

## Outdoor Compact Substations

For Distribution Transformers Up To 2MVA/12KV & 1MVA/24KV



**ABB**

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## I. 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.

محطات محولات إيه بي بي أراب المدمجة تتميز بـ :  
أبعاد مدمجة للتركيب خارج المباني وسط الأحياء السكنية .  
خصائصها الفنية تجعلها بدون مشاكل في التشغيل .  
مصممة ومصنعة خصيصاً للأحوال الجوية ودرجة الحرارة بمصر  
والشرق الأوسط وأفريقيا .  
تصنع من صاج مسحوب على البارد أو صاج الوزنك ثم لدهن بدهان  
إلكتروستاتيكي مقاوم للصدعات والعوامل الجوية وكذلك دهان حجري  
للأماكن الساحلية (اختياري)  
سقف مزدوج مخفض للحرارة ولزيادة درجة التبريد داخل المحطة .  
صاح لمختلف أنواع المحولات ( الماكو - إيه بي بي - أخرى )  
تصميمات خاصة لطلبات عملائنا الغير تقليدية مثل محطة داخل حاوية  
أو محمولة على قاطرة أو مركبة على قاعدة أو أي مواصفة أخرى .



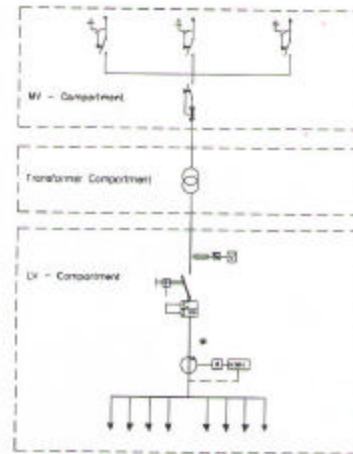
## 2. General Overview

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 .

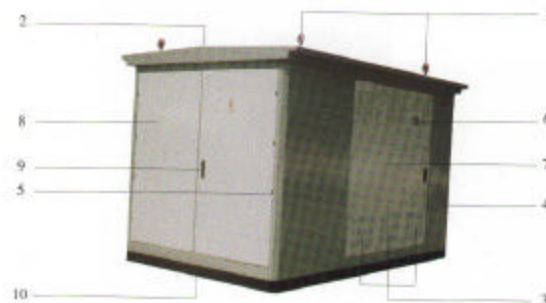
The MV and LV compartments are provided with double doors . All doors are equipped with stainless steel rigid hinges and rigid locking devices . Also all doors are equipped with rubber gaskets to keep a high degree of protection .



The kiosk compartments :

### 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



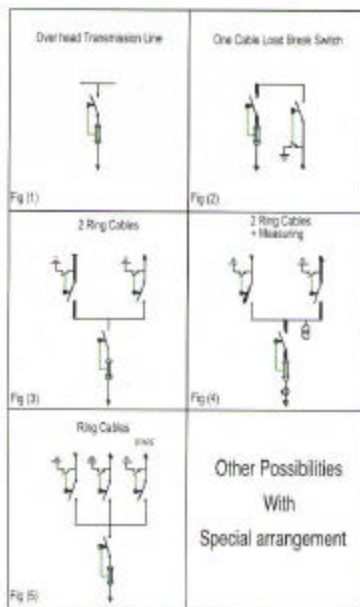
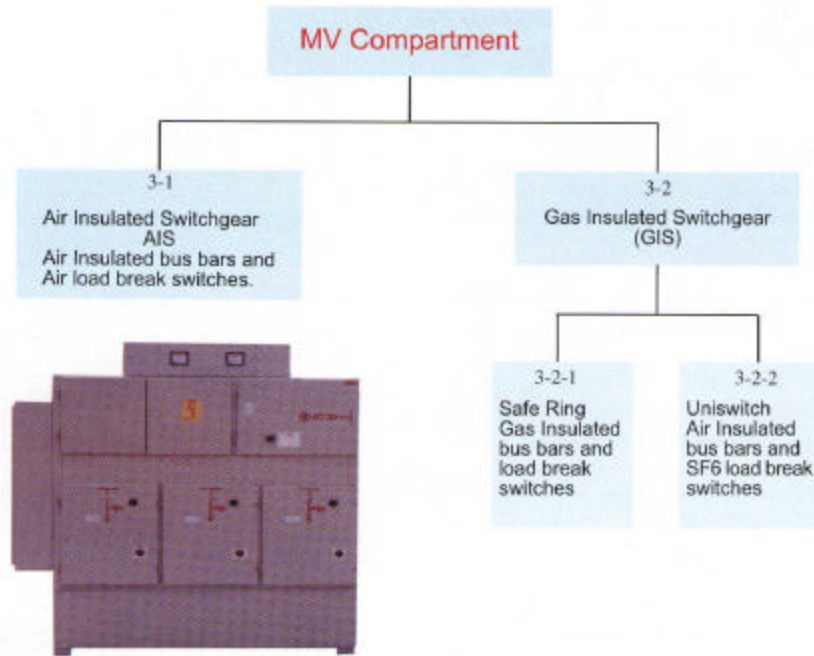
### International Standards

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

### 3. Medium Voltage Compartment



- 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

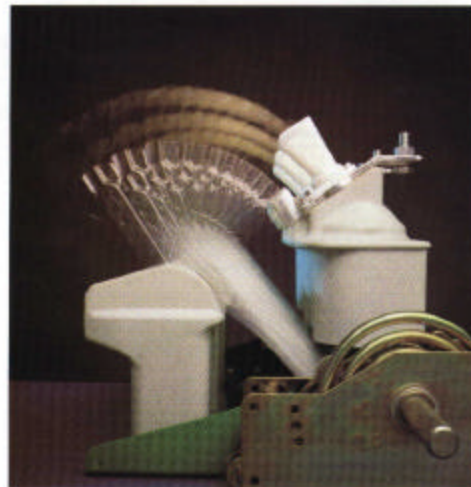
- Currents exceeding their rated current .
- Ring circuits .
- Cables and overhead lines .
- Capacitor banks .

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), 129 (visible isolating distance)





### 3.1.1 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 129, 254 and 694 concerning general purpose switches, IEC publication 420 regarding correct co-operation between switch disconnector and fuse.

Rated voltage	Un	kv	12 kV			17.5 kV			24 kV			
Rated current	In	A	400	630	1250	400	630	1250	400	630	1250	
Max. rated current	I	A	400	630	1150	400	630	1150	400	630	1150	
Short circuit making capacity	I <sub>ma</sub>	kA peak	67	67	67	67	50	50	50	50	50	
Peak withstand current	I <sub>dyn</sub>	kA peak	75	75	75	50	50	50	50	50	50	
Short time current	1 sec. <sup>4)</sup>	I <sub>th</sub>	kA off	30	30	30	25	25	25	20	20	20
	2 sec.	"	"			25			20 <sup>6)</sup>	20 <sup>6)</sup>	20	
	3 sec.	"	"	20	20	20			16	16	16	
Mainly active load breaking capacity <sup>1)</sup> (test duty 1 and 2, IEC 265)	I	A	400	630	1250	400	630	1250	400	630	1250	
Mainly capacitive breaking capacity (test duty 4, IEC 265)	I	A	150	150	150	45	45	45	80	80	80	
Mainly inductive breaking capacity cos φ = 0,15	A	A	16	16	16	16	16	16	16	16	16	
Rated earth fault breaking capacity, IEC 265												
Earth fault breaking capacity, fig. 6	I	A	150	150	150	70	70	70	25	25	25	
Capacitive breaking capacity, fig. 7	I	A	90	90	90	40	40	40	21*	21*	21*	
			* at 20,6 kV									
Max. breaking capacity in co-operation with fuses (IEC 420 1990-11)	A	A	1600	1600		800	800		800	800		
max. fuse size 5)	In	A	125	125		63	63		63	63		
Power frequency withstand voltage 50 Hz 1 min.												
- to earth and between poles		kV		35			46			55		
- across isolating distance		kV		45			60			70		
Impulse withstand voltage 1,2/50 us.												
- to earth and between poles		kV		75			95			125		
- across isolating distance		kV		85			110			145		
Pole distance	P	mm	150 and 210			170			235 and 275			
Max. operating torque at:												
- closing K/A mech.		Nm	115 - 120 Nm									
- opening K/A mech.		Nm	K-mech. 120 Nm / A-mech. 3 Nm									
Operating angle on the shaft		degrees	130									
Opening time		ms	40 - 60									
Arc time		ms	10 - 20									

#### Earthing switch type E<sup>2)</sup> for NAL/NALF and type EB

Rated voltage	Un	kv	12	17,5	24	
Peak withstand current <sup>3)</sup>	I <sub>dyn</sub>	kA peak	62/75	40/62	38/50	
Short time current	1 sec.	I <sub>th</sub>	kA off	30	25	20
	2 sec.	"	"	25	20	
	3 sec.	"	"	20	16	
Short circuit making capacity <sup>4)</sup>	I <sub>ma</sub>	kA peak	62/67	40/62,5	39/50	
Test voltage 50 Hz 1 min.		kV	35	45	55	
Power frequency withstand voltage 1,2 / 50 us.		kV	75	95	125	
Pole distance	P	mm	150 and 210		170	235 and 275

<sup>1)</sup> Mechanical interlocking can be fitted, but not for KS - mechanism.

<sup>2)</sup> At In = 630 A, 100 x CO. At In = 1250 A, 20 x CO.

<sup>3)</sup> When fed from switch disconnector/earthing switch side.

<sup>4)</sup> Also available for 25 kA 2 sec. with reinforced frame.

<sup>5)</sup> 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

Line voltage (KV)	TRANSFORMER RATINGS (KVA)																
	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
HIGH VOLTAGE FUSE LINKS In (A)																	
3	25	25	40	40	63	63	63	100	100	100	160	2X100	2X160				
5	16	25	25	25	40	40	63	63	63	100	100	100	160	2X100	2X160		
6	16	16	25	25	25	40	40	63	63	63	100	100	100	160	2X100	2X160	
10	10	16	16	16	25	25	25	40	40	63	63	63	100	100	100	160	2X100
12	10	16	16	16	16	25	25	25	40	40	63	63	63	100	100	160	160
15	10	10	16	16	16	16	25	25	25	40	40	63	63	63	100	100	2X200
20	10	10	10	16	16	16	16	25	25	25	40	40	63	63	63	100	100
24	10	10	10	10	16	16	16	16	25	2	25	40	40	63	63	63	100



## 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 .

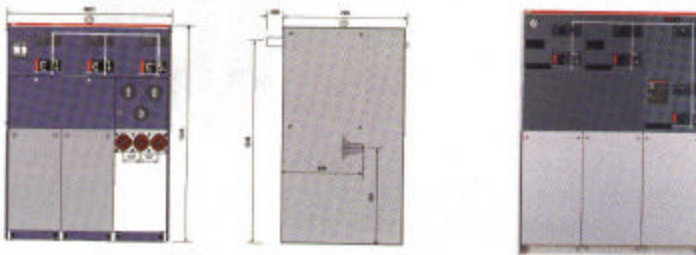
It can be supplied in a number of different configurations suitable for most switching applications in 12/24 KV distribution networks .

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 .



**N.B.**  
Other types of ABB SF6 disconnector could be installed in a special design

#### Technical specification

	C. module		F. module		V. module	
	Switch disconnector	Earthing switch	Switch fuse	Downstream earthing switch	Vacuum circuit breaker	Earthing switch
Rated voltage	kV 12 / 17,5 / 24	12 / 17,5 / 24	12 / 17,5 / 24	12 / 17,5 / 24	12 / 17,5 / 24	12 / 17,5 / 24
Power frequency withstand voltage	kV 28/ 38 / 50	28/ 38 / 50	28/ 38 / 50	28/ 38 / 50	28/ 38 / 50	28/ 38 / 50
Inputs withstand voltage	kV 95 / 95 / 125	95 / 95 / 125	95 / 95 / 125	95 / 95 / 125	95 / 95 / 125	95 / 95 / 125
Rated current	A 630 / 630 / 630		see <sup>1)</sup>			
Breaking capacities:						
closed loop	A 630 / 630 / 630					
off load cable charging	A 135 / 135 / 135					
off load transformer	A		20 / 20 / 20			
earth fault	A 200 / 150 / 150				21 / 16 / 16	
earth fault cable charging	A 115 / 87 / 87				52,5 / 40 / 40	
Short circuit breaking current	kA		see <sup>2)</sup>		21 / 16 / 16	
Making capacity	kA 62,5 / 52,5 <sup>3)</sup> / 40	62,5 / 52,5 <sup>3)</sup> / 40	see <sup>2)</sup>	12,5 / 12,5 / 12,5		52,5 / 40 / 40
Short time current 1 sec.	kA 25 / - / -	25 / - / -		5 / 5 / 5		
Short time current 3 sec.	kA 21 / 21 <sup>3)</sup> / 21	21 / 21 <sup>3)</sup> / 21				21 / 16 / 16

1) Depending on the current rating of the fuse

2) Limited by High Voltage fuse links

3) Test done at 15,2kV

SafePlus is tested according to IEC publications IEC 60129 , IEC 60056, IEC 60420, IEC 60694 and IEC 60298

### 3.2.2 Medium Voltage Compartment Air Insulated switchgear with SF6 L.B.S Uniswitch

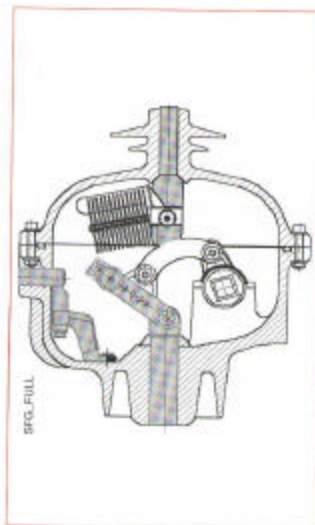
#### Ring Main Unit Type : Uniswitch

UniSwitch, the light 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.



Ring main unit

Light compact distribution switchgear  
**Ring Main Unit** for applications like:  
Residential suburban  
Electrical distribution  
Compact secondary substation



#### 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. 30 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 O/Earth.

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-K3 operating mechanism
- SFG with UES-A3 operating mechanism

#### Optional equipment

Auxiliary contacts:

- closed position 2NO-2NC
- open position 2NO-2NC
- earth position 2NO-2NC

Shunt trip coil:

For SFG with UES-A3 operating mechanism.

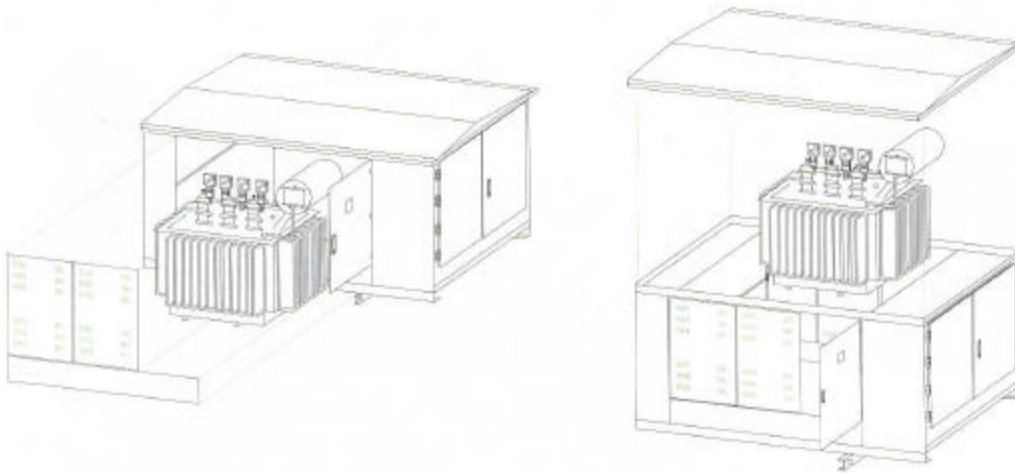
Push-button for mechanical tripping of SFG with UES-A3 operating mechanism.

Motor operation: See item 5.4.

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## 4. Transformer Compartment

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- 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 copper 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 .





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 .

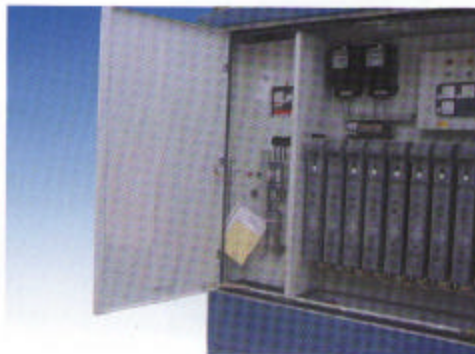


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#### 2- Fused Load Break Switches

For the same example of the 500KVA/12KV 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 MV side 24KV or 2000KVA with MV side 12KV, the outgoing feeders with moulded case circuit breakers may be one of the following:

- Six frame size MCCB 1250A .
- Eight frame size MCCB 400A .
- Twelve frame size MCCB 250A .

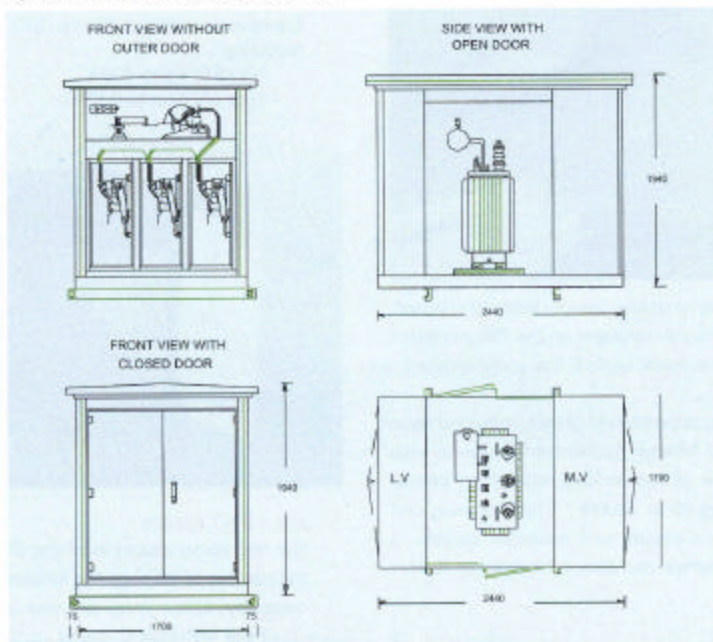
#### N.B

It is available to provide the LV compartment optionally with:

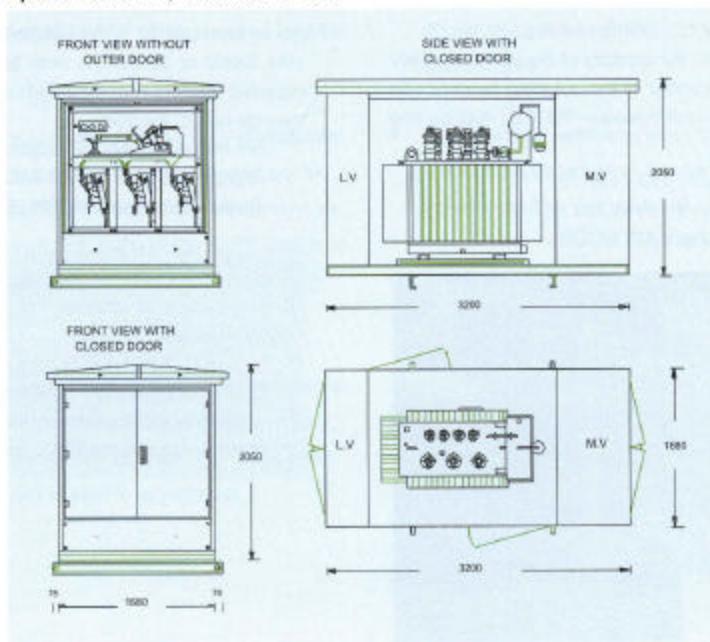
- a) K.W.H. & K.V.A.R.H. for incoming feeder .
- b) Control equipment for street lighting line .
- c) Other specifications for the L.V compartment could be supplied but with special dimensions .

## 6. Drawings & Arrangements

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

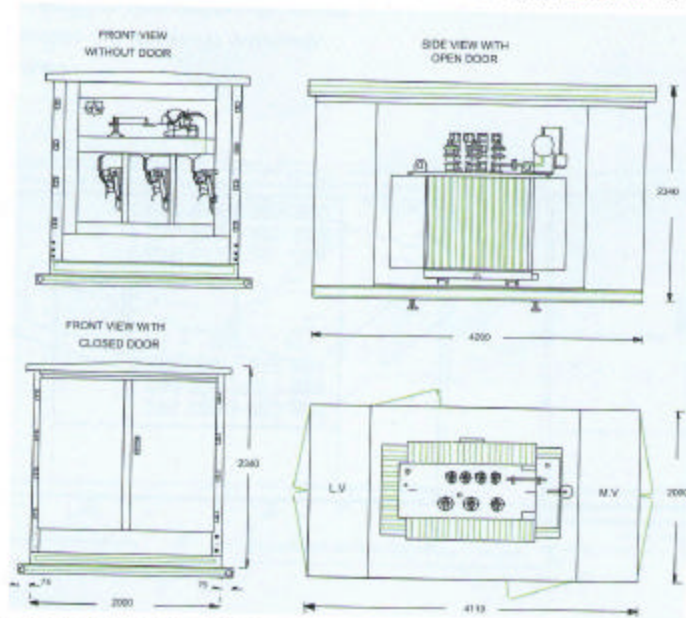


b) - Dimension drawings for transformer substation up to 160 KVA, MV side 12 KV

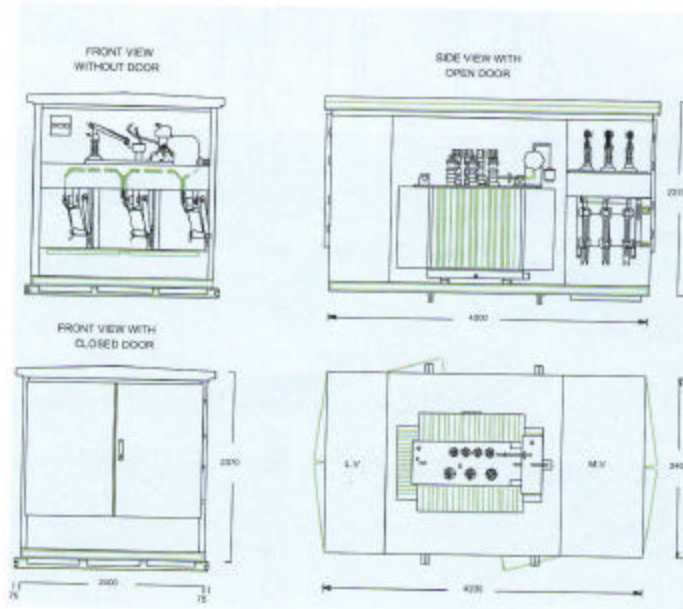


## 6. Drawings & Arrangements

c) - Dimension drawings for transformer substation 1000 KVA, MV side 12 KV

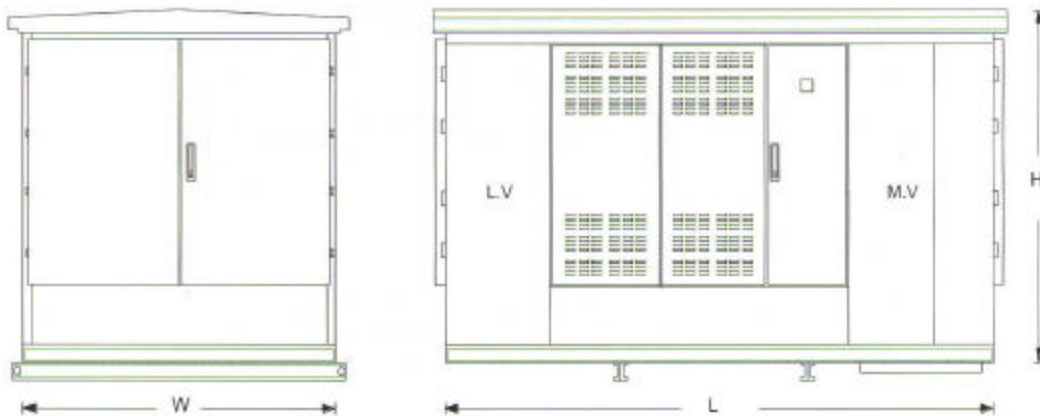


d) - Dimension drawings for transformer kiosk 2000 KVA, MV side 12 KV & 1000 KVA, MV side 24 KV





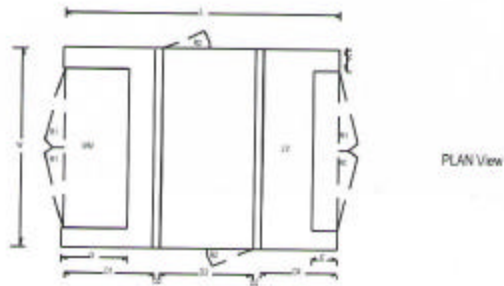
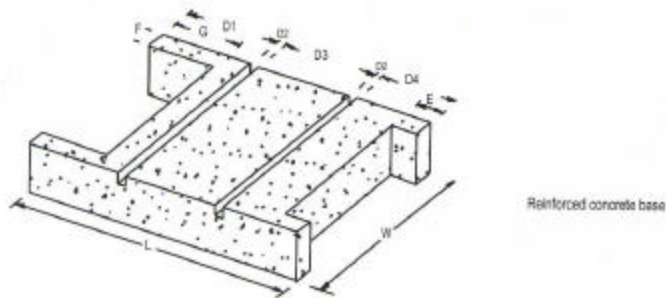
## 7. Dimensions in ( mm )



Kiosk Description	( H ) Height	( W ) Width	( L ) Length	Weight without Transformer
Rating up to 160 KVA Voltage 12 KV Type AB 12-K160	1970 mm	1700 mm	2440 mm	≈ 1.5 ton
Rating up to 500 KVA Voltage 12 KV Type AB 12-K500	2050 mm	1680 mm	3200 mm	≈ 2.4 ton
Rating up to 1000 KVA Voltage 12 KV Type AB 12-K1000	2370 mm	2000 mm	4110 mm	≈ 3 ton
Rating up to 1000 KVA/24KV Rating up to 2000 KVA/12KV Type AB 24/12-K1000/K2000	2370 mm	2400 mm	4200 mm	≈ 3.5 ton

## 8. Recommended Base Foundation

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



Dim	Kiosk Type	L	W	D1	D2	D3	D4	E	F	G	R1	R2
	AB12-K160	2440	1700	700	60	1180	440	400	220	700	929	400
	AB12-K500	3200	1680	800	60	1390	900	400	220	700	929	400
	AB12-K1000	4110	2000	1245	120	1470	1065	400	240	700	940	480
	AB12-K2000	4200	2420	1390	120	1420	1170	400	240	1010	940	490
	AB24-K1000	4200	2420	1390	120	1420	1170	400	240	1010	940	490

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**Samples of previous deliveries**

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