- Distance protection and transient/intermittent earth fault protection in REF630
- Voltage regulation of two winding transformers in RET630
- Motor differential protection in REM630
New devices and applications
Arc protection UFES meets REA101

„UFES meets REA“

- Different internal arc monitoring and supervision functions
  - Optical loop or lens sensors
  - Over current detection
  - Selectivity
- Ultra fast internal arc extinguishing with UFES
- Short trip time
  < 4 ms (after detection)
High Voltage Products for OEMs
High voltage capacitors and filters

Capacitor and harmonic filtering solutions up to 800 kV to improve the efficiency and reliability of utility and Industrial networks.

HV and MV capacitors:
- Shunt capacitors
- Surge Capacitors
- Filter capacitors
- Single-, three- and split phase capacitor units

Applications:
- Reactive power compensation
- Improvement of asset utilization
- Reduction of network losses
- Compliance with grid regulations
High voltage capacitors and filters

Special features:

- Quality and technology leadership
- Products supported by application know-how
- Extensive portfolio coverage
Low voltage capacitors and filters

Capacitor units, banks and harmonic filters up to 1000 V to improve the efficiency and reliability of industrial and commercial networks

Applications:
- Automatic Power factor correction
- Harmonic filtering
- Load balancing
- Reactive power compensation
- Dynamic voltage support

Special features:
- ‘Best in class’ functionality
- High level of reliability and safety
- Compliance with Power Quality regulations
Capacitor Accessories

Capacitor controllers

- User friendly interface
- Extensive range of control modes (power factor etc.)
- Measurement & monitoring
- Data logging
- Protection
- Communication
- Easy programming & commissioning
- Durable IP54 power coated, stainless steel enclosure
- Touch screen color display further easing access to setup and monitoring functions
Capacitor Accessories

PS Switch
- ABB vacuum interrupter technology
- Lightweight
- Magnetic actuator – 50,000+ close-open operations
- Mechanical or electrical latching
- Maintenance free
- Rated voltage: up to 36 kV, 200 - 400 A
Medium Voltage Surge Arresters

Applications
- High current systems
- Wind Power
- Traction and Railway systems
- Railway applications
- Transformers protection
- Cable Installations
- Cable & cable sheath protection (including Linkboxes)
- MV AIS and GIS cubicles and switchgear
- Industries (capacitor banks, motors etc.)
Cable accessories

- Outdoor cable terminations – Porcelain and Composite
- Dry flexible cable terminations
- Cable connectors for GIS and transformer
- Premoulded cable joints
- Tools and accessories
- 12 kV - 420 kV

Extensive training courses – world renowned
Transformer Products and Components
Transformer Products and Insulating Components
Product offering

- Distribution Transformers
- Dry Transformers
- Transformer components
Power and productivity for a better world™