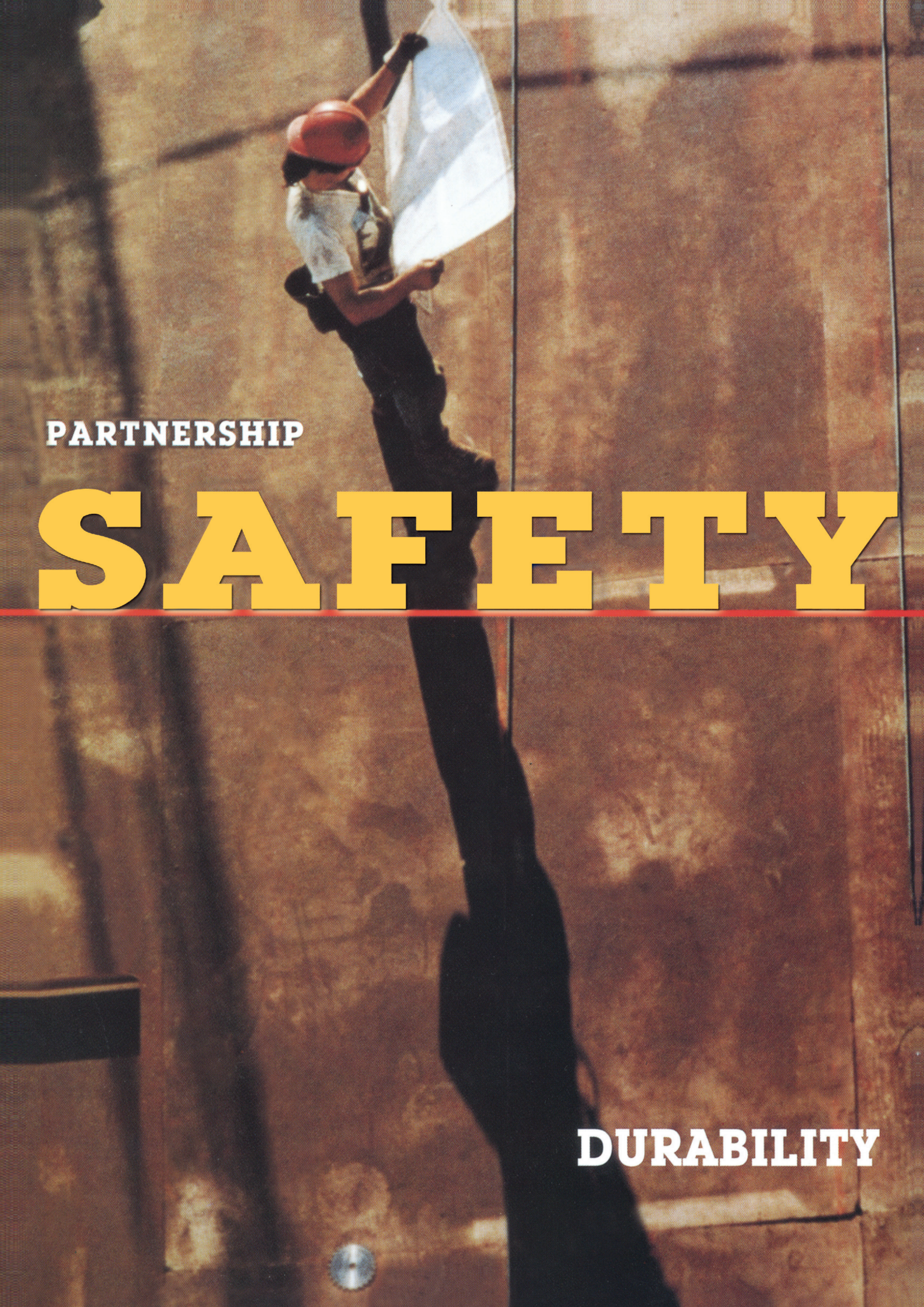
GAS INSULATED RING MAIN UNIT

alfa-R up to 36kV

www.alfanar.com

الفنار alfanar


PARTNERSHIP
SAFETY
DURABILITY

Contents

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SF6-Free RMU Up to 24kV

alfanar

1- Introduction to SF6 Free RMU Up to 24kV

A - SF6-Free RMU Solutions

Welcome to the future of medium voltage distribution with our environmentally-friendly and SF6-free Ring Main Unit (RMU). In a world increasingly focused on sustainability and reducing greenhouse gas emissions, our innovative RMU technology offers a solution that not only meets but exceeds environmental standards.

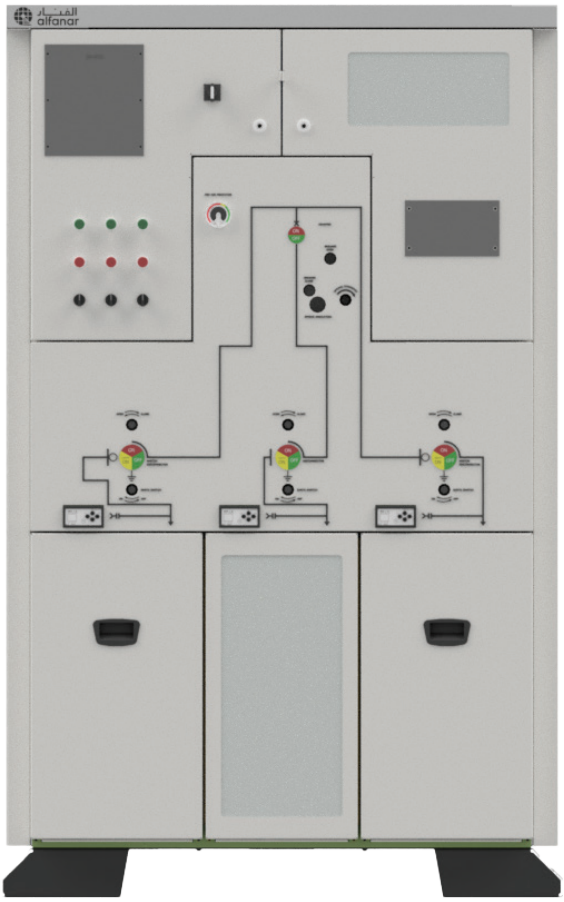
Say goodbye to the use of sulfur hexafluoride (SF6) gas, notorious for its high global warming potential, and embrace a cleaner, greener alternative without compromising on performance or reliability. Join us as we revolutionize medium voltage distribution, paving the way for a more sustainable and responsible energy future.

Environmental Impact of SF6

The environmental ramifications of sulfur hexafluoride (SF6) loom large on the horizon, primarily due to its exceptionally high Global Warming Potential (GWP) and its remarkable persistence in the atmosphere. SF6, though unparalleled in its effectiveness for energy transmission and distribution, possesses a GWP over 23,000 times greater than carbon dioxide over a 100-year period. This staggering metric underscores the potent contribution of SF6 to the greenhouse effect, amplifying the impact of anthropogenic activities on climate change.

Moreover, SF6 has a lengthy atmospheric lifespan, lasting for centuries once released. The traditional reliance on SF6 in energy infrastructure, while ensuring efficient electricity delivery, has consequently become a source of environmental apprehension. The release of SF6 during maintenance, accidents, or at the end of a product's life cycle contributes significantly to the accumulation of greenhouse gases in the atmosphere. This poses a dual challenge—ensuring reliable energy transmission while mitigating the environmental toll of SF6.

Urgency permeates this discourse, prompting a critical reevaluation of our energy infrastructure practices and the imperative to find viable alternatives. As the environmental clock ticks, the quest for SF6-free technologies gains significance, offering a pathway to align the energy sector with sustainable practices and mitigate the pressing environmental concerns associated with SF6 usage.



2- Operating Conditions and Standards

- alfa-R has an embedded hermetically-sealed gas tank filled with dry air having a rated pressure of 1.3 bar, abs. and a minimum operating pressure of 1.05 bar, abs.

- The expected lifetime of the product is more than 40 years with a leakage rate of less than 0.1 % per year.

- No maintenance or gas refilling is required during the lifetime of the alfa-R.

- The main busbar and switching compartment has an IP 67 protection degree rating whereas the other sections of indoor products are rated at IP 41 and the outdoor products are rated IP 54.

Operating conditions:

- Ambient temperature range from -25 °C to 55 °C
- Altitude range of (0-2500 m)*
- Maximum relative humidity of 100%

alfa-R fully complies with the following IEC Standards used under general operating conditions.

	STANDARDS	CLASSIFICATION	
alfa-R	IEC 62271-200	Partition	PM
		Loss of Service Contuinity	LSC 2
		Internal arc	A (FLR) 21 kA-1 s
SWITCH-DISCONNECTOR	IEC 62271-103	General purpose, M2, E3	
CIRCUIT BREAKER	IEC 62271-100	M2, E2 (for cable network)	
DISCONNECTOR	IEC 62271-102	M1, E0	
EARTHING SWITCH	IEC 62271-102	E2	
VOLTAGE DETECTION SYSTEM	IEC 61243-5	Voltage Presence Indicating System (VPIS)	
CABLE BUSHING	IEC 50181	Outer cone plug-in bushing with interface type C	

3- Technical Data Sheet

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-R
Voltage (Ur)	24 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	50 kVrms
- power frequency withstand voltage (Ud) – across the isolating distance	60 kVrms
- lightning impulse withstand voltage (Up) – common value	125 kVpeak
- lightning impulse withstand voltage (Up) – across the isolating distance	145 kVpeak
Frequency (fr)	50/60 Hz
Normal current (Ir)	630 A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	21 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	54.6 kA
Duration of short-circuit (tk – tke)	1 s
Internal arc classification (IAC) (type of accessibility and classified sides)	AFLR
Arc fault current (IA)	21 kA
Arc fault duration (tA)	1 s
Partition class	PM
Loss of service continuity category	LSC 2
Degree of protection	IP54 / IP41
Type of application	indoor/outdoor
Rated supply voltage of auxiliary and control circuits (Ua)	DC 24 V
Type of neutral earthing	Solidly earthed neutral

Technical Data Sheet

Load Break Switch

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-L
Voltage (Ur)	24 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	50 kVrms
- rated impulse withstand voltage	125 kVrms
Main active load breaking current	630A
Closed loop breaking current	630A
Cable charging breaking current	10A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	21 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	54.6 kA
Duration of short-circuit (tk – tke)	1 s
Mechanical endurance	M2
Electrical endurance	E3
Weight	70 Kg
Short circuit duration	1 s
Earth fault breaking current	30A
Operating mechanism	alfa-L
Closing device	24 VDC
Opening device	24 VDC
Motor	24 VDC

Technical Data Sheet

Vacuum Circuit Breaker

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-V
Voltage (Ur)	24 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	50 kVrms
- rated impulse withstand voltage	125 kVrms
DC component (referred to time constant = 45 ms)	55%
Minimum opening time	20 ms
Frequency (fr)	60 Hz
Normal current (Ir)	630 A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	21 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	54.6 kA
Duration of short-circuit (tk – tke)	1 s
Mechanical endurance	M2
Electrical endurance	E2
Weight	90 kg
Rated operating sequence	O 0.3s - CO - 3min - CO
Applied standard	IEC 62271-100
Operating mechanism	alfa-V
Closing device	24 VDC
Opening device	24 VDC
Motor	24 VDC

CONVENTIONAL alfa-R 17.5 kV

1- Introduction to alfa-R 17.5 kV

A - alfa-R Solution

alfa-R units are designed to supply reliable energy and protect electrical equipment in secondary distribution networks up to 36 kV. alfa-R units are the best solution for indoor/outdoor distribution substations as their compact design makes them suitable for various network applications such as transformer substations, wind power plants, industrial zones, etc. alfa-R SF6 gas insulated units offer the following features.

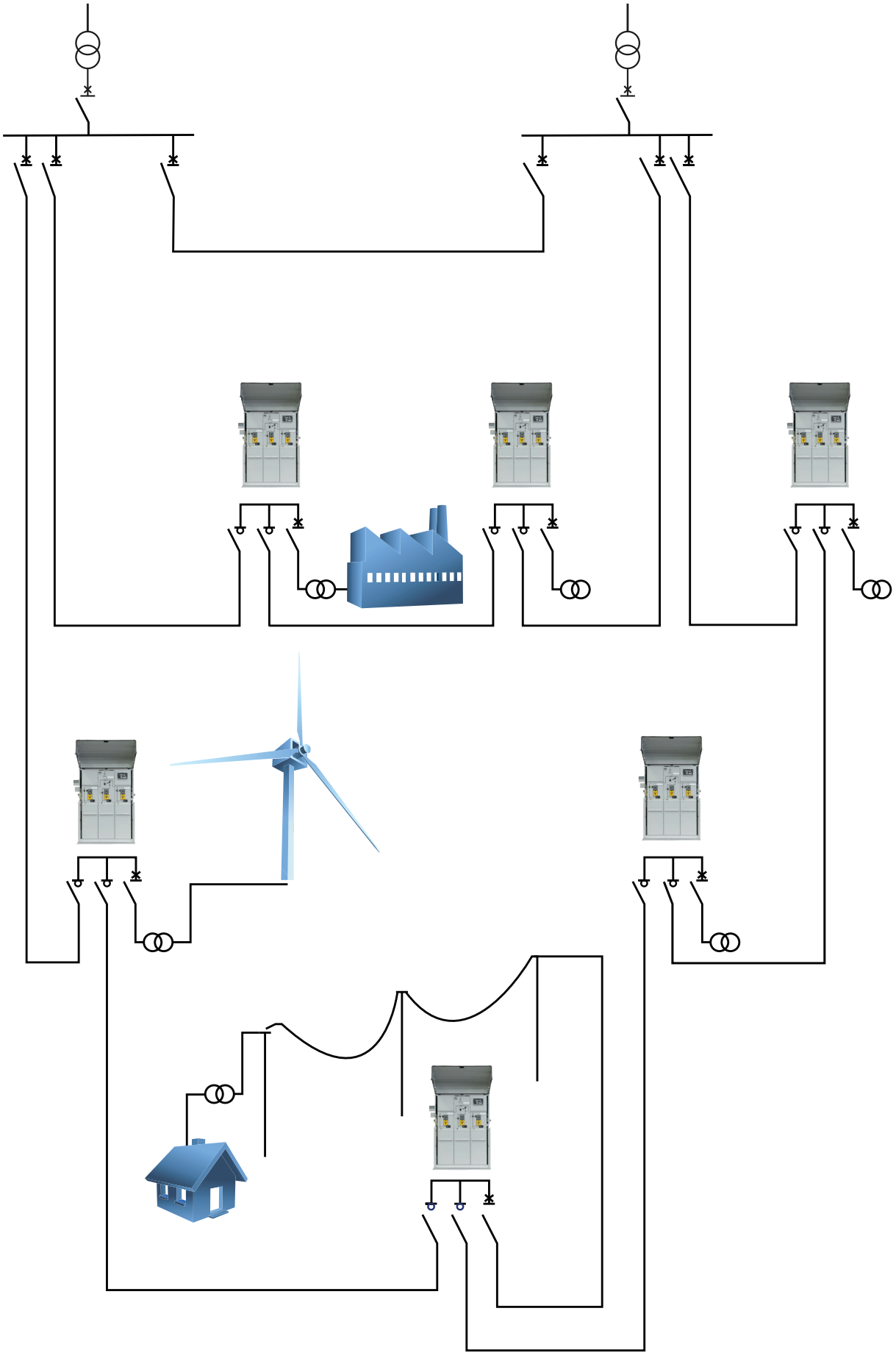
B. Key Features

- Compact design and type tested.
- High-level operator safety, high-level operational reliability.
- Lower filling SF6 gas pressure and lower minimum operating SF6 gas pressure.
- Hermetically sealed pressure system, leakage rate less than % 0.1 per year.
- Resistant to pollution, insensitive to humidity and altitude.
- Modular and compact type (extensible and non-extensible).
- Lower maintenance cost.
- Suitable for remote control and monitoring.
- Comply with relevant IEC and EN standards.
- Compact type RMU's can be manufactured to be extensible for either both sides or for only the left/right side.

C. Safety

- The durable design withstands internal arc, providing protection against thermal and dynamic effects.
- Ability to visually check the position of the Earthing Switch (Close or Open) through the front pane surveillance window.
- Consecutive interlocking systems prevent incorrect operation.
- Access to the cable compartment and fuse compartment is only possible if the related Earthing Switch/Switches are in the earthed position.

2- alfa-R in Power Grids

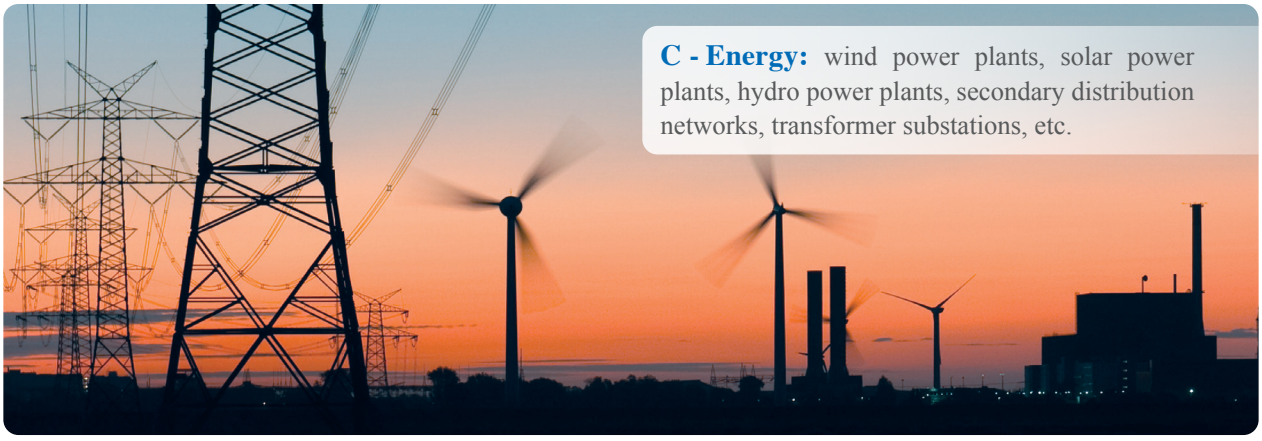


3- Applications

alfa-R units are widely used in the following applications:

A - Infrastructure and buildings: ports, railway stations, airports, hospitals, schools, hotels, malls, commercial centers, holiday resorts, etc.

B- Industries: water, iron and steel, automotive, oil and gas, etc.



C - Energy: wind power plants, solar power plants, hydro power plants, secondary distribution networks, transformer substations, etc.

D - Special applications: high air pollution areas, high humidity areas, etc.

4- Operating Conditions and Standards

- alfa-R has an embedded hermetically-sealed gas tank filled with SF6 gas having a lower filling SF6 gas pressure (1,1 bar, abs.) and lower minimum operating SF6 gas pressure (1,05 bar. abs.).

- The expected lifetime of the product is more than 30 years with a leakage rate of less than 0.1 % per year.

- No maintenance or gas refilling is required during the lifetime of the alfa-R.

- The main busbar and switching compartment has an IP 67 protection degree rating whereas the other sections of indoor products are rated at IP 41 and the outdoor products are rated IP 54.

Operating conditions:

- Ambient temperature range from -25 °C to 55 °C
- Altitude range of (0-1000 m)*
- Maximum relative humidity of 100%

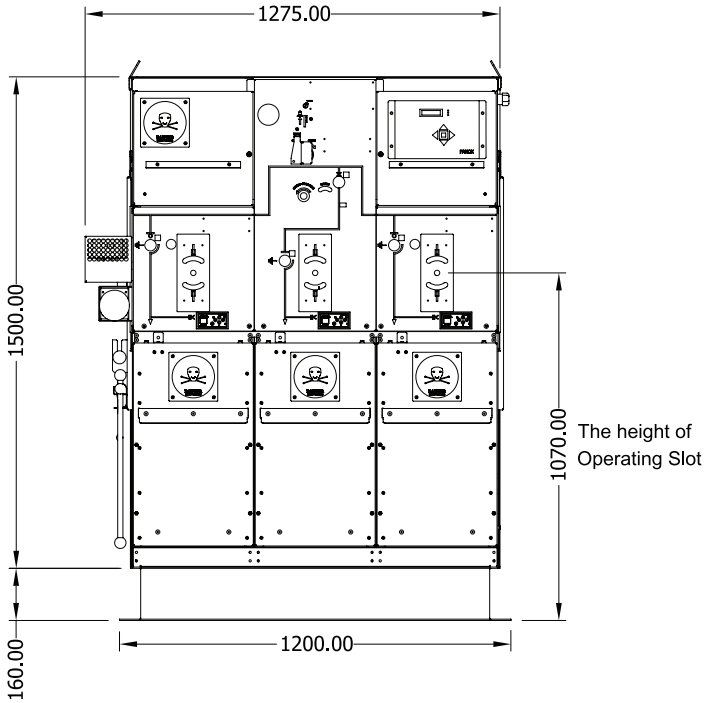
alfa-R fully complies with the following IEC Standards used under general operating conditions.

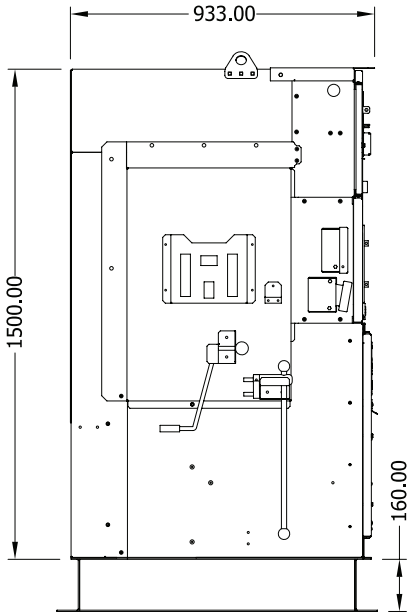
	STANDARDS	CLASSIFICATION	
alfa-R 36	IEC 62271-200	Partition	PM
		Loss of Service Contuinity	LSC 2
		Internal arc	A (FLR) 21 kA-1 s
SWITCH-DISCONNECTOR	IEC 62271-103	General purpose, M2, E3	
CIRCUIT BREAKER	IEC 62271-100	M2, E2 (for cable network)	
DISCONNECTOR	IEC 62271-102	M1, E0	
EARTHING SWITCH	IEC 62271-102	E2	
VOLTAGE DETECTION SYSTEM	IEC 61243-5	Voltage Presence Indicating System (VPIS)	
PLUG-IN BUSHINGS	IEC 50181	Outer cone plug-in bushing	

*: For 1000+ m please contact alfanar

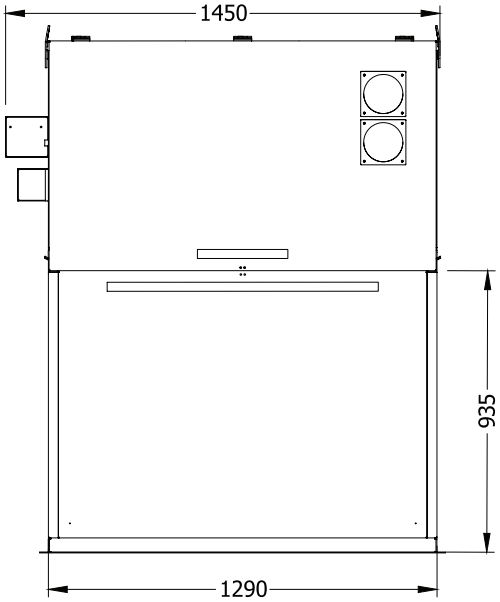
5- alfa-R Ranges and Dimensions

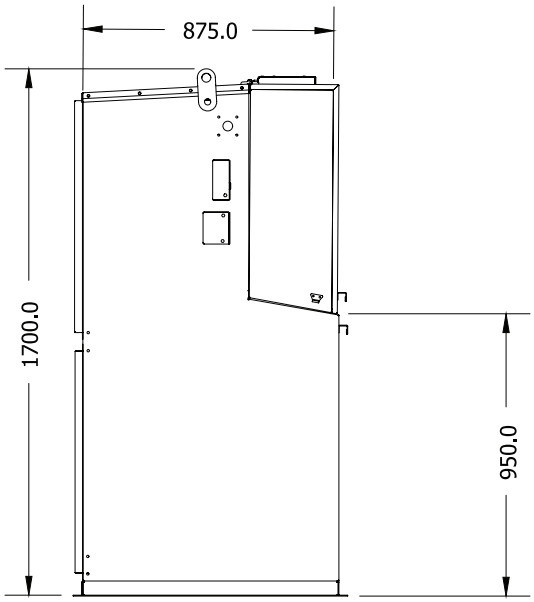
5.1 alfa-R-SBS_21kA(NON-EXTENSIBLE INDOOR)



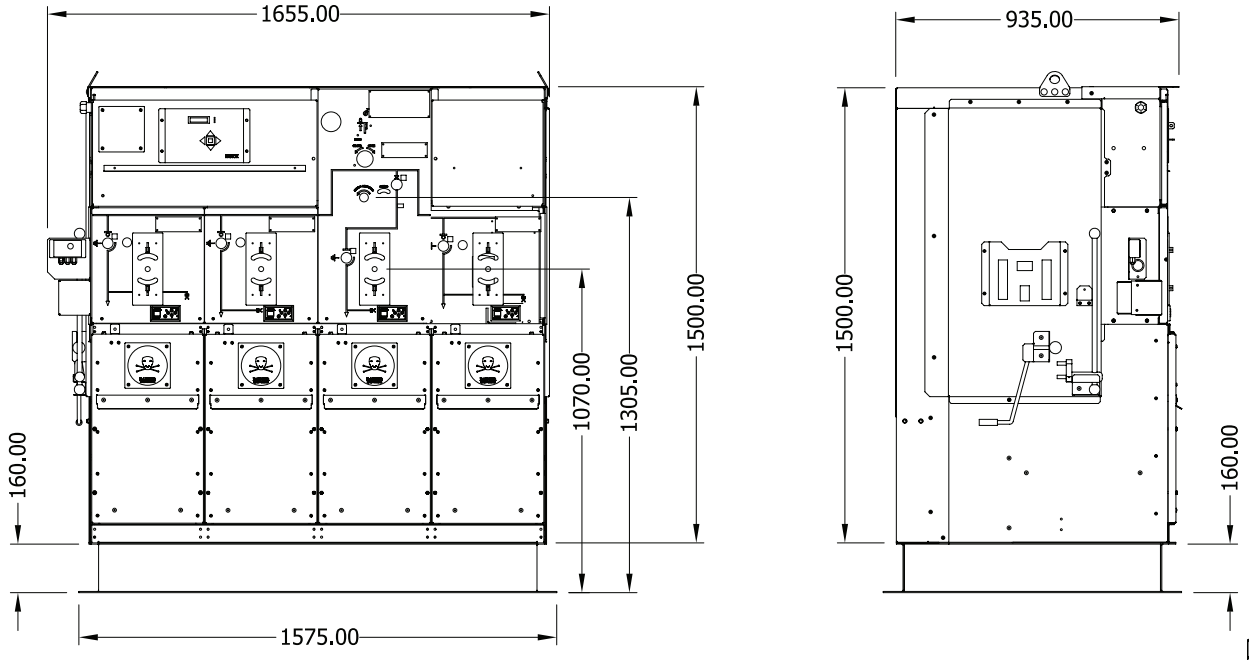


5.2 alfa-R-SBS_21kA(NON-EXTENSIBLE OUTDOOR)

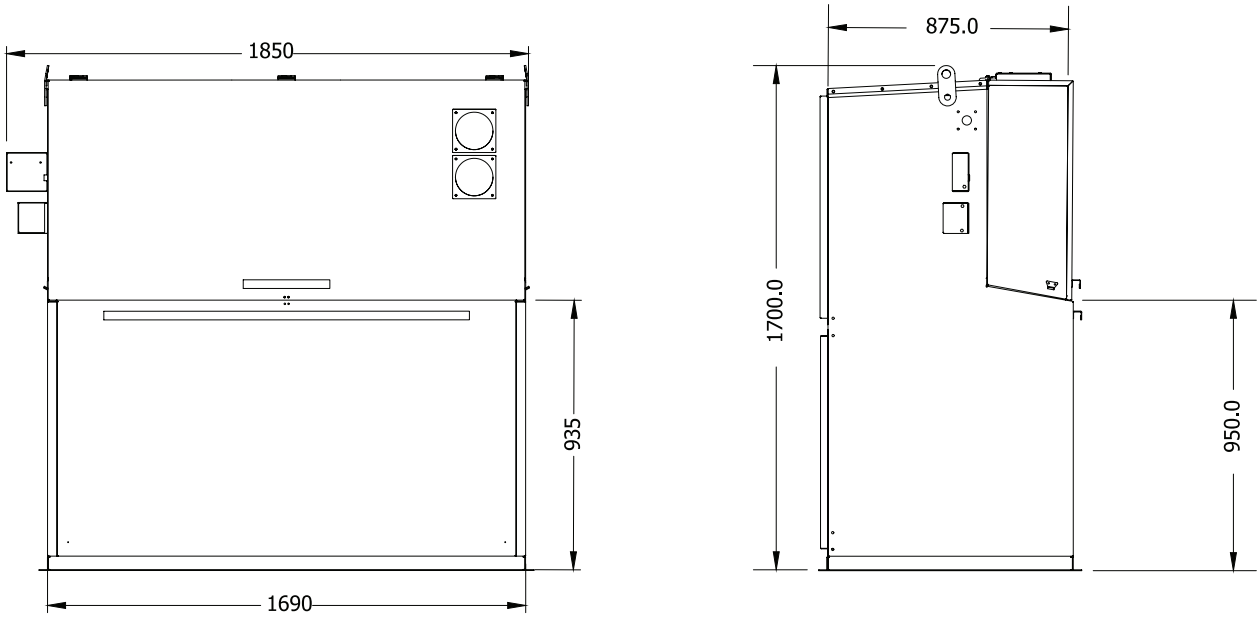




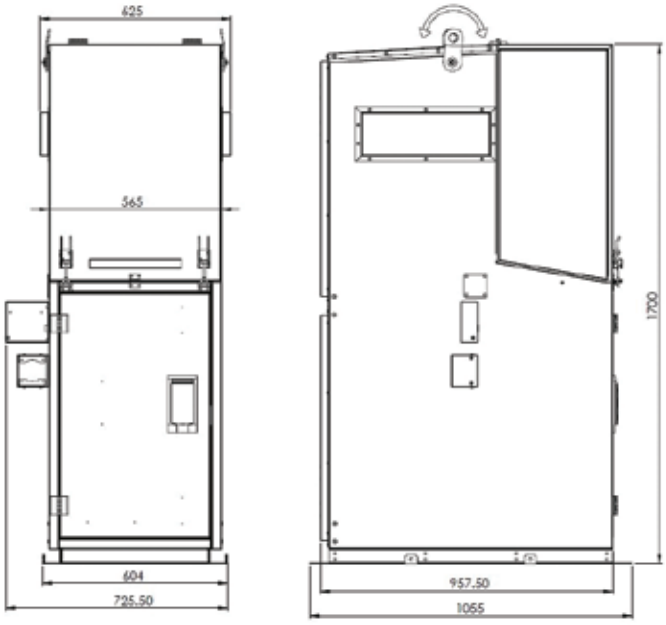
5.3 alfa-R-SSBS_21kA(NON-EXTENSIBLE INDOOR)



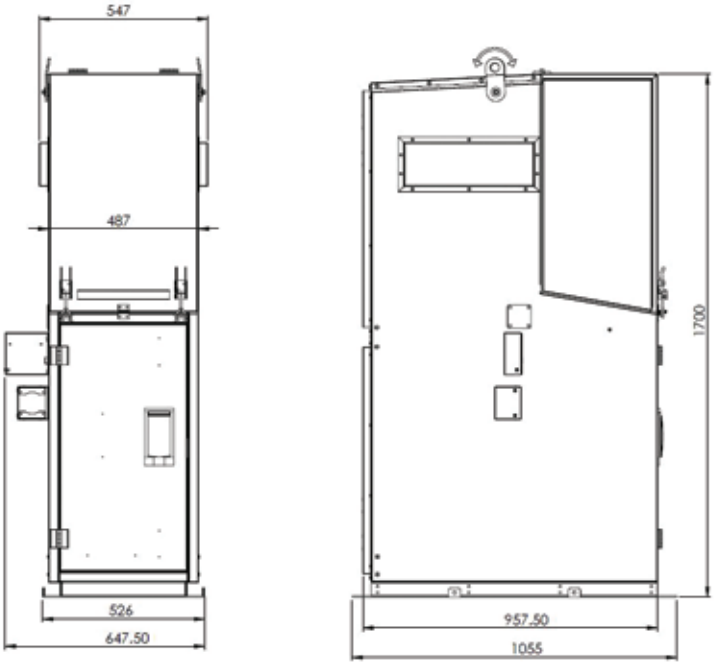
5.4 alfa-R-SSBS_21kA(NON-EXTENSIBLE OUTDOOR)



5.5 alfa-R-B_21kA(EXTENSIBLE OUTDOOR) - Modular



5.6 alfa-R-S_21kA(EXTENSIBLE OUTDOOR) - Modular



6- Technical Data Sheet

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-R
Voltage (Ur)	17.5 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	38 kVrms
- power frequency withstand voltage (Ud) – across the isolating distance	45 kVrms
- lightning impulse withstand voltage (Up) – common value	95 kVpeak
- lightning impulse withstand voltage (Up) – across the isolating distance	115 kVpeak
Frequency (fr)	50/60 Hz
Normal current (Ir)	630 A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	21 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	54.6 kA
Duration of short-circuit (tk – tke)	1 s
Internal arc classification (IAC) (type of accessibility and classified sides)	AFLR
Arc fault current (IA)	21 kA
Arc fault duration (tA)	1 s
Partition class	PM
Loss of service continuity category	LSC 2
Degree of protection	IP54 / IP41
Type of application	indoor/outdoor
Rated supply voltage of auxiliary and control circuits (Ua)	DC 24 V
Type of neutral earthing	Solidly earthed neutral

Technical Data Sheet

Load Circuit Breaker

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-R
Voltage (Ur)	36 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	70 kVrms
- rated impulse withstand voltage	170 kVrms
Main active load breaking current	630A
Closed loop breaking current	630A
Cable charging breaking current	20A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	25 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	65 kA
Duration of short-circuit (tk – tke)	1 s
Mechanical endurance	M1
Electrical endurance	E3
Weight	70 Kg
Short circuit duration	1 s
Earth fault breaking current	60A
Operating mechanism	alfa-R
Closing device	24 VDC
Opening device	24 VDC
Motor	24 VDC

Technical Data Sheet

Vacuum Circuit Breaker

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-R
Voltage (Ur)	36 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	70 kVrms
- rated impulse withstand voltage	170 kVrms
DC component (referred to time constant = 45 ms)	25%
Minimum opening time	33 ms
Frequency (fr)	60 Hz
Normal current (Ir)	630 A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	25 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	65 kA
Duration of short-circuit (tk – tke)	1 s
Mechanical endurance	M1
Electrical endurance	E1
Weight	90 kg
Rated operating sequence	O-0.3-CO3min-Co
Applied standard	IEC 62271-100
Operating mechanism	alfa-R
Closing device	24 VDC
Opening device	24 VDC
Motor	24 VDC

7- Product Construction

Compact alfa-R units are an excellent solution for secondary distribution networks. The units cover all medium voltage functions such as connection, supply and protection of MV equipment for different applications.

Standard Equipment

- 2 (two) feeders with Switch-disconnector:

• Switch-disconnector (three-positioned, open-closed-earthed)
• Integrated capacitive Voltage Presence Indicator System.
• Operating mechanism
• Interface C bushings

- 1 (one) / 2 (two) pc feeder with Vacuum Circuit Breaker:

• Vacuum circuit breaker
• Disconnector with earthing switch
• Over current and earth fault relay
• Current transformer
• Integrated capacitive Voltage Presence Indicator System
• Operating mechanism
• Interface C bushings

- SF6 Gas Pressure Manometer

- Main Busbar, Earthing Bar

- Operating Handle

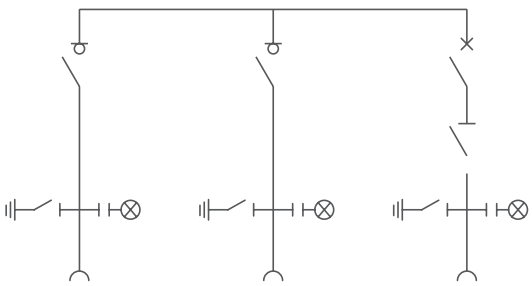
- Pad-locking facility

Optional Equipment

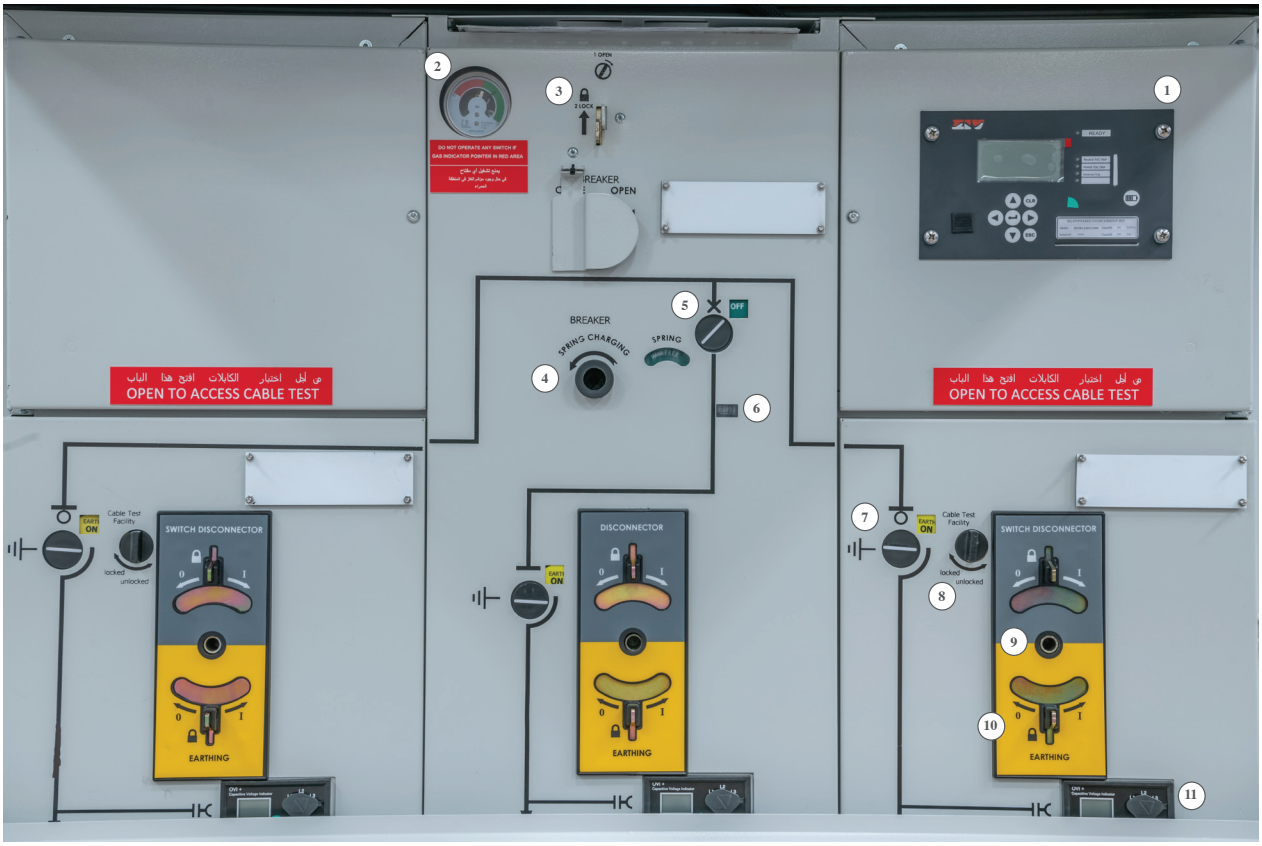
• SF6 Gas Pressure Manometer (hermetic and double contact)
• Remote OPENING and CLOSING operation with cable
• Motor + Gear Box

For Extensible Type Compacts RMU's

• Extension Boots
• Extension Bar
• Screened Plug



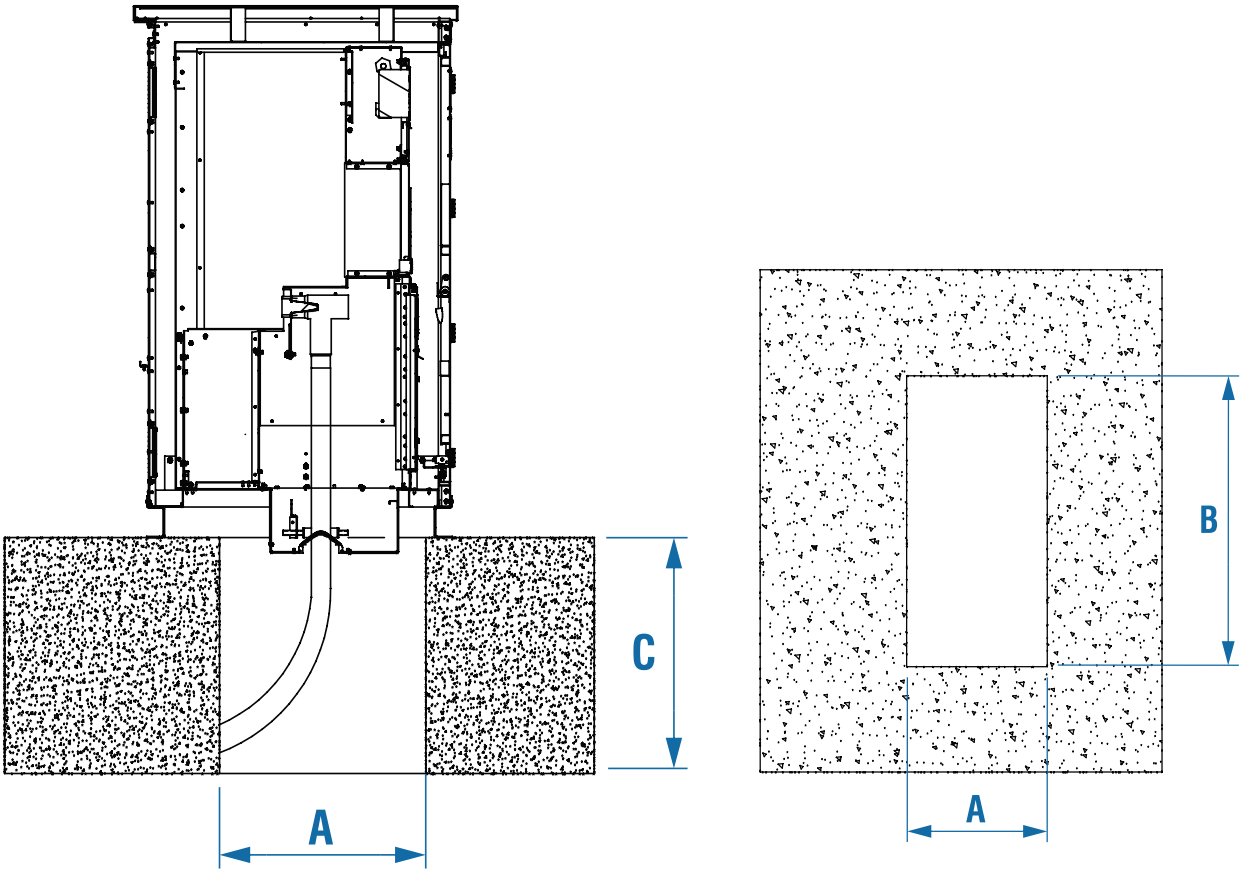
8- Control Panels



1. Self powered protection relay
2. Gas level indicator
3. Pad-lock
4. Circuit breaker operation (motor optional)
5. Position indicator for circuit breaker
6. Operation counter
7. Position indicator for switch disconnector
8. Cable test facility lock
9. Switch-disconnector operation (motor optional)
10. Shutter padlock facility
11. Voltage presence indicator

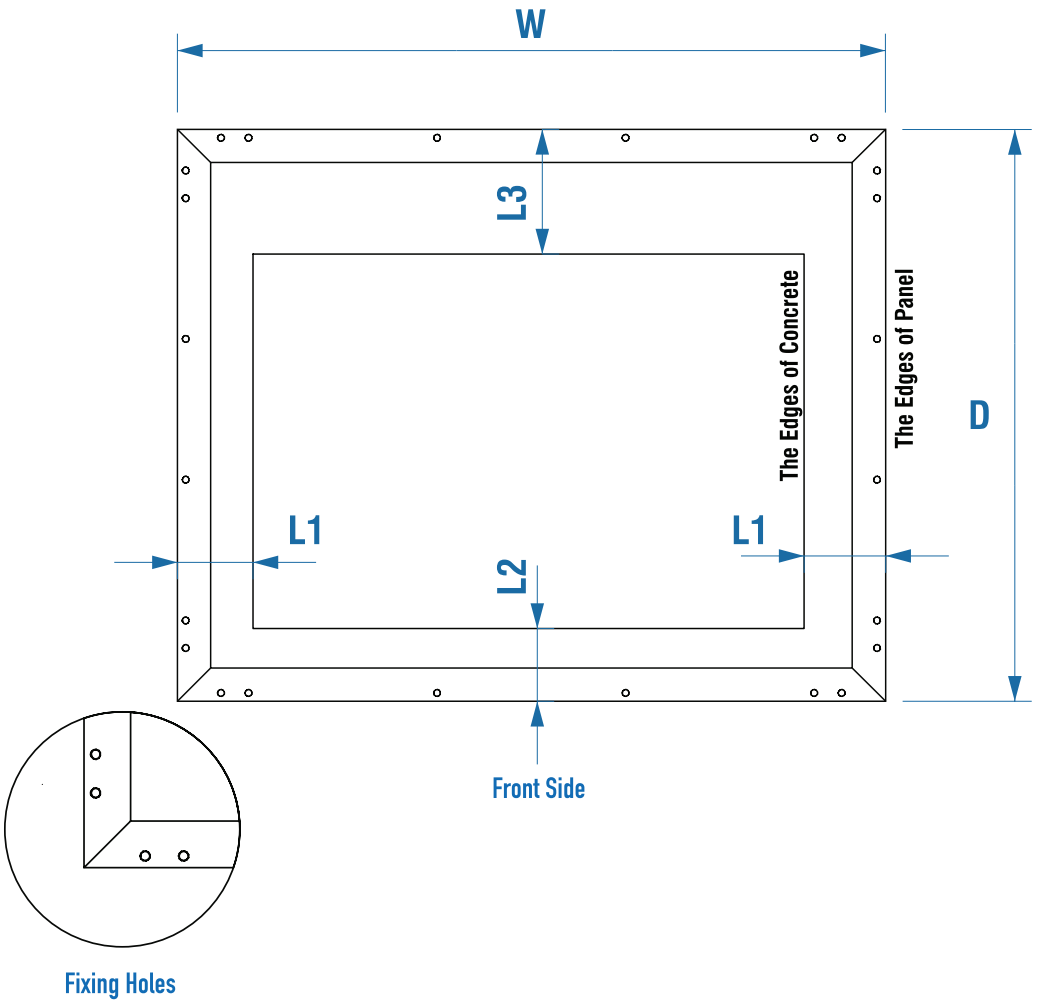
9- MV Cables Connections

The floor must be well leveled and the unit must be fixed with anchor bolts in accordance with the dimensional drawing for the number of modules or units as appropriate.



RMU Type	A mm	B mm	C mm
SBS 3-way Indoor	700	1060	1200
SBS 3-way Outdoor	630	1140	1200
SBBS / SSBS 4-way Indoor	700	1435	1200
SBBS / SSBS 4-way Outdoor	630	1510	1200

The ground where the equipment will be fixed should be prepared in the following manner:



RMU Type	Width (W) mm	Depth (D) mm	L1 mm	L2 mm	L3 mm
3-way Indoor	1200	9	70	75	205
3-way Outdoor	1350	9	105	150	9
4-way Indoor	1575	9	70	75	205
4-way Outdoor	1660	9	105	150	9

alfa-R 36kV

10- Introduction to alfa-R 36kV

A - alfa-R Solution

alfa-R units are designed to supply reliable energy and protect electrical equipment in secondary distribution networks up to 36 kV. alfa-R units are the best solution for indoor/outdoor distribution substations as their compact design makes them suitable for various network applications such as transformer substations, wind power plants, industrial zones, etc. alfa-R SF6 gas insulated units offer the following features.

B. Key Features

- Compact design and type tested.
- High-level operator safety, high-level operation reliability.
- Lower filling SF6 gas pressure and lower minimum operating SF6 gas pressure.
- Hermetically sealed pressure system, leakage rate less than % 0.1 per year.
- Resistant to pollution, insensitive to humidity and altitude.
- Modular and compact type (extensible and non-extensible).
- Lower maintenance cost.
- Suitable for remote control and monitoring.
- Comply with relevant IEC and EN standards.
- Compact type RMU's can be manufactured to be extensible for either both sides or for only the left/right side.

C. Safety

- The durable design withstands internal arc, providing protection against thermal and dynamic effects.
- Ability to visually check the position of the Earthing Switch (Close or Open) through the front pane surveillance window.
- Consecutive interlocking systems prevent incorrect operation.
- Access to the cable compartment and fuse compartment is only possible if the related Earthing Switch/Switches are in the earthed position.

11- Operating Conditions and Standards

- alfa-R has an embedded hermetically-sealed gas tank filled with SF6 gas having a lower filling SF6 gas pressure (1,1 bar, abs.) and lower minimum operating SF6 gas pressure (1,05 bar. abs.).

- The expected lifetime of the product is more than 30 years with a leakage rate of less than 0.1 % per year.

- No maintenance or gas refilling is required during the lifetime of the alfa-R.

- The main busbar and switching compartment has an IP 67 protection degree rating whereas the other sections of indoor products are rated at IP 41 and the outdoor products are rated IP 54.

Operating conditions:

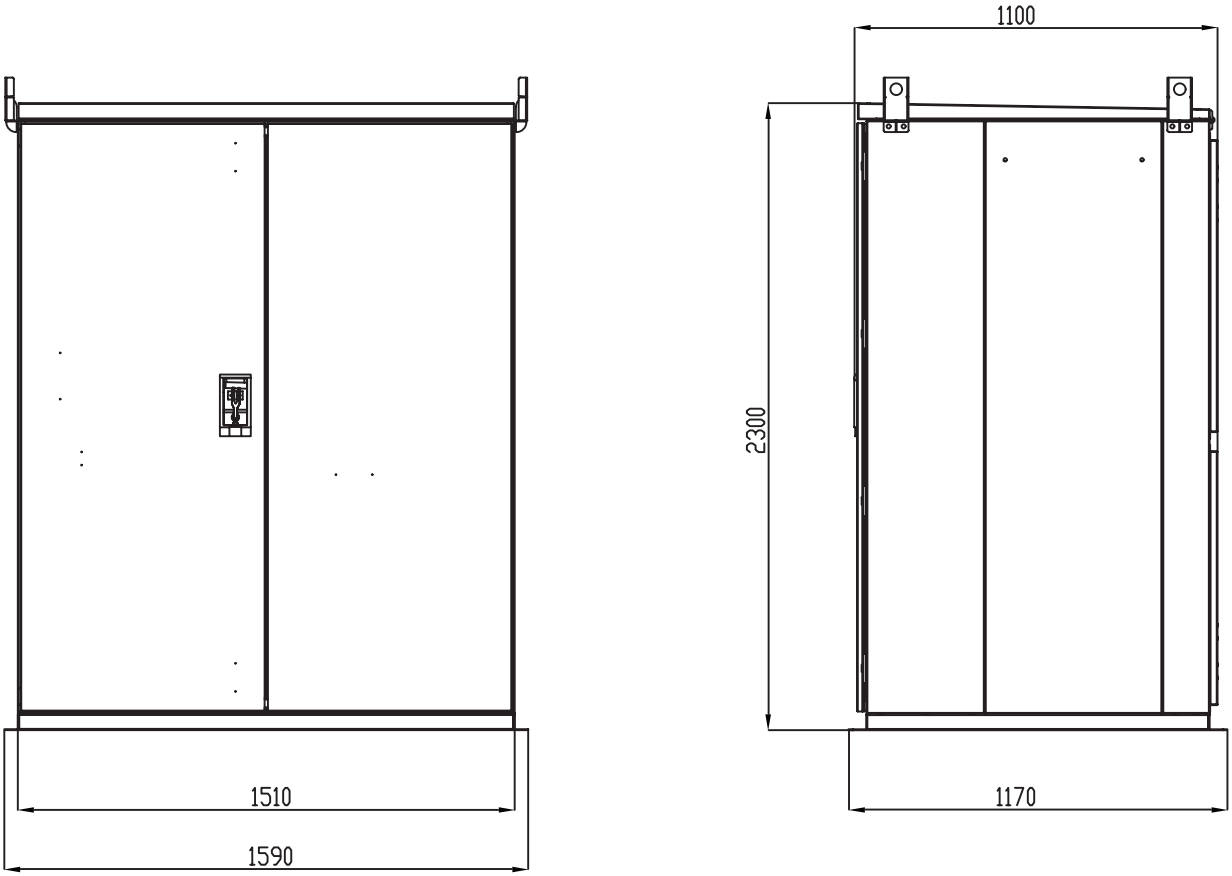
- Ambient temperature range from -25 °C to 55 °C
- Altitude range of (0-1000 m)*
- Maximum relative humidity of 100%

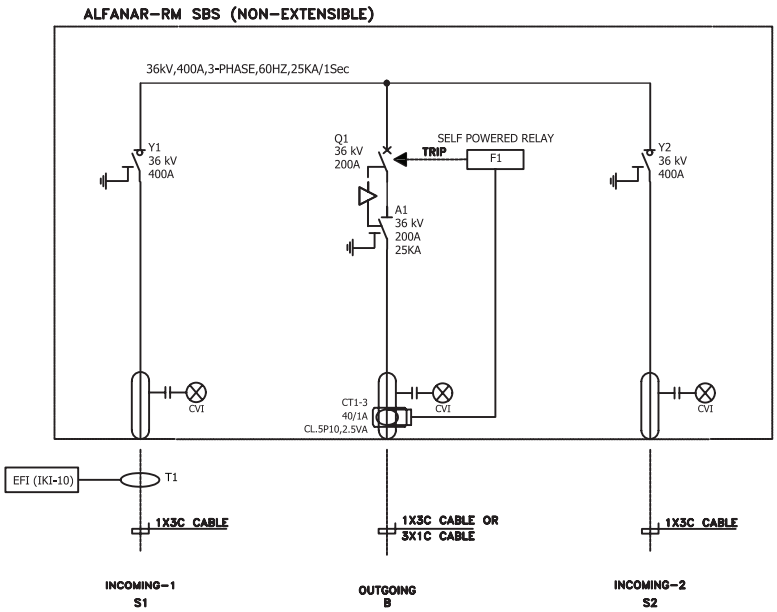
alfa-R fully complies with the following IEC Standards used under general operating conditions.

	STANDARDS	CLASSIFICATION	
alfa-R 36	IEC 62271-200	Partition	PM
		Loss of Service Contuinity	LSC 2
		Internal arc	A (FLR) 25 kA-1 s
SWITCH-DISCONNECTOR	IEC 62271-103	General purpose, M2, E3	
CIRCUIT BREAKER	IEC 62271-100	M2, E2 (for cable network)	
DISCONNECTOR	IEC 62271-102	M1, E0	
EARTHING SWITCH	IEC 62271-102	E2	
VOLTAGE DETECTION SYSTEM	IEC 61243-5	Voltage Presence Indicating System (VPIS)	
PLUG-IN BUSHINGS	IEC 50181	Outer cone plug-in bushing	

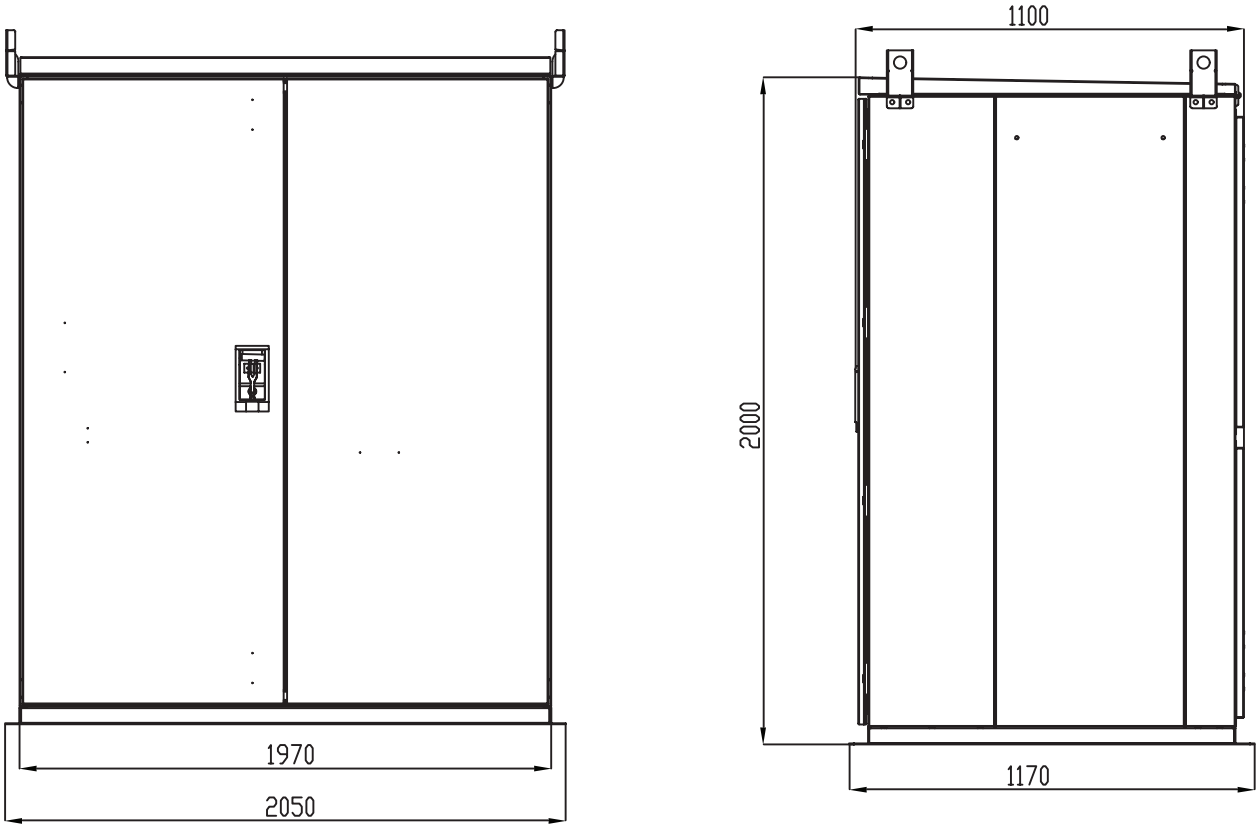
12- alfa-R Ranges and Dimensions

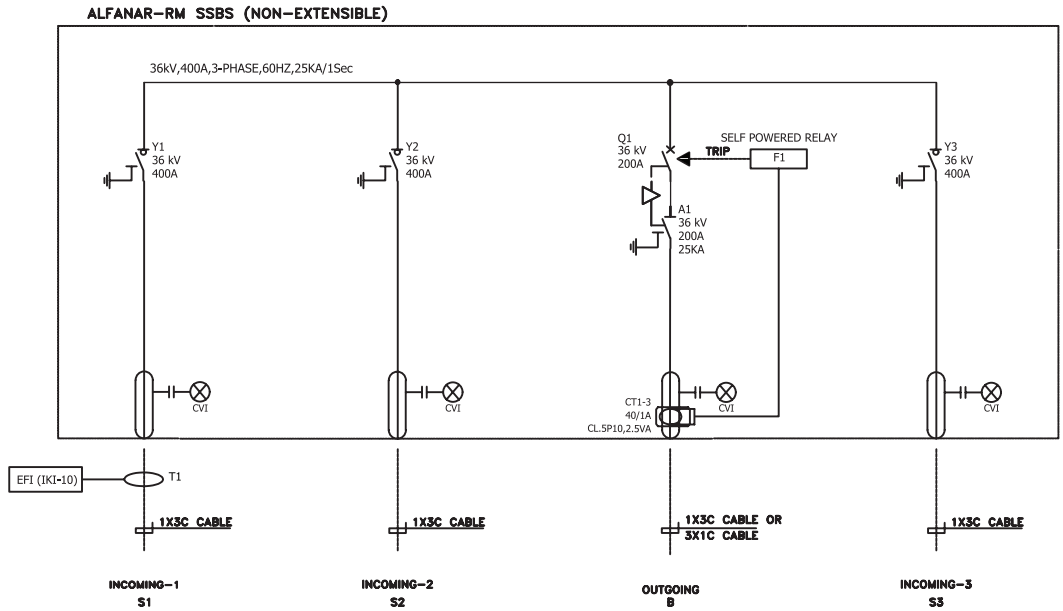
12.1 alfa-R-SBS_25kA(NON EXTENSIBLE OUTDOOR)



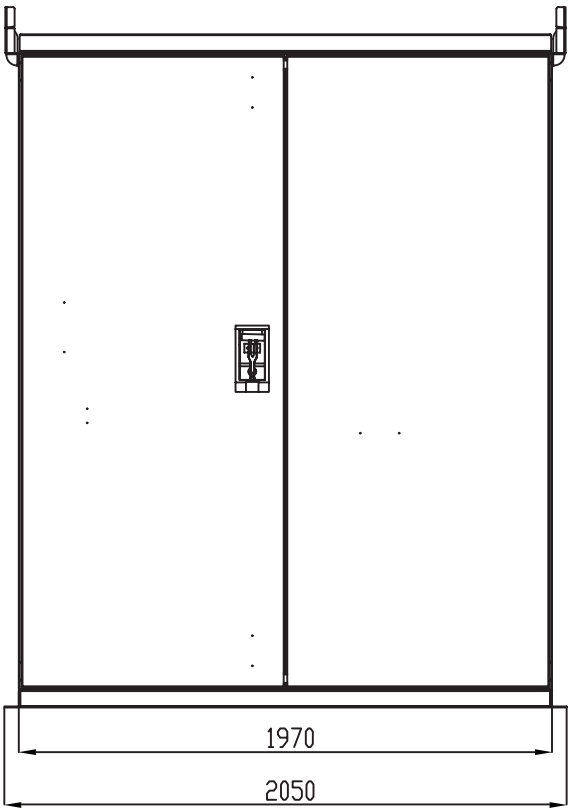


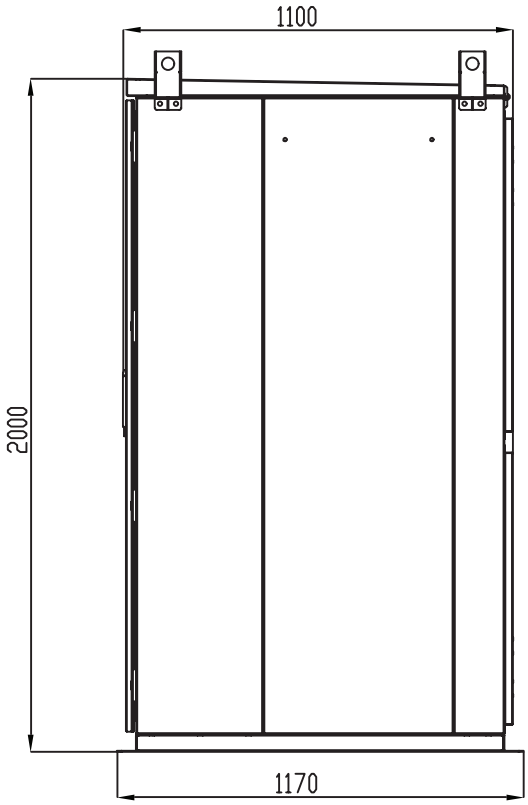
12.2 alfa-R-SSBS_25kA(NON EXTENSIBLE OUTDOOR)

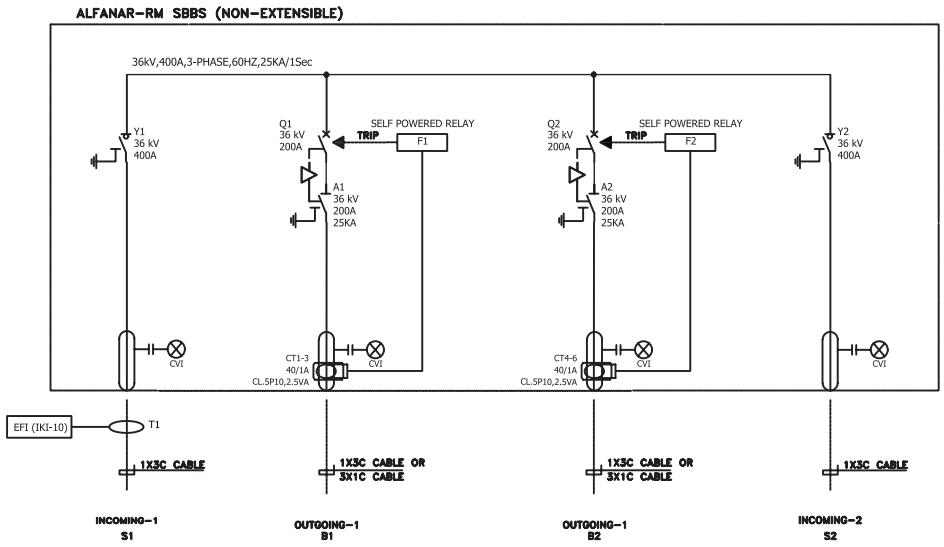




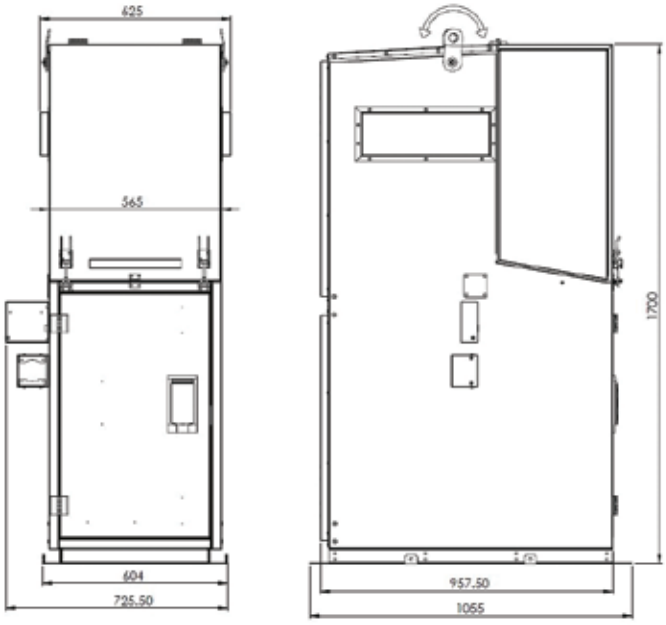
12.3 alfa-R-SBBS_25kA(NON EXTENSIBLE OUTDOOR)



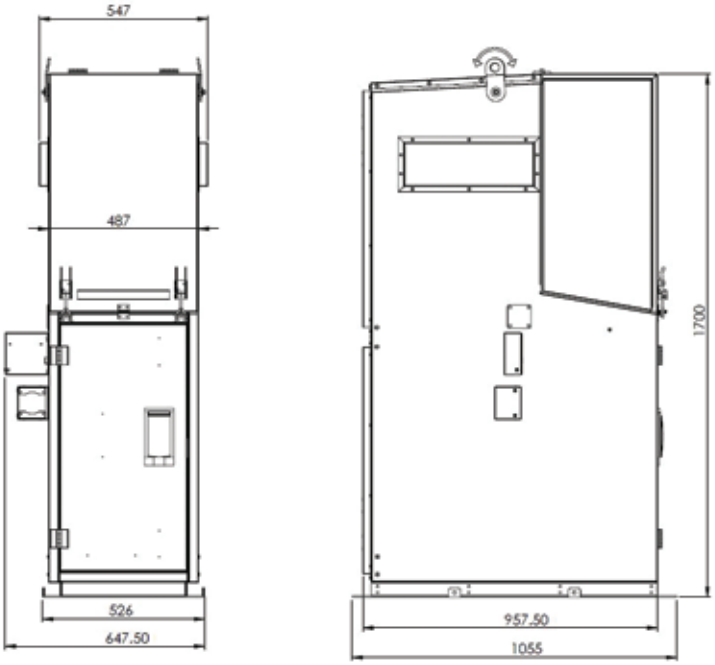




12.4 alfa-R-B_25kA(EXTENSIBLE OUTDOOR) - Modular



12.5 alfa-R-S_25kA(EXTENSIBLE OUTDOOR) - Modular



13- Technical Data Sheet

Electrical Characteristics	
Manufacturer	alfanar Electrical Systems
Type	alfa-R
Voltage (Ur)	36 kV
Insulation level	
- power frequency withstand voltage (Ud) – common value	70 kVrms
- power frequency withstand voltage (Ud) – across the isolating distance	80 kVrms
- lightning impulse withstand voltage (Up) – common value	170 kVpeak
- lightning impulse withstand voltage (Up) – across the isolating distance	200 kVpeak
Frequency (fr)	50/60 Hz
Normal current (Ir)	630 A
Short-time withstand current for main (Ik) and earthing circuits (Ike)	25 kA
Peak withstand current for main (Ip) and earthing circuits (Ipe)	65 kA
Duration of short-circuit (tk – tke)	1 s
Internal arc classification (IAC) (type of accessibility and classified sides)	AFLR
Arc fault current (IA)	25 kA
Arc fault duration (tA)	1 s
Partition class	PM
Loss of service continuity category	LSC 2
Degree of protection	IP54
Type of application	indoor/outdoor
Rated supply voltage of auxiliary and control circuits (Ua)	DC 24 V
Type of neutral earthing	Solidly earthed neutral

14- Main Components

Compact alfa-R units are an excellent solution for secondary distribution networks. The units cover all medium voltage functions such as connection, supply and protection of MV equipment for different applications.

Standard Equipment

- 2 (two) feeders with Switch-disconnector:

• Switch-disconnector (three-positioned, open-closed-earthed)
• Integrated capacitive Voltage Presence Indicator System.
• Operating mechanism
• Interface C bushings

- 1 (one) pc feeder with Vacuum Circuit Breaker:

• Vacuum circuit breaker
• Disconnector with earthing switch
• Over current and earth fault relay
• Current transformer
• Integrated capacitive Voltage Presence Indicator System
• Operating mechanism
• Interface C bushings

- SF6 Gas Pressure Manometer

- Main Busbar, Earthing Bar

- Operating Handle

- Pad-locking facility

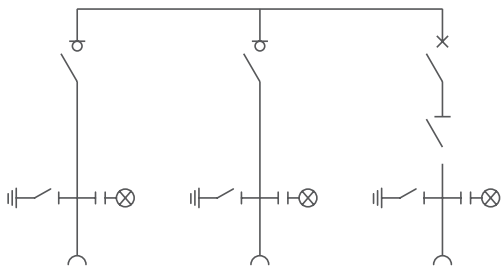
Optional Equipment

• SF6 Gas Pressure Manometer (hermetic and double contact)
• Remote OPENING and CLOSING operation with cable
• Motor + Gear Box

For Extensible Type Compacts RMU's

• Extension Boots
• Extension Bar
• Screened Plug

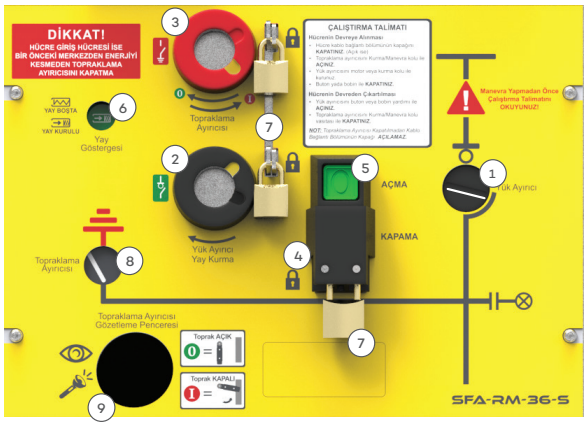
SLD



15- Control Panels

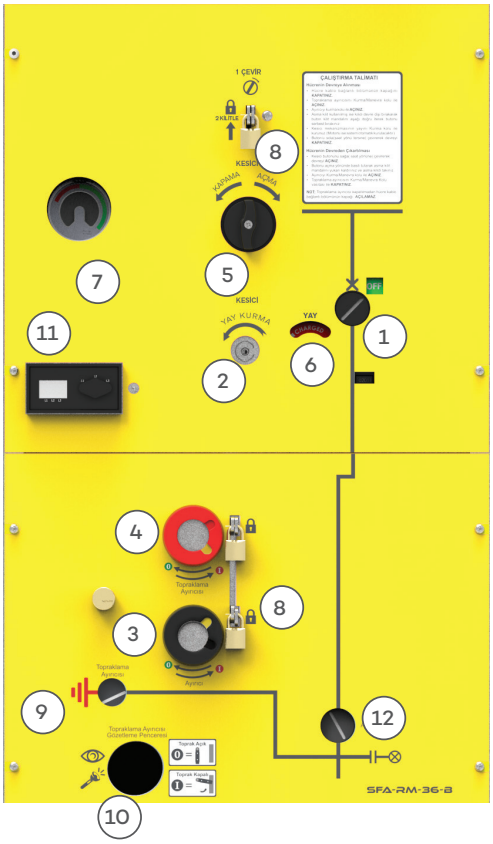
15.1 For Cubicle with Switch-Disconnector

1. Position indicator for switch-disconnector
2. Operating handle slot for switch-disconnector
3. Operating handle slot for earthing switch
4. Push button for closing operation of switch disconnector (mechanically)
5. Push button for opening operation of switch disconnector (mechanically)
6. “Spring Charged” or “Spring Discharged” indicator for switch-disconnector
7. Pad-locking
8. Position indicator for earthing switch
9. Surviallance window (for earthing switch contact position)



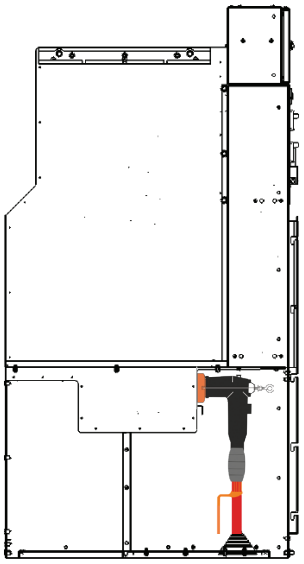
15.2 For Cubicle with Vacuum Circuit Breaker

1. Position indicator for circuit breaker
2. Operating handle shaft for charging spring
3. Operating handle shaft for disconnector
4. Operating handle shaft for earthing switch
5. Thump knot for OPENING and CLOSING
6. “Spring Charged” or “Spring Discharged” indicator for switch disconnector
7. SF6 Gas manometer
8. Padlocking
9. Position indicator for earthing switch
10. Surviallance window (for earthing switch contact position)
11. Voltage presence indicator
12. Position indicator for disconnector



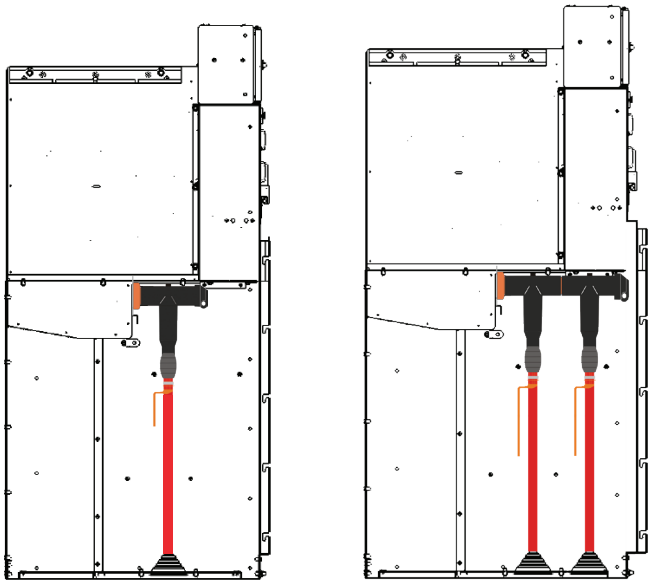
16- MV Cables Connections

Cables connections of the alfa-R.36 is done in the Cables Connections Compartment which is located at the front of the cubicle using Separable Cable Connectors.



Separable Connector Type “L”

Contact Type: Bolted
Rated Current: 630 A
Interface: C



Separable Connector Type “T”

Contact Type: Bolted
Rated Current: 630 A
Interface: C

WARNING!

1. Separable connectors should have type test reports/certificates according to the related standards.
2. Manufacturer’s installation instructions must be followed.
3. Metal screen of the HV cable should be connected to the earthing bar of the cubicle.

Smart RMU up to 36 kV

17- Introduction to Smart RMU

A - Smart RMU

alfa-R - Smart has an integrated (RTU) to provide remote monitoring and control capability via the control center. Connection between the local RTU and control center is established over a secured Virtual Private Network connection (VPN) or through an access point named “APN”

B. Key Features

The exchanged data

- Status information from RTU to data center
- Control signal from control center to RTU
- Analog measurements

Status information from RTU to data center

- Close/Open for each CB/LBS
- Earth status for each circuit
- Lock /Unlock for each circuit
- Selector switch status local/remote
- SF6 Gas pressure low/normal
- Power supply status
- Door Open/Close

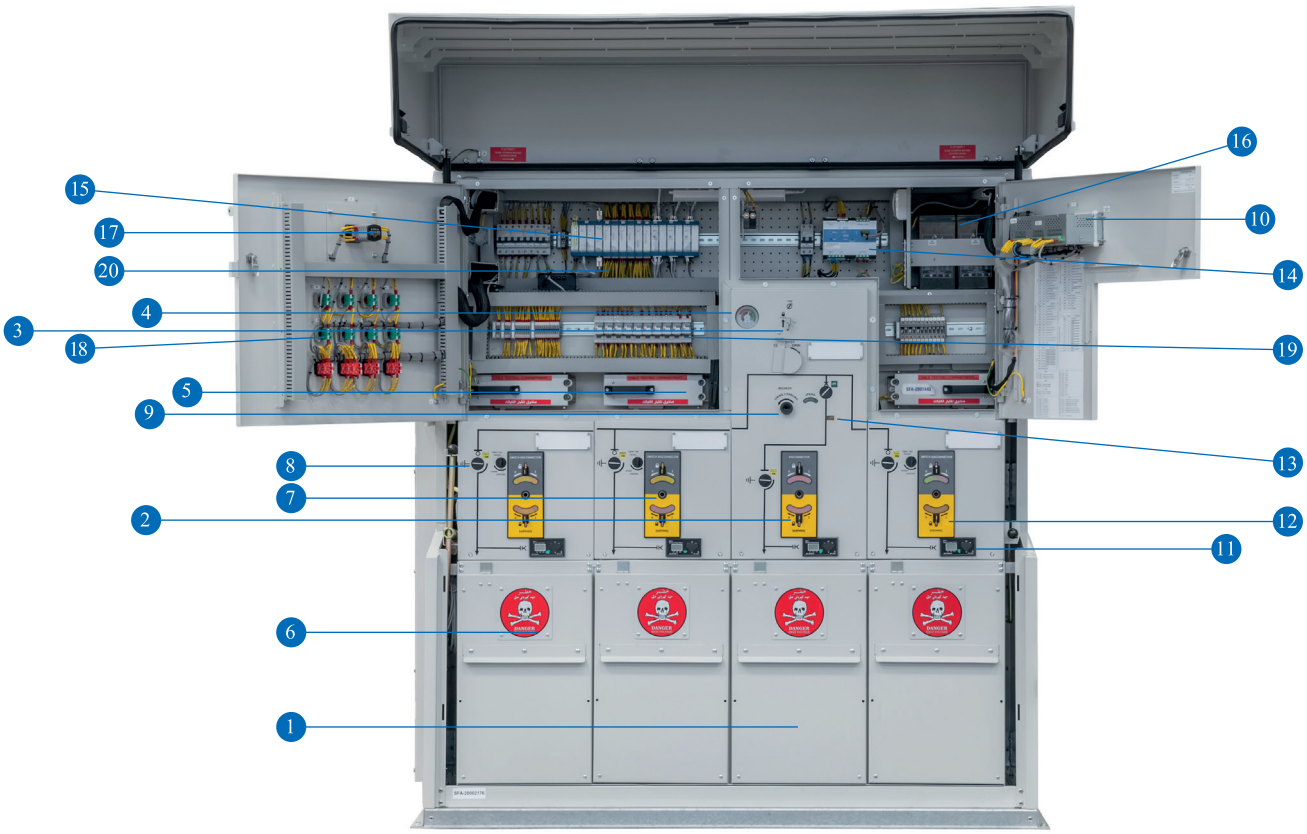
Control command from control center to RTU

- Close/Open for each circuit
- Lock/Unlock for each circuit

Analog measurements

- V_ phase (A,B,C)
- I_ phase (A,B,C)
- Frequency
- Total active power [kW]
- Total reactive power [kVAR]
- Total apparent power [kVA]v

18- Product Breakdown

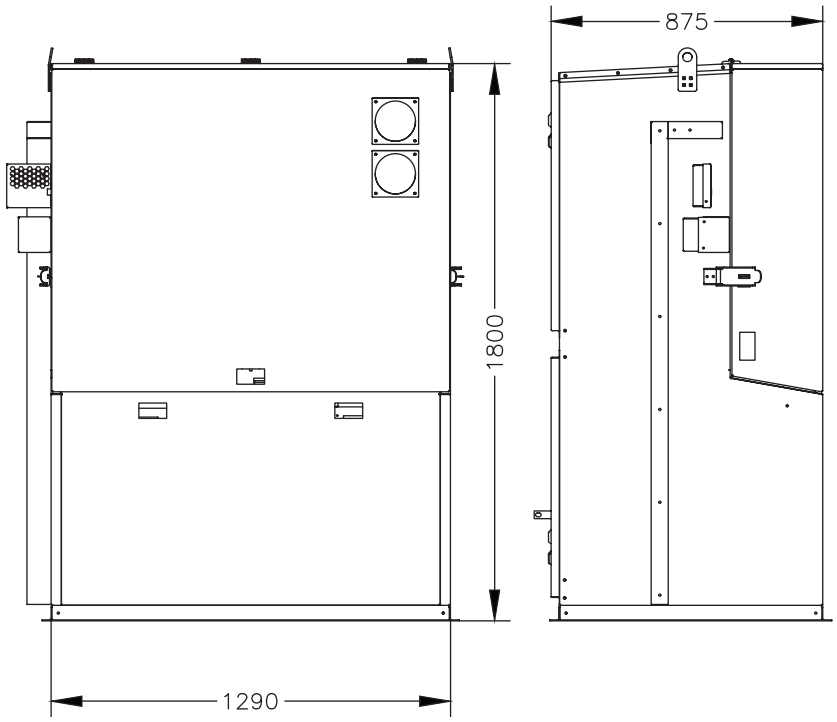


1. Tee-Off Switch Cable Compartment
2. Disconnector Switch
3. Vacuum Circuit Breaker
4. Gas Pressure Indicator
5. Cable Test Compartment
6. Ring Switch Cable Compartment
7. Switch-disconnector Operation (Motor Optional*)
8. Interlocking Knob for Cable Test Compartment
9. Circuit Breaker Operation (Motor Optional*)
10. Protection Relay
11. Voltage Presence Indicator
12. Shutter Padlock Facility
13. Operating Counter
14. Battery Charger
15. RTU
16. Batteries
17. Local / Remote Selector Switch
18. Indication Lamps
19. Interposing Relays

19. Dimensional Drawings

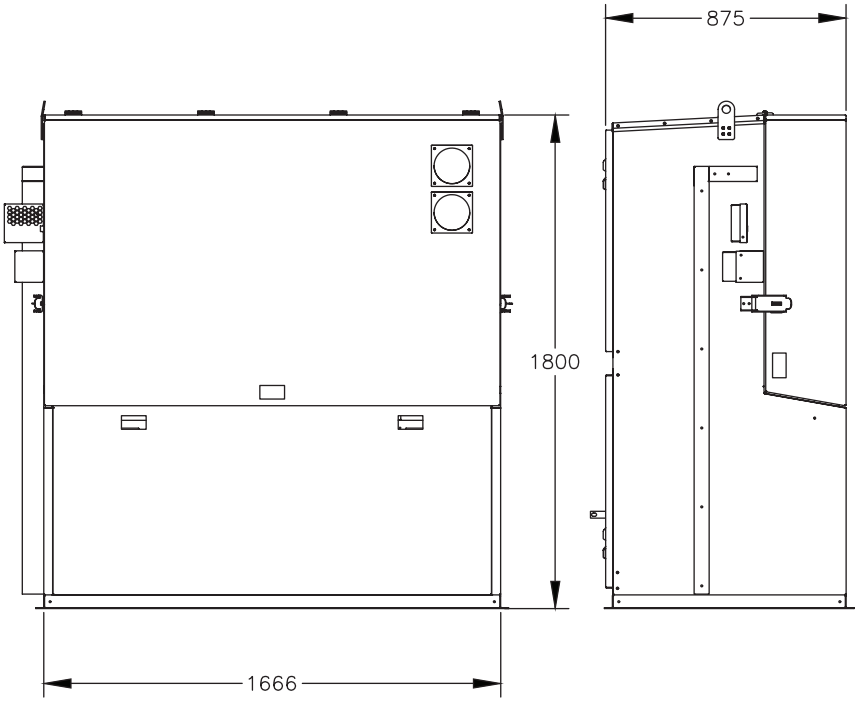
19.1 Smart RMU 17.5 kV

SBS 3-Way Outdoor Type RMU



17.5 kV, 2 ring switches up to 630A + 1 vacuum circuit breaker up to 630A

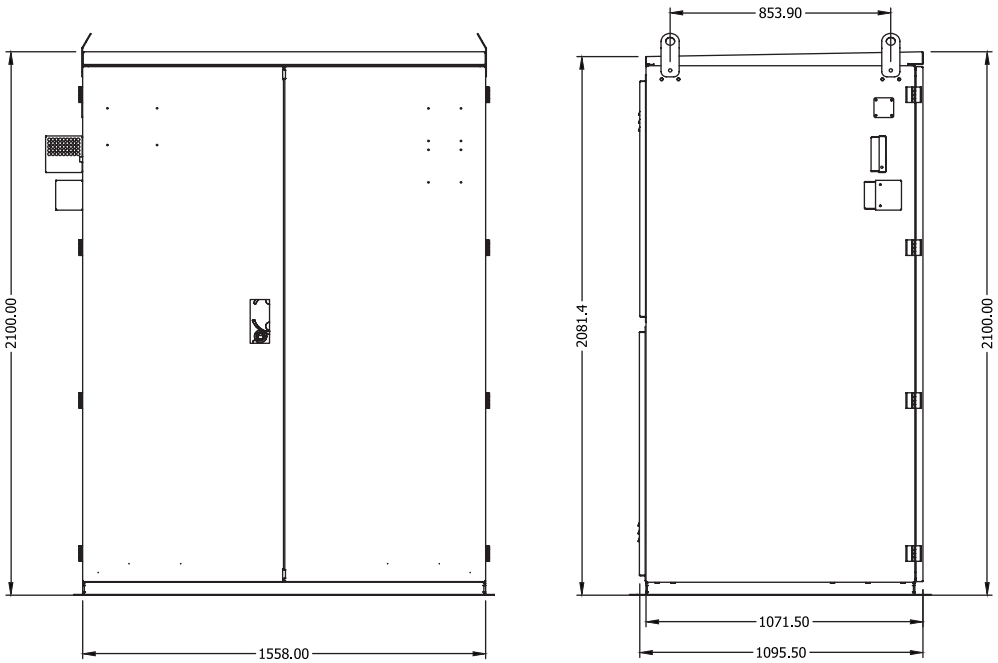
SBBS and SSBS 4-Way Outdoor Type RMU



17.5 kV, 2 ring switches up to 630A + 2 vacuum circuit breakers up to 630A
17.5 kV, 3 ring switches up to 630A + 1 vacuum circuit breaker up to 630A

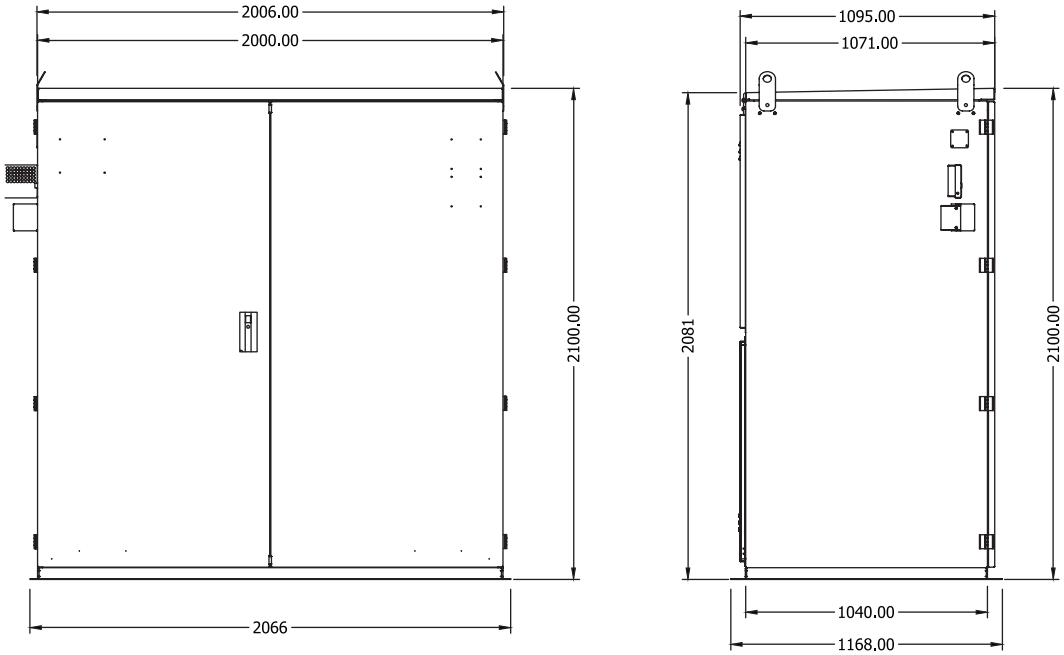
19.2 Smart RMU 36 kV

SBS 3-Way Outdoor Type RMU



36 kV, 2 ring switches up to 630A + 1 vacuum circuit breakers up to 630A

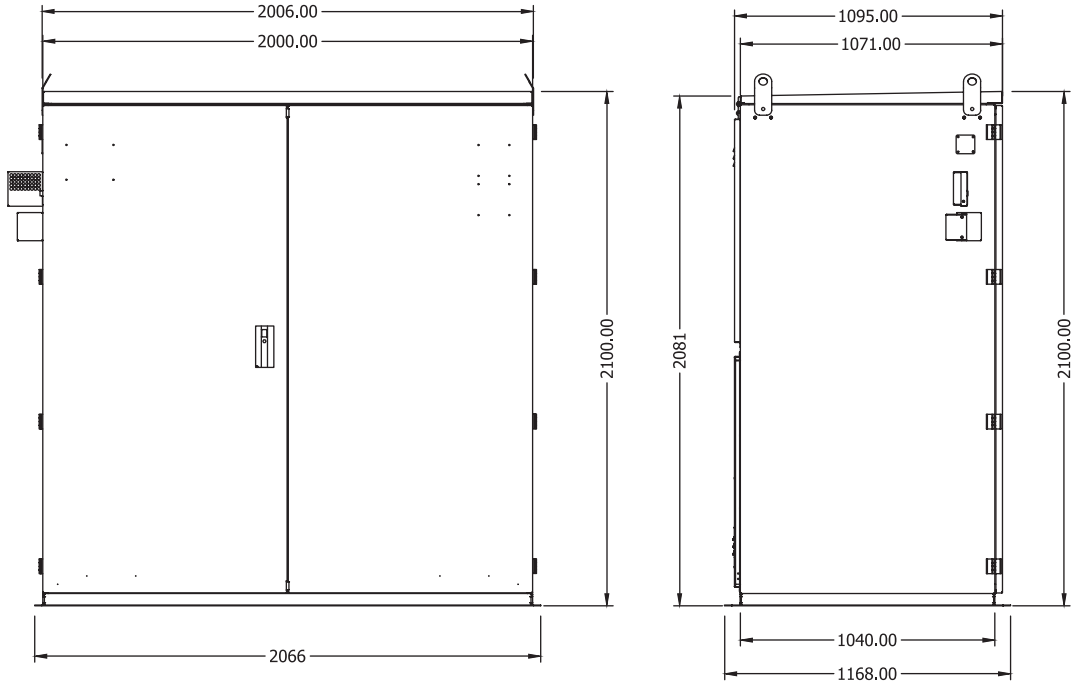
SBBS 4-Way Outdoor Type RMU



36 kV, 2 ring switches up to 630A + 2 vacuum circuit breakers up to 630A

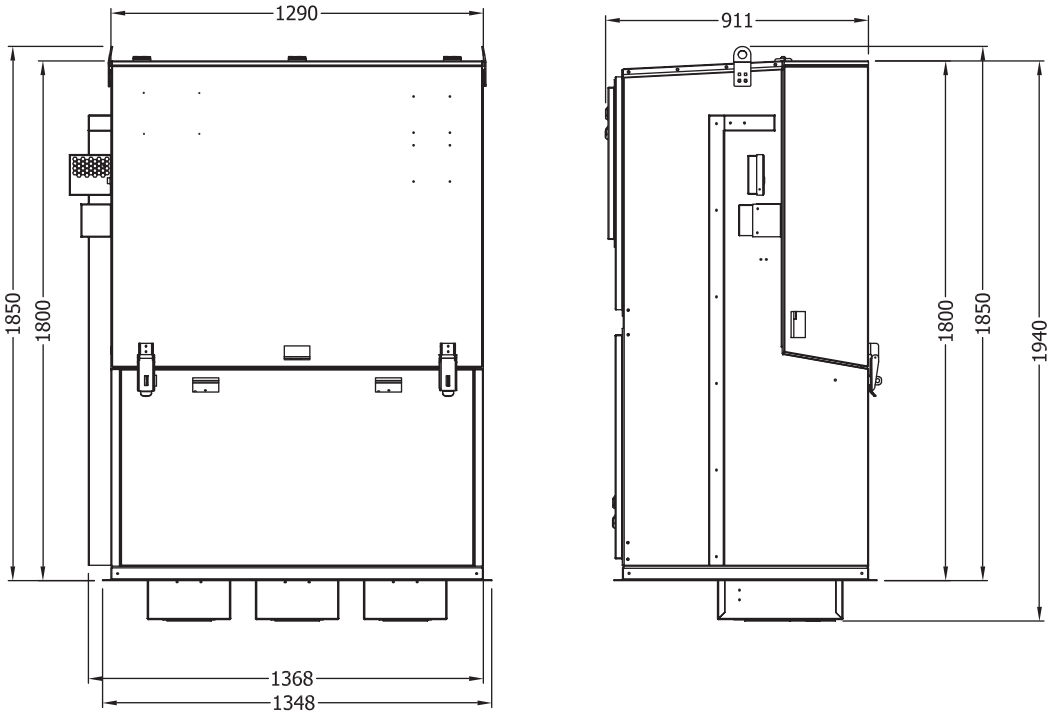
19.2 Smart RMU 36 kV

SSBS 4-Way Outdoor Type RMU



36 kV, 3 ring switches up to 630A + 1 vacuum circuit breakers up to 630A

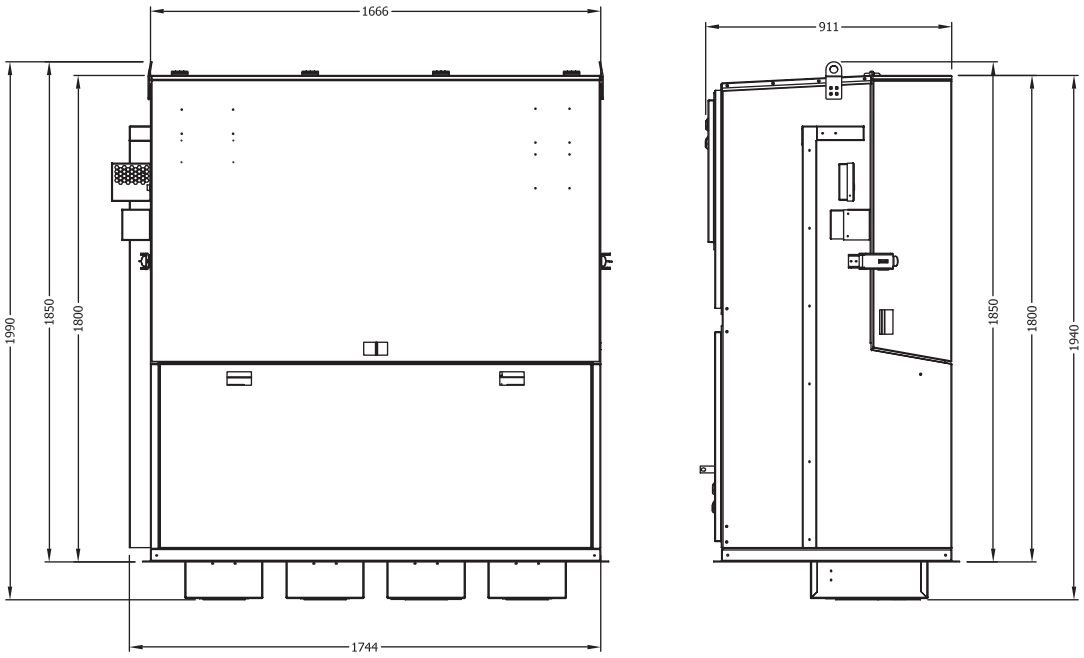
SSS 3-Way Outdoor Type RMU



36 kV, 3 ring switches up to 630A

19.2 Smart RMU 36 kV

SSSS 4-Way Outdoor Type RMU



36 kV, 4 ring switches up to 630A

20. Technical Data Sheet

20.1: Smart RMU 17.5 kV

Rated Voltage 17.5 kV		17.5 kV
Busbar Rating 400/ 630 A		400 / 630 A
Rated Frequency		50 / 60 Hz
Rated Nominal Current For Ring Switch		400 / 630A
Rated Nominal Current For Tee-off Feeder		200 / 400 / 630 A
Rated Short Time Withstand Current		21 kA / 1s
Internal Arc Calcification		A (FL) 21kA / 1s indoor A (FLR) 21kA / 1s outdoor
Rated Filling SF6 Gas Level For Insulation		1.3 bar (absolute)
Minimum Functional SF6 Gas Level		1.1 bar (absolute)
Relative Humidity		100 %
IP Class (Gas Tank / Indoor / outdoor)		IP 67 / IP41 / IP54
Rated Lightning Impulse Withstand Voltage		95 kV-peak
Rated Power Frequency Withstand Voltage		38 kV-rms
Applied Standard		IEC 62271-200
Ring Switch Feeder (S)	Type of Switch-Disconnector	General purpose, three-positioned (OPEN-CLOSED-EARTHED)
	(OPEN-CLOSED-EARTHED)	E3 / E0
	Mechanical Endurance	M1
	Nominal Current	400 / 630 A
	Short-Circuit Making Current	21 kA (also valid for earthing switch) 54.6kA Peak
	Applied Standard	IEC 62271-103/102
Tee-off Feeder (B)	Type of Breaker	Vacuum
	Electrical Endurance	E3
	Mechanical Endurance	M1
	Nominal Current	200 /400/630 A
	Short-Circuit Breaking Current	21 kA
	Applied Standard	IEC 62271-100

20.2: Smart RMU 36 kV

Rated Voltage	36 kV	
Busbar Rating 400/ 630 A	400 / 630 A	
Rated Frequency	50 / 60 Hz	
Rated Nominal Current For Ring Switch	400 / 630A	
Rated Nominal Current For Tee-off Feeder	200 / 400 / 630 A	
Rated Short Time Withstand Current	25 kA / 1s	
Internal Arc Calcification	A (FL) 25kA / 1s indoor A (FLR) 25kA / 1s outdoor	
Rated Filling SF6 Gas Level For Insulation	1.3 bar (absolute)	
Minimum Functional SF6 Gas Level	1.1 bar (absolute)	
Relative Humidity	100 %	
IP Class (Gas Tank / Indoor / outdoor)	IP 67 / IP41 / IP54	
Rated Lightning Impulse Withstand Voltage	170 kV-peak	
Rated Power Frequency Withstand Voltage	70 kV-rms	
Applied Standard	IEC 62271-200	
Ring Switch Feeder (S)	Type of Switch-Disconnector	General purpose, three-positioned (OPEN-CLOSED-EARTHED)
	(OPEN-CLOSED-EARTHED)	E3 / E0
	Mechanical Endurance	M1
	Nominal Current	400 / 630 A
	Short-Circuit Making Current	25 kA (also valid for earthing switch) 65kA Peak
	Applied Standard	IEC 62271-103/102
Tee-off Feeder (B)	Type of Breaker	Vacuum
	Electrical Endurance	E3
	Mechanical Endurance	M1
	Nominal Current	200 /400/630 A
	Short-Circuit Breaking Current	25kA
	Applied Standard	IEC 62271-100

Compact RMU up to17.5 kV

21- Introduction to Smart RMU

A - Smart RMU

alfa-R is designed and tested as per the new IEC standard 62217-200. This panel is available up to 630A, 21kA/ 1 sec.

alfa-R is GIS Type (SF6) Insulation, complies with the highest quality requirements and are factory-assembled and type-tested in accordance with IEC 62271-1, 62271-200 and 62271-100 and SEC 32-SDMS-01, 32-SDMS-04 and 32-SDMS-11 Standards.

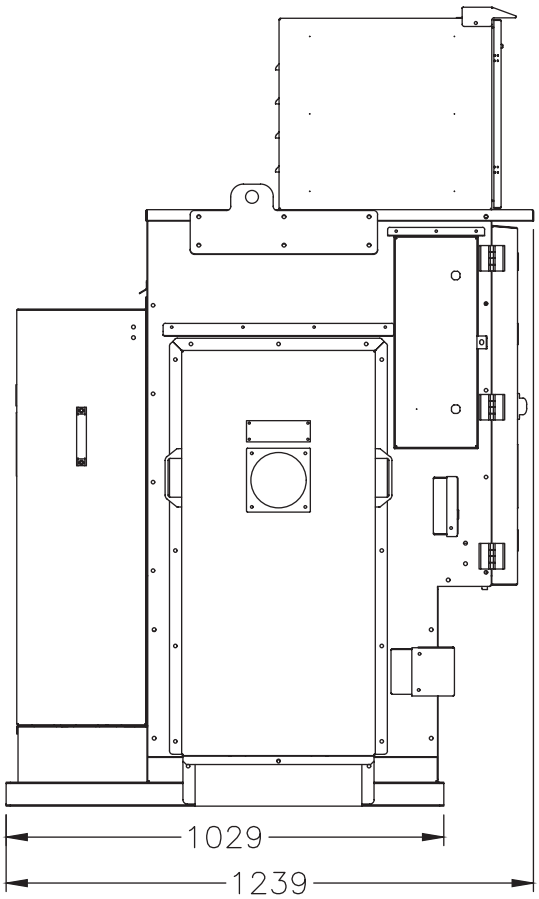
B. Key Features

- Compact design up to 17.5 kV; CESI type tested
- Switching units sealed in SF6 gas filled stainless steel tank
- High level operator safety and operating reliability
- Embedded cable testing compartment, easy and safe cable testing without cable connection removal
- High quality tank welding, leakage rate of less than 0.1% per year
- Maintenance free unit offering a life expectation of over 30 years
- Smart interlocking padlocking system for maximum operator safety
- Different feeder combinations with switch disconnector and vacuum circuit breaker
- Compatible with SCADA systems for remote control and monitoring
- Motorized options for circuit breakers and switches
- High resistance to pollution and humidity

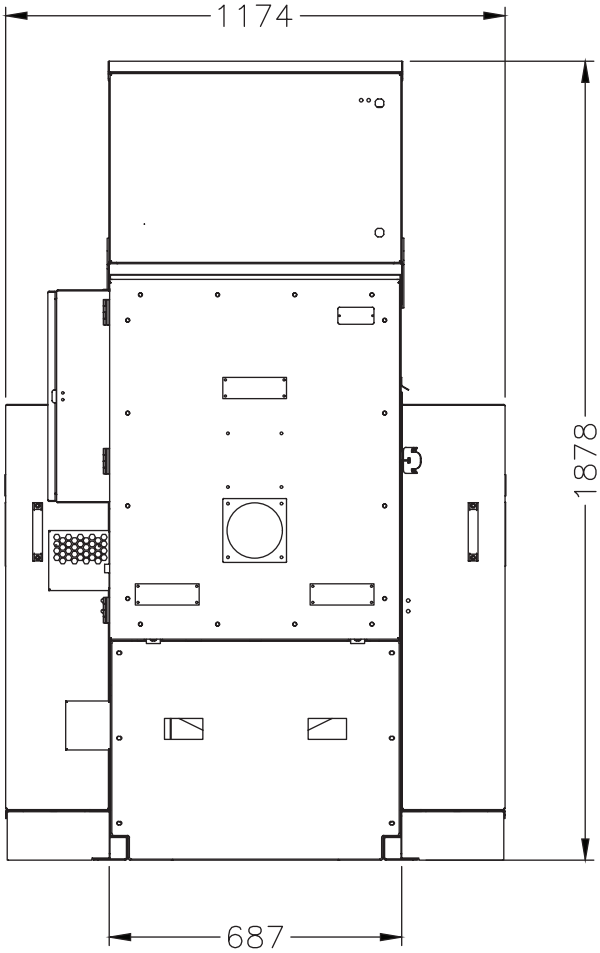
22. Dimensional Drawings

Compact RMU 17.5 kV

SBS 3-Way Outdoor Type RMU



SIDE VIEW



FRONT VIEW

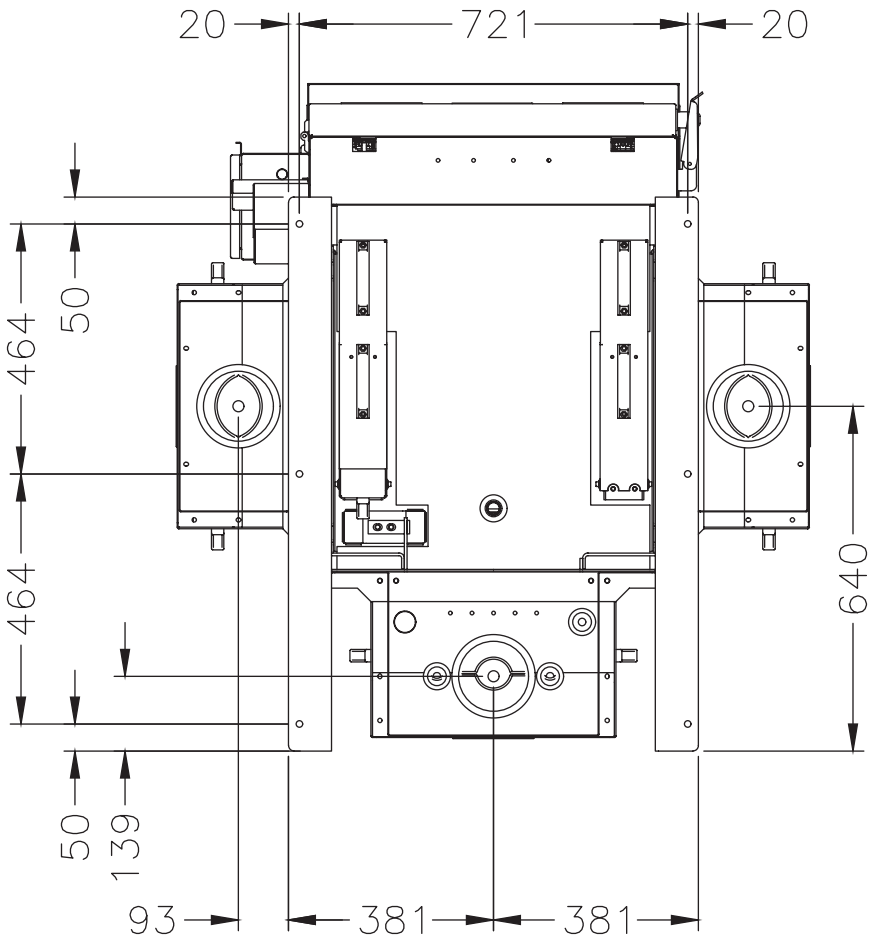
23. Technical Data Sheet

Compact RMU 17.5 kV

Rated Voltage 17.5 kV		17.5 kV
Busbar Rating 400/ 630 A		400 / 630 A
Rated Frequency		50 / 60 Hz
Rated Nominal Current For Ring Switch		400 / 630A
Rated Nominal Current For Tee-off Feeder		200 / 400 A
Rated Short Time Withstand Current		21 kA / 1s
Internal Arc Calcification		A (FL) 21kA / 1s indoor A (FLR) 21kA / 1s outdoor
Rated Filling SF6 Gas Level For Insulation		1.2 bar (absolute)
Minimum Functional SF6 Gas Level		1.1 bar (absolute)
Relative Humidity		100 %
IP Class (Gas Tank / Indoor / outdoor)		IP 67 / IP41 / IP54
Rated Lightning Impulse Withstand Voltage		95 kV-peak
Rated Power Frequency Withstand Voltage		38 kV-rms
Applied Standard		IEC 62271-200
Ring Switch Feeder (S)	Type of Switch-Disconnector	General purpose, three-positioned (OPEN-CLOSED-EARTHED)
	(OPEN-CLOSED-EARTHED)	E3 / E0
	Mechanical Endurance	M2
	Nominal Current	400 / 630 A
	Short-Circuit Making Current	21 kA (also valid for earthing switch) 54.6kA Peak
	Applied Standard	IEC 62271-103/102
Tee-off Feeder (B)	Type of Breaker	Vacuum
	Electrical Endurance	E2
	Mechanical Endurance	M1
	Nominal Current	200 /400 A
	Short-Circuit Breaking Current	21 kA
	Applied Standard	IEC 62271-100

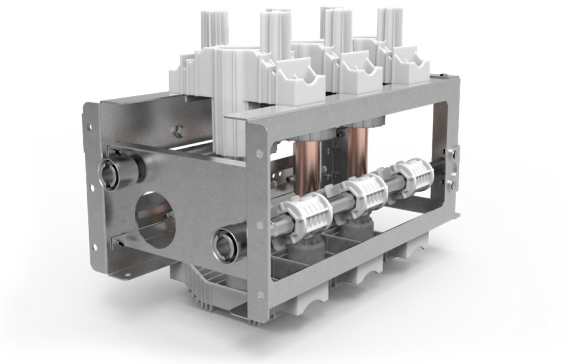
24- Installation / Foundation View

The floor must be well leveled and the unit must be fixed with anchor bolts in accordance with the dimensional drawing for the number of modules or units as appropriate.



Dimension	W mm	D mm	H mm
LBS cable box	455	245	955
Tee-off cable box	453	306	980

25- Main Components



25.1 SWITCH-DISCONNECTOR (with earthing switch)

- Applied Standard: IEC 62271-103
- Three-phase, three positioned (OPEN-CLOSE-EARTHED)
- Load current is quenching in the SF6
- Electrical Endurance Class: E3
- Electrical Endurance Class: E2 (for earthing switch)
- Mechanical Endurance Class: M2

OPERATING MECHANISM OF THE SWITCH-DISCONNECTOR

- Stored energy operation
- Standard mechanism: Type M018
- Optional mechanism: Type M019
- Independent of the operator operation
- Comply to motor specifications

M018 Type Mechanism

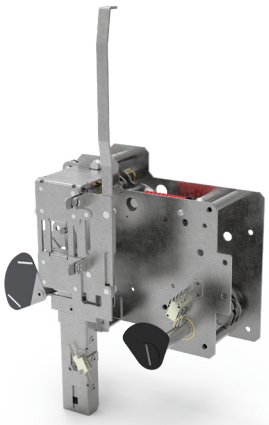
- Opening and Closing operation takes place at one stage. The position of the switch (closing, opening and earthing operation) is performed manually using the operating handle. For motorized types, mentioned operation is performed via geared motor.

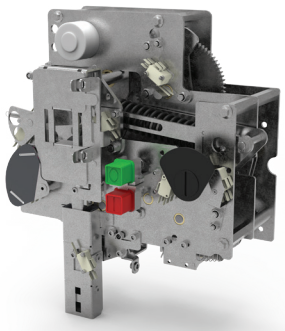
M019 Type Mechanism

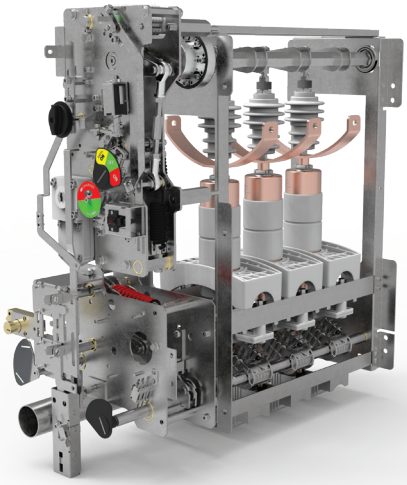
- Energy storage is performed by the operator using the operating handle or via geared motor (for motorized mechanism)

Releasing of the energy is performed;

- By operator using push button (mechanically)
- By shunt coils (electrically)







25.2 VACUUM CIRCUIT BREAKER+DISCONNECTOR WITH EARTHING SWITCH UNIT

Vacuum Circuit Breaker

- Applied Standard: IEC 62271-100
- Electrical Endurance Class: E2
- Mechanical Endurance Class: M1

Disconnector

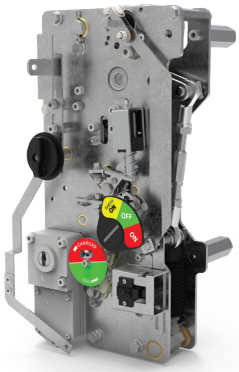
- Applied Standard: IEC 62271-102
- Three-phase, three positoned (OPEN-CLOSED-EARTHED)
- Mechanical Endurance Class: M2

Earthing Switch

- Applied Standard: IEC 62271-102
- Electrical Endurance Class: E2

OPERATING MECHANISM OF THE VACUUM CIRCUIT BREAKER

- Operating mechanism is based on stored energy within a spring. Storing of energy is provided with either a geared motor (electrically) or with an operating handle (manually). Releasing of energy is conducted using either the push button on the front panel (manually) or using a shunt coil (electrically)
- During the breaker closing operation , the closing spring charges both of the spring of opening and the spring of trip-coil
- Suitable for rapid re-closing
- Suitable for self-powered relay application



AUXILIARY SERVICE VOLTAGES

	VOLTAGE*
Motor	220 VAC; 220 VDC; 110 VDC; 24 VDC; 48 VDC
Coil	24 VDC; 48 VDC: 110 VDC

*Contact **alfanar** if different service voltage is required.

25.3 – Gas Pressure Indicator

Gas density is an important operating parameter for SF6 insulated MV equipment. If the required gas density is not sufficient, safe operation cannot be guaranteed. On alfa-R units, a gas pressure indicator is fitted to the tank to provide a reliable warning indication against low gas levels. The gas pressure indicator shows the minimum pressure for safe operation.

25.4 – Voltage Presence Indication System

All alfa-R units are integrated with a voltage presence indication system. A voltage signal comes from the VPIS through the voltage divider positioned in the cable entrance of bushings.

The VPIS can be used to check whether a voltage is present across the cables.

25.5 – Protection Relay

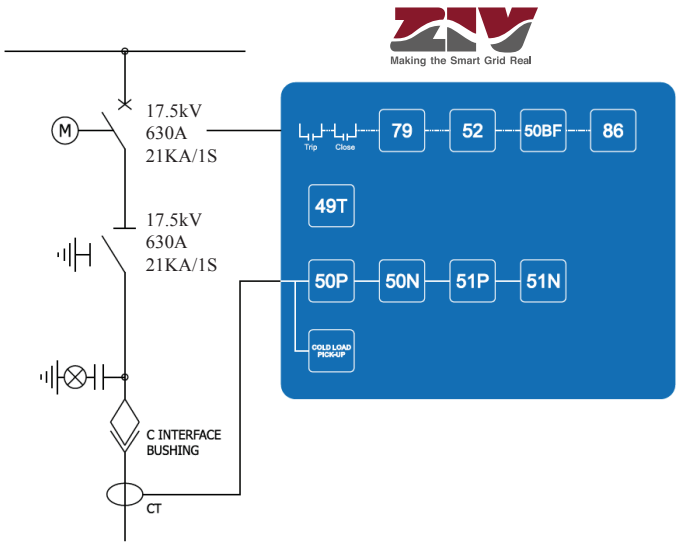
Overcurrent Protection

1- 50P/50N Function: Phase/Neutral Instantaneous Overcurrent

Time of operation is independent from the current of operation flowing through the relay. Hence, if the phase current increases more than its determined value for an equal or greater amount of time than the specified value, then protection function activates (trips) and does not reset itself till the value of the phase drops below the point of current pick-up.

The function activates at 100% of the preset input, and deactivates at 95%, where the reset is instantaneous.

The accuracy of the operating time is equal to the present time plus a maximum of 30 ms.



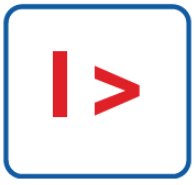
2- 51P/51N Function: Phase/Neutral Time Overcurrent Protection

A - Definite Time O/C Protection

If the option “Definite time” is selected for the curve setting, the unit operating time is set by the parameter “Operating time” to trip the fault after a preset specific time setting.

If the unit operates with defined time, the function is activated at 100% of the set tap value, and it deactivates at 95%. If the unit operates with a curve, the function is activated at 110% of the set pick-up value, and it deactivates at 100%. The reset is instantaneous in both cases. The activation time is accurate to ±5% or ±30ms, whichever is greater, of the theoretical activation time. The curves used are IEC 60255-151.

B - Inverse Time O/C Protection (IDMT)



If a curve (e.g. inverse, very inverse or extremely inverse) is selected for the curve setting, the operating time principally depends on the current value which is set through the curve type, and dial and tap settings.

26- Accessories

26.1 - Operating Handles

In alfa-R units, there are two operating handles; the first one is for the operation of the load break switch and the second is for charging the spring of vacuum circuit breaker. The design of the operating handles enables a safe and easy operation for the user.

Switch Disconnector & Disconnector Operating Handle

Circuit Breaker Spring Charging Handle

26.2 - IR / PD Windows

The alfa-RU can be optionally equipped with IR & PD Windows, a new feature that complies with the new requirements of the Saudi Electric Company.

The inclusion of an infrared inspection window is considered a very effective method for maintenance personnel to identify any possible problems with loose electrical terminations without the need to shut down the RMU. The window consists of polymer and mesh optics to allow thermal infrared inspection by employing broadband media.

The inclusion of a partial discharge window is to facilitate the ability to measure partial discharge of a live RMU and estimate the expected life of insulation components.

26.3 - Motorization Kit (LBS / VCB)

Motors with gearboxes can easily be installed to load break switches and circuit breaker mechanisms either in the factory or on-site. A built-in electrical interlocking system prevents any unintentional operations.

When the unit is installed with the motor mechanism, it can be used with intelligent systems such as SCADA, DAS, etc. With the help of a selector switch, alfa-R units can be controlled remotely by choosing the remote control option.

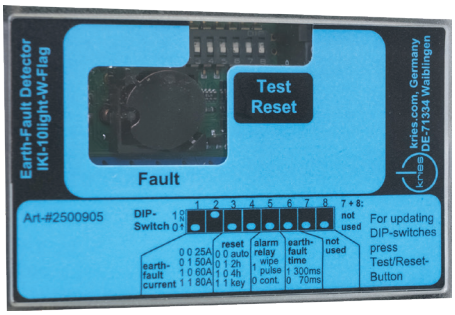
Motor with Gearbox

26.4- Earth Fault Indicator (EFI)

EFI can also be implemented in alfa-R units. EFIs help the operator to easily find the fault location in medium voltage ring networks.

Earth fault is indicated with a LED flashlight and a flag when asymmetrical currents are detected in three phase cables.

EFI is fed via either auxiliary supply with internal batteries or a core balance current transformer.



EFI

26.5- Operation Counter for Load Break Switch Mechanism

In alfa-R units, implementation of an operation counter for mechanical operation of load break switches is available as an option.

26.6 – CVI Auxiliary Contacts

To automate voltage indication in alfa-R units, auxiliary contacts could be integrated with CVI units.
This feature makes it suitable for alfa-R to accommodate the following:

Absence of voltage applications
- Alarms on voltage loss
- Automatic transfer systems

Presence of voltage applications
- Earth locking on presence on voltage
- Alarms on voltage presence

CVI Auxiliary Contacts

26.7 – Gas Pressure Indicator with Contacts

As an optional feature a gas pressure indicator with electrical switch contacts can be implemented.

The gas pressure indicator warns the operator when the gas density drops below the defined “alarm” level.

Gas Pressure Indicator

27- Control and Measuring Function

alfa-R - Smart has an integrated (RTU) to provide remote monitoring and control capability via the control center.

Connection between the local RTU and control center is established over a secured Virtual Private Network connection (VPN) or through an access point named “APN”.

The exchanged data

- Status information from RTU to data center
- Control signal from control center to RTU
- Analog measurements

Status information from RTU to data center

- Close/Open for each CB/LBS
- Earth status for each circuit
- Lock /Unlock for each circuit
- Selector switch status local/remote
- SF6 Gas pressure low/normal
- Power supply status
- Door Open/Close

Control command from control center to RTU

- Close/Open for each circuit
- Lock/Unlock for each circuit

Analog measurements

- V_ phase (A,B,C)
- I_ phase (A,B,C)
- Frequency
- Total active power [kW]
- Total reactive power [kVAR]
- Total apparent power [kVA]

Smart alfa-R, Main Component

a) ZIV-TCA/D (RTU with built-in directional Fault Passage Indicator)

Key Features of ZIV-TCA/D

1 - Powerful programmable logic engine.
2 - 2500 event log and five Fault Registers (TCA-D/E 4000).
3 - Oscillography recorder (five COMTRADE files and a sampling rate of 7200 Hz).
4 - Diagnosis and Maintenance WebUI.
5 - TCA-D/E:
- Up to 5 FPI functions per IED.
- Up to 64 digital inputs.
- 16 configurable digital outputs for alarm signalling or LBS control commands.
- 24 analogue channels.
- Voltage measurement supported directly in busbar or installed in feeder bushings.
- 4000 event logger and oscillography recorder function (sample rate 4800 Hz).
- Fault Isolation Automatism (FIA).
- Cybersecurity: authentication and encryption

b) Power supply and batteries

SFA Smart-RMU is equipped with battery charger powered by external AC supply.
All the equipment such as aux relays, RTU, modem, and trip close motor coils are operated by a 24VDC which comes from a AC/DC converter capable of providing sufficient power. This unit has a battery system to ensure sustainability of the power supply.

c) ZIV-IRS (Self-Powered Overcurrent Protection)

Where a dependable auxiliary power source is not available, the IRS Relay can be energized either directly from Main Current Transformers, AC/DC Auxiliary Voltage or through the USB Front Port.

Notes

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