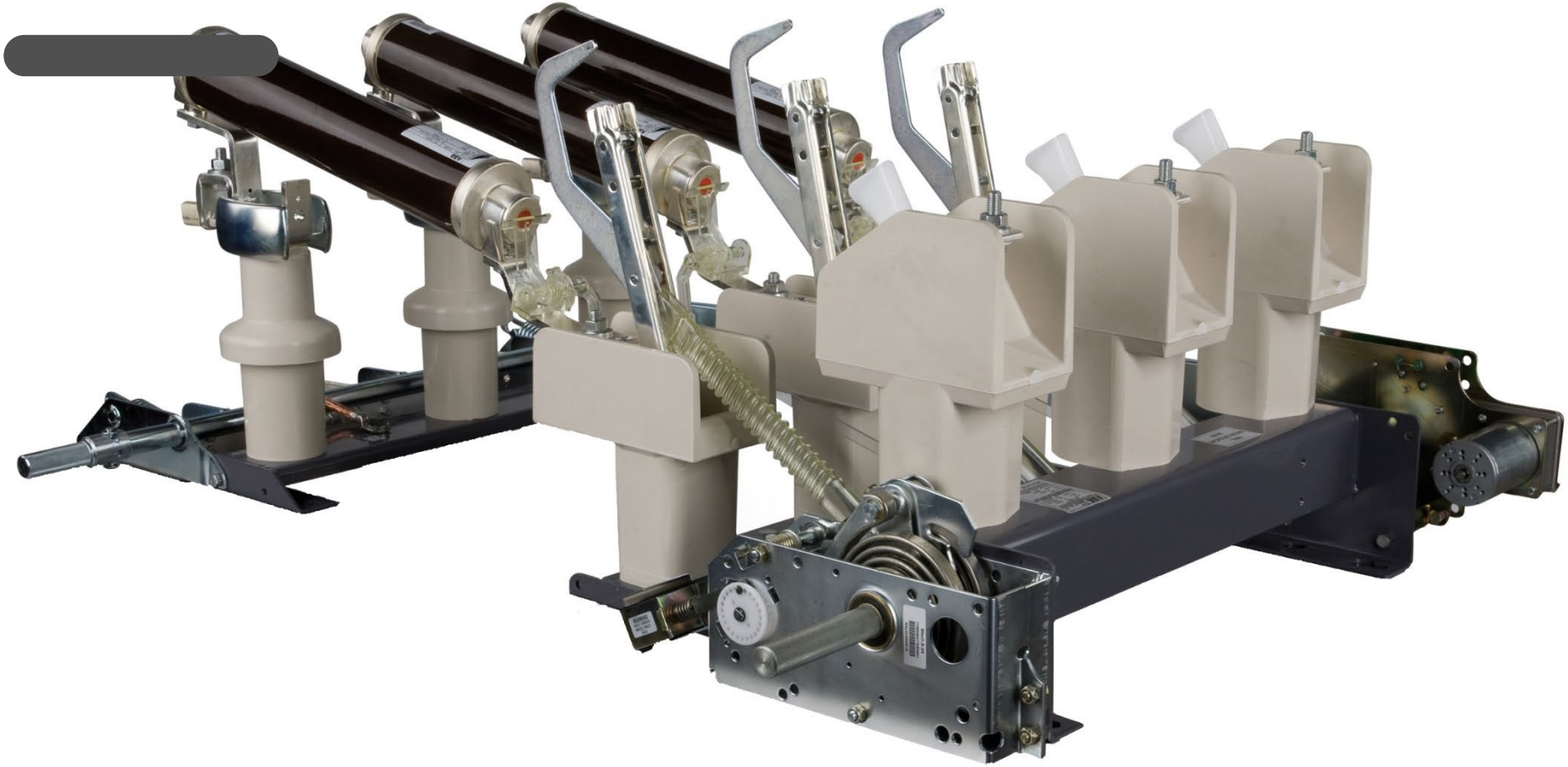


GPG CPP, INDOOR SWITCHES OVERVIEW TRAINING, 2021

Indoor Switches

Product and application presentations

Agenda

Scope

- Welcome note
- Product&design
- Application market&market environment
- Summary

Presentation goals

- General recognition of portfolio &application
- Become familiar with product values&business development

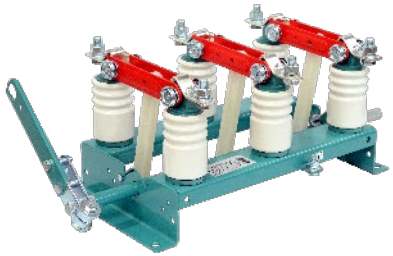
2021

Indoor switches – Product&design

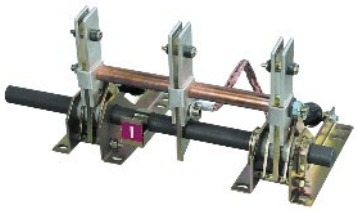
Indoor switches

Introduction – indoor switches product classification

Disconnectors



Earthing switches



Switch-disconnectors

Load break switches

Contactors

Circuit breakers

Indoor air insulated switch-disconnectors

Portfolio – indoor air insulated switch-disconnectors

NAL/NALF/NALFWind

IEC standards

– 12-36 kV
  - Rated current:…1250A
  - STC: …31.5 kA (1s)
  - Making: …67 kA peak

VersaRupter (UR for USA)

ANSI standard

– 4.73-34.5 kV
  - Rated current: …1200A
  - STC: …40 kA (3s)
  - Fault close:…61 kA RMS

NAL CSA (Canada)

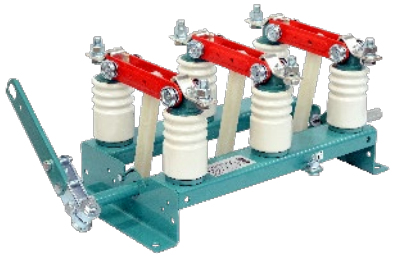
CSA 22.2 compliance

– 4.16-34.5 kV
  - Rated current:…1200A
  - STC:…25 kA (3s)
  - Fault close:…40 kA RMS

Indoor air insulated switch-disconnectors

Portfolio – IEC indoor air insulated disconnectors and earthing switches

OW/OWD/OJON



Free standing disconnectors

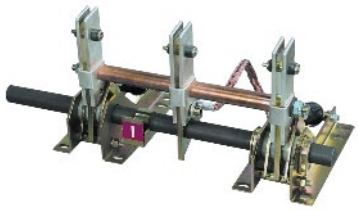
- 12-36 kV
  - Rated current: 630-4600A
  - STC:… 90 kA (1s)

OJWN/EB

Free standing earthing switches

- 12-36 kV
  - STC: …40 kA (1s)
  - Making capacity: …100kA peak

EK6/STE



Build in earthing switches

- 12-40.5 kV
  - STC: …50 kA (1s)
  - Making capacity: …120kA peak

Indoor air insulated switch-disconnectors

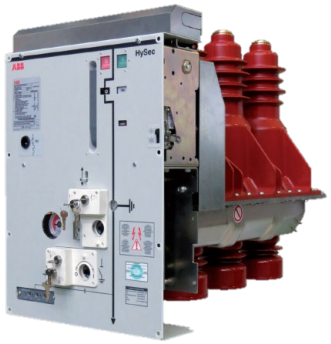
Portfolio – IEC indoor SF6 insulated load break switches and transient-free capacitor switch

GSec

Load break switch

– …24kV/ …800A
  - 375 mm panel width
  - Three positions
  - Electrical endurance: E3

HySec



Circuit breaker with integrated disconnector/earthing

– 24kV/630A
  - 500 mm panel width
  - Metallic partition

DS1

IEC/ANSI Diode-based capacitor switch

– 17.5 kV/630A IEC
– 15.0 kV/600A ANSI
  - 10,000 CO full capacitive currents
  - 50,000 CO mechanical

Fuses

Portfolio – IEC current limiting fuses

CEF

Protection of transformers

– …36kV/ …200A

- Advanced protection against thermal overload (TCU)
- Suitable for coordination with on load switches

CEF-S

Protection of transformers

– ….40.5 kV/….63A

- Superior fast acting performance for wind/solar application
- Applicable with on load switches

CMF

Protection of motor circuits

– …12 kV/…315A

- Resistance to frequent motor start-up currents
- DIN/BS Connections
- Applicable with contactors

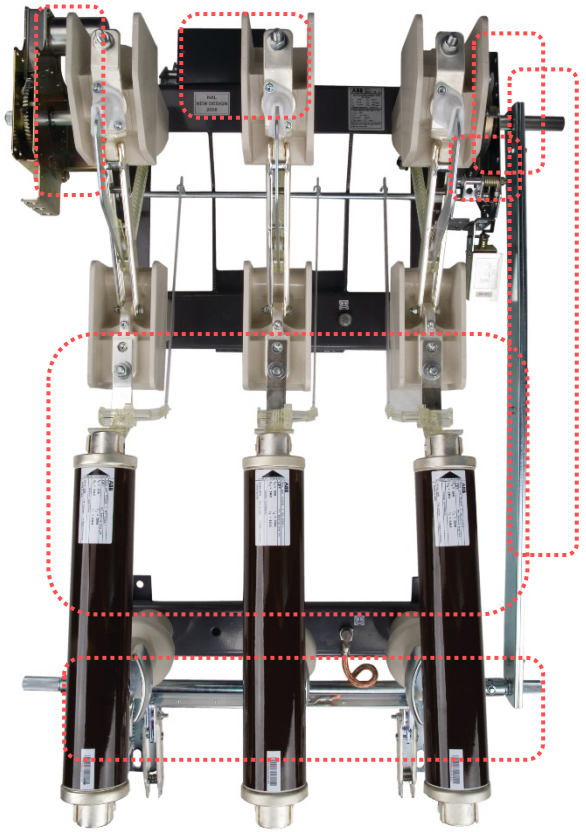
Indoor air insulated switch-disconnectors

NAL/Versa Rupter design principles

Modular design for easy adaptation inside panels and compact transformer stations

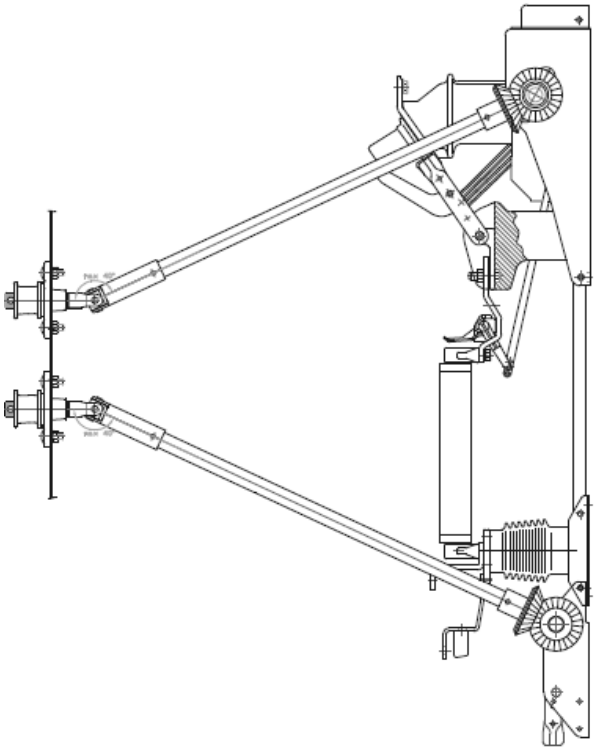
The NAL can be easily configured in line with specific application requirements

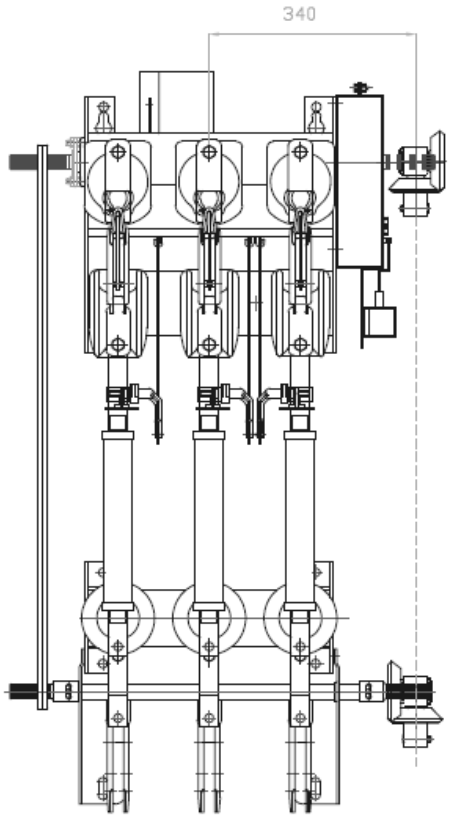
– Main configurable components
  - Single or double spring mechanism
  - Fuse base with or w/o fuse tripping system – upper/lower
  - Earthing switch – upper/lower
  - Auxiliary contacts for switch and earthing switch
  - Motor drives – shaft and front mounted
  - Mechanical interlocks
  - Blown fuse indicator
  - Blocking and tripping coils

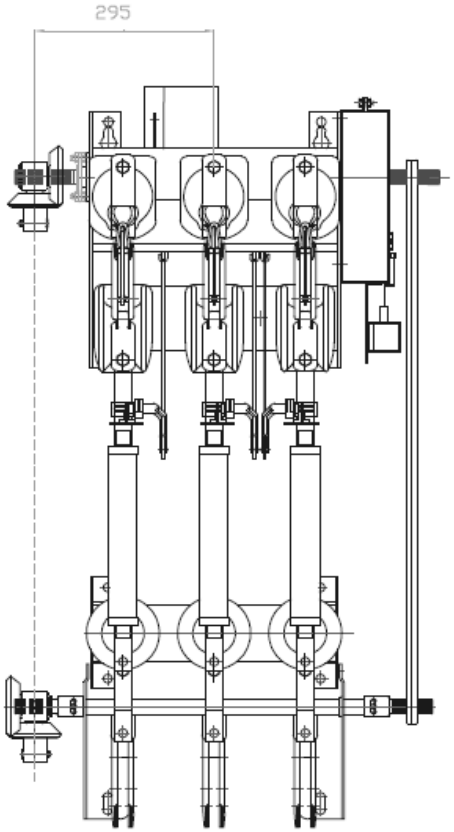


Indoor air insulated switch-disconnectors

NAL/Versa Rupter application arrangements







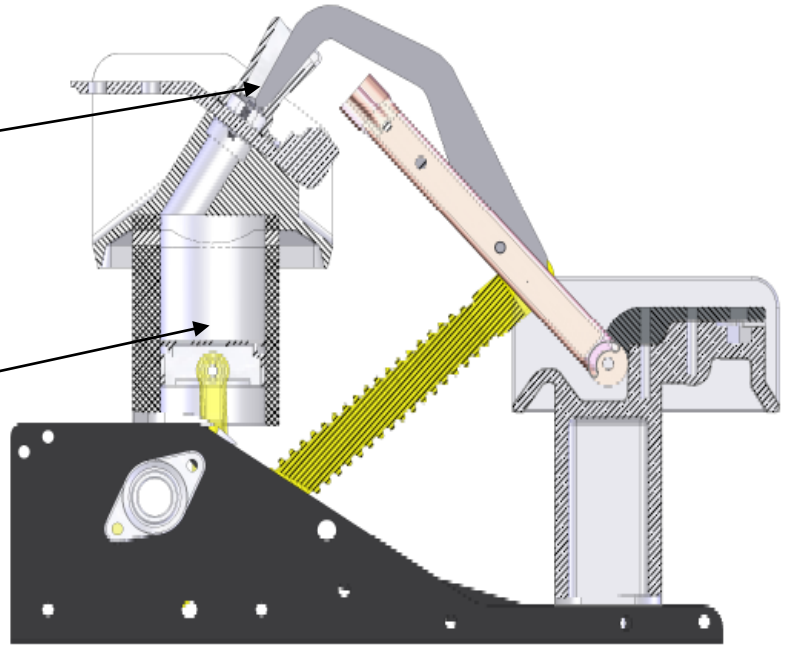
Indoor air insulated switch-disconnectors

NAL/Versa Rupter design principles

Unique combination of two arc extiguinishing systems

Two active breaking systems during interruption process

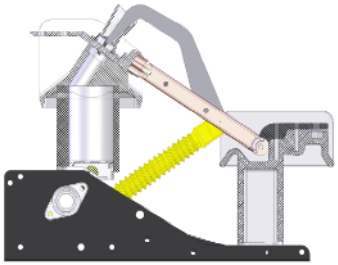
- Gas blast (current dependent)
  - Whenever high overload current must be interrupted the high temperature appears inside arcing chamber, that activates intensive gas molecules release process
- Air blast (current independent)
  - Whenever NAL opens, air has been compressed inside cylinder of hollow insulator by moving up the piston, that is mechanically interlocked with main shaft
  - The compressed air is blown through arcing chamber to support interruption of small load currents



Indoor air insulated switch-disconnectors

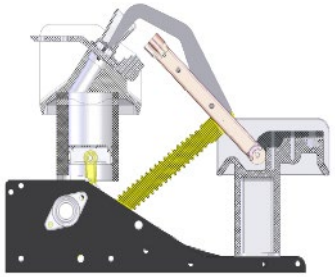
NAL /Versa Rupter operation principles

Unique combination of two arc extiguinishing systems



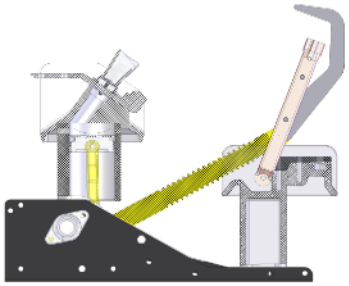
Closed position

- Main and arcing knives are closed
- Current floats through main knives



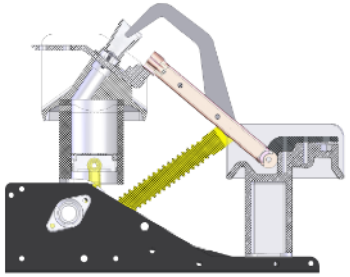
Opening process

- Main knives open first
- Current load stays on arcing knives only
- Arcing knives open and break load current



Completely opened

- All knives are disconnected
- Visible insulation break



Closing process

- Main knives close first
- Arcing knives close
- Load current is connected to terminals

NAL has very efficient combination of two arc extinguishing systems that supports 100 breaking operations at 630 A rated current value

Indoor air insulated switch-disconnectors

NAL design configurations

Smart choice of available product basic variants with standard and severe application variants

NAL variants

- Pole distance
  - 12 kV – 150 mm, 170 mm and 210 mm,
  - 17.5 kV – 170 mm and 210 mm,
  - 24 kV – 170 mm*, 235 mm and 275 mm,
  - 36 kV – 360mm, 400 (NALFWind) mm

  *with insulation barriers
- Rated currents
  - 400, 630 and 1250 A at 12/17.5/24 kV,
  - 630/800/1000 A at 36 kV,
  - 200A at 36 kV NALFWind
- STC: 16-31.5 kA (1s)
- Making capacity: 50/67 kA (peak)

Indoor air insulated switch-disconnectors

NAL /Versa Rupter operating mechanism

Mechanisms:

- K – single spring,- for manual operation

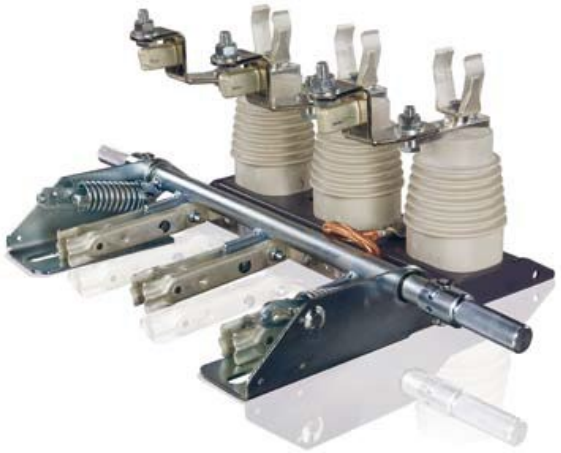
- A – double spring – opening spring may be charged that allows immediate opening of the switch by:
  - mechanical,
  - electrical,
  - fuse tripping release

Indoor air insulated switch-disconnectors

Earthing switches

Earthing switches available for NAL:

- Quick type E – earthing switch attached to the switch and/or to the fuse base insulators and equipped with quick spring mechanism with making capacity,
- Quick type EB – free standing earthing switch for assembling at both sides of the switch configuration or for independent application,

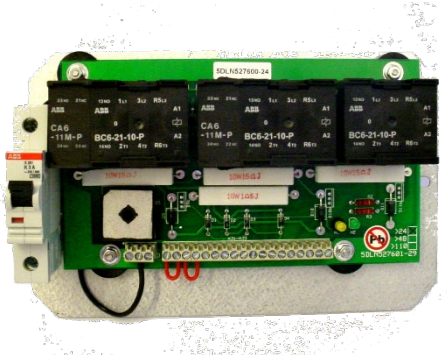


Indoor air insulated switch-disconnectors

Motor drive type NM

Mounted directly on the NAL shaft or on the front of application panel

- Remote operations (time and resources savings),
- Motor drive dedicated for operating springs type K and A (not suitable for earthing switches E,EB),
- Does not need maintenance in normal service conditions ,
- Can be integrated and delivered with RTU, protection relay and gateways,
- Wide range of supplying voltages and blocking coils types:
  - 24, 48, 110/125, 230 AC/DC ,
- Operating temperatures (-40°C +55°C),
- Dedicated front bearing HE for motors,
- Reliable,
- Silent operations,
- Easy for use – compact design.



Indoor air insulated switch-disconnectors

Motor drive type NM

Mounted directly on the NAL shaft or on the front of application panel

Applicable for switchgears and transformer substations

- Local or remote control suitable for radio or internet operations and control
- Possible integration with SCADA system
- Ready for Smart Grid networks with easy integration with ABB Gateways
- Mounted on the left or right hand side of the disconnector with a spacer bracket

Retrofit and new installations

Indoor air insulated switch-disconnectors

Motor drive type UEMC41

For frontal assembly on the application panel or directly on the switch shaft

Suitable for switch-disconnectors, disconnectors and earthing switches due to adjustable rotating angle.

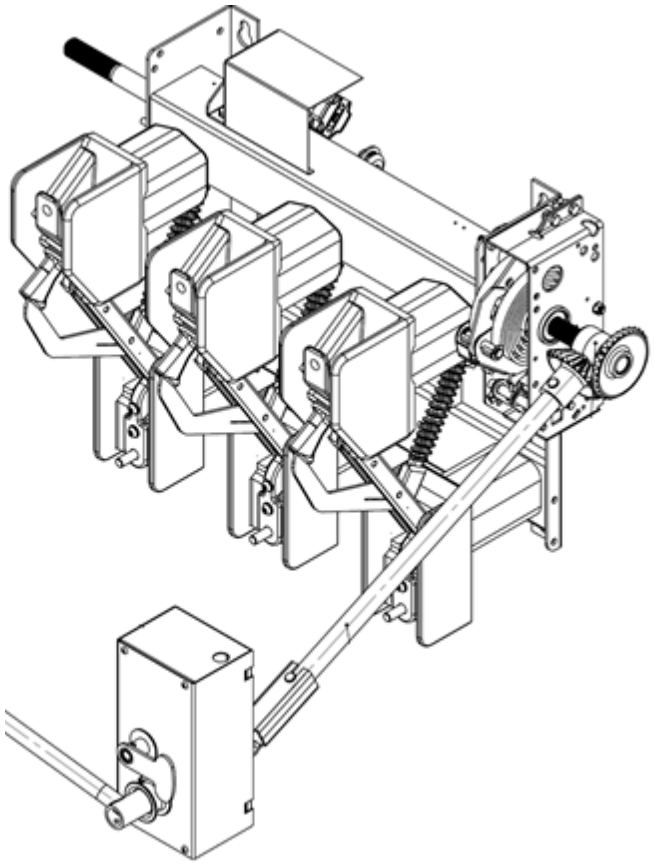
Control and commands send locally or remotely (radio, internet).

Operating time from 4 up to do 10 s depends on applicable switch and operating load.

Compliance with the following IEC standards:

- EN 60335-1, EN 62271-1,
- EN 62271-102, EN 62271-103

Retrofit and new installations



Indoor air insulated switch-disconnectors

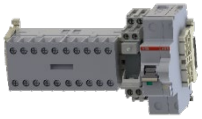
Motor drive type UEMC41

For frontal assembly on the application panel or directly on the switch shaft

- Remote control (saving time and manpower),
- Flexibility of application to unique design with adjustable rotation angle allowing application with wide variety of switches and earthing switches,
- No maintenance needed (for 5000 operations and 10 years),
- Flexibility in application (same device for different switches),
  - Easy adjustable rotation angle (from 0° to 300°)– possibility to adjust on side,
- Could be supplied together with RTU/relay and communication module,
- Wide range of applications and supplying voltages:
  - 24, 48, 110/125, 220/230 AC/DC,
- Working temperature (from -40°C to +70°C),
- Reliability:
  - High number of operation – up to 5000 cycles (tested with NAL 24A),
  - Max. torque 300 Nm,
- Safety:
  - Continuous power supply,
  - Mechanical and electrical locking,
  - Low noise level,
- Easy to use - compact design.

UEMC 41 with integrated control unit

UEMC 41 with external control unit



UEMC 41 with loose components for OEM

Indoor air insulated switch-disconnectors

NAL – manual operation

HE rotating operating system

- HE is intended to preform maneuvers of NAL/F and earthing switches types E/EB from the front of application panel.
- HE enable both manual and motor operations for motor drives is placed at HE bevel gear.

Indoor air insulated switch-disconnectors

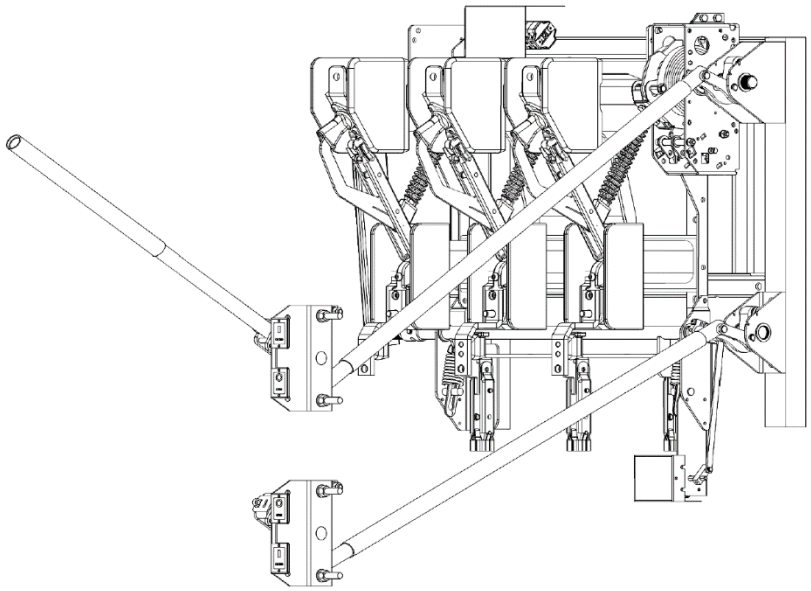
NAL – manual operation

NEMD vertical operating system

- NEMD is intended to preform maneuvers of NAL/F and earthing switches types E/EB from the front of application panel.
- Manual operations can be performed by vertical up and down movements of hand level

Specification:

- Optional blocking by pad lock
- Moving angle of operating handle MAX 90°
- Mechanical withstand 2000 c/o



Indoor air insulated switch-disconnectors

Accessories for NAL

Manual drive HE, coils and auxiliary contacts

Shunt trip coil mounted on all A-mechanisms. This coil is available for the following voltages: 24, 48, 110, 220 V DC and 110, 220 V AC. It shall always be connected in series with an auxiliary switch.

Manual operation of HE consists of lower part (can be equipped with blocking coil) , upper part and connection rod.

Auxiliary switch can be mounted on all switch disconnectors, max. 8NO and 8NC and on all earthing switches except LCES, max. 4NO + 4NC.

Auxiliary switch for blown fuse.

Wide selection of accessories for both switch-disconnectors and earthing switches

Indoor SF6 insulated load break switches

GSec design principles

Three position compact load break switch

Multifunctional apparatus for cost efficient and space saving panel application contains of:

- 800/630 A rated currents
- 210 active load interruptions
- Highest electrical endurance for load break switch E3 and earthing switch E2
- 5000 mechanical operation for LBS with single spring actuator
- Up to 63 kA making capacity and up to 25 kA (2s) STC
- Anti-Seismic test according IEEE 693
- High altitude application (2500 m)
- Transfer current 1750A (125A fuse)@ 12 kV

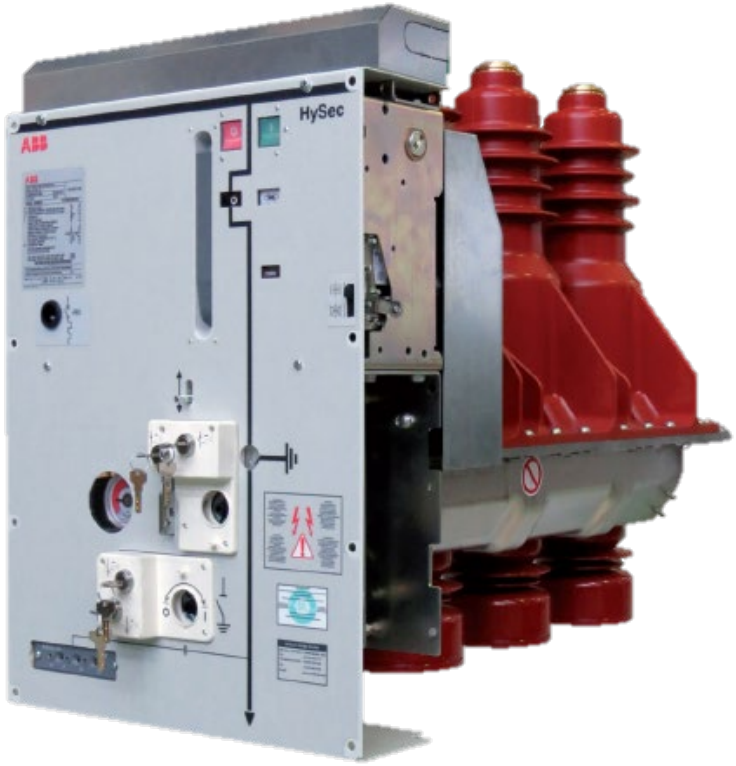
Indoor SF6 insulated combined CB

HySec design principles

Combination of SF6 insulated line disconnector/earthing and VI breaker

Multifunctional apparatus for cost efficient and space saving panel application contains of:

- VI circuit breaker
- SF6 insulated disconnector and earthing switch
- … 24 kV/ 630A
- No cooper connection and no links between apparatus
- 21 kA (3s) STC



Indoorcapacitor switch

DS1 design principles

DS. -diode-based transient-free capacitor switch EC/ANSI

Capacitor switch features:

- Transient-free - Pre/Restrike-free
- NO inrush current/no overvoltages
- 50,000 c/o
- 10,000 c/o full capacitive current

2021

Indoor switches - Application market&market environment

Indoor switches

Indoor switches application concept

Why do we use indoor switch-fuse combination?

Objectives

– Melt fuse must be replaced to continue energy supply

Values

– Switch-fuse combinations are commonly applicable as line and transformer switches as economic alternative to circuit breakers
– Capable to interrupt full range overload and short circuits current due to high breaking performance of fuses and automatic fuse tripping system IEC 62271-105
– Significant reduction of prospective short time current value due to extremely fast operating time of current limiting fuses

Indoor switches

Switch-fuse combination according to IEC 62271-105

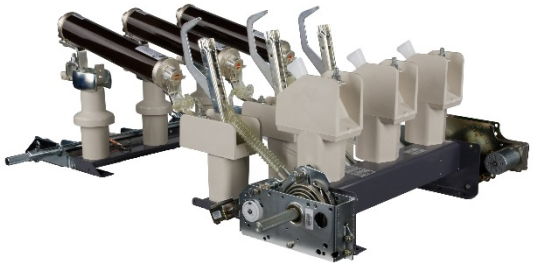
Switch-disconnector

Interruption of overload currents up to few kA only with visible insulation break

Current limiting fuses

Interruption of high short circuit currents without visible insulation break

Switch-fuse combination

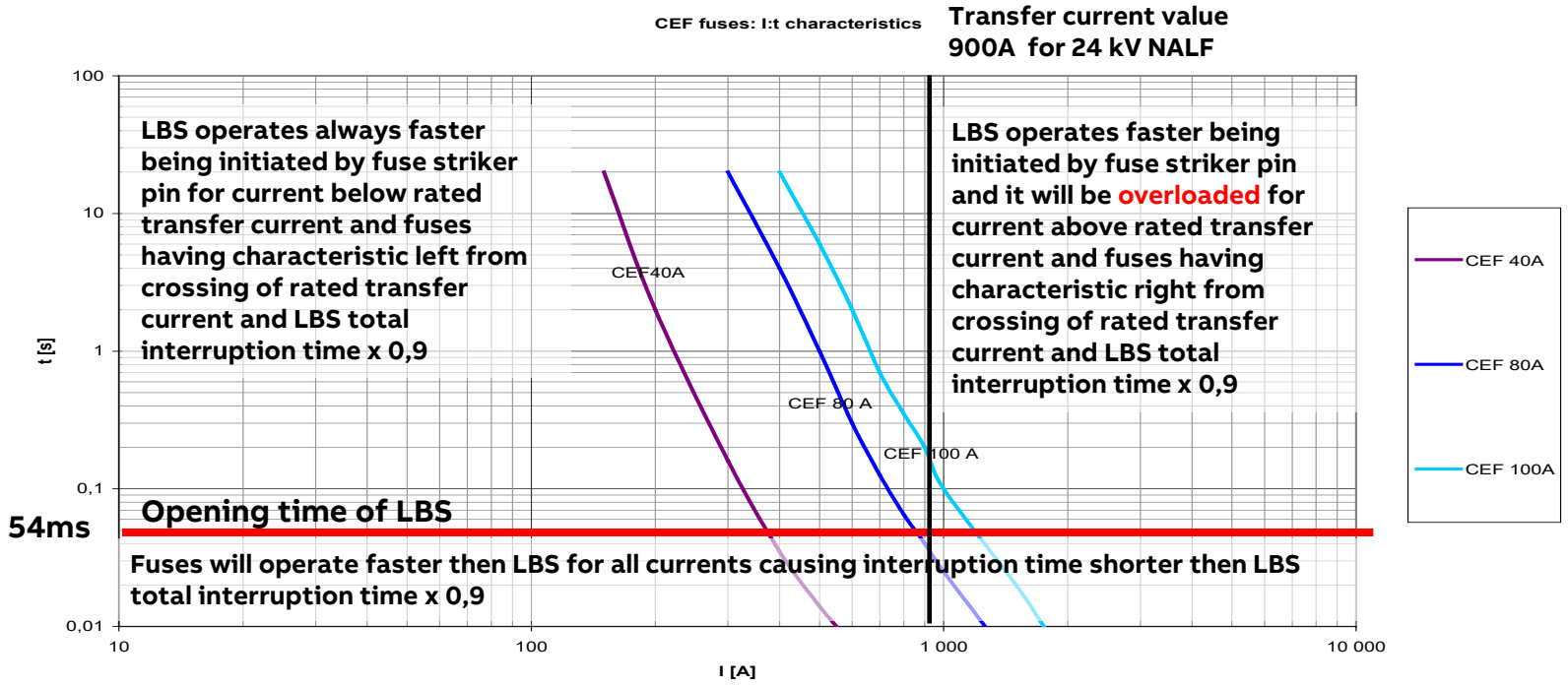


Interruption of both small and high overload currents with visible insulation break

The real and cost efficient full range protection

Indoor switches

Switch-fuse combination according to IEC 62271-105



Indoor switches

Reference list of ABB fuses

NALF

Transformer rated voltage [kV]	Transformer rated output (kVA)																Fuse rated voltage [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	
	CEF Fuse-link In [A]																	
3	16	25	25	40	40	50	63	80	100	125								3.6/7.2
5	10	16	25	25	40	40	50	63	80	100	125							
6	6	16	16	25	25	40	40	50	63	80	100	125						
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125			12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125		
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	125	17.5
20	6	6	6	10	10	16	16	16	20	20	25	31.5	40	50	63	80		24
24	6	6	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	
30	6	6	6	6	6	10	10	10	16	16	16	25	25	25	40	40		36
36	6	6	6	6	6	10	10	10	16	16	16	25	25	25	40	40		

Transformer rated voltage [kV]	Transformer rated output (kVA)											Fuse rated voltage [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	
	CEF-S Fuse-link In [A]												
3	16	25	40	50									
5	10	16	25	40	40	50							
6	10	16	20	25	40	40	50						12
10	10	10	16	20	20	20	40	40	50				
12	10	10	16	16	20	20	20	40	40	50			
15	10	10	10	16	16	16	20	25	40	40			
20	10	10	10	10	16	16	16	20	25	40	40		24
24	10	10	10	10	16	16	16	20	20	25	40	40	

The table was calculated according to standards IEC 60787 and IEC 60271-105 (for operating voltages up to 24 kV) and IEC 420/1990-11 for 36 kV. The following transformer work conditions were assumed:
- Maximum long-lasting overload – 150%
- Magnetizing inrush current – 12•In during 100 ms
- Transformer short-circuit voltage according to IEC 60076-5
- Standard ambient working conditions of fuses

The table above details the rated current of a particular fuse-link for a given line voltage and transformer rating. For different criteria, the fuse selection must be recalculated.

The given limits of the rated current of fuse are not mandatory for use with NAL/NALF switch disconnector without fuse tripping system. Rated current values of the corresponding fuses for these applications are given in the ABB catalogue titled "Fuses."

Switch disconnector type NAL 7

GSec

3. Specific product characteristics

GSec has been tested with ABB CEF fuses for transformer protection to IEC 60282-1/ DIN 43625 standards.

Three fuses (one for each phase) for transformer protection can be connected in series with the switch-disconnector.
Selection of the fuses according to the voltage and power of the transformer, must be made in conformity with the data indicated in the table below.

Transformer protection and choice of fuses
when the isolators are used to control and protect transformers, they are fitted with a particular type of current-limiting fuses which guarantee selectivity with other protection devices and can take the high transformer connection currents without deteriorating.
In this case, protection against overcurrents on the medium voltage side of the transformer is not indispensable since this task is carried out by the protection provided on the low voltage side.
Protection on the medium voltage side can be entrusted just to the fuse, which must be chosen taking into account the no-load connection current since this can be the same or 10 times more that the rated current depending on the power of the transformer and the type of laminations used (hot-rolled or grain oriented).
Maximum inrush current occurs when the circuit-breaker closes at peak voltage.
A further result to be guaranteed is protection against faults in the low voltage winding and in the part of the connection between this and the circuit-breaker on the secondary, thus avoiding the use of fuses with rated current which is too high, in order to ensure tripping within a short time even under these fault conditions.
Rapid calculation of the short-circuit current at the secondary terminals of the transformer and on the supply side of the circuit-breaker on the secondary. If installed at a significant distance, allows the tripping time to be verified on the fuse blowing curve.
The usage table given below takes both the required conditions into account, i.e. rated current high enough to prevent untimely fuse blowing during the no-load connection stage and, in any case, of a value which guarantees protection of the machine against faults on the low voltage side.

Choice of fuses for transformer protection

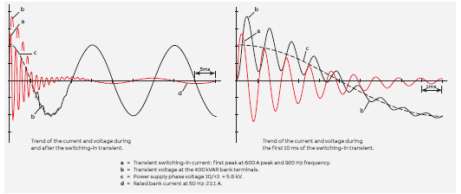
Rated voltage of the transformer [kV]	Transformer power rating [kVA]																		Rated voltage of fuses U_n [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	
	Rated current of fuse I_n [A]																		
3	16	25	25	40	40	50	63	80	100	125	160[2]	–	–	–	–	–			3.6/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	160[2]	–	–	–			
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160[2]	–	–			
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	160[2]			12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125[2]			
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	125[2]		17.5
20	6	6	6	10	10	16	16	16	20	20	25	31.5	40	50	63	80	100[2]		24
24	6	6	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100[2]	

V-Contact VSC

Selection table for fuses for transformers

Rated voltage of the transformer	Rated transformer power [kVA]																		Rated voltage of the fuse
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	
[kV]	Rated current of fuse CEF [A]																		[kV]
3	16	25	25	40	40	50	63	80	100	125	160	200	250	315	2x250 (1)	2x315 (1)			3.6/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	160	200	250	315	2x250 (1)	2x315 (1)	
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160	200	250	315	2x250 (1)	
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	160	200	2x160 (1)	12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125	160	200	

Use CMF fuses.
(1) External fuse carrier required.

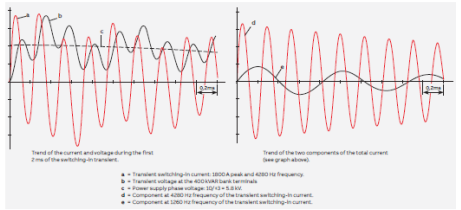


Trend of the current and voltage during and after the switching-in transient.

Trend of the current and voltage during the first 10 ms of the switching-in transient.

a = Transient switching-in current: first peak at 600 A peak and 920 Hz frequency.
b = Transient voltage at the 400 kVAR bank terminals.
c = Power supply phase voltage 10/√3 = 5.8 kV.
d = Rated bank current at 50 Hz: 23.1 A.

Fig. A – Example of a current transient during connection of a single capacitor bank.



Trend of the current and voltage during the first 2 ms of the switching-in transient.

Trend of the two components of the total current (see graph above).

a = Transient switching-in current: 1800 A peak and 4280 Hz frequency.
b = Transient voltage at the 400 kVAR bank terminals.
c = Power supply phase voltage: 10/√3 = 5.8 kV.
d = Component at 4280 Hz frequency of the transient switching-in current.
e = Component at 1260 Hz frequency of the transient switching-in current.

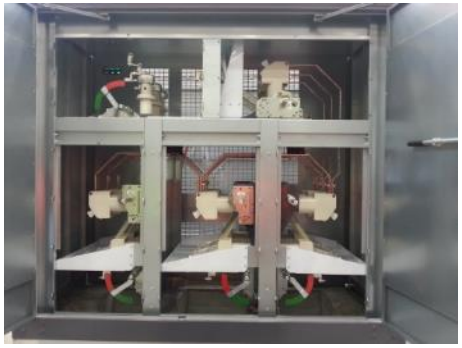
Fig. B – Example of a current transient during connection of a capacitor bank with another one already supplied with voltage.

Avoid the study of fuse installation and have guaranteed coordination and functionality

Indoor air insulated switch-disconnectors

NAL/VR Application inside substations IEC and ANSI

ABB CSS IEC



Compact design with side mounted switches, NALF in upper level and up to three NAL in lower level

OEM substation IEC

Back or side mounted switches, stations with transformers or coupling units

OEM substation ANSI

Back mounted switches in padmounts Dead-Front and Live-Front types

Standard NAL/F is addressed for normal service conditions (Design class 0) whereas NAL/F –H is suitable for severe operating conditions (Design class 2) acc. to IEC 62271-304

Indoor air insulated switch-disconnectors

Prefabricated substation/CSS application highlights

Observations from transformer substations with NAL/F indoor switches

ABB has wide experience of NAL indoor switch-disconnector application inside transformer substations (CSS) based on feedback provided by customers and from our own observations of installed base. We have listed below some factors that could have important influence on installation lifetime;

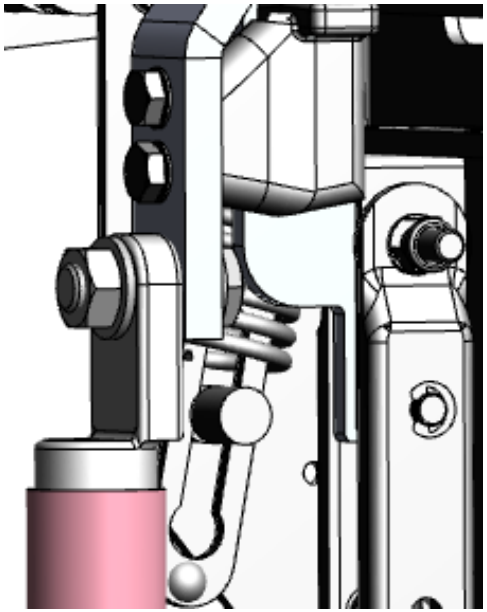
- Wrong installation of the cable termination generating corona including:
  - Reversed cable
  - Long bolts used even the terminal is on the right way
  - Wrong type of cable terminal
- Water in cable trench (Backfilling of cable trench is needed)
- Direct access to the cable trench from outside where water and animals can easily penetrate
- Severe conditions in terms of dust on those CSSs located nearby pollution sources like roads, cement plant and frequent water condensation with water dropping directly on switches and busbars
- Frequent water condensation

Indoor air insulated switch-disconnectors

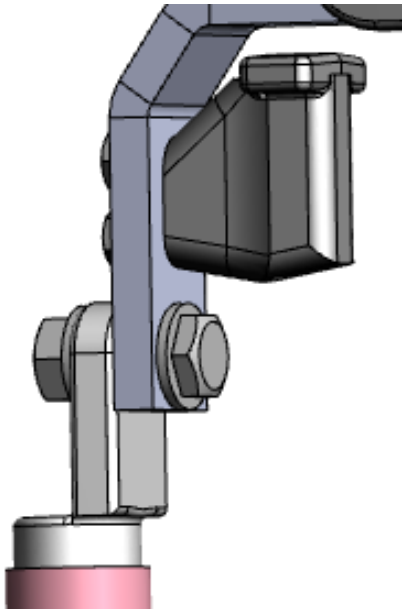
Prefabricated substation/CSS application highlights

Proper installation

Proper installation



Proper installation



Proper installation reduces risk of corona and extends application lifetime significantly

Indoor air insulated switch-disconnectors

Prefabricated substation/CSS application highlights

NAL-H

Remarks

The regular **NAL/F** with BMC insulators is **design class 0 (C_0P_L)** that corresponds to normal service condition application and standard NAL works fine everywhere where this operating conditions are provided.

Wherever we observe harsh operating conditions, special type of the switch-disconnector **NAL/F-H** is recommended that has been type tested according to **IEC 62271-304 design class 2** for **severe operating conditions.**

Regardless type of the switch all installation work, station design, location selection, ground preparation, maintenance must be done in professional way to keep installation in good conditions within assumed lifetime.

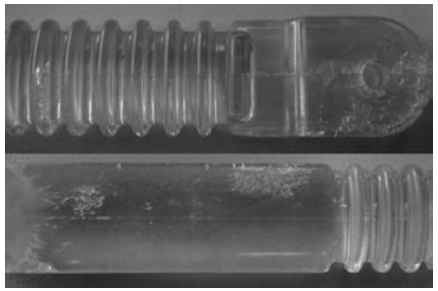
NAL

High quality solutions for prefabricated substations

Indoor air insulated switch-disconnectors

Prefabricated substation/CSS application highlights

Application highlights



Remarks

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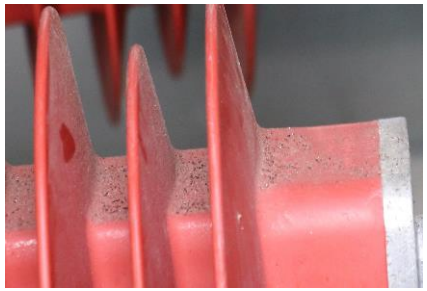
Application highlights



Product maintenance is related to application and operating conditions

Indoor air insulated switch-disconnectors

NAL/VR application inside air insulated switchgears

ABB ZS1 IEC (on the picture)/panel builders

Highlights for typical panel applications

- ZS1 primary
  - Switch on the side in common compartment with IT (12-24 kV)
  - Doors interlocked
  - Manual and motor drives
- Panel builder primary and secondary
  - Switch on the side or on the back
  - IEC compact secondary panels (615 mm for 24 kV)
  - With or w/o fuse holders

Application inside primary and secondary panels

Indoor air insulated switch-disconnectors

NAL application inside open switchgears

Old distribution stations IEC

Highlights for retrofit of old distribution stations

– Open cells stations
  - Switch on the back operated from front of installation (12-24 kV)
  - Simplified access prevention (fence protection only)
  - Installed in concrete housing connected to overhead lines
  - Manual or motorized

Retrofit of old distribution stations

Indoor SF6 insulated load break switches

GSec application inside switchgears

IEC air insulated panels - ABB UniSec and OEM

Compact switchgear with swith three position load break switch

– Applications highlights

- Prevent cable door opening in case Switch Disconnector is not in Earth position
- Prevent motor operation when the lever is in Switch Disconnector line seat (by means of micro switch)
- Mechanical interlock between Switch Disconnector, earthling switch downstream fuses
- Blocking magnet on switch disconnector position both Line and Earth

Compact design with powerful switches

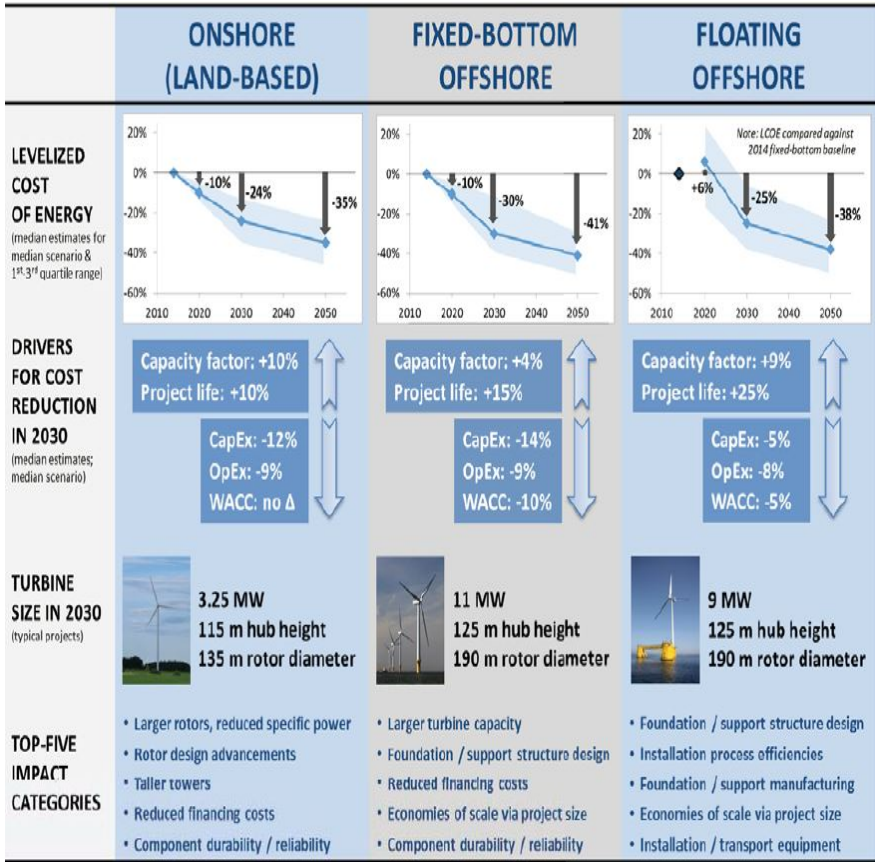
Indoor air insulated switch-fuse combination

NALFWind for wind&solar farms

Windfarm challenges

The worldwide demand for renewable energy is growing constantly, with wind power as one of the fastest growing sectors. To meet the current and future needs of network operators, manufacturers and designers of wind power systems need to be able to call on both advanced technologies and in-depth knowledge.

More and more demanding expectations to reduce cost of generated energy have required both design and performance optimization of wind farms, especially considering available alternative renewables energy sources (solar, biomass, biogas, hydro etc.).



Right hand side table source: Forecasting Wind Energy Costs and Cost Drivers LBNL- 1005717

Indoor air insulated switch-fuse combination

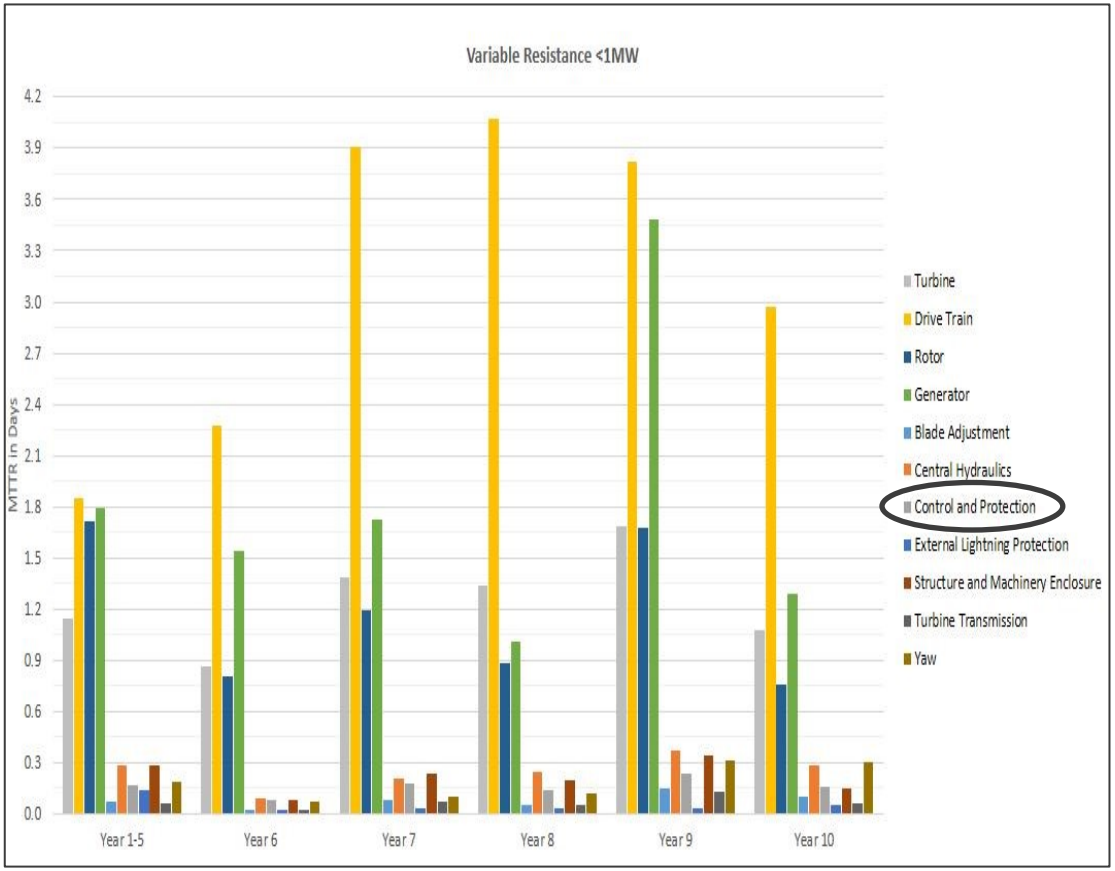
Introduction

Maintenance evaluation

The electrical control&protection wind&solar farm installation required periodical maintenance. This installation part are second or third most frequently inspected components throughout 10 years of reviewed lifetime.

When these electrical installation is located outside wind tower there is much easier and faster access provided that significantly reduces servicing time and cost.

All these is achievable today!



Source: The Wind Energy Operations & Maintenance Report 2017-NewEnergy Update

Indoor air insulated switch-fuse combination

Wind farm typical application concepts for MV installations

Nacelle design principles

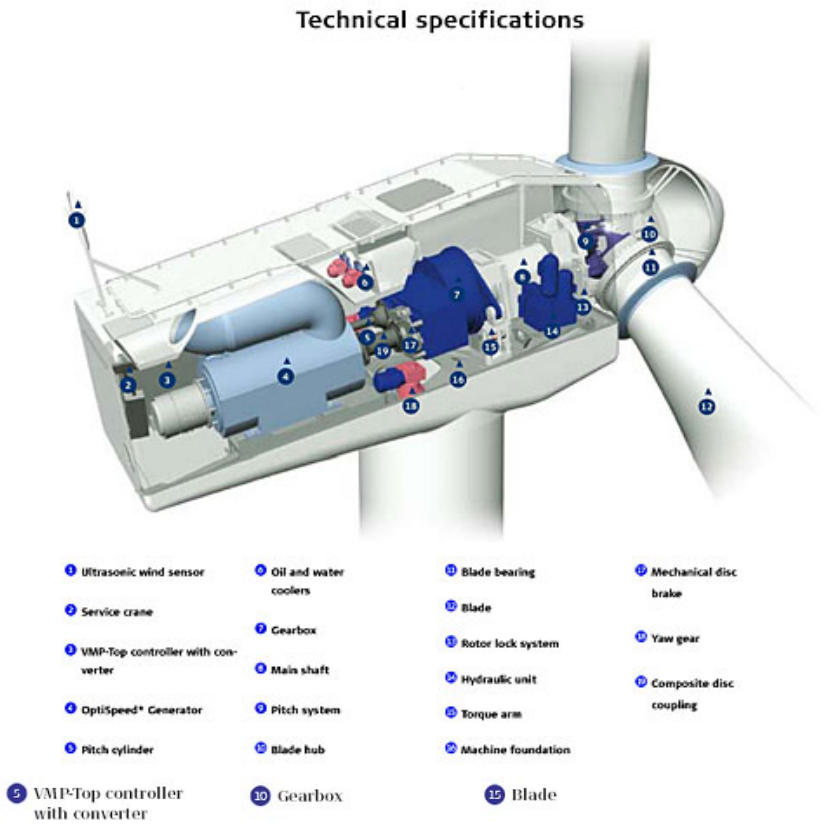
Transformer inside wind tower

– Nacelle with gear box - generator voltage is increased by transformer, transferred by HV cable down to further connecting points

Transformer outside wind tower

– Generator voltage 0.69 kV is transferred down by LV cable that are coming to transformer substation outdoor or indoor one

Applicable inside nacelle without transformers



Indoor air insulated switch-fuse combination

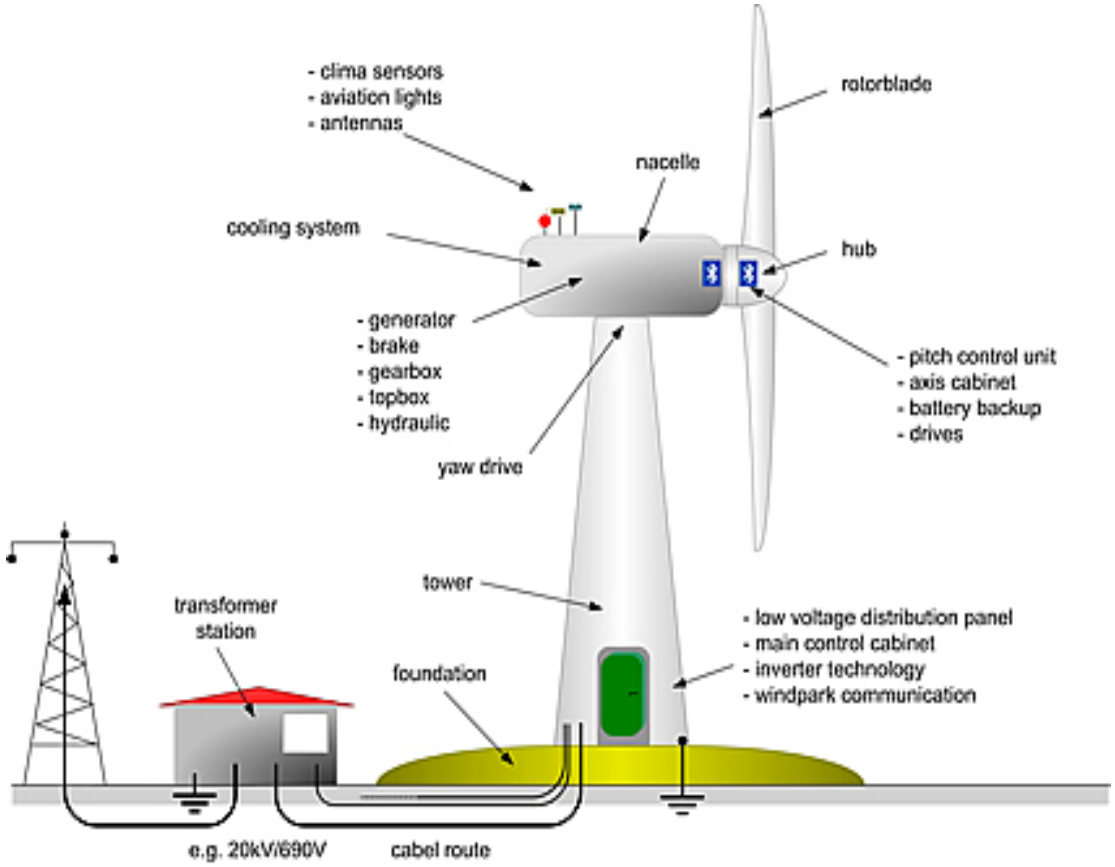
Introduction

Grid connection schemes

The electrical installation in the area of connection between wind tower and the grid needs to be optimized;

- The process considers both connecting lines (cables, overhead lines) switching&protection equipment and transformers;
- The cost-efficient scheme require balance between functionality and performance;

All these is achievable today!



Indoor air insulated switch-fuse combination

Technology comparison

Switch-fuse combination open air

Features

- Electrical&mechanical performance level M1/E1 according to IEC
- **High capability for transformer protection by current limiting fuses up to 3000kVA**
- Visible insulation gap
- **Easy access to all breaking components**
- Limited maintenance
- Possibility to use inside/outside wind towers (inside in big nacelle only)

RMU switch-fuse combination

Features

- Electrical&mechanical performance level M1/E1 according to IEC
- Capability of transformer protection by fuses up to 1600 kVA
- Mechanical switch position indicator
- Breaking components placed inside closed tank
- **Maintenance free**
- Possibility to use inside and outside wind towers (**including installation thru narrow door gate)**

ABB offers best solutions for wind/solar installations

Indoor air insulated switch-fuse combination

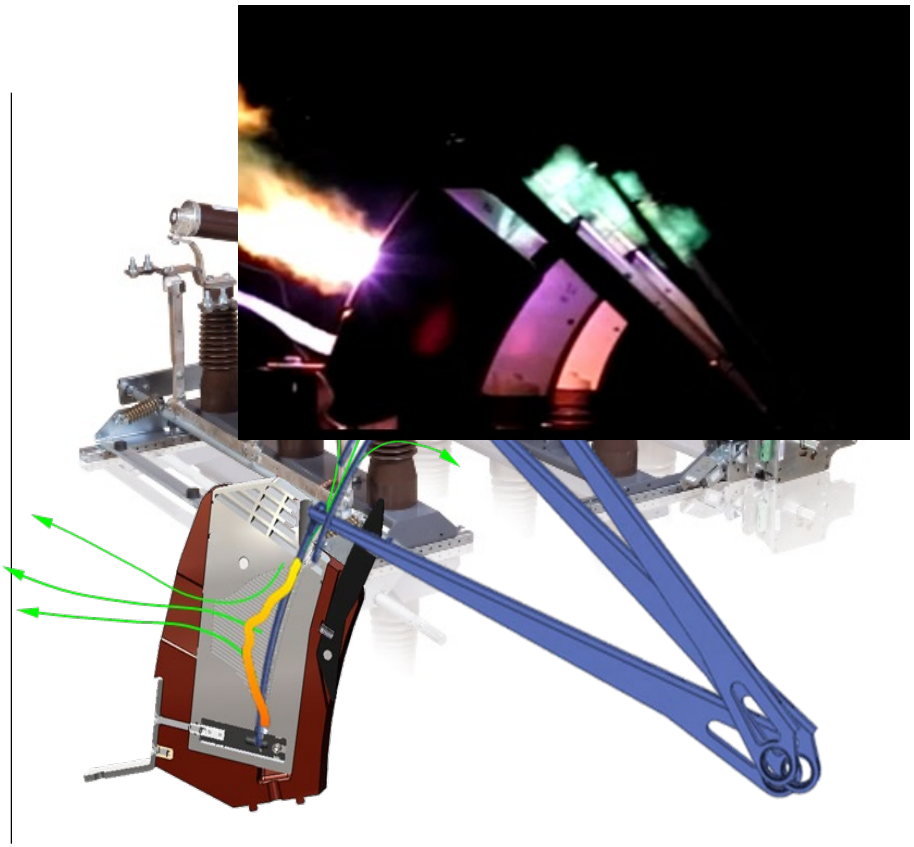
NALFWind design principles

Modular design for easy adaptation inside compact transformer stations

The NALFWind is 36 kV air-insulated switch-fuse combination with short circuit breaking current 31,5 kA (with CEF-S 63 A fuses)

– Main configurable components

- Fuse base with fuse tripping system and blown fuse indicator – protection up to 3000 kVA at 36 kV with CEF-S 30/40.5 kV 63 A fast acting fuses
- Earthing switch with making capacity of 79 kA (peak with CEF-S 63 A fuses)
- Auxiliary contacts for switch and earthing switch
- Motor drives – shaft and front mounted
- Mechanical/electrical interlocks



Indoor air insulated switch-fuse combination

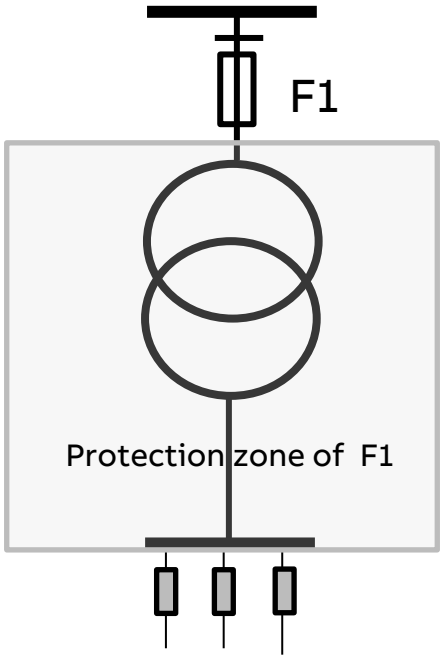
CSS application highlights

NALFWind in CSS

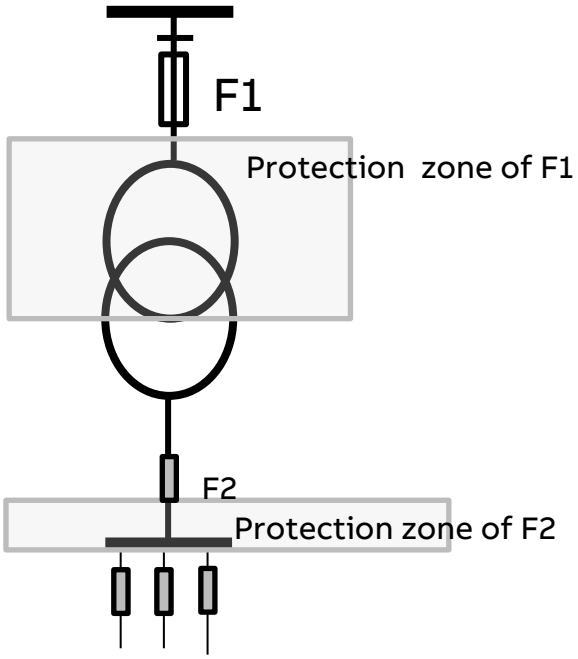
LV side protection

- Protection against short circuit that appears on LV transformer side thanks to MV CEF-S fuses with specially designed higher sensitivity for overload currents at 0.1 s
- Easy protection coordination with transformer characteristic including overload range

CEF-S model



Standard model



Indoor air insulated switch-fuse combination

CSS application concept

NALFWind in CSS

Proposal for ABB CSS Mercure family CSS with NALFWind 36 kV switch-fuse combination with upper fuse base and CEF-S 30/40.5 kV fast acting current limiting fuses.

- Optional equipment:
  - Earthing switch with making capacity.
  - Passive voltage indicators type VV-B

2021

Indoor switches – Summary

Indoor switches

Customer’s benefits of medium voltage indoor switches

Full range protection

ABB switch-disconnectors type NAL and load break switches type GSec create full range and autonomous protection against overload currents. in cooperation with ABB CEF current limiting fuses.

Installation safety has been combined with protection efficiency!!!

Installation efficiency

Easy installation and compact dimensions allows installation place optimization. Low investment cost vs. offered high switching and protection performances makes indoor switches very attractive solution for installation with distribution transformers. Over 800,000 switches delivered worldwide with continues product improvements

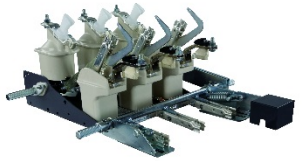
All these give Customer reliable design for wide range of application!!

Continuous operation

ABB indoor switches are reliable in wide range operating conditions including harsh environments.

High quality of components make this product ready for operation with limited maintenance schedule throughout whole product life time

Customer’s assets have been continuously protected!!



Indoor switches

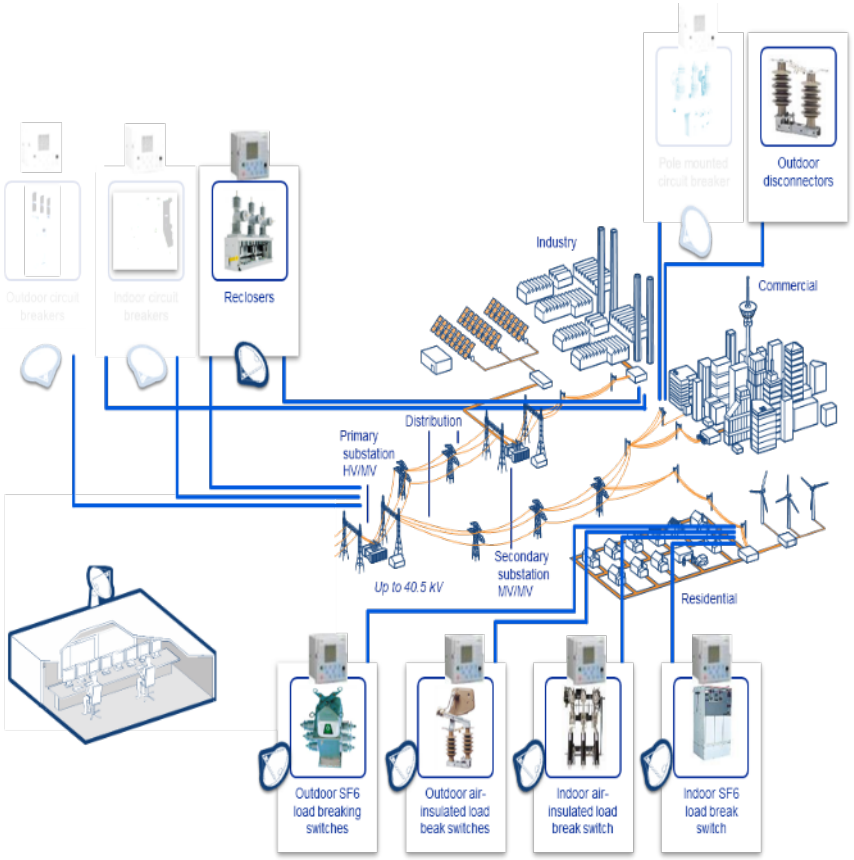
Summary

Indoor air switches our values

The indoor switches are the main solution for protection of distribution transformers and cable switches we are part of EPMV Apparatus Group offering:

- Valuable 40 years presence on the application market across the globe with over 800,000 installed switches
- Technical support for product configuration and selection for specific requirements
- Motorized switches for network automations
- Competitive solution for wind/solar farms
- Best electrical performance classes

Take us home and enjoy it!



Indoor switches

Indoor switch-disconnectors NAL and CEF fuses – application highlights

NALF 17

Commercial Switchgear Canada – NAL CSA Group Certified Product Listed installed in the outdoor panels.

NALF and CEF 24

Toromocho copper mine located in **Junin Peru at 4300 MASL. ABB NALF** and **CEF** were delivered for Chinalco mining in 2010.

CEF/CMF

Tihange is one of the two large-scale nuclear power plants in **Belgium** that makes up to 52% of the total Belgian nuclear generating capacity. ABB **CEF 3.6/7.2 kV** (1E classified) and CMF fuses are installed there

Indoor switches

We make our Customers competitive


ABB