Outdoor Compact Substations
For Distribution Transformers Up To 2MVA/12KV & 1MVA/24KV
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Features

- ABB Arab compact substations are prefabricated metal-clad outdoor enclosures with compact dimensions and low installation space. It can be easily located close to load centres.
- Technical characteristics ensure trouble free operations and supply energy to the customers without interruption.
- Wide range of variety for capacity up to 2MVA, voltage up to 24KV, medium voltage compartment and low voltage compartments (see page 4 & 11).
- ABB Arab robust compact substations designed and manufactured to suit the tropical climate in Egypt, Middle East and Africa.
- Sheet steel sections with weather-proof electrostatic coating, stone paint, alu-zinc sheet steel could be used on request depending on weather conditions.
- Double roof system with natural air to facilitate the air circulation and support the substation cooling system.
- Valid for different types of distribution transformers ABB, ELMACO, etc.
- Special designs for special purposes are also available (container, mobile on truck, pad-mounted, etc.)
- Personal safety, minimum maintenance, simple installation and reliability are our main features.

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The housing is assembled as an integrated unit from sheet steel built on heavy channel steel skid frame to withstand the weight of the kiosk with its components.

To reduce the equipments ambient temperature and prevent heating through the roof due to sun radiation, the roof is made of double layers with foam installation in between, the upper layer is made of a solid Alu-Zinc alloy to give the advantage of corrosion resisting in different climates.

The MV and LV compartments are arranged at both sides of the substations with the transformer compartment in between.

The MV and LV compartments are provided with double doors. All doors are equipped with stainless steel rigid hinges and rigid locking devices. Also, all doors are equipped with rubber gaskets to keep a high degree of protection.

**General Description**

1. Roof mounted lifting eyes (on request)
2. Double roof with neutral ventilation
3. Ventilation louvers
4. MV compartment door
5. Heavy-duty door hinges
6. Earth fault indicator
7. Transformer compartment door
8. LV compartment door
9. Opening handle
10. Base for Kiosk

**International Standards**

ABB Arab design of compact substations is based on the relevant IES standards and conforms with the Egyptian standards specification authority. The relevant standards are:

- **IES 61330**: High-Voltage / Low-Voltage prefabricated Substations.
- **IES 60298**: Metal-enclosed Switchgear.
- **IES 60265-1**: High-Voltage Switches.
- **IES 60420**: High-Voltage alternating current fuse-switch combinations.
- **IES 60694**: Common clauses for high-Voltage switchgear and controllers standards.
- **IES 60282-1**: HRC fuse links.
- **IES 60076**: Power Transformers.
- **IES 60947-1**: Low Voltage Switchgear.
Medium Voltage Compartment

MV Compartment

3-1
Air insulated Switchgear
AIS
Air insulated bus bars and
Air load break switches.

3-2
Gas Insulated Switchgear
(GIG)

3-2-1
Safe Ring
Gas Insulated
bus bars and
load break
switches

3-2-2
Uniswitch
Air Insulated
bus bars and
SF6 load break
switches

- It comprises a Ring Main Unit (RMU) including up to three cable load break switches and one automatic fused load break switch for transformer.
- Different possibilities of medium voltage circuit arrangement as shown.
- All circuit arrangement can be provided with earth fault indicators.
3.1.1 Medium Voltage Compartment
Air Insulated Ring Main Units
Air Load Break Switches

Technical description of 12/24KV air load break switch (Rotary) type NAL / NALF

General:

The NAL series comprises switch disconnectors and fuse switch disconnectors with tripping device.

All switches are also available with a fitted earthing switch.

The NAL type switch disconnectors are designed according to the knife contact principle. An intensive cooling and reliable quenching of the arc which occurs during switching is achieved by the use of modern quenching techniques applied to the switch design.

The knife contact switch disconnectors, type NAL, is particularly characterized by its small dimensions, sturdy components, simple operation and high operating level of safety.

It is suited for the switching of:
- Currents exceeding their rated current
- Ring circuits
- Cables and overhead lines
- Capacitor banks

The switches are divided into the following two types according to their manner of drive mechanism:
1. Type NAL .... K: Knife - contact spring operated mechanism for closing or opening the switch.
2. Type NAL .... A: Stored energy mechanism for closing and opening.

Regulation and tests

The NAL type switch disconnectors comply with the regulation for multi-purpose isolators according to DIN 5760 part 3/VDE 0670 part 3 as well as with IEC publication 265 (general usage switching equipment), 128 (visible isolating distance).
### Medium Voltage Compartment

#### Air Insulated Ring Main Units

#### Air Load Break Switches

## Technical Specifications

### Switch disconnector types NAL, NALF

The switch disconnector complies with IEC publications 126 - 254 and 894 concerning general purpose switches, IEC publication 430 regarding correct co-operation between switch disconnector and fuse.

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>12 kV</th>
<th>17.5 kV</th>
<th>24 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un kV</td>
<td>12</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>400</td>
<td>633</td>
<td>400</td>
</tr>
<tr>
<td>Rated current</td>
<td>400</td>
<td>633</td>
<td>400</td>
</tr>
<tr>
<td>Max. rated current</td>
<td>400</td>
<td>633</td>
<td>400</td>
</tr>
<tr>
<td>Short circuit breaking capacity</td>
<td>67</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Peak withstand current</td>
<td>75</td>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td>Short time current</td>
<td>1 sec</td>
<td>2 sec</td>
<td>3 sec</td>
</tr>
<tr>
<td>Mainly active load breaking capacity</td>
<td>400</td>
<td>633</td>
<td>400</td>
</tr>
<tr>
<td>Mainly capacitive breaking capacity</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Mainly inductive breaking capacity</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Rated earth fault breaking capacity, IEC 265</td>
<td>150</td>
<td>150</td>
<td>70</td>
</tr>
<tr>
<td>Capacitive breaking capacity, fig. 7</td>
<td>90</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>Power frequency withstand voltage 50 Hz 1 min.</td>
<td>35</td>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>Impulse withstand voltage 1,5/50 us.</td>
<td>75</td>
<td>95</td>
<td>125</td>
</tr>
<tr>
<td>Pole distance</td>
<td>150 and 210</td>
<td>170</td>
<td>235 and 275</td>
</tr>
<tr>
<td>Max. operating torque at:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- closing K/A mech.</td>
<td>115 - 170 Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- opening K/A mech.</td>
<td>K-mech. 120 Nm / A-mech. 3 Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating angle on the shaft</td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arc time</td>
<td>40 - 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arc time ms</td>
<td>10 - 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Earthing switch type E ** for NAL/NALF and type EB

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>U kV</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak withstand current</td>
<td>62.7/5</td>
<td>40/80</td>
<td>38/50</td>
<td></td>
</tr>
<tr>
<td>Short time current</td>
<td>1 sec</td>
<td>2 sec</td>
<td>3 sec</td>
<td></td>
</tr>
<tr>
<td>Short circuit breaking capacity</td>
<td>62/7</td>
<td>40/62.5</td>
<td>38/50</td>
<td></td>
</tr>
<tr>
<td>Test voltage 50 Hz 1 min.</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Power frequency withstand voltage 1.2/50 us.</td>
<td>75</td>
<td>95</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>Pole distance</td>
<td>150 and 210</td>
<td>170</td>
<td>235 and 275</td>
<td></td>
</tr>
</tbody>
</table>

** Mechanical interlocking can be fitted, but not for KS - mechanism.

** At ln = 630 A, 150 x CO. At ln = 1250 A, 20 x CO.

** When fed from switch disconnector/earthing switch side.

** Also available for 25 kA 2 sec, with reinforced frame.

** Max. fuse size is ref. to time current characteristics for CEF.
3.1.2 Medium Voltage Compartment
Air Insulated Ring Main Units
Fuse Links

The high voltage current limiting fuse links for distribution networks are characterized by:
- very low minimum breaking current.
- small power losses.
- low arc-voltage.
- high breaking capacity.

The high voltage current limiting fuse links comply with DIN 57670/VDE 0670 part 4, and IEC publication 282.

The low power losses, between 30 to 50% of what is normal for other high voltage fuse-links, make these fuse-links, specially suitable in compact switchgear.

The fuse-links are equipped with a combined indicator and striker system.

The tripping device is actuated, as soon as the fuse element interrupts the current path.

Selection of fuse-links for protection of transformers

<table>
<thead>
<tr>
<th>Line voltage (KV)</th>
<th>TRANSFORMER RATINGS (KVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

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3.2 Medium Voltage Compartment
3.2.1 Gas Insulated switchgear
Safe Ring

Ring Main Unit Type: Safe Ring

Safe ring is R.M.U for the secondary distribution network.

It can be supplied in a number of different configurations suitable for most switching applications in 12/24 KV distribution networks.

Safe ring is completely sealed system with a stainless steel tank containing all live parts and switching devices.

A sealed steel tank with constant atmospheric conditions.

Ensures a high level of reliability as well as personnel safety and virtually maintenance free - system.

The safe ring permits the choice of either a switch fuse or C.B with relay protection for the transformer feeder.

Technical specification

<table>
<thead>
<tr>
<th></th>
<th>C module</th>
<th>F module</th>
<th>V module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>12/17.5/24</td>
<td>12/17.5/24</td>
<td>12/17.5/24</td>
</tr>
<tr>
<td>Power frequency withstand (kV)</td>
<td>28/38/50</td>
<td>28/38/50</td>
<td>28/38/50</td>
</tr>
<tr>
<td>Insulation withstand voltage (kV)</td>
<td>95/95/125</td>
<td>95/95/125</td>
<td>95/95/125</td>
</tr>
<tr>
<td>Rated current (A)</td>
<td>600/1000/1300</td>
<td>600/1000/1300</td>
<td>600/1000/1300</td>
</tr>
<tr>
<td>Breaking capacities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short circuit breaking current (KA)</td>
<td>62.5/125/120</td>
<td>62.5/125/120</td>
<td>62.5/125/120</td>
</tr>
<tr>
<td>Short time current 1 sec. (KA)</td>
<td>25/50/100</td>
<td>25/50/100</td>
<td>25/50/100</td>
</tr>
<tr>
<td>Short time current 3 sec. (KA)</td>
<td>21/32/32</td>
<td>21/32/32</td>
<td>21/32/32</td>
</tr>
</tbody>
</table>

1) Depending on the current rating of the fuse
2) Limited by High Voltage fuse links
3) Tested at 10.2kV

SafePlus is tested according to IEC publications IEC 60129, IEC 60076, IEC 60420, IEC 60694 and IEC 60238
3.2.2 Medium Voltage Compartment
Air Insulated switchgear with SF6 L.B.S
Uniswitch

Ring Main Unit Type: Uniswitch

Uniswitch, the flexible switchgear developed as a modular, simple to apply design, with fewer components, providing a high reliable, quality and safe product for you, our Customer.

Switch-disconnector, type SFG

The switch-disconnector, type SFG, has the following 3 positions:
- CLOSE
- OPEN
- EARTHING

The switch-disconnector is using SF6 as extinguishing and insulation medium. The switch housing is equipped with two thermo plastic windows to allow visual inspection.

Each switch is sealed for life (i.e. 36 years) and maintenance free. SF6 gas pressure is 1.4 bar and the SFG switch incorporates a capacitive divider for voltage indication. Mechanical endurance is 5000 C/O and 1000 G/Each.

The switch and operation mechanism are installed in a removable top unit, making it easy to convert SDF to a SDC cubicle, or vice versa.

Switch types
- SFG with UES-A3 operating mechanism
- SFG with UES-A3 operating mechanism

Optional equipment
Auxiliary contacts:
- closed position 2NC-2NC
- open position 2NC-2NC
- earth position 2NC-2NC

Shunt trip coil:
For SFG with UES-A3 operating mechanism.

Push-button for mechanical tripping of SFG with UES-A3 operating mechanism

Motor operation: See item 6.4.
4. Transformer Compartment

- The transformer compartment is designed for a 3-phase oil immersed power transformer with power up to 2000 KVA at rated MV 12KV and up to 1000KVA at rated MV 24KV either supplied by ABB or equivalent.

- The transformer is connected to the LV distribution board via cooper busbars or cables based on the transformer capacity, and to the MV equipment via XLPE screened cables, each of the XLPE cables is equipped with two cable end box for three single phase connection.

- For service purposes, sufficient space is provided to the personnel to go in and work freely, necessary opening are provided for air entry and exhaust, so that the temp. rise is kept to a minimum.

- In substations up to 500 KVA / 12 KV the transformer could be placed into its compartment either from dismantable or from the longitudinal side door. For above rating it is preferable to place the trans. from the roof side.

- Dust-rejecting ventilating louvers, are situated at both ends of the transformer compartment and dimensioned for self-cooling.

- The lower part of this compartment functions as an oil collection pit with a sufficient volume to contain all the transformer oil.

- Two doors in both longitudinal sides of the transformer compartment provide maximum flexibility to inspect and maintain the transformer.
Low Voltage Compartment

The LV compartment contains the LV distribution board. It is built on a steel frame mounted on the compartment floor and fixed to the back wall of the compartment.

The main incoming apparatus is usually moulded case automatic air circuit breaker (open frame type is also available) complete with overload and short circuit protection with rating up to 3200A. The incoming unit is equipped with voltmeter and selector switch, 3 ammeters, 3 signal lamps and space for optional K.W.H meter.

To satisfy different requirements for outgoing feeders, 3 basic types are available providing these outgoing feeders with:

1- Moulded Case Circuit Breakers
   As an example for the capacity of the 500 KVA/12KV substation, the number of the outgoing feeders with moulded case circuit breakers (MCCB) may be one of the following:
   - Nine frame size 250A MCCB
   - Six frame size 400A MCCB
   - Four frame size 630A MCCB

2- Fused Load Break Switches
   For the same example of the 500KVA/12K substation, the number of the outgoing feeders using fused load break switches (SF) may be one of the following:
   - Six (SF) up to 400A
   - Four (SF) up to 630A

3- 3ph HRC fuses
   For the same example of the 500KVA substation the number of the outgoing feeders with high rupturing capacity fuses may be one of the following:
   - Four with H.R.C. fuses up to 630A
   - Five with H.R.C. fuses up to 250A

For several requirements
   As an example for a substation 1000KVA with M side 24KV or 2000KVA with MV side 12KV, the outgoing feeders with moulded case circuit breaker may be one of the following:
   - Six frame size MCCB1250A
   - Eight frame size MCCB 400A
   - Twelve frame size MCCB 250A

N.B.
   It is available to provide the LV compartment optionally with:
   a) K.W.H. & K.V.A.R.H. for incoming feeder
   b) Control equipment for street lighting line
   c) Other specifications for the LV compartment could be supplied but with special dimensions.
6. Drawings & Arrangements

a) - Dimension drawings for transformer substations up to 500 KVA, MV side 12 KV

b) - Dimension drawings for transformer substations up to 160 KVA, MV side 12 KV
c) - Dimension drawings for transformer substation 1000 KVA, MV side 12 KV

![Front View Without Door](image1)

![Side View With Open Door](image2)

![Front View With Closed Door](image3)

![Side View With Open Door](image4)

(d) - Dimension drawings for transformer kiosk 2000 KVA, MV side 12 KV & 1000 KVA, MV side 24 KV

![Front View Without Door](image5)

![Side View With Open Door](image6)

![Front View With Closed Door](image7)

![Side View With Open Door](image8)
### Dimensions in (mm)

<table>
<thead>
<tr>
<th>Kiosk Description</th>
<th>(H) Height</th>
<th>(W) Width</th>
<th>(L) Length</th>
<th>Weight without Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating up to 160 KVA</td>
<td>1970 mm</td>
<td>1700 mm</td>
<td>2440 mm</td>
<td>≈ 1.5 ton</td>
</tr>
<tr>
<td>Voltage 12 KV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type AB 12-K160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating up to 500 KVA</td>
<td>2050 mm</td>
<td>1680 mm</td>
<td>3200 mm</td>
<td>≈ 2.4 ton</td>
</tr>
<tr>
<td>Voltage 12 KV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type AB 12-K500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating up to 1000 KVA</td>
<td>2370 mm</td>
<td>2000 mm</td>
<td>4110 mm</td>
<td>≈ 3 ton</td>
</tr>
<tr>
<td>Voltage 12 KV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type AB 12-K1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating up to 1000 KVA/24 kV</td>
<td>2370 mm</td>
<td>2400 mm</td>
<td>4200 mm</td>
<td>≈ 3.5 ton</td>
</tr>
<tr>
<td>Rating up to 2000 kVA/12 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type AB 24/12-K1000/K2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Recommended Base Foundation

Recommended base foundation reinforced concrete base as the following drawings and dimensions.

<table>
<thead>
<tr>
<th>Hook Type</th>
<th>L</th>
<th>W</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB12-K160</td>
<td>2440</td>
<td>1700</td>
<td>700</td>
<td>66</td>
<td>1190</td>
<td>440</td>
<td>400</td>
<td>220</td>
<td>700</td>
<td>929</td>
<td>400</td>
</tr>
<tr>
<td>AB12-K200</td>
<td>3200</td>
<td>1680</td>
<td>800</td>
<td>66</td>
<td>1390</td>
<td>906</td>
<td>400</td>
<td>220</td>
<td>700</td>
<td>929</td>
<td>400</td>
</tr>
<tr>
<td>AB12-K1000</td>
<td>4110</td>
<td>2000</td>
<td>1245</td>
<td>120</td>
<td>1470</td>
<td>1065</td>
<td>400</td>
<td>240</td>
<td>700</td>
<td>940</td>
<td>490</td>
</tr>
<tr>
<td>AB12-K2000</td>
<td>4200</td>
<td>2420</td>
<td>1390</td>
<td>120</td>
<td>1420</td>
<td>1170</td>
<td>400</td>
<td>240</td>
<td>1010</td>
<td>940</td>
<td>490</td>
</tr>
<tr>
<td>AB24-K1000</td>
<td>4200</td>
<td>2420</td>
<td>1390</td>
<td>120</td>
<td>1420</td>
<td>1170</td>
<td>400</td>
<td>240</td>
<td>1010</td>
<td>940</td>
<td>490</td>
</tr>
</tbody>
</table>
Samples of previous deliveries