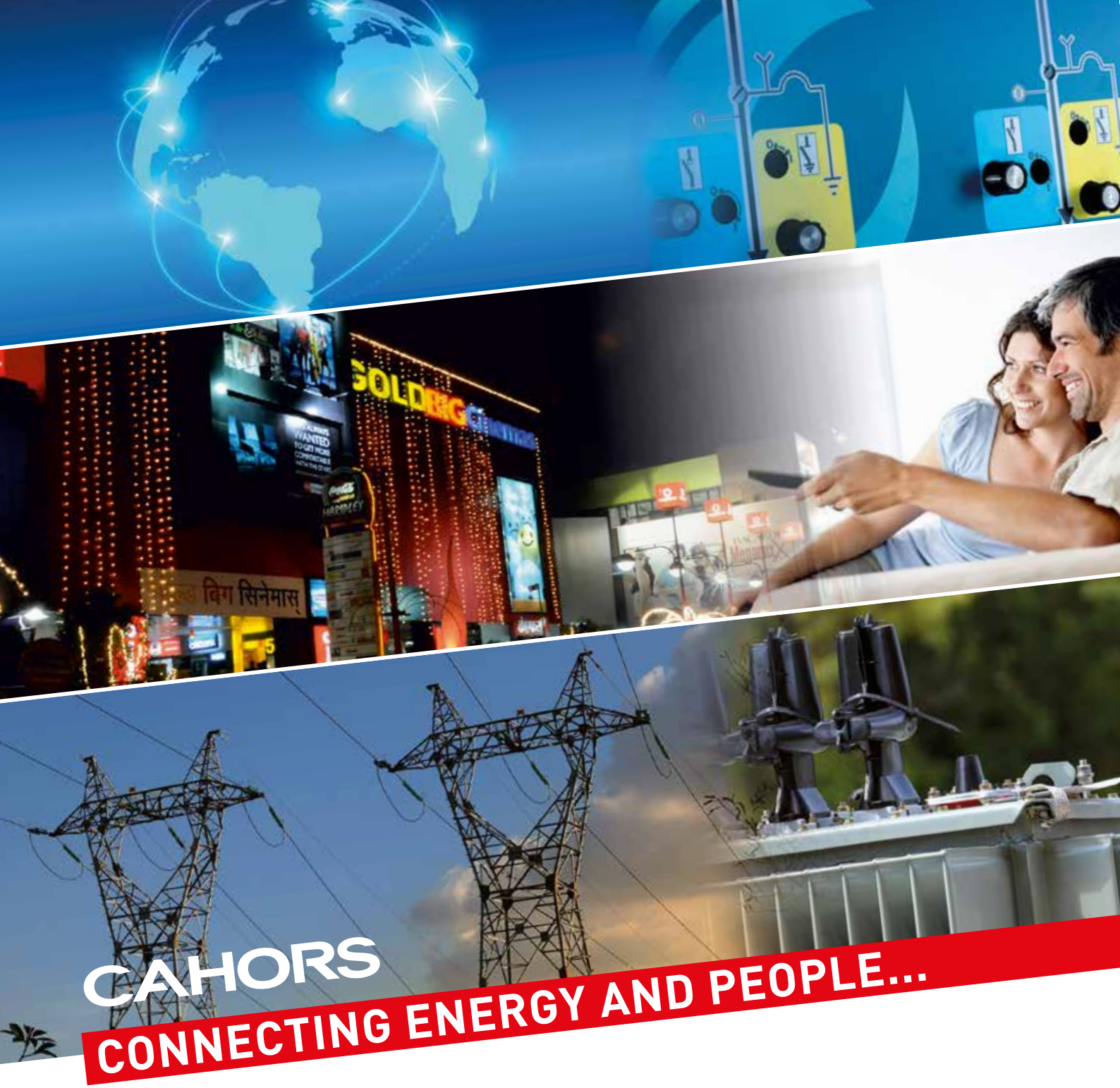
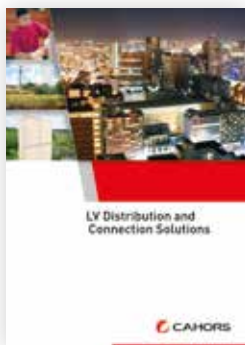


ANTARES®

Gas insulated switchgear
up to 24 kV



Sales documentation can be sent to you on request



CAHORS: an expert in energy distribution networks.

CAHORS designs, manufactures and markets solutions and equipment dedicated to public and private electricity distribution networks.

Innovation is the fundamental energy at Cahors.

Innovation in developing new products, in our manufacturing processes, in our management and working methods. Cahors is firmly on the road to sustainable development, and supports the Global Compact.

Cahors is a key player in the development of Smart Grids for almost 30 years. It offers a wide range of connected solutions tailored to your needs and requirements.

- **Solutions for Medium Voltage Networks**

CAHORS offers comprehensive solutions, equipment and services suited to the specificities of Medium Voltage electricity distribution networks, all around the world.

Our complementary business units and skills, combined with technological expertise enable us to develop substations integrating transformers, Medium Voltage switchgears, Low Voltage boards, high tech electronics, and even remote network monitoring.

- **Solutions for Low Voltage Networks**

CAHORS develops a range of solutions tailored to all needs: connection, metering, distribution and protection. Our products ranges can be adapted to the requirements of any type of location: underground connections, street lighting units, cabinets, floor distribution panels and electric charging stations.

- **Solutions for Communication Networks**

CAHORS innovates in connecting and communicating data. Our connectors, terminals and casings can be placed on all telecom networks. CAHORS deploys a whole range of solutions, in electronics, analogical and digital: IPTV, copper networks, optic fibre and civil engineering.

- **Distribution of fluids**

CAHORS helps to develop drinking water and gas distribution networks on all five continents. Our units, underground modules and comprehensive connecting solutions combine efficiency and environmental integration. Our expertise in electronics has led to remote readings of fluid meters.

CAHORS, a worldwide commercial and industrial presence!



Already present on four continents, CAHORS keeps adapting its industrial and commercial capacities to match the needs of regional and global markets. Its various industrial facilities around the world allow significant research and manufacturing capacities. Each site can manufacture small and large production runs and answers specific orders with the greatest reactivity. The sales team at CAHORS maintains an ongoing dialogue with their customers in Europe, Africa, Asia and the Americas and offers them complete solutions to suit their needs.

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**SWITCHBOARD
PRESENTATION**

1

**ANTARES®, RANGE OF
FUNCTIONAL UNITS**

2

SWITCHBOARD USE

3

CHARACTERISTICS

4

**ACCESSORIES
AND OPTIONS**

5

INSTALLATION

6

**ANTARES® AND
SUSTAINABLE
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7

**MEDIUM VOLTAGE
SERVICES**

8



SWITCHBOARD PRESENTATION

■ ANTARES, SAFE, COMPACT, AND FREE-MAINTENANCE SWITCHBOARD

ANTARES is a **medium voltage secondary distribution switchboard** up to 24 kV, 630 A, 25 kA-1s, used in applications such as **public distribution, renewable energies, infrastructure and industry.**

The switchboard extensibility, the wide range of unit functions, the compactness and the ease of installation can fit with various switchboard requirements. Both Fuses and Vacuum Circuit Breaker (VCB) transformer protection technologies are available and can be fitted in ANTARES Switchboard.

■ GIS, ELECTRICALLY INSULATED SWITCHBOARD BY SF6 GAS

The medium-voltage main circuit of the ANTARES switchboard, such as **Vacuum Circuit Breaker, Load Break Switch and busbar** are placed in **SF6 insulating gas** (Sulphur Hexafluoride - SF6). The SF6 gas acts as insulating and arc extinguishing medium for **very compact solution**. Stainless steel tank confines the primary circuit in a hermetically sealed environment and give the **insensibility to the outside environment** (Vermin, Humidity, Dust, Pollution).

■ SWITCHBOARD SAFETY

ANTARES is **fully type tested** and has been designed for **maximum safety of the operators and equipment, specifically** in case of internal arcing in the equipment:

- Safety valves to avoid gas overpressure and non-guided projection
- Guidance at the rear to direct the hot gases
- Front and side protection for the operator.

■ INSTALLATION FACILITY, A PRIORITY FOR ANTARES SWITCHBOARD

ANTARES functional units are **ultra-light, ultra-compact**, thanks to design orientation and SF6 gas technology. For instance, the footprint on the floor for a switchboard with 3 functional units is minimized at 842 mm x 1125 mm and average mass of 230 kg for 3 ways unit.

The switchboard extension facilities give the **opportunity to assemble into a complete switchboard, functional unit by functional unit, with narrow installation access.**

Then, the installation of ANTARES is very easy whatever its installation location: **Compact Sub-Station, underground or on upper floors.**

■ MAINTENANCE FREE DESIGN

- Maintenance free & service life of **40 years** for the primary circuit with no gas filling during the service life.
- Simplified maintenance on other parts of the functional units, **thanks to long experience, customer feedbacks and design excellence.**

■ SIMPLE OPERATION DESIGN

The overall design of ANTARES switchboards **guarantees simple and reliable use:**

- Clear indication and mimic diagram with color code
- Voltage presence indicator lamps on each phase
- Interlocking to ensure the correct sequences of operations
- Option of Locks and Padlock system available
- Can be used in substations with or without operation corridors.



ANTARES Switchboard in compact MV/LV substation for Public distribution



ANTARES in a MV/LV substation (Ultra compact size) - Public Distribution



ANTARES in renewable photovoltaic MV/LV substation

Standards and quality



Design and assembly under quality assurance system

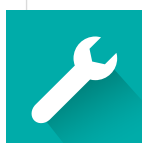
Groupe CAHORS industrial base for Switchgear has been certified for many years:

- ISO 9001: 2008
- ISO 14001: 2004



Switchboard operating conditions

- Ambient temperature from -25°C to +40°C (up to +55°C for reduced service currents)
- Average value over 24 hours at +35°C max
- Typical maximum altitude for installation above sea level is 2,000 m (However, much higher altitudes are possible on request)
- Sulphur hexafluoride (SF6) type of insulating gas
- Rated pressure at 1 350 mbar (+20°C).



Tests on functional units & switchboard

Various factory routine tests and internal tests, integrated in quality assurance plan are carried out on ANTARES switchboard during manufacturing and before it is shipped to the customer including:

- Tank SF6 leak
- Tightness test
- Mechanical test for control mechanisms
- Dielectric tests.



Tank SF6 leak test at Cahors Factory



HV shock wave test on Antares switchboard



Conformity and type test according to International standards

The ANTARES switchboards comply with the requirements of the following standards and regulations

Description	IEC Standard
Switchboard	IEC 62271-200 IEC 62271-1
Circuit breaker DPT*	IEC 62271-100
Behavior in the event of Internal Arc Faults	IEC 62271-200
Earthing switch in DPT, AD, AI, IFC, IFA*	IEC 62271-102
Disconnecter in DPT*	IEC 62271-102
General use switch AI*	IEC 62271-103
Switch-disconnector fuse Combination IFC*, Association IFA*	IEC 62271-105
Voltage Presence Indicators Voltage Detection System	IEC 62271-206 or IEC 61243-5
Protection against accidental contact, foreign bodies and ingress of water	IEC 60529

*refer to page 11 for ANTARES Switchboard functions



Short circuit test on Antares switchboard



Range of switchgears fully type tested according to IEC in accredited laboratories



Switchboard Protection Index (IP)

- Main electrical circuits: IP67
- Cable connection compartment, Operating mechanisms, low voltage compartment: IP2XC
- Switchgear: IK 07.



Switchboard Internal Arc Classification (IAC)

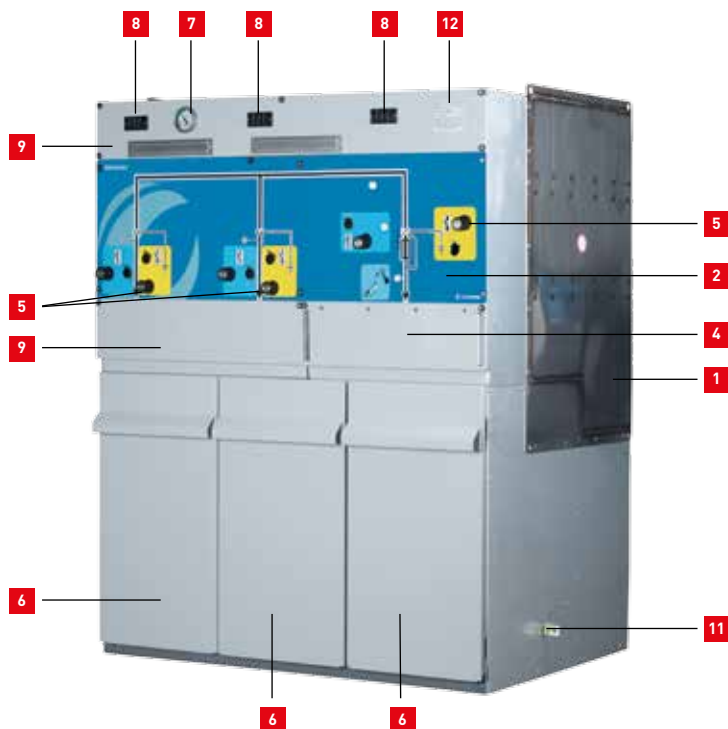
ANTARES is over-pressurized, filled with SF₆ gas, sealed for life and its tank complies with IEC 62271-200 with the Internal AFL 20kA - 1sec arc classification. Following test criteria are followed to guarantee maximum safety:

- Correctly secured doors and covers with limited deformation
- No fragmentation of the enclosure and no projection
- No hole in accessible side
- No ignition of thermal indicators due to hot gases
- Enclosure remains at earth



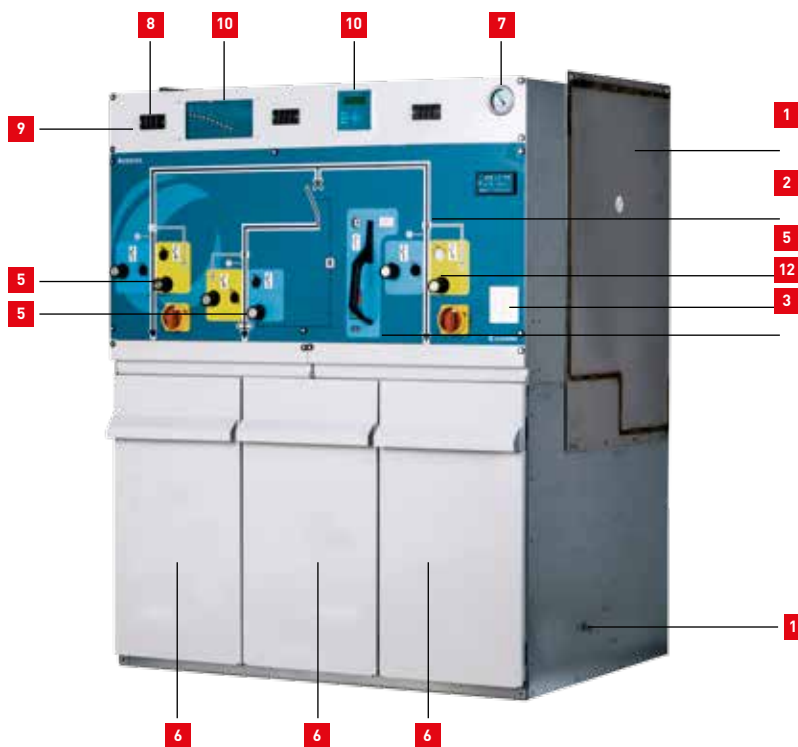
Internal Arc Class test on Antares switchboard

Switchboard Product description

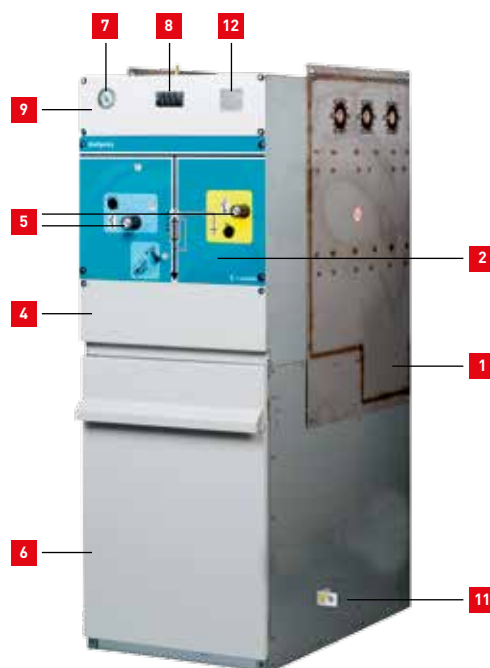


- 1 Hermetically-sealed stainless steel tank filled with gas to insulate the main circuit
- 2 Operating mechanism compartment and mimic diagram
- 3 Vacuum circuit-breaker
- 4 Fuse compartment
- 5 3-position switch-disconnector
- 6 Cables compartment door
- 7 Tank pressure manometer
- 8 Voltage presence detection system and low voltage part
- 9 Available low-voltage compartment
- 10 Protection relay
- 11 Earthing connection
- 12 Rating and identification plate

ANTARES Switchboard AI IFC function, protection by fuses with switch combination



ANTARES Switchboard AI DPT AI function, protection by vacuum circuit-breaker



ANTARES Switchboard eIFCe function, protection by fuse with switch combination

IDENTIFICATION PLATE

The rating plate supplies information on the version, the short time rated current, rated voltage and components.



EXAMPLE

ANTARES

12 - 20 - eAI.AI.IFCE

Switchboard range _____

Rated voltage: 12 kV _____

Short circuit current: 20 kA _____

Functional units _____

Order: from left to right

e = extension _____



ANTARES® RANGE OF FUNCTIONAL UNITS



Range of functions

AI	IFC	IFA
Cable incoming or outgoing feeder with switch-disconnector and earthing switch	Transformer protection with switch-disconnector fuse combination (C = Switch fuse Combination) and earthing switch	Transformer protection with switch-disconnector fuse association (A = Switch fuse Association) and earthing switch

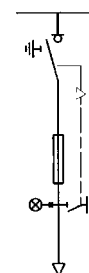


Functions

- Connect or disconnect the incoming/outgoing cables with the main busbar even under load;
- Insulate the incoming/outgoing cables with the main busbar;
- Earthed three-phase cables;
- Indicate the voltage presence on three-phase cables.

- Supply, control and protect by fuses technology up to 2 000 kVA distribution transformers;
- Insulate the outgoing cables with the main busbar;
- Earthed three-phase cables;
- Safety for fuse replacement with the earthed of fuses from both upstream and downstream. Both earthing switches are activated simultaneously with a single operating mechanism.
- 2 protection strategies available, when the mechanical striker pin trips on the blowing of at least one of the fuses, then:
 - IFC (Switch Combination): the switch-disconnector is opened mechanically on all three phases.
 - IFA (Switch Association): the switch-disconnector stays mechanically closed on all three phases. In this case, fuse without mechanical striker can be used.
- Indicate the voltage presence on three-phase cables.

Mimic Electric diagrams



COMPACT VERSION OF ANTARES

This version can be easily integrated into a substation thanks to its compact size and small footprint. Up to 4 functional units can be assembled in a single tank insulated by SF6 gas.

EXTENSION SYSTEM OF ANTARES

is available to extend a switchboard with additional functional unit. ANTARES switchboard can be extended on either left or right side (single extension version) or both left and right sides (double extension version).

These versions offer the following advantages:

- Flexibility and modularity of the application
- Economic solution for secondary distribution applications
- Transport through narrow environment such as small corridor, stairs




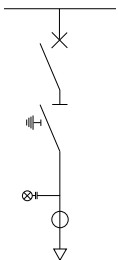
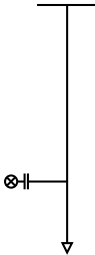

- Installation in very limited space locations such as through a narrow opening or hatch is possible
- Additional functional units can be arranged in any order
- Subsequent extension is possible if waiting extension system is pre-installed on the switchboard.

LATERAL AND TOP CONNECTION OF CABLES SYSTEM FOR ANTARES SWITCHBOARD

is available to supply directly the main busbar of the medium voltage switchboard.

These versions offer the following advantages:

- Flexibility of the switchboard incoming – outgoing supply of the application
- Economic solution for vertical secondary distribution applications

DPT	LD	AD
Transformer protection with vacuum circuit-breaker (including toroidal current transformers) and earthing switch	Direct incoming or outgoing feeder without earthing switch	Direct incoming or outgoing feeder with earthing switch
		
<ul style="list-style-type: none"> - Supply, control and protect by Vacuum Circuit Breaker technology up to 6 300 kVA distribution transformers; - Safe transformer protection as fault trips require no auxiliary voltage. Toroidal transformers on main 3 phases cables is used to measure current and to power protection relay. - Insulate the outgoing cables with the main busbar; - Earthed three-phase cables; - Indicate the voltage presence on three-phase cables. 	<ul style="list-style-type: none"> - Connect permanently the incoming/ outgoing cables with the main busbar; - Optionally, LD can indicate the voltage presence on three-phase cables. 	<ul style="list-style-type: none"> - Connect permanently the incoming/outgoing cables with the main busbar; - Earthed three-phase cables; - Indicate the voltage presence on three-phase cables.
		

Switchboard available configuration

SINGLE FUNCTIONAL UNIT WITH DOUBLE EXTENSIONS (RIGHT AND LEFT)



eDPTe

1 function - Version available

eDPTe



eAle

1 function - Version available

eAle

eLDe

eADe



eIFCe

1 function - Version available

eIFAe

eIFCe

COMPACT VERSION WITHOUT EXTENSION



AI IFC

2 functions - Version available

AI	AI
AI	IFA
AI	IFC
AI	AD
AI	DPT
LD	DPT
AD	DPT
DPT	DPT



AI DPT AI

3 functions - Version available

AI	AI	AI
AI	AI	IFA
AI	AI	IFC
AI	DPT	AI
AI	DPT	DPT



AI IFC AI IFC

4 functions - Version available

AI	AI	AI	AI
AI	AI	AI	IFC
AI	AI	AI	IFA
AI	AI	AI	DPT
AI	IFA	AI	IFA
AI	IFC	AI	IFC
AI	DPT	AI	DPT

COMPACT VERSION WITH EXTENSION (EXAMPLES)

All the above ANTARES switchboards can be extended on both left and right sides (single extension and double extensions)



2 functions eAI IFCe



3 functions eAI AI IFCe



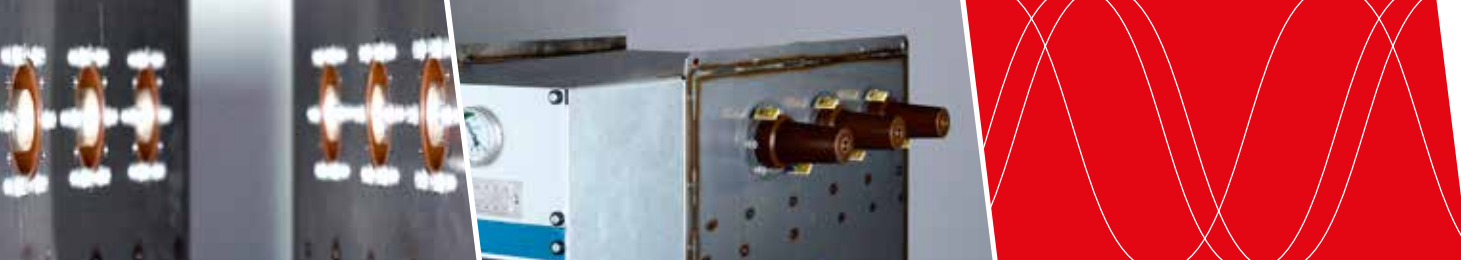
4 functions eAI IFC AI IFCe

Overall dimensions

Dimensions and weights of Compact & Extensible ANTARES Switchboard

Function	Number of functional units	Height (mm)	Depth (mm)	Width (mm)	Approximative weight (kg)
eAle*	1	1424	840	425	106
eIFCe		1424	840	550	145
eIFAe		1424	840	550	136
eDPTe		1424	840	610	149
eADe		1424	840	425	106
eLDe		1424	840	425	90
AI AI*	2	1424	840	812	155
AI.IFC*		1424	840	812	189
AI. IFA*		1424	840	812	180
AI.AD		1424	840	812	155
AI.DPT*		1424	840	997	198
LD.DPT		1424	840	997	182
AD-DPT		1424	840	997	198
DPT.DPT		1424	840	1162	233
AI.AI.AI*	3	1424	850	1125	205
AI.AI.IFC*		1424	850	1125	238
AI.AI.IFA*		1424	850	1125	229
AI.DPT.AI*		1424	850	1125	231
AI.DPT.DPT*		1424	850	1310	273
AI.AI.AI.AI*	4	1424	850	1537	253
AI.AI.AI.IFC*		1424	850	1537	286
AI.AI.AI.IFA*		1424	850	1537	277
AI.AI.DPT.AI*		1424	850	1537	279
AI.IFC.AI.IFC*		1424	850	1537	319
AI.IFA.AI.IFA*		1424	850	1537	301
AI.DPT.AI.DPT*		1424	850	1600	313

*If Voltage Injection plugin systems is required, replace 1424 number with 1579.



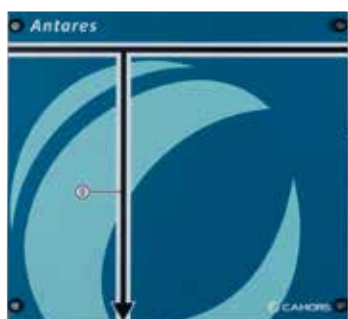
SWITCHBOARD USE

User interface



Description

A clear mimic diagram, an electrical circuit drawing and a color code are provided as user interface to operate easily and safely ANTARES switchboard.



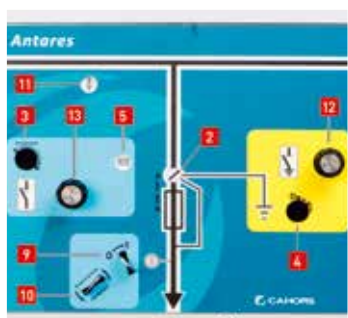
Direct incoming feeder without earthing switch LD



Direct incoming feeder with earthing switch AD



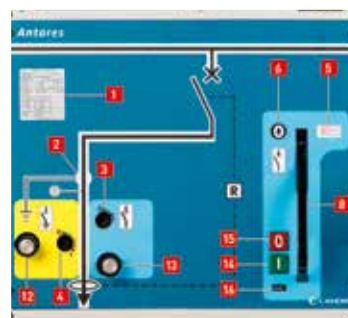
Incoming/outgoing feeder with switch-disconnector AI



Outgoing feeder with IFC switch-disconnector fuse combination



Outgoing feeder IFA switch-disconnector fuse combination



Transformer protection with vacuum circuit-breaker DPT

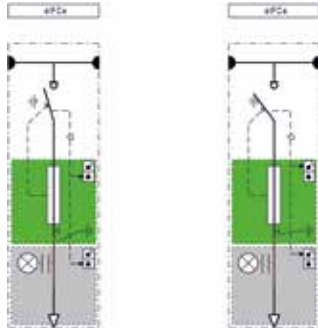
- | | |
|---|---|
| 1 Identification plate | 10 Pushbutton to open switch-disconnector |
| 2 Switch-disconnector and earthing switch position indicator | 11 Fuse tripping indicator |
| 3 Lever hub socket for the switch-disconnector control mechanism | 12 Pad lockable knob to free hub socket for the earthing switch |
| 4 Lever hub socket for the earthing switch | 13 Pad lockable knob to free hub socket for the switch-disconnector |
| 5 Indicator showing the status of the spring (primed or released) | 14 Pushbutton to close circuit-breaker |
| 6 Vacuum circuit-breaker position indicator | 15 Pushbutton to open circuit-breaker |
| 7 Earthing switch indicator | 16 Operations counter |
| 8 Lever for the vacuum circuit-breaker control mechanism | |
| 9 Pushbutton to close switch-disconnector | |

Interlocks, padlocking & security locks

INTERLOCKING OF THE FUNCTIONAL UNITS

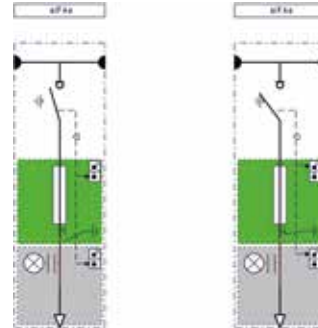
Personnel safety and reliability of the operation are given by interlocking system that prevents any incorrect use. ANTARES switchboards are equipped in series with the following interlocks.

IFC



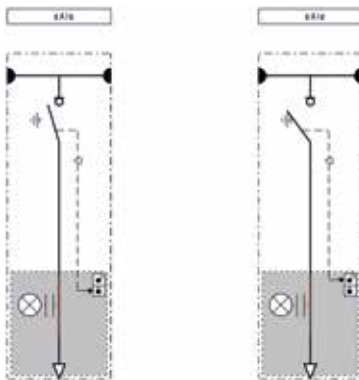
Cables compartment and fuses compartment have access unlocked, if earthing switch is in closed position. Switch disconnector is locked when earthing switch is in closed position. Switch disconnector cannot be closed when the cable compartment cover is not present.

IFA



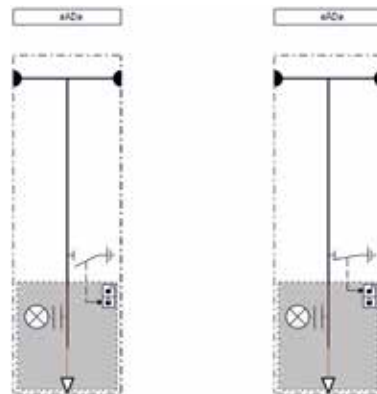
Cables compartment and fuses compartment have access unlocked, if earthing switch is in closed position. Switch disconnector is locked when earthing switch is in closed position. Switch disconnector cannot be closed when the cable compartment cover is not present.

AI



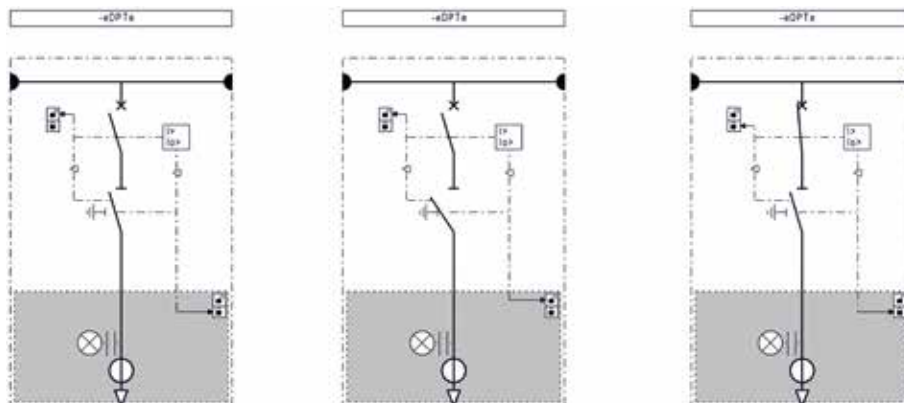
Cables compartment has access unlocked, if earthing switch is in closed position. Switch disconnector is locked when earthing switch is in closed position. Switch disconnector cannot be closed when the cable compartment cover is not present.

AD



Cables compartment has access unlocked, if earthing switch is in closed position.

DPT



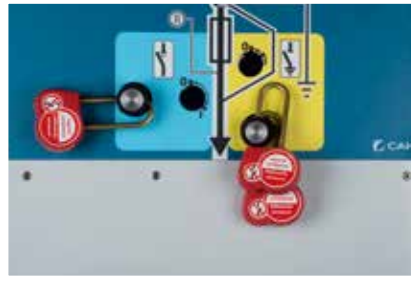
Cables compartment has access unlocked, if earthing switch is in closed position. Switch disconnector is locked when earthing switch is in closed position. Switch disconnector is locked when Vacuum Circuit Breaker is in closed position. Switch disconnector cannot be closed when the cable compartment cover is not present.

● Fuse compartment ● Cables compartment 🔒 Locked 🔓 Unlocked

PADLOCKING & SECURITY LOCKS OF THE FUNCTIONAL UNITS



Obstruction of the lever hub socket by padlock



Security lock

Mechanism / Compartment	Position	ANTARES lock, padlock possibilities	
		Security Lock	Padlock
Switch disconnecter (AI, IFA, IFC, DPT)	Closed	No	Yes
	Open	Yes	Yes
Earthing switch (AI, AD, IFA, IFC, DPT)	Closed	Yes	Yes
	Open	Yes	Yes
Vacuum Circuit Breaker (DPT)	Closed	No	No
	Open	Yes	No
Cable compartment door (All functions)	Removed	No	No
	Fitted	No	Yes
Fuses compartment Door	Removed	No	No
	Fitted	No	Yes
Pushbutton/Turn button on Vacuum Circuit Breaker (DPT)	Closed	No	Yes
	Open	No	Yes
Pushbutton/Turn button on Switch disconnecter (IFC)	Closed	No	Yes
	Open	No	Yes

Extensibility

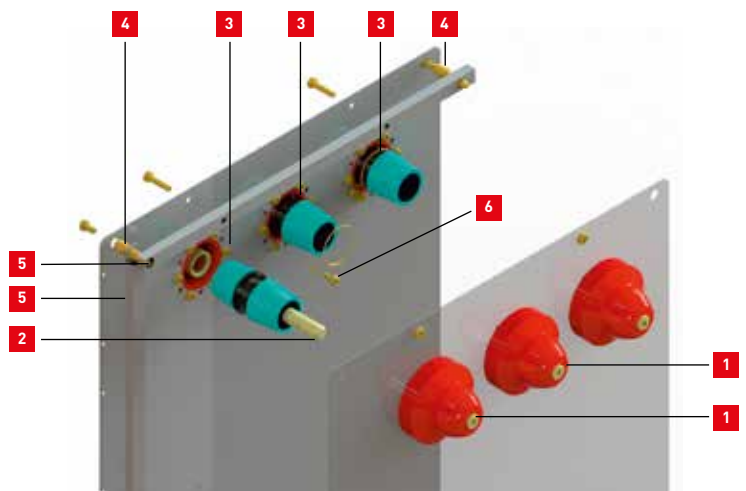
EXTENSIBILITY OF ANTARES FOR BUSBAR MAXIMUM CURRENT UNTIL 630 A



Description

ANTARES switchboard offers extensible configurations for secondary distribution applications especially for:

- Adaptation to installation requirements (limited access, weight and volume of the complete switchboard assembly).
- Connection of additional units either on the left or on the right side for functional unit position flexibility.
- Foreseeable future extension of the switchboard



- 1 Busbars attached to fixed parts on each functional unit
- 2 Conductive links to wire the busbars on each functional unit together (small dimensional variation on the position is accepted by fixed tulip contact)

- 3 Insulating tubes covering the small link for dielectric insulation
- 4 Guiding mechanical pins for alignment in all directions
- 5 Mechanical stops to guarantee the proper assembly.
- 6 Earthed spring

SIMPLE ASSEMBLY PROCESS

The extension assembly of the ANTARES switchboard is done using the following process:



STEP 1: during the assembly of an extension, an additional space of at least 520 mm* is necessary to place expandable AI functional unit.



STEP 2: place the 3 conductive links in the extension module



STEP 3: place Insulating tubes on each conductive link



STEP 4: fix the earthed springs on insulating tubes

* Please refer to the table on p.42



STEP 5: bolt the mechanical stops, approach and connect the 2 switchboards together by using guiding mechanical pins



STEP 6: bolt the assembly until mechanical stops



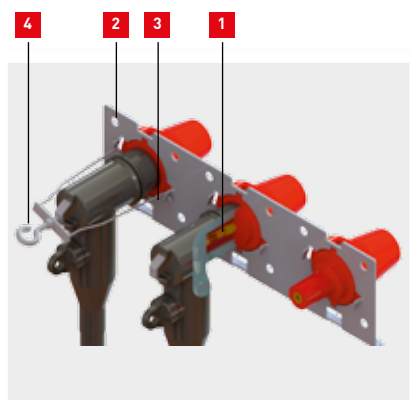
In waiting extension module

Cable compartment

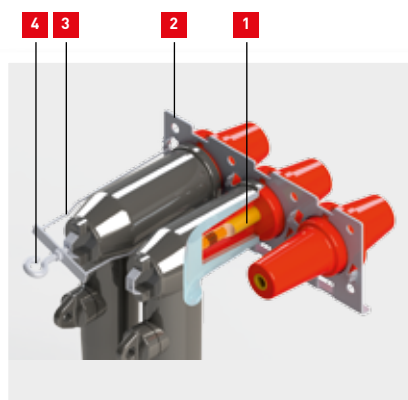
CONNECTOR CONE

PLUGIN BUSHING FOR SWITCHBOARD CABLE CONNECTION

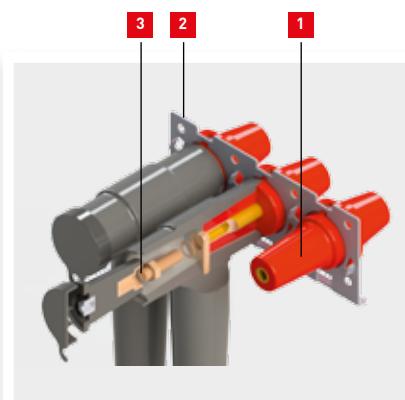
ANTARES can be equipped with the following connector cone types in accordance with EN-50181



Type A (250 A)



Type B (400 A)



Type C (630 A)

- 1 Sliding contact pin
- 2 Support plate
- 3 Mounting flange
- 4 Mounting device

- 1 Sliding contact pin
- 2 Support plate
- 3 Mounting flange
- 4 Mounting device

- 1 Cross member - Male
- 2 Support plate
- 3 Screw contact

Note: All cable connectors are elbow type whatever the functional unit

CABLE COMPARTMENT OF FUNCTIONAL UNITS VERSUS AVAILABLE CONNECTOR CONE TYPES IN ACCORDANCE WITH EN-50181

Switchboard function	AI, LD, AD	IFC, IFA	DPT
Connector cone type A (250 A)	-	Yes	Yes (optional)
Connector cone type B (400 A)	Yes (optional)	-	Yes (optional)
Connector cone type C (630 A)	Yes	Yes (optional)	Yes

ANTARES switchboard is equipped with connector cone type A (250 A), B (400 A) or C (630 A)



IFC, IFA, DPT:

EN 50181 plug-in bushing 250A, with A type connection (lr: 250 A; contact finger \varnothing M7.9 +0.02/-0.05 mm)



AI, AD, LD, DPT:

EN 50181-400A plug-in bushing, with B type connection (lr: 400 A; contact finger \varnothing M14 +0/-0.04 mm)



AI, LD, AD, DPT, IFA, IFC:

EN 50181 630A plug-in bushing, with C type connection (lr: 630 A; \varnothing M16 mm)

CABLE COMPARTMENT OF FUNCTIONAL UNITS VERSUS AVAILABLE CABLE ARRANGEMENTS

ANTARES cable compartment is spacious and allows for various cable arrangements:

Switchboard function	AI, LD, AD	IFC, IFA	DPT
Single cable per phase	Yes	Yes	Yes
Two cables per phase	Yes	Yes*	Yes*
Single cable per phase + surge arresters	Yes	No	No
No cable - bushing protected by insulating plug	Yes	Yes	Yes
CT cores (open or closed type)	Yes	Yes	Yes
Electronic Voltage sensors on 630A elbow connector	Yes	Yes	Yes

* For C type connector only



Single cable per phase connection



Two cables per phase



Cables & surge arresters



AI cable compartment with open CT cores



No cable - bushing protected by 250 A insulating plug (type A connector)



No cable - bushing protected by 400 or 630 A insulating plug (type B or C connector)



AI cable compartment with open CT cores



DPT cable compartment with protection CT cores



Various electronic Voltage sensors on elbow connector

Top & Side cable attachment

In order to connect the main busbar of the switchboard, ANTARES offers as an option, various cable connections type: top or side connection for single cable per phase with the following connector cone types.

Switchboard function	AI, LD, AD		IFC, IFA		DPT	
	Top	Side	Top	Side	Top	Side
Type A (250 A)	No	No	No	No	No	No
Type B (400 A)	Yes	Yes	Yes	Yes	Yes	Yes
Type C (630 A)	Yes	Yes	Yes	Yes	Yes	Yes



Cable 630 A/400 A on top of unit



Cable 630 A/400 A on side of unit

Fuses compartment

For a better accessibility, the fuses compartment is located between cable compartment and IFC, IFA mechanism. This compartment is closed by bolted plate that guarantee Internal Arc Class withstand for personal safety. The interlocking of the compartment is given by mechanical finger from mechanism. For maximum safety during the replacement of fuses, the fuses compartment can only be opened if earthing switches are correctly closed.



STEP 1: for fuse replacement and personal security, use safety equipment (gloves, cover, insulating footstool, ...).



STEP 2: place lever on the hub socket for earthing switch operation



STEP 3: close the earthing switch to free interlock of fuse compartment



STEP 4: unscrew the fuse compartment to access fuse holder



STEP 5: extract the fuses and replace all the fuses at the same time



STEP 6: fix securely all fuse holders and screw the fuse compartment cover

Cable testing

Underground cables are required to be checked after installation, before being put into service and periodically during service life of an installation. Depending on the cable elbow connectors used in medium voltage switchgear, different options are available within ANTARES switchboard to test the cables dielectric characteristics by voltage injection.

VOLTAGE INJECTION PLUGIN SYSTEM

First case is when, there is no specific access point acting as a cable testing facility to connect the voltage source. In this case, the cable elbow connectors have no access point (e.g. plugged elbow connector), so the only way to test the cables is to disconnect them one by one.

In this case, Antares switchboard can be provided with a **voltage injection plugin system** (optional).



Wiring of the Injection plugin system



Insulation of the injection points

Optionally, Antares Switchboard can be equipped on AI unit (cable incoming or outgoing feeder with switch disconnector) with specific injection points acting as always accessible cable testing facility to connect the voltage source.

In service, the specific points for voltage injection are shorted by an accessible external earthing bar. So, to inject the test voltage, it is necessary to open the earthing circuit of the switchgear, by removal of the short-circuiting bar as explained in the figures.



Voltage is applied to check HV cable dielectric properties

INSULATING TEST ROD TOOL

Second case is when, there is no specific point acting as a cable testing facility to connect the voltage source but the cable connectors have access point (e.g. bolted elbow connector). In this case, we have the possibility to connect the voltage source in a specific point by removing the back-plug of the connector and placing an **insulating test rod tool** through it.



STEP 1: open the cable compartment



STEP 2: remove the back-plug of the elbow connector and place the tool adaptors



STEP 3: place the rod tool on the adaptor



STEP 4: start the injection test

When bolted elbow connector is used, Antares Switchboard can be delivered with insulated test rod tool. The test voltage is supplied as explained in the figures.



CHARACTERISTICS

AI, IFC, IFA, DPT, LD AND AD FUNCTIONS

Rated voltage and Level of insulation			
Rated voltage (kV)	12	17.5	24
Rated frequency (Hz)	50/60		
Rated power frequency withstand voltage / 50 Hz, 1min (kV)			
Phase to earth and between phases	28	38	50
On the sectionalized distance	32	45	60
Rated lightning impulse withstand voltage - 1.2/50µs (kV peak)			
Phase to earth and between phases	75	95	125
On the sectionalized distance	110		145
Level of insulation of the sectionalized distance for the cable test (kV)			
Maximum DC feeder test voltage (15 min)	50	50	50
Rated current			
Rated current for busbar & incoming or outgoing feeder, components AI, AD, LD (A)	400 or 630		
Rated current for busbar & outgoing feeder, components IFA, IFC (A)	250 (outgoing) / 400 or 630 (busbar)		
Rated current for busbar & outgoing feeder, components DPT (A)	250, 400 or 630 (outgoing) / 400 or 630 A (busbar)		
Rated short-circuit making capacity (kA)	50		
Rated short time current, main electrical circuit (kA/s)	20/3 or 25/1		
Rated short time current of earthing circuit AI, AD, DPT (kA/s)	20/3 or 25/1		
Rated short circuit breaking current of circuit breaker DPT (kA (rated voltage))	25 (12 kV) or 20 (24 kV)		
Rated short time current of earthing circuit IFA, IFC (kA/s)	2/1		
Rated opening sequence for DPT	O – 3 min – CO – 3 min – CO Optional: O – 0.3s – CO – 3 min – CO		
Number of operating cycles without inspection			
	Mechanical	Electrical	Capacitive
Switch –disconnecter for AI, IFA, IFC, DPT (IEC 62271 - 103)	M2 class (IEC 62271-103) 5 000 operations	E3 class 100 breaks at In pf = 0,7	-
Earthing switch for AD, AI, IFA, IFC, DPT (IEC 62271 - 102)	M1 class (IEC 62271-102) 2 000 operations	E2 class 5 short circuit making	-
Circuit Breaker for DPT (IEC 62271 - 100)	M1 class (IEC 62271-100) 2 000 operations	E2 class 0 - 0,3 s CO15s - CO T10 - T30 - T60 - T100s	C1 class

CHOICE OF MECHANISMS AND EQUIPMENT

3 types of mechanism operating principles

Type A	<p>Type A mechanism is a tumbler mechanism with a dead point passage. The energy is stored and free during the handle movement.</p> <ul style="list-style-type: none"> - Manual: the opening or closing operation is independent of the operator force and speed. The operation is then performed without any duration or time constraint. - Motorized: the opening or closing operations are performed by a motor. Manual opening and closing is still possible.
Type B	<p>Type B mechanism is a spring mechanism with 2 latch-in features for opening and closing. The energy needed for opening and closing is stored during the load of a spring.</p> <p>The operator manually loads spring in one single operation for next closing and future opening. Closing can be completed by using turn-button. The fuse switch-disconnector mechanism is thus ready for a snap opening operation. Tripping can be performed with a coil, a fuse striker or a turn-button.</p>
Type C	<p>These operating mechanisms use the energy stored by springs to close and open the circuit-breaker on the DPT function.</p> <ul style="list-style-type: none"> - Manual: the operator manually operates to load the control mechanism's spring. The spring is held in place by a latch, freed manually by a mechanical button, causing: <ul style="list-style-type: none"> - the release of the spring - the closing of the CB - the arming of the trip spring, now held in place by a latch. <p>It is thus possible to open the circuit-breaker by freeing the trip spring latch manually (mechanical button) or electrically (electro-magnet).</p> <p>Note: with the circuit-breaker closed, it is possible optionally to rearm the closing spring, which authorises a rapid re-closure cycle.</p> <ul style="list-style-type: none"> - Motorized: the closing spring is armed by a motor (arming time < 15 s). Opening and closure operations are carried out electrically (magnets). <p>Note: It is possible to arm, close and trip the circuit-breakers manually.</p>

		Functions					
Type of operating mechanism		AI	IFC	IFA	DPT	LD	AD
Switch - disconnector	Type A	●		●	●		
Fuse switch - disconnector (only manual)	Type B		●				
Earthing switch (manually drive only)	Type A	●	●	●	●		●
Circuit-breaker	Type C				●		
Possible options on mechanism		AI	IFC	IFA	DPT	LD	AD
Manual opening and closing as a standard		●	●	●	●		●
Mechanical position indicator as a standard		●	●	●	●		●
Motorization as an option		●			●		
Trip coil			● (option)		● (standard)		
2nd trip coil					● (option)		
Autonomous tripping device without any auxiliary source (striker)			●				
Operating counter		● (option)	● (option)	● (option)	● (standard)		● (option)
Optional auxiliary contact		AI	IFC	IFA	DPT	LD	AD
Switch -disconnector position		●	●	●	●		
Earthing switch position		●	●	●	●		
Fuse blown indicators			●				
Vacuum circuit-breaker position					●		

Note: electrical characteristics available on request for trip coil, motorization, auxiliary contacts

ACCESSORIES AND OPTIONS

Fuses & Selection of Medium Voltage fuses



Types of Medium Voltage fuses

The fuses are used for IFC or IFA functional units to protect distribution transformers. Fuses that have an integrated thermal striker are used for IFC to switch off the switch-disconnector in case of short circuit or to prevent a thermal overload in the fuse holder.



Technical characteristics

The fuses meet the IEC 60282-1 standards and in case of striker, "Medium" type with a maximum initial tripping force of 80 N.



MV fuse according to IEC 60282-1 standard

Voltage	Length (mm)
Up to 12 kV	292 (with mechanical adaptation to extend to 442 mm)
17.5 kV	442
24 kV	442



Rated fuses selection table

Rating in A, no overload, $-25^{\circ}\text{C} < T^{\circ}\text{C} < 40^{\circ}\text{C}$

Operating rated Voltage (kV)	Power rating of transformer (kVA)															
	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000
12	10	10	16	20	25	25	31,5	40	50	50	63	80	100			
17.5	10	10	10	10	16	20	25	31,5	31,5	40	50	50	63	80	100	
24	10	10	10	10	16	16	20	25	25	31,5	40	40	63	63	80	100

Low voltage equipment

LOW VOLTAGE CABINET

When control function requires additional room for electrical equipment, ANTARES Switchboard can be equipped with full range of Low Voltage cabinets.



216 mm low voltage
single cabinet



432 mm low voltage
single cabinet



432 mm low voltage
double cabinet



432 mm low voltage
double cabinet- internal
arrangement

EQUIPMENT OF MECHANISMS

Control mechanisms for the three-position switch, equipment (optional)

MOTOR-DRIVEN CONTROL MECHANISM (OPTIONAL)

The manual control mechanisms of ANTARES switchgear can be equipped with motor-driven mechanisms for the three-position switch-disconnector.

→ Operating voltages for motor-driven control mechanisms:

- Motor drive voltage: 48 Vdc.
- Motor rating: 100 W/2 A max.
- Transition time: < 7 sec.
- Insulation: dielectric 50 Hz / 1 min at 2 kV and lightning impulse withstand 5 kV peak.

→ Three types of control principles are possible:

- Local control by push-button (optional).
- Remote control (standard) from a terminal (motor drive management not integrated).
- Remote control via connector for CAHORS Icontrol T remote control connection (integrated motor drive management) (optional).

LATCHING MECHANISM RELEASE (OPTIONAL)

Stored-energy control mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the electromagnetic coil of the shunt release, e.g. for tripping in the event of a transformer fault (temperature) or emergency push-button. To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary contact which is mechanically coupled with the three-position switch-disconnector.

AUXILIARY CONTACT BLOCK (OPTIONAL)

Each control mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary contact block for the position indication.

→ Contact properties:

AC Operation (50 or 60 Hz)		DC Operation	
Voltage Vac	Rated Current A	Voltage Vdc	Rated Current A
Voltage up to 690 Vac max	20 (except for breaking)*	24	20
		48	12
		60	4.5
		110	1
		220	0.4
		440	0.3

*Breaking capacity: 180 A up to 240 Vac, 150 A up to 440 Vac, 90 A up to 690 Vac

- **Insulation:** dielectric 50 Hz / 1 min at 1 kV and lightning impulse withstand 8 kV peak between poles and 2 kV peak between contacts.

→ Contact architecture:

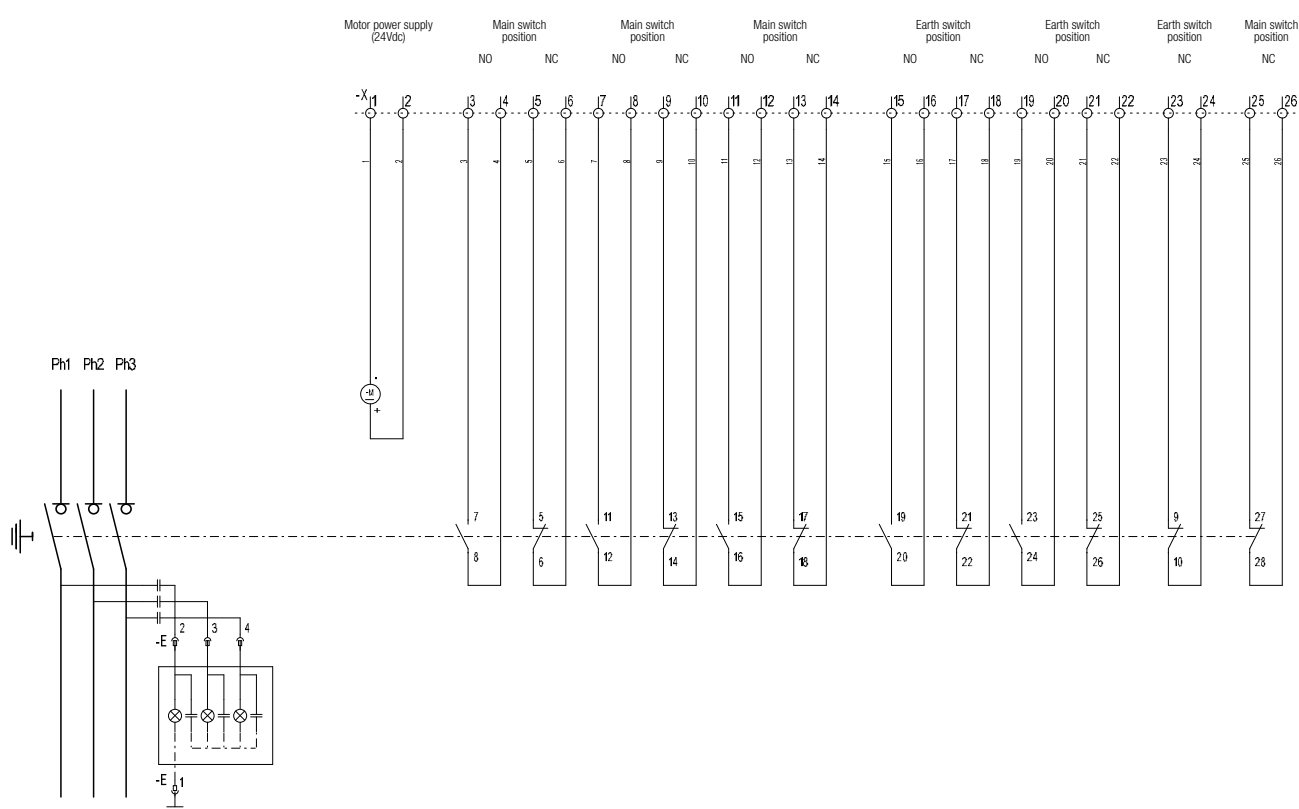
•Switch-disconnector function:

CLOSED and OPEN: 3 NO + 4 NC

•Earthing switch function:

CLOSED and OPEN: 2 NO + 3 NC.

TYPICAL WIRING DIAGRAM FOR MOTOR AND AUXILIARY CONTACTS



VOLTAGE PRESENCE INDICATION SYSTEM (VPIS) OR VOLTAGE DETECTION SYSTEM (VDS)

The absence or presence of voltage at incoming or outgoing feeder cables can be verified directly on the switchboard by using **Voltage Detection System (VDS)** or **Voltage Presence Indicating System (VPIS)**.

VOLTAGE DETECTION SYSTEM

is powered by capacitive divider in the A, B or C type connector.

- VDS is in accordance to IEC 61245-5 standard;
- Connectors on the front panel allow the use of phase comparator tool;
- Arrow sign can be seen on LCD display technology when voltage is present.



VDS, Voltage Detection system

LEDS VOLTAGE PRESENCE INDICATOR SYSTEM (VPIS)

is powered by capacitive divider in the A, B or C type connector.

- VPIS is in accordance to IEC 62271-206 standard;
- Connectors on the front panel allow the use of phase comparator tool;
- Extended lifetime by LEDs technology;
- Clear view on each LEDs from the front.



VPIS, LEDs Voltage Presence Indicator System

FAULT PASSAGE INDICATORS AND ASSOCIATED CURRENT TRANSFORMER

To improve power availability and manage network load, ANTARES can be fitted with “Sentinel” short circuit & earth fault Passage Indicator (FPI) integrated in ANTARES Low Voltage front panel.

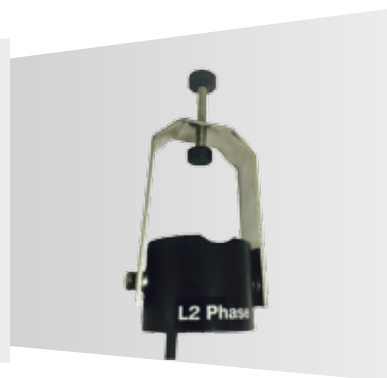
Sentinel® FPI is designed to detect fault on cable system in ring networks with one input/open ring arrangement. Fault current is sensed by cable mounted sensor, which gives level of the current. If phase/earth current exceed programmed set current and time response, fault will be indicated by high visibility flashing red LEDs in front of the device and auxiliary relay contact will be activated. By this auxiliary relay contact, an outdoor lamp (option) can give the fault passage indication without entering the substation.



Fault passage indicator



Earth fault sensor



Overcurrent sensor

→ **Overcurrent & Earth fault detection with DIP microswitches are available for manual settings:**

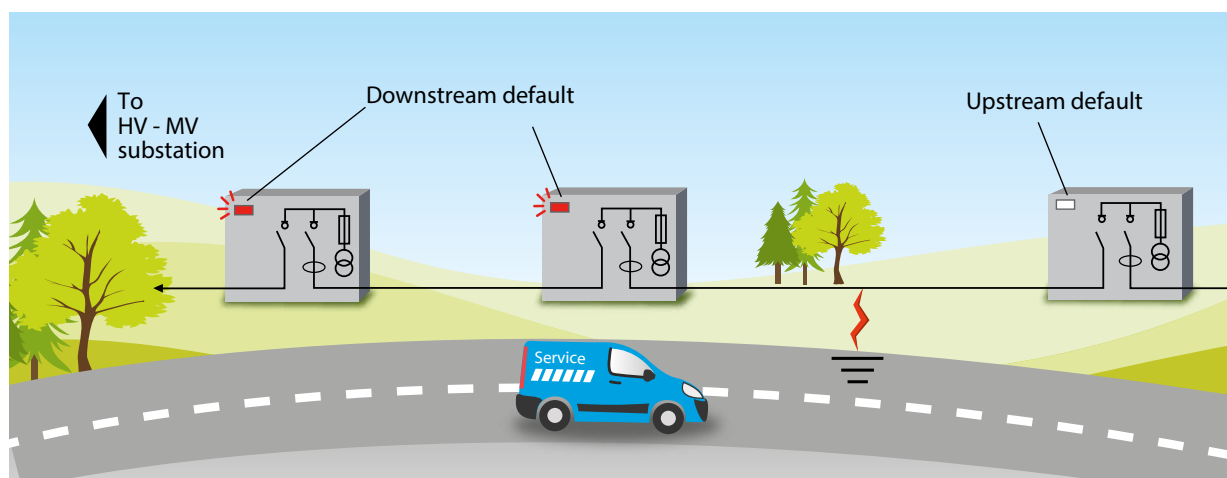
- Phase short circuit pickup level from 100 A to 1200 A, in 100 A increments
- Phase Fault response time from 40 to 500ms
- Earth short circuit pickup level from 10 A to 100 A
- Earth Fault response time from 40 to 500ms

→ **Reset Options are available for fault indication reset:**

- Self reset for recovery of operating current
- Self reset in the event of momentary fault (by monitoring the current after a fault)
- Reset through potential free input (AC/DC voltage)
- Manual reset by front side push button
- Automatic reset by configurable timer (hour)

→ **Fault Indication for communication to SCADA by 3 potential free contacts indicate:**

- Earth fault
- Short circuit
- Low battery voltage

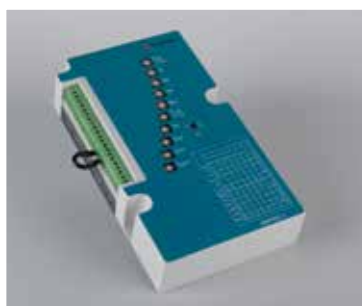


Defaults are indicated by one color and only fault passage indicators located between HV/MV substation and defaults flash. The part of the network which is faulty is located between the last flashing FPI and the first non-flashing FPI.

PROTECTION RELAYS

ANTARES can be fitted with different types of protection relays:

- Autonomous protection relays directly integrated behind ANTARES front face: SMPRO-1 or SMPRO-1 + DR1
- Autonomous protection relays directly integrated in low voltage cabinet : SMPRO-2
- Other protection relays can be located in ANTARES low voltage cabinet.



SMPRO-1 self-powered protection relay

SMPRO-1 SELF-POWERED PROTECTION RELAY

The SMPRO-1 is a Current Transformer self-powered protection relay, with a very compact design, for medium voltage switchboards with circuit-breakers.

The following protection functions can be found in SMPRO-1 and all the protection parameters are adjusted with the rotary switches:

- 3 phases definite time over current and short-circuit protection with variable tripping times (ANSI 50/51)
- 3 phases over current protection with selectable inverse time characteristics and definite time short-circuit current element (ANSI 50/51)
- Definite time and inverse time earth over current protection by internal calculation (ANSI 50N/51N).

Low energy pulse output tripping circuit breaker is available.



SMPRO-1+ DR1 self-powered protection relay

SMPRO-1 + DR1 SELF-POWERED PROTECTION RELAY

In addition to SMPRO-1, Data Retrieval device type DR1 provides serial communication with SMPRO-1. It is an externally powered unit and it can be used for data retrieval as well as for parameter setting. It has five programmable relays which can be used for annunciation. It is wired to SMPRO-1 on RS485 port. It has a RS232 port on the front panel and supporting software for connection to a PC. External supply of +12V is required for SMPRO-1 communication with DR-1. DR-1 is not a part of the standard supply, it is an accessory.



SMPRO-LS2

SMPRO-LS2 SELF-POWERED PROTECTION RELAY

The SMPRO-LS2 is a Current Transformer self-powered protection relay using high-speed micro controller **samples** through a **12 bit A/D converter for current analysis**. The micro controller performs powerful Digital Algorithms to find out Amplitude of fundamental current signal, and then these values are used for protection and metering function. Input current is displayed on 16 x 2 LCD display for metering.

The relay is buffered by a battery for feeding the LCD display and SCADA communication. After tripping operation, relay maintains fault indication on LCD display. During this time, the relay uses power through internal battery. Reading of Fault data and setting of relay can be done on battery.

Failure of the battery has no effect on the protection function of the relay. The battery has service life of more than 5 years.

→ Over Current / Earth Fault Protection

The relay has inverse time over current / earth fault function as well as instantaneous protection for both. Following is summary of different protection functions provided by relay.

ANSI	IEC	Protection Function
50	I >>	Instantaneous Over Current Protection
50N	IE >>	Instantaneous Earth Fault Protection
51	I>T, Ip	Time Over Current Protection (Phase)
51N	IE >t, IEP	Time Over Current Protection (Earth)

→ Measurement and Communication Function

In normal condition the relay displays all the settings. Using the front keyboard, the display can be programmed to show the actual current flowing through the relay. If current is in fault range, the relay gives trip command. The type of the fault is displayed on LCD display.

During the fault condition, the relay measures the fault current and stores it in non-volatile memory. The fault current can be read using keyboard on LCD display. All settings can be done locally and saved in non-volatile memory.

STANDARD CURRENT TRANSFORMER FOR SELF-POWERED PROTECTION RELAY

SMPRO self-powered relay is activated by standard and toroidal type current transformers and is described in the table below.



Bottom view of toroidal type current transformers on external cone cable plug-in terminals.

Description	Conversion	Rated power	Degree of precision
CT1	30/1 A	2,5 VA	10P5 / 5P10
CT2	50/1 A	2,5 VA	10P5 / 5P10
CT3	100/1 A	2,5 VA	10P5 / 5P10
CT4	200/1 A	2,5 VA	10P5 / 5P10
CT5	400/1 A	2,5 VA	10P5 / 5P10
CT6	600/1 A	2,5 VA	10P5 / 5P10

STANDARD VOLTAGE ELECTRONIC SENSORS

SMPRO self-powered relay is activated by standard and toroidal type current transformers and is described in the table below.



Various electronic voltage sensor



Applications

MV sensors are a key component of a smart grid. Reliability, accuracy and compact size enable the most demanding distribution automation applications. Easy to integrate in new and existing MV switchgear functional units, they are a perfect complement to deploy advanced functionalities that enhance the medium voltage systems operation.



Main Features

- Small dimensions and light weight
- Improved accuracy with linear response over different operations and environmental conditions.
- On site calibration is not required
- Protection and measurement functions using the same sensors
- Direct compatibility with electronics
- Easy installation
- A full range of tests applied to guarantee the maximum safety
- Resin housing

TECHNICAL SPECIFICATIONS

Insulation Voltage		24 kV
Routine test	Dielectric strength	at 50 kV
	Partial discharges	<50pC at 28.8 kV
	Accuracy	1%
Type tests	AC Voltage test, dry and wet	at 50 kV
	Lightning impulse voltage test (BIL)	at 125 kV
Operating conditions (according to EN 60870-2-2 Class C2)		Temperature from -10°C to +60°C Relative humidity from 15 to 100%
Storage conditions (according to EN 60870-2-2 Class C3)		Temperature from -25°C to +75°C Relative humidity from 10 to 100%
Voltage divider ratio		10.000/1 V
Frequency		50 Hz / 60 Hz

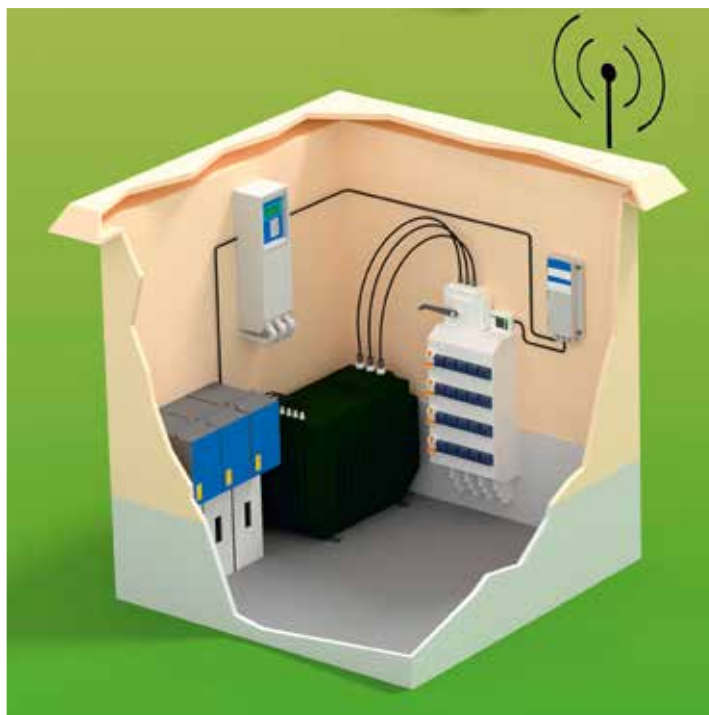
REMOTE CONTROL AND MONITORING

ANTARES Cable incoming or outgoing feeders (AI) can be motorized allowing the remote control and monitoring of the functional unit.

Complete automation of the network is therefore possible and avoids costly human interventions on sites.

To enable communication with the network control room (SCADA), Icontrol-T integrates communication systems such as:

- Modem solutions for telephone lines
- Private Radio network
- GSM/GPRS network.
- a range of protocols as:
 - Modbus- RTU, Modbus-IP
 - IEC 870-5-101, 5-104
 - DNP3



I CONTROL-T

AN INTERFACE DESIGNED FOR TELECONTROL OF MV NETWORKS

I Control-T is a “plug and play” or multifunction interface that integrates all the functional units necessary for remote supervision and control of ANTARES:

- acquisition of the different types of information: switch position, fault detectors, current values...
- transmission of switch open/close orders
- exchanges with the control center.

Required particularly during outages in the network, I Control-T is of proven reliability and availability, being able to ensure switchgear operation at any moment. It is simple to set up and to operate.

FUNCTIONAL UNIT DESIGNED FOR THE MEDIUM VOLTAGE NETWORK

- IControl-T is designed to be connected directly to the MV switchgear, without requiring a special converter.
- It has an integrated MV network fault current detection system (overcurrent and zero sequence) with detection thresholds that can be configured channel by channel (current value and fault acknowledgement time).
- Appropriate protocols (IEC 870-5-101/104, DNP3 or Modbus) and large choice of media (GSM/GPRS, radio, PSTN, etc.) are suitable for open communications.
- Automatism functions are available:
 - automatic permutation between 2 MV power sources.
 - automatic switch opening/closing in case of voltage drop.
 - automatic switch opening/closing in case of downstream feeder cable fault.

MEDIUM VOLTAGE SWITCHGEAR OPERATING GUARANTEE

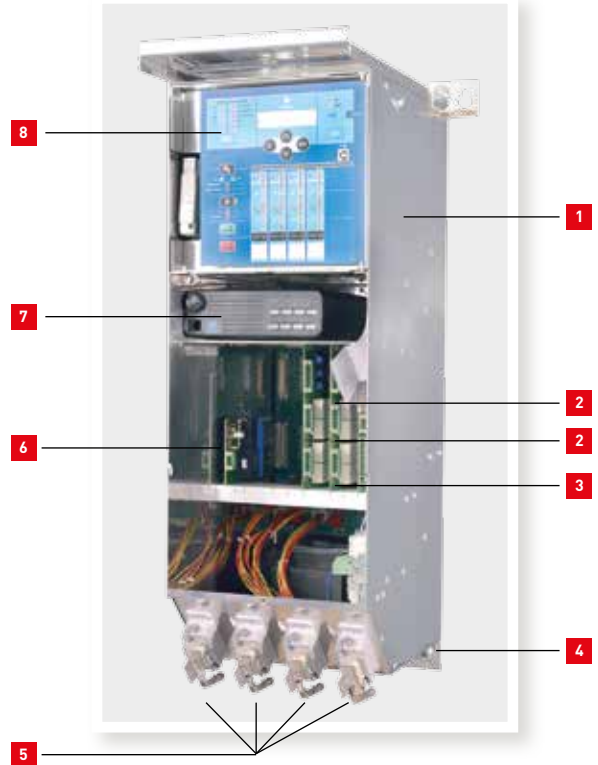
It is a backed up power supply which guarantees continuity of service for several hours in case of loss of the auxiliary source, and supplies power to the I Control-T and the MV switchgear motor mechanisms.



This feeder remote control unit is modular design which meet different needs. It is composed of electronic subassemblies, each performing a particular function.



I Control-T Remote terminal unit



- 1 Battery
- 2 LBS switch telecontrol cards / Fault passage indicators
- 3 Power supply electronic card for UPS function
- 4 Input connectors (Cable glands)
- 5 Connector to control Medium Voltage Load Break Switch
- 6 Communication modem card
- 7 Radio location
- 8 Central unit / Human Machine interface (HMI)

SENTINEL®-FRTU FEEDER REMOTE TERMINAL UNIT

If ANTARES Cable incoming or outgoing feeders (AI) is not motorized, remote monitoring of the functional unit can be done with SENTINEL®-FRTU device.

Thus ANTARES switchgear and the substation where it is installed can be remote monitored.



An interface designed for distribution network remote monitoring.

Installed in substations, SENTINEL®-FRTU allows to consolidate data and events gathered within substation, and it allows to send these data remotely.

Simple to set-up, remote substation monitoring with SENTINEL®-FRTU allows DNOs to improve network management.

→ Features

SENTINEL®-FRTU can be equipped with a GSM/GPRS modem or it can be connected to different communication modules such as Ethernet modem.

SENTINEL®-FRTU embeds a web server which allows to view gathered data from any web browser of a computer connected.

Thus gathered data by SENTINEL®-FRTU can be viewed locally or remotely.

Equipped with a GSM / GPRS module, SENTINEL®-FRTU can also send telephone-type alarms to DNOs service crews when a monitored value exceeds a predefined thresholds

- Passage of a fault on the MV network which will help to quickly identify and isolate the faulty section
- High transformer temperatures which means a network overload
- Etc....

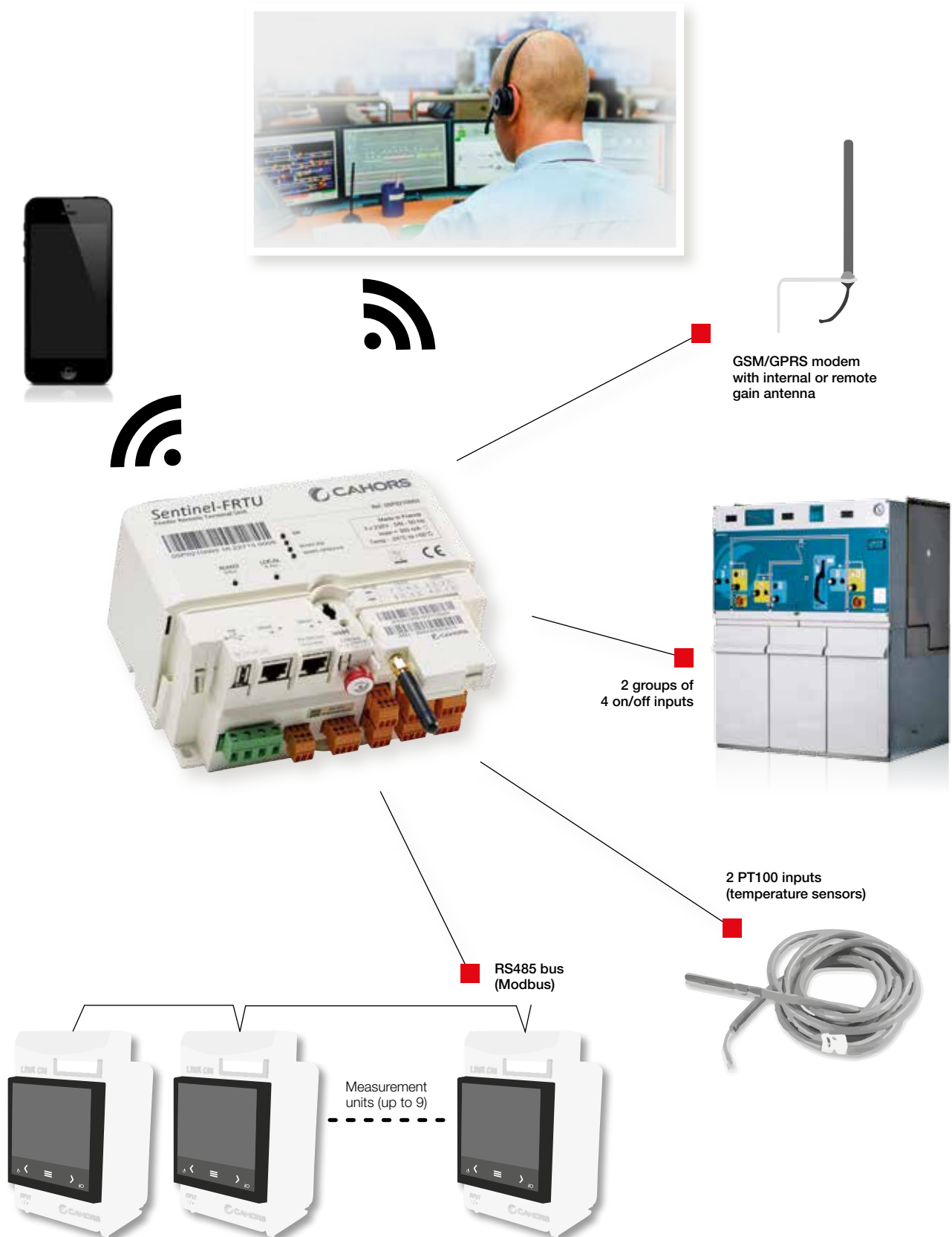
→ Substation monitoring

Any data can be saved and timestamped by SENTINEL®-FRTU.

Types of data and events that can be gathered by SENTINEL®-FRTU:

- MV switch or circuit breaker positions
 - From the ANTARES switchgear position indicators
- Passage of faults on the MV network
 - From the integrated FPI of ANTARES switchgear
- Temperatures within the substation or from the MV/LV Transformer
 - From PT100 probes
- LV or MV network electrical parameters
 - From dedicated measuring system
- Detection of substation Intrusion, substation flood, surge arresters triggering, etc.
 - From external relay outputs of any appropriate device
- Detection of SF6 presence
 - From manometer in Antares switchgear

SYSTEM ARCHITECTURE



Accessories

STANDARD ACCESSORIES SUPPLIED WITH ANTARES SWITCHBOARD

→ **operating lever** (1 lever per switchboard)

OPTIONAL ACCESSORIES SUPPLIED WITH ANTARES SWITCHBOARD

→ **Operation counter**

→ **Phase control tool**

→ **Double side panel**

→ **Voltage injection rod tool kit**

→ **Base frame, single height**

→ **Base frame, double height**

→ **SF6 extraction Tool**

→ **Manometer with or without contact**

→ **Lifting tool**

→ **No cable bushing**



Operating lever



Operation counter



Phases control tool



Voltage injection rod tool kit



Base frame, single height (260 mm)



Base frame, double height (520 mm)



Lifting tool



Manometer with auxiliary contact



Manometer without auxiliary contact



SF6 extraction Tool



Double side panel



No cable-bushing protected by insulating plug (type A, B or C connector)



INSTALLATION

Selection of cables and separable connectors

The cables connection compartments have been designed to accept connection systems with the following arrangement.

■ CABLE WITH SYNTHETIC INSULATION SINGLE CONNECTION PER PHASE FOR AI, LD, AD AND DPT FUNCTIONS

630 A connector, external cone as per EN 50181, C type connector



400 A connector, external cone as per EN 50181, B type connector



■ CABLE WITH SYNTHETIC INSULATION DOUBLE CONNECTION PER PHASE FOR AI, LD AND AD FUNCTIONS

630 A connector, external cone as per EN 50181, C type connector



400 A connector, external cone as per EN 50181, B type connector



■ CABLE WITH SYNTHETIC INSULATION SINGLE CONNECTION PER PHASE FOR IFC/IFA TRANSFORMER PROTECTION (250 A)

250 A connector, external cone as per EN 50181, A type connector



CABLE WITH SYNTHETIC INSULATION **SINGLE CONNECTION PER PHASE WITH SURGE ARRESTER FOR AI, LD** **AND AD FUNCTIONS**

630 A connector, external cone as per EN 50181, C type connector



400 A connector, external cone as per EN 50181, B type connector



CABLE WITH SYNTHETIC INSULATION **SINGLE CONNECTION PER PHASE FOR DPT, AI FUNCTION**

630 A connector, external cone as per EN 50181, C type connector



400 A connector, external cone as per EN 50181, B type connector



SEPARABLE CONNECTORS INTERFACE A WITH EARTHING SHIELD

$I_r = 250 \text{ A}$

12kV						24kV				
Manufacturer	Designation	Ø [mm]	Conductor	Additional equipment for dual cable arrangement	Surge Arrester	Designation	Ø [mm]	Conductor	Additional equipment for dual cable arrangement	Surge Arrester with
CAHORS	-	-	-	-	-	CSE-250-A-24-25 (02154)	18.6-21.3	25	-	-
CAHORS	-	-	-	-	-	CSE-250-A-24-50 (02156)	20.2-23.0	50	-	-
CAHORS	-	-	-	-	-	CSE-250-A-24-95 (02151)	23.4-26.0	95	-	-
3M	93-EE 605-2/-95	12.2-25.0	25-95	NONE	NONE	93-EE605-2/-95	12.2-25.0	25-95	NONE	NONE
3M	92-EE 615-2/-120	19.8-22.8	120	NONE	NONE	93-EE615-2/-120	24.0-27.0	120	NONE	NONE
3M	92-EE 615-2/-150	21.3-24.3	150	NONE	NONE	93-EE615-2/-150	25.5-28.5	150	NONE	NONE
ABB	CSE-A 12250-01	10.0-12.0	10-16	NONE	NONE	CSE-A24250-01	13.0-22.0	10-16	NONE	NONE
ABB	CSE-A 12250-02	13.0-22.0	25-95	NONE	NONE	CSE-A24250-02	17.0-25.5	25-95	NONE	NONE
EUROMOLD	158LR/G	12.6-18.7	16-70	NONE	NONE	K158LR/G	12.6-18.7	16-25	NONE	NONE
EUROMOLD	158LR	18.4-26.4	70-95	NONE	NONE	K158LR	18.4-26.4	25-95	NONE	NONE
NKT	EASW 10/250	12.7-19.2	25-95	NONE	NONE	EASW20/250	17.0-25.0	25-95	NONE	NONE
NKT	CE 12-250	16.9-25.0	95-120	NONE	NONE	CE24-250	16.9-25.0	25-120	NONE	NONE
PRYSMIAN	FMCE-250	10.0-21.3	16-95	NONE	NONE	FMCE-250	18.6-26.0	35-95	NONE	NONE
SÜDKABEL	SEW 12	12.2-25.0	25-150	NONE	NONE	SEW24	17.3-25.0	25-95	NONE	NONE
TYCO	RSES	13.5-33.5	16-120	NONE	NONE	RSES	13.5-33.5	16-120	NONE	NONE

SEPARABLE CONNECTORS INTERFACE B WITH EARTHING SHIELD, $I_r = 400 \text{ A CABLE}$

12kV						24kV				
Manufacturer	Designation	Ø [mm]	Conductor	Additional equipment for dual cable arrangement	Surge Arrester	Designation	Ø [mm]	Conductor	Additional equipment for dual cable arrangement	Surge Arrester with
CAHORS	-	-	-	-	-	CSE-400-B-24-95 (04526)	22.9-25.1	95	-	-
CAHORS	-	-	-	-	-	CSE-400-B-24-150 (04527)	26.0-28.3	150	-	-
CAHORS	-	-	-	-	-	CSE-400-B-24-240 (04528)	29.8 -32.7	240	-	-
3M	93-EE 605-4/-95	15.0-23.5	25-95	NONE	MUT 23	93-EE605-4/-95	15.0-23.5	25-95	NONE	MUT23
3M	93-EE 605-4/-240	21.8-32.6	95-240	NONE	MUT 23	93-EE605-4/-240	21.8-32.6	95-240	NONE	MUT23
ABB	CSE-A 12400-01	13.0-20.0	25-70	NONE	NONE	CSE-A24400-01	17.0-24.0	25-70	NONE	NONE
ABB	CSE-A 12400-02	18.5-30.5	95-300	NONE	NONE	CSE-A24400-02	22.5-35.0	95-300	NONE	NONE
EUROMOLD	400LR/G	12.0-37.5	50-240	NONE	NONE	K400LR/G	12.0-37.5	25-240	NONE	NONE
EUROMOLD	400TE/G	12.0-37.5	70-240	400CP-SC + 400TE/G	156SA + 400RTPA	K400TE/G	12.0-37.5	25-240	K400CP-SC + K400TE/G	156SA + K400RTPA
NKT	CE 24-400	12.7-34.6	25-300	NONE	NONE	CE24-400	12.7-34.6	25-300	NONE	NONE
NKT	CB 36-400	12.7-40.0	25-300	CC 12-630	CSA 12	CB36-400	12.7-40.0	25-300	CC24-630	CSA24
PRYSMIAN	FMCE-400	18.5-30.4	70-300	NONE	NONE	FMCE-400	18.5-35.3	35-300	NONE	NONE
PRYSMIAN	FMCT-400	18.5-30.4	70-300	NONE	NONE	FMCT-400	18.5-35.3	35-300	NONE	NONE
SÜDKABEL	SEHDT 12.1	17.7-30.4	70-300	NONE	NONE	SEHDT22.1	18.0-32.6	25-240	NONE	NONE
SÜDKABEL	SET 12-B	15.0-32.6	50-300	KU 23.1/22 + SET 12-B	MUT 23	SET24-B	15.0-32.6	25-240	KU23.1/22 + SET24-B	MUT23
TYCO	RSES	12.7-34.6	25-240	NONE	NONE	RSES	12.7-34.6	25-240	NONE	NONE

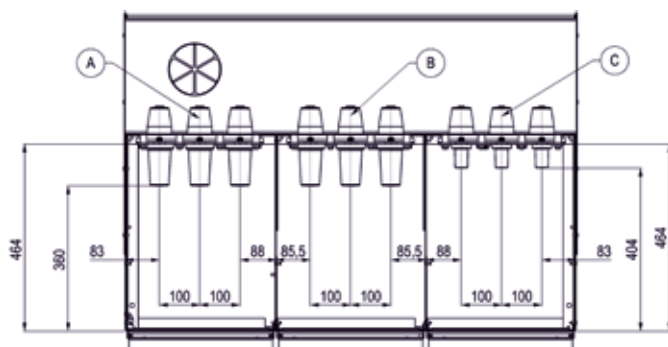
SEPARABLE CONNECTORS INTERFACE C WITH EARTHING SHIELD

$I_r = 630 \text{ A CABLE}$

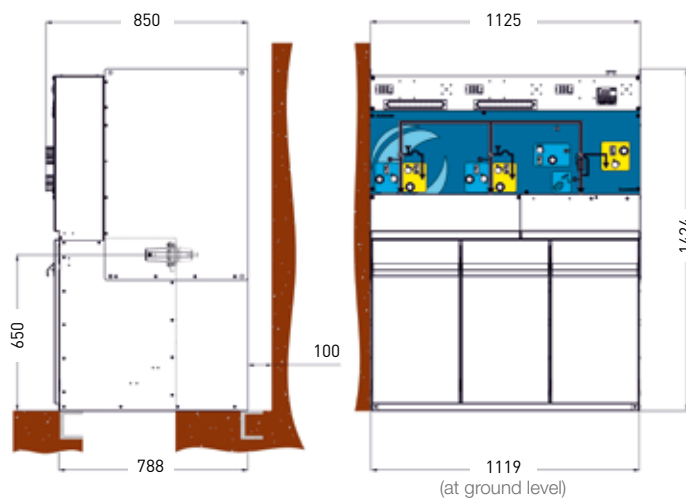
Manufacturer	Designation	Ø [mm]	12kV			24kV				
			Conductor	Additional equipment for dual cable arrangement	Surge Arrester	Designation	Ø [mm]	Conductor	Additional equipment for dual cable arrangement	Surge Arrester
3M	93-EE705-6/-95	15.0-23.5	50-95	KU23.1 + 93-EE705-6/95	MUT23	93-EE705-6/-95	15.0-23.5	50-95	KU23.1 + 93-EE705-6/-95	MUT23
3M	93-EE705-6/-240	21.8-32.6	120-240	93-EE 718-6/150-240	MUT23	93-EE705-6/-240	21.8-32.6	95-240	93-EE718-6/150-240	MUT23
ABB	CSE-A12630-01	13.0-20.0	25-70	CSEP-A12630-01	CSAP-A12	CSE-A24630-01	17.0-24.0	25-70	CSEP-A24630-01	CSAP-A24
ABB	CSE-A12630-02	18.5-30.5	95-300	CSEP-A12630-02	CSAP-A12	CSE-A24630-02	22.5-35.0	95-300	CSEP-A24630-02	CSAP-A24
ABB	CSE-A12630-03	30.5-45.0	400-630	CSEP-A12630-03	CSAP-A12	CSE-A24630-03	30.5-45.0	400-630	CSEP-A24630-03	CSAP-A24
EUROMOLD	400TB/G	12.0-37.5	25-300	400CP-SC + 400TB/G	400PB-XSA	K400TB/G	12.0-37.5	25-300	K400CP-SC + K400TB/G	400PB-XSA
EUROMOLD	400LB	12.0-37.5	25-300	400CP-SC + 400TB/G	400PB-XSA	K400LB	12.0-37.5	25-300	K400CP-SC + K400TB/G	400PB-XSA
EUROMOLD	400TB-630	12.0-37.5	25-300	300PB-630	300PB-10SA	K430TB-630	12.0-37.5	25-300	K300PB-630	300PB-10SA
EUROMOLD	400TB/G	23.5-56.0	185-630	440CP + 440TB/G	400PB-XSA	K440TB/G	23.5-56.0	185-630	K440CP + K440TB/G	400PB-XSA
NKT	CB12-630	12.7-34.6	25-300	CC12-630	CSA12	CB24-630	12.7-34.6	25-300	CC24-630	CSA24
NKT	AB12-630	12.7-34.6	25-300	AC12-630	ASA12	CC24-630	34.0-45.6	400-630	CC24-630 or CC24-630	CSA24
PRYSMIAN	FMCTs-400	18.5-30.4	70-300	FMPCs-400-12 + FMCT1-400	400PBX-XSA	FMCTs-400	18.5-35.3	35-300	FMPCs-400-24 + FMCTs-400	400PBX-XSA
PRYSMIAN	FMCTs-400/1250	18.5-42.0	70-300	FMPCs-400-12 + FMCTs-400/1250	400PBX-XSA	FMCTs-400/1250	18.5-47.1	35-630	FMPCs-400-24 + FMCTs-400/1250	400PBX-XSA
SÜDKABEL	SET12	15.0-32.6	50-300	SEHDK 13.1	MUT23	SET24	15.0-32.6	25-240	SEHDK23.1	MUT23
SÜDKABEL	SET12	15.0-32.6	50-300	KU23.2/22 + SET12	MUT23	SET24	15.0-32.6	25-240	KU23.2/23 + SET24	MUT23
SÜDKABEL	SEHDT13	31.3-36.4Y	400-500	NONE	KU33 + MUT23	SEHDT23.1	31.9-34.6	300	KU23.2/23 + SEHDT23.1	MUT23
TYCO	RSTI-L	12.7-34.6	25-300	RSTI-CC-L	RSTI-SA	RSTI-L	12.7-34.6	25-300	RSTI-CC-L	RSTI-SA
TYCO	RICS	FLEXIBLEN	25-300	NONE	RDA	RSTI-56LXX	34.0-45.6	400-630	RSTI-66CP-M16 + RSTI-56LXX	NONE

Overall dimension drawings

ANTARES - 3 FUNCTIONS SWITCHBOARD - AI AI IFC CONFIGURATION

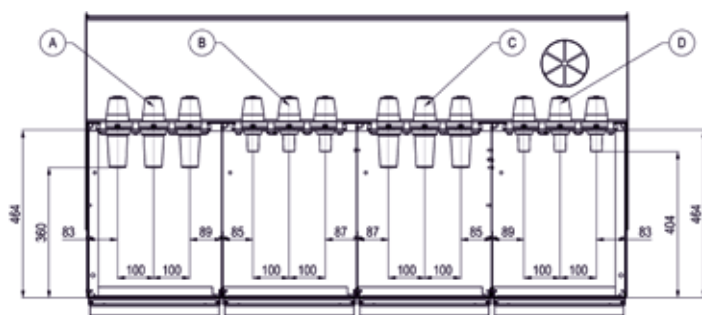


Cable compartment dimensions

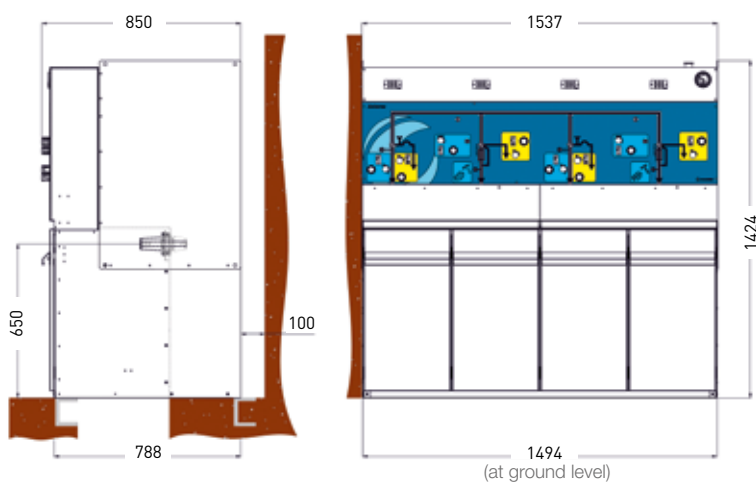


A	B	C
Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 250 A

ANTARES - 4 FUNCTIONS SWITCHBOARD - AI IFC AI IFC CONFIGURATION

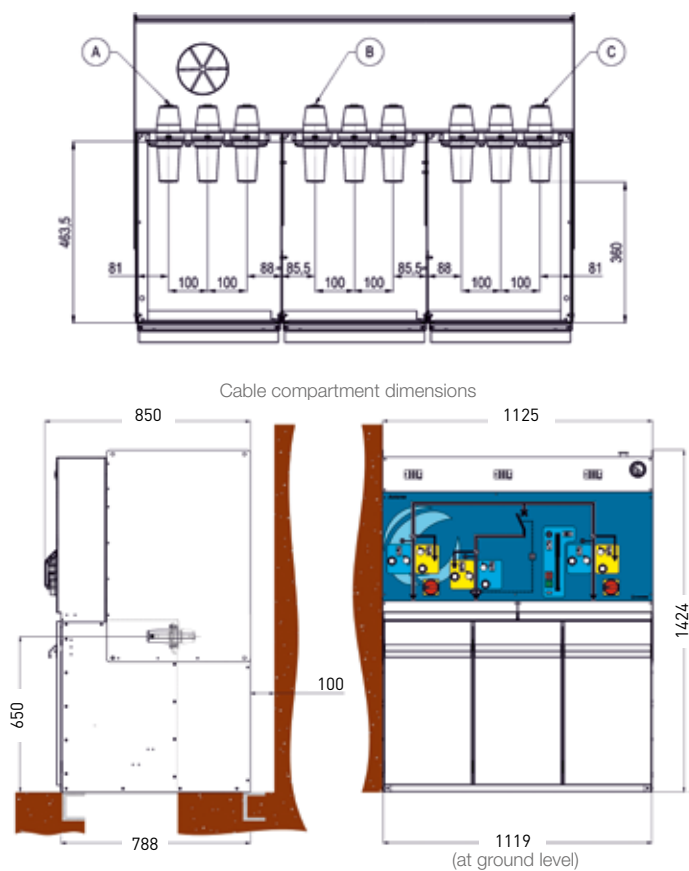


Cable compartment dimensions



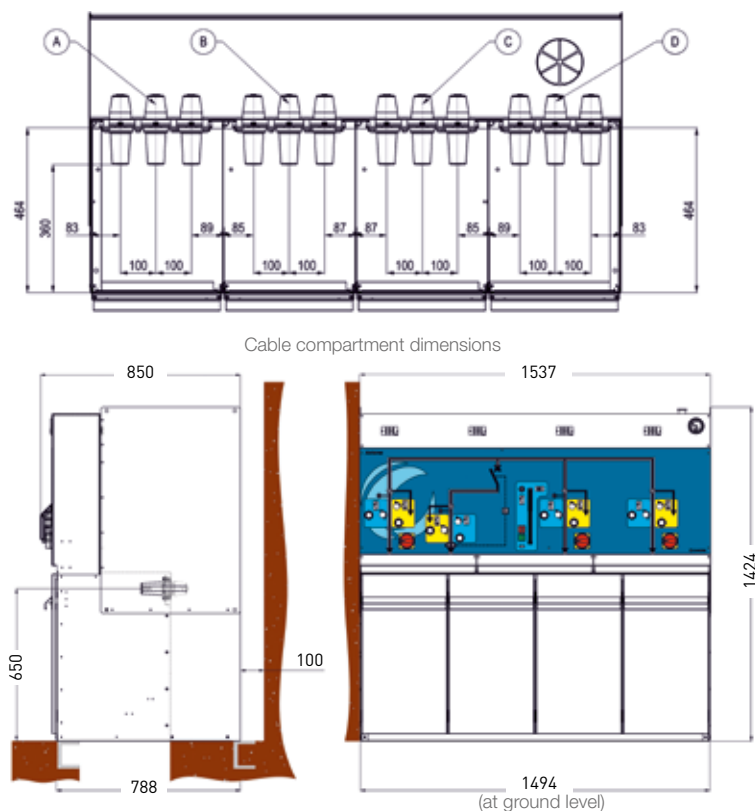
A	B	C	D
Plug-in type bushing 630 A or 400 A	Plug-in type bushing 250 A	Plug-in type bushing 630 A or 400 A	Plug-in type bushing 250 A

■ ANTARES - 3 FUNCTIONS SWITCHBOARD - AI DPT AI CONFIGURATION



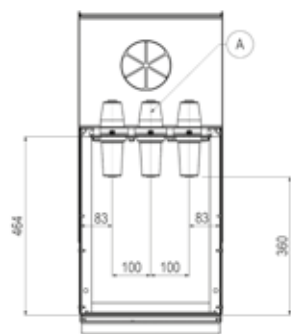
A	B	C	D
Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A

■ ANTARES - 4 FUNCTIONS SWITCHBOARD - AI DPT AI AI CONFIGURATION

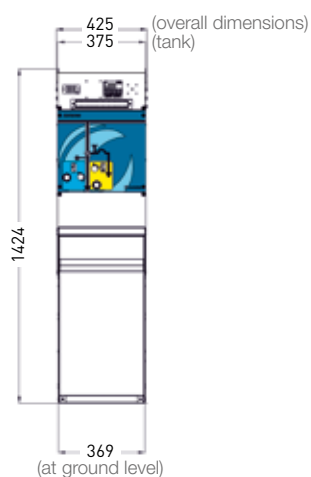
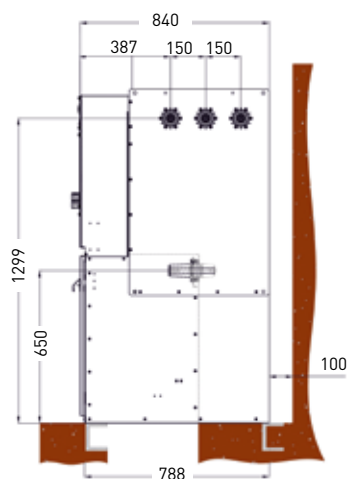


A	B	C	D
Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A

■ ANTARES - 1 FUNCTION SWITCHBOARD - AI CONFIGURATION



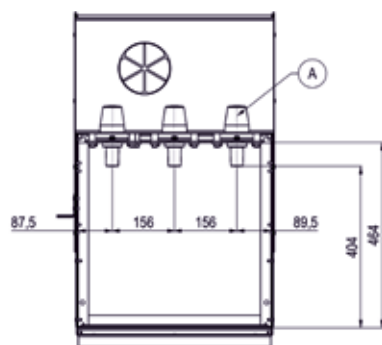
Cable compartment dimensions



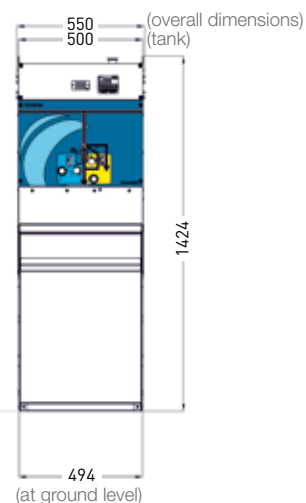
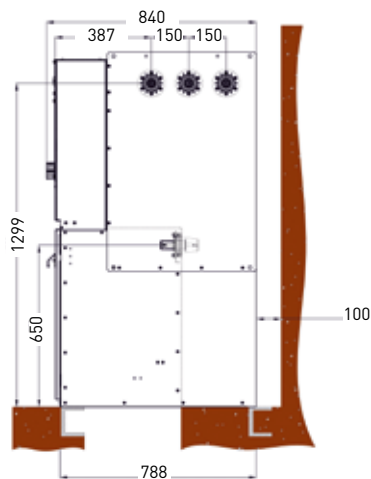
A

Plug-in type bushing 630 or 400 A

■ ANTARES - 1 FUNCTION SWITCHBOARD - IFC / IFA CONFIGURATION



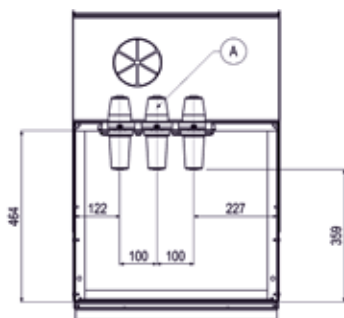
Cable compartment dimensions



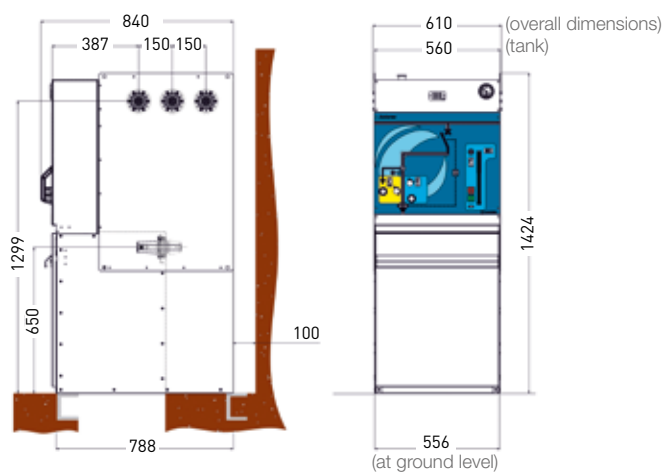
A

Plug-in type bushing 250 A

ANTARES - 1 FUNCTION SWITCHBOARD - DPT CONFIGURATION



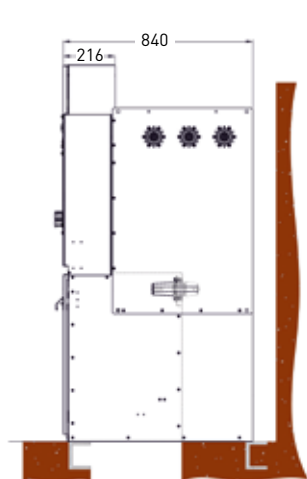
Cable compartment dimensions



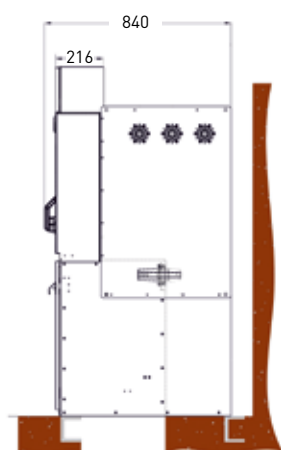
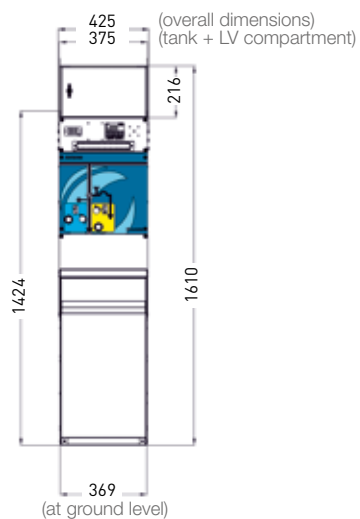
A

Plug-in type bushing 630 or 400 A

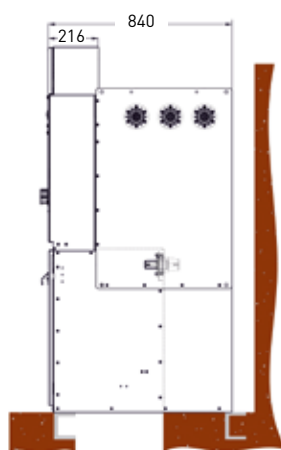
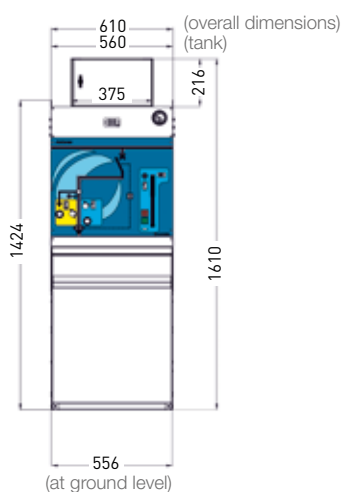
■ ANTARES - 1 FUNCTION SWITCHBOARD - AI, DPT OR IFC+ LV CABINET



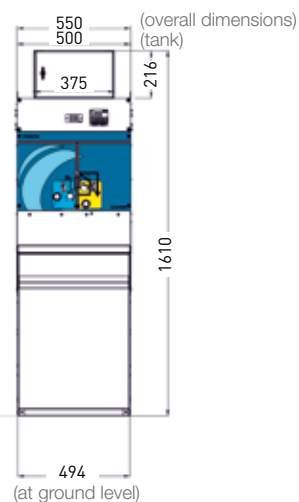
eAle switchboard with 216 mm LV cabinet



eDPTe switchboard with 216 mm LV cabinet

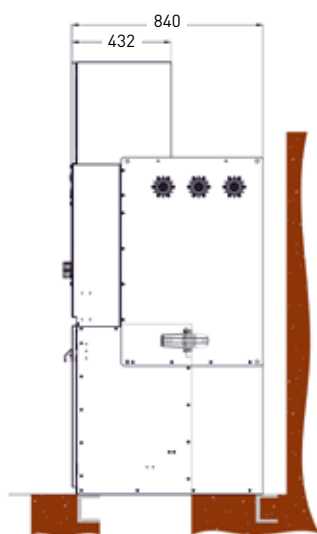


eIFCe switchboard with 216 mm LV cabinet

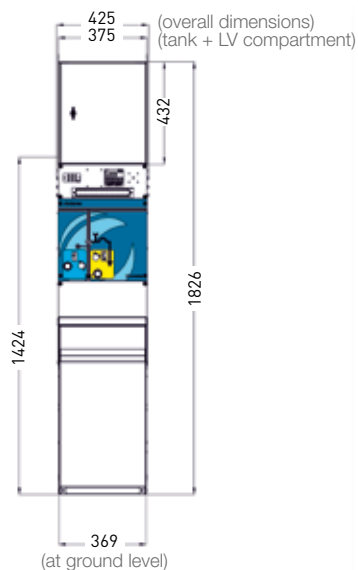


eAle switchboard with 216 mm LV cabinet

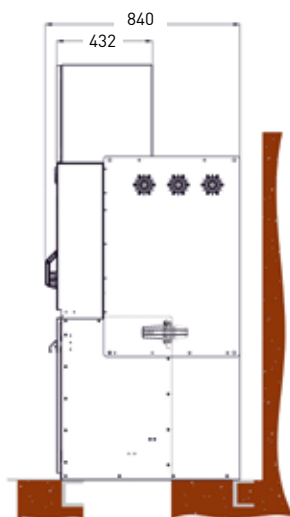
■ ANTARES - 1 FUNCTION SWITCHBOARD - AI, DPT OR IFC+ LV CABINET (432 MM) CONFIGURATION



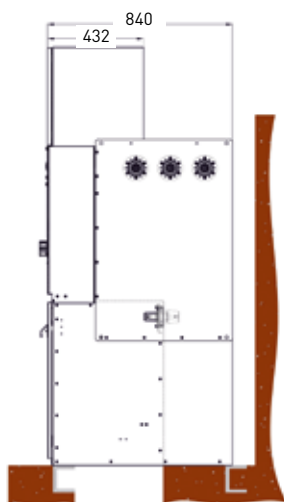
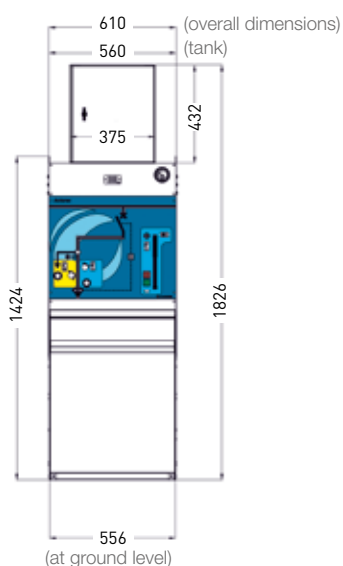
eAle switchboard with 432 mm LV cabinet



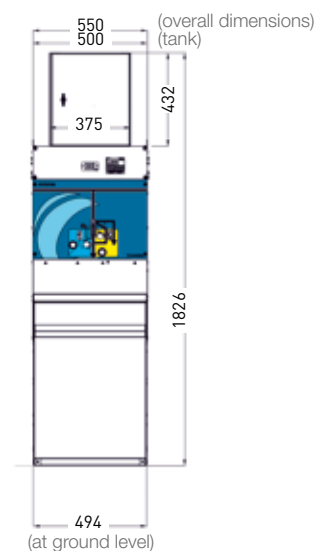
eAle switchboard with 432 mm LV cabinet



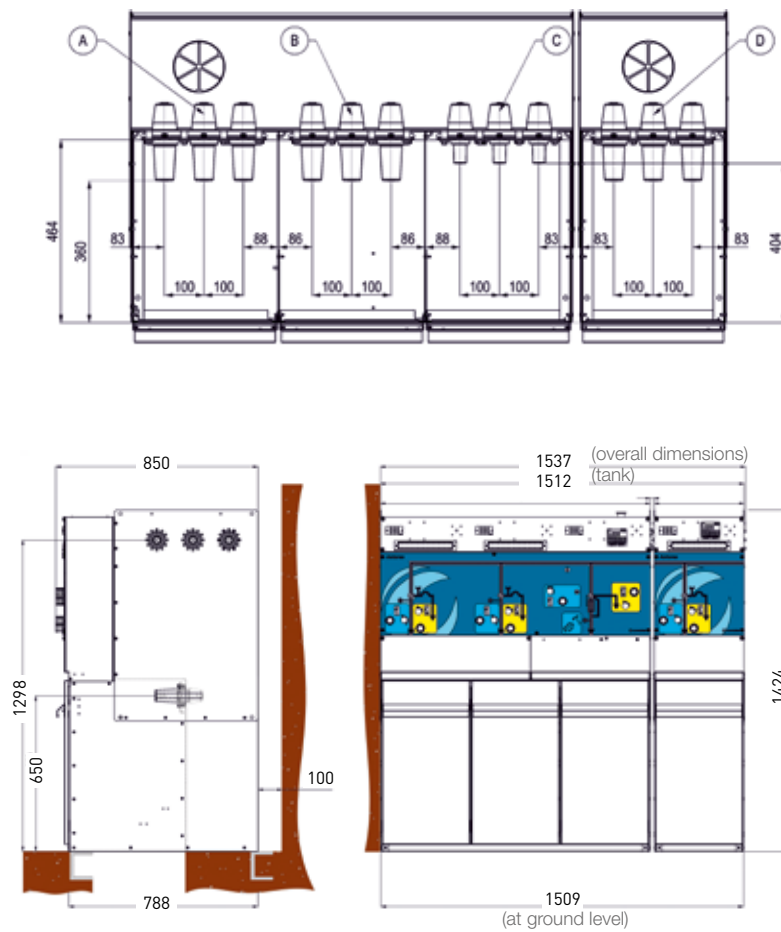
eDPTe switchboard with 432 mm LV cabinet



eIFCe switchboard with 432 mm LV cabinet



■ ANTARES - 4 FUNCTIONS SWITCHBOARD INCLUDING ONE INTERNAL EXTENSION MODULE



AI AI IFCe + eAle switchboard

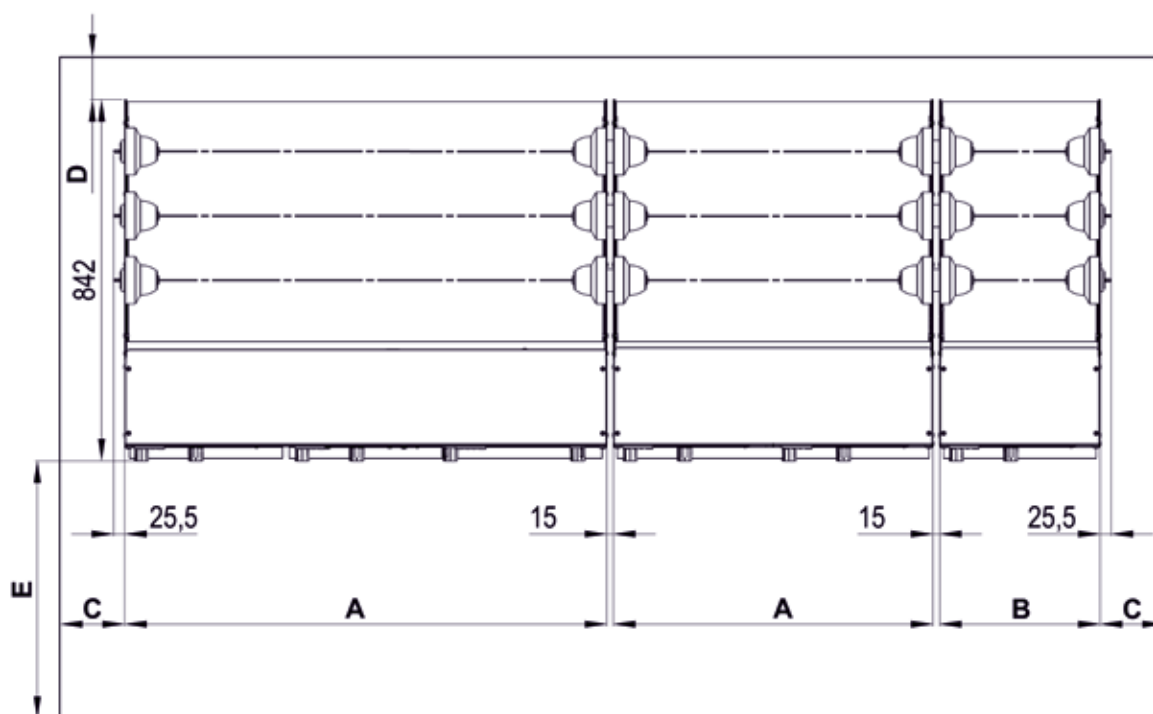


A	B	C	D
Plug-in type bushing 630 or 400 A	Plug-in type bushing 630 or 400 A	Plug-in type bushing 250 A	Plug-in type bushing 630 or 400 A

Indoor installation

Figure and table below shows minimum walls distances with ANTARES Switchboard

TOP VIEW



Functions and distances			Space (mm)
A	Unit 2 functions		750 - 935 - 1050
	Unit 3 functions		1125 - 1310
	Unit 4 functions		1496 - 1572
	Unit 1 function AI,LD,AD		390
B	Unit 1 function IFC-IFA		510
	Unit 1 function DPT		570
C	Distance with the side wall of the building for extensions at the extremity of the switchboard		520
D	Distance between the rear of the switchboard and the building's wall	Release of overpressures only towards the bottom	100
E	Minimum width of passage in front of the ANTARES Switchboard for a subsequent extension to the existing: the national standards / instructions must be respected!		800

Cable bending radius

The minimum cable bend radius that are connected to the RMUs should respect the values on the table below:

Cable cross section (mm ²)	Depth of the trench (mm)*	
	Single core cable bending radius	Twisted cable bending radius
50	450	600
95	450	700
150	600	800
240	600	900
300	800	900

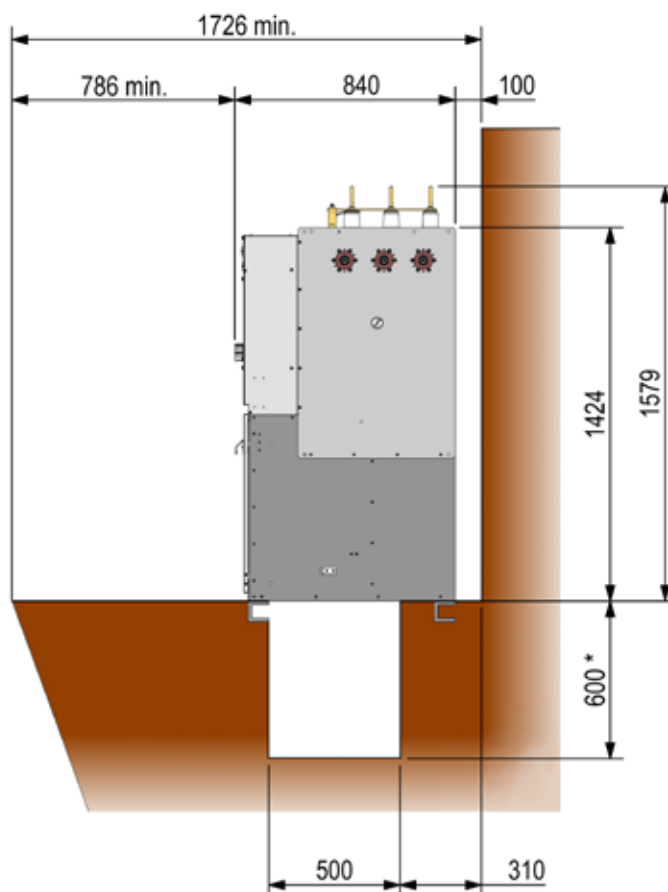
*Refer to space and dimensional characteristics of the trench (civil work section)



Each cable has to emerge from the trench by an average of 700 mm (vertically taken from each MV connector) in order to be connected easily.

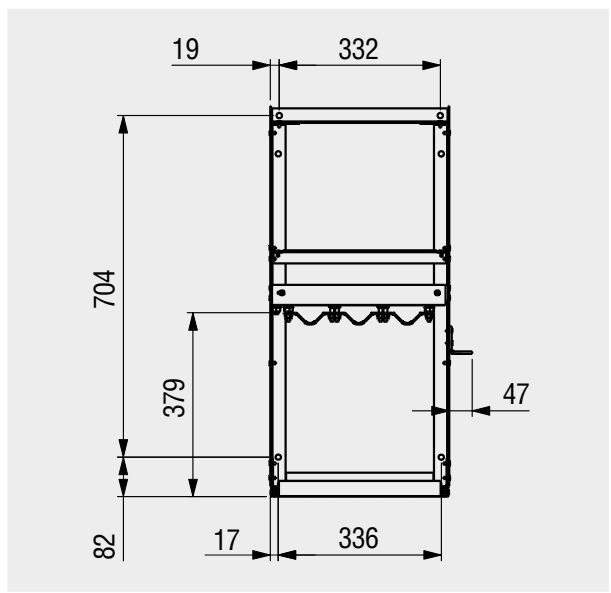
Civil work

Space and dimensional characteristics of the trench

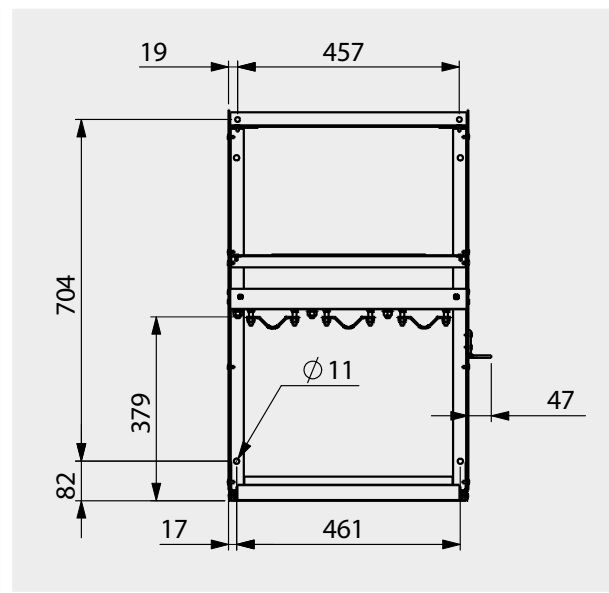


*Refer to table of depth of the trench (cable bending radius section)

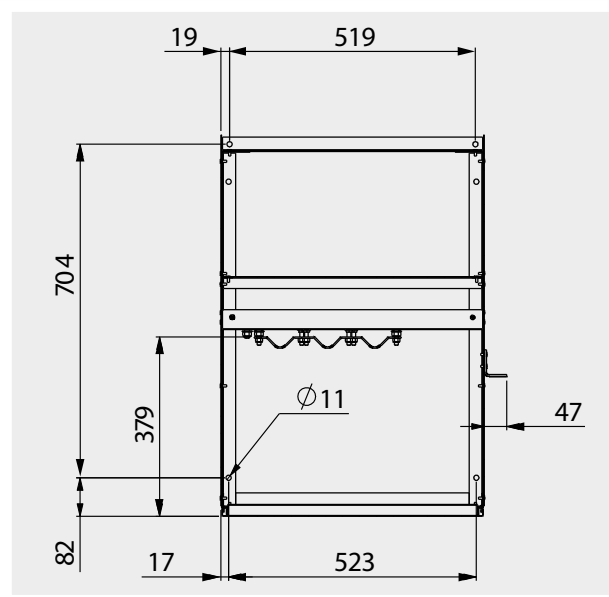
Floor openings and fixing points



For AI, LD and AD versions



For IFA and IFC versions



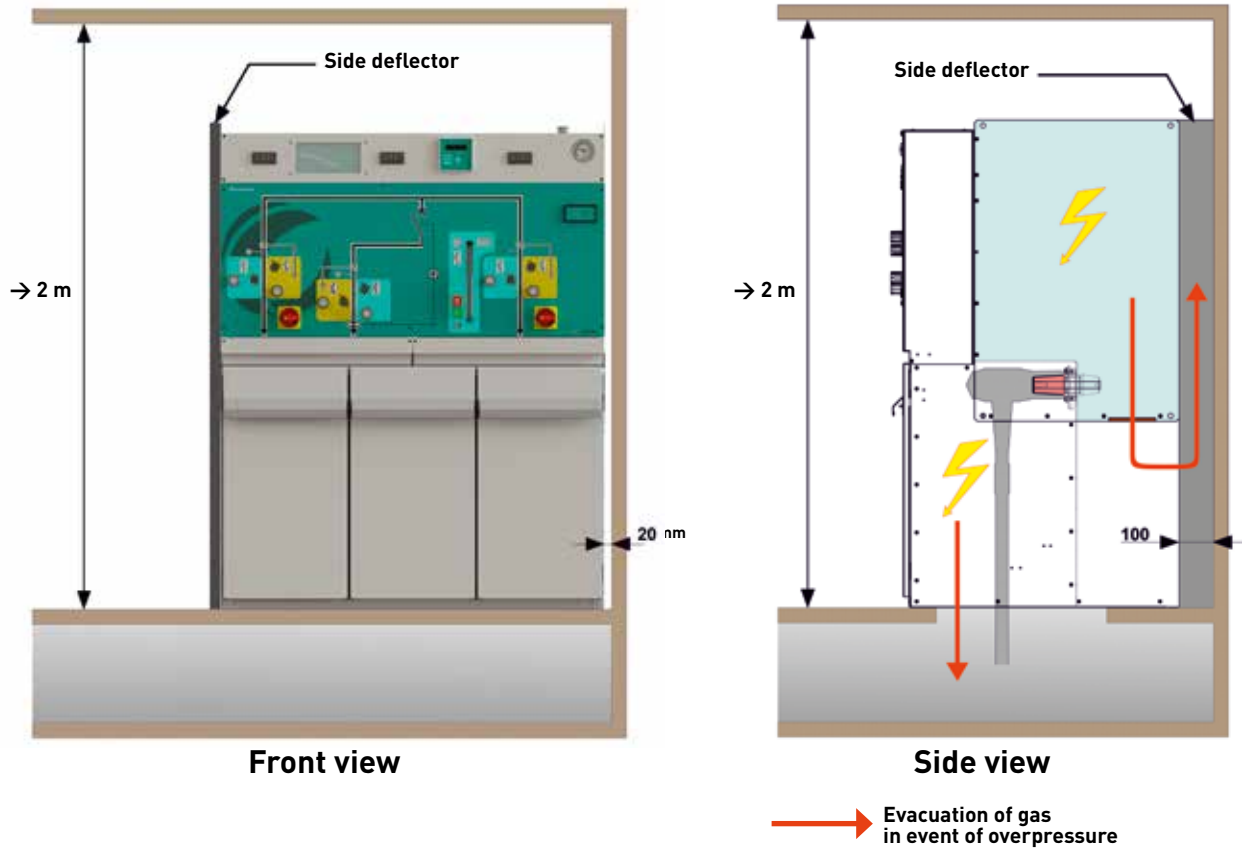
For DPT version

Evacuation of overpressures

Recommendations for installation in transformer substations to meet IAC classification according to IEC 62271-200.

Below is shown an installation example of an ANTARES Switchboard with solutions for the gases control in case of overpressure due to internal arc:

IAC AFL Class 20kA/1sec



Switchboard Packaging and transport

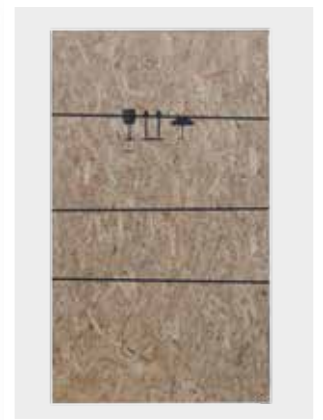
PACKAGING

For road, maritime and rail transport of ANTARES switchboard, two options of packaging are available:

- Packing under protective dust sheet. The unit is delivered fixed on a wooden pallet by two plastic tapes, bolts or both. For better protection when unpacking or during the transport, additional cardboard protections are provided at least on mechanism.
- Packing under protective dust sheet and then packaged in a wooden box with solid walls and a protective cover.



Packing under protective dust



ANTARES switchboard packaged in a wooden box

HANDLING

The ANTARES switchboard must be transported vertically:

- When moving using a forklift, the switchboard can be moved only if the device is on a pallet. When transporting a switchboard, the maximum width of transport is 1570 mm.



Handling using a forklift



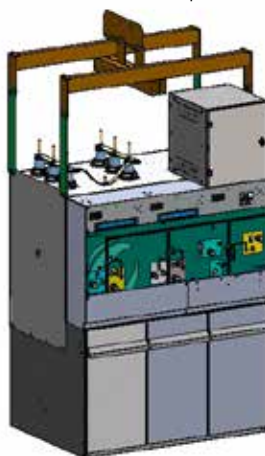
- When moving without a pallet :

→ Switchboard without LV compartment: lifting slings must be hooked on to the switchboard's lifting rings. The angle with the lifting slings must be at least 45°.

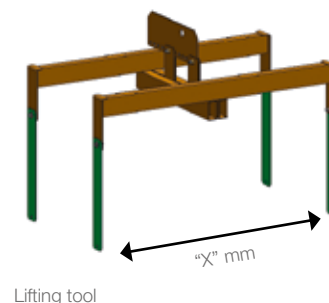


Handling using 4 lifting slings and overhead lifter.

→ Switchboard without LV compartment : dedicated lifting tools must be used to prevent any damage on LV compartment. The lifting tool should be hooked on to the switchboard's lifting rings and the arm is set at the width of the complete unit.



Switchboard with LV cabinet



Lifting tool

Numbers of functions	"X" width in mm from arms whatever the composition of the switchboard
1	560
2	1050
3	1310
4	1570



ANTARES® & SUSTAINABLE DEVELOPMENT

SUSTAINABLE DEVELOPMENT

KEEPING QUALITY AND THE ENVIRONMENT AT THE HEART OF OUR COMPANY CULTURE

We pull out all the stops to control and limit the environmental impact of our activities. Both management and the production process are subject to continuous efforts for improvement. All of the medium voltage companies within the Groupe CAHORS are ISO 9001 certified, and the largest are ISO 14001 certified as well.

OUR COMMITMENTS

On the basis of our membership **of the Global Compact** (January 2013) and driven forward by our generation contract, signed in December 2013, we have set out our corporate responsibility strategy for all the companies in the Groupe CAHORS.

PROMOTING HEALTH AND SAFETY IN THE WORKPLACE

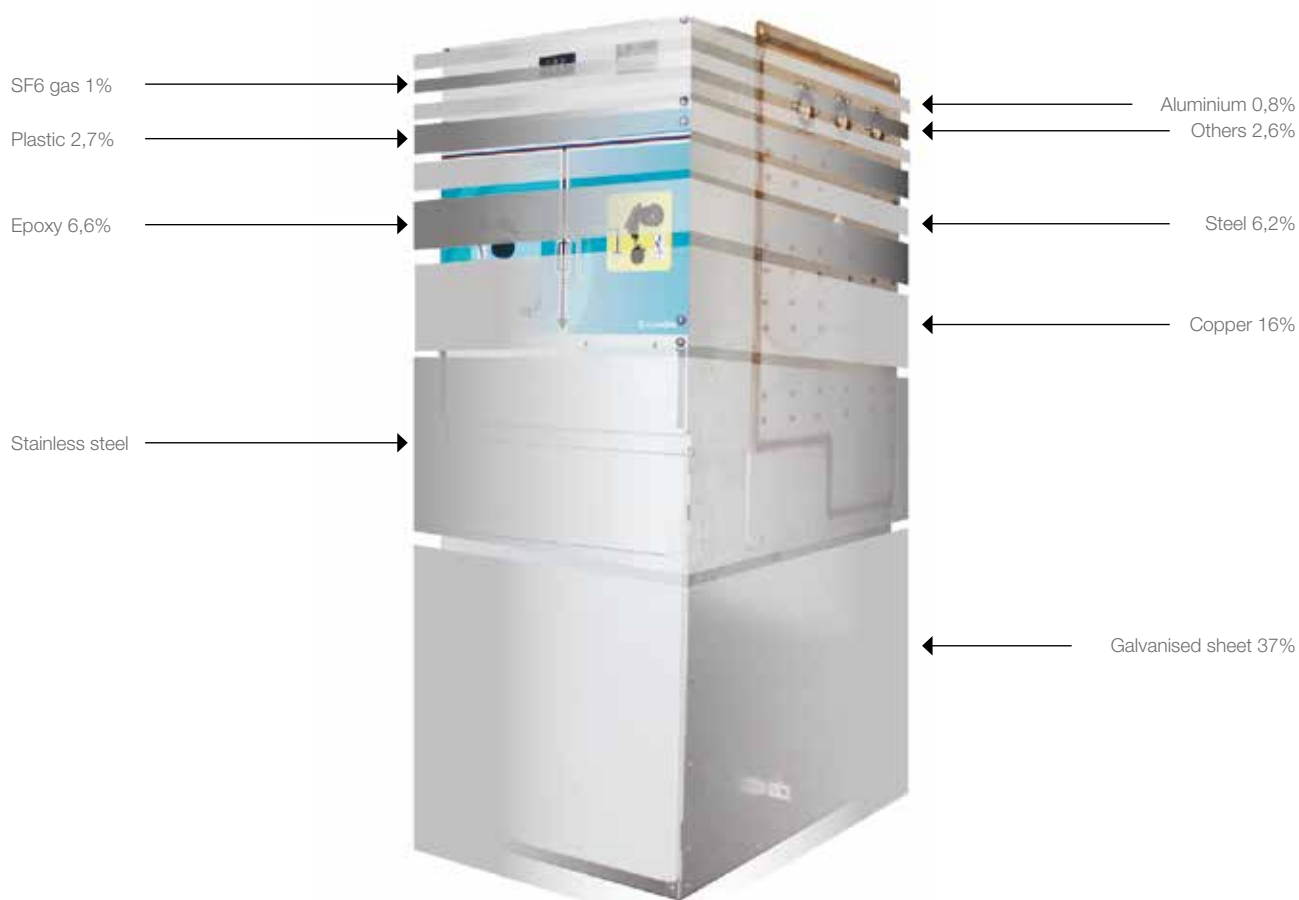
This commitment shines through the sheer number of OHSAS 18001 certificates our Group subsidiaries have been awarded, as well as through increased ergonomics and a stress and hardship inventory.

CLIENTS AND SUSTAINABLE INNOVATION

We are committed to consistently increasing the number of innovative and environmentally beneficial services we can offer:

- Eco-designed products, to reduce environmental impact of the products during their lifetime
- End-of life management for our products to reduce greenhouse effect gases related to SF6
- Solutions to connect renewable energies to the electrical networks

END OF THE ANTARES SWITCHBOARD SERVICE LIFE



Example of material spreadsheet for AI function

→ ALL MATERIALS RECYCLABILITY

At the end of the Antares switchboard life, separation of the material is possible.
The list of material is given in the above figure to estimate the value for the companies in charge of the material recycling.

SF6 GAS RECOVERING

→ SF6

As Antares Switchboard contains Sulphur Hexafluoride (SF6), special care must be taken in the recycling process. The Kyoto Protocol classifies this gas as a greenhouse gas by its high Global Warming Power (GWP). We provide tool used to connect specific valve into the tank to extract the SF6 gas by a vacuum pump. The extracted gas should be stored and recycled by dedicated gas specialist.





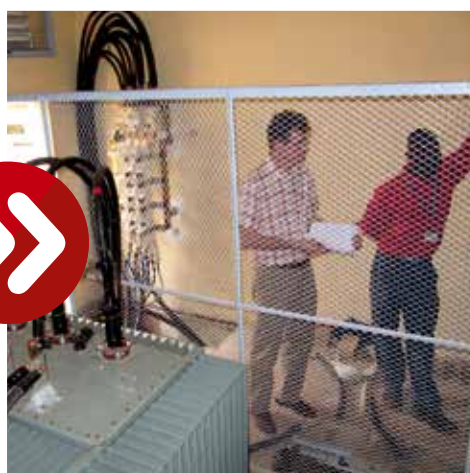
MEDIUM VOLTAGE SERVICES

SPECIFIC SERVICES

The global expertise of CAHORS in the field of network architecture ensures its customers are provided with the following services:

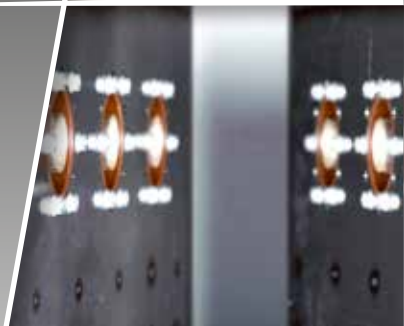
- Analysing the operating systems.
- Offering the most suitable technical solutions.
- Training operators on standard evolutions, operation and maintenance of products.
- CAHORS "services": to meet your expectations, with experts at your disposal, and the benefit of a local sales presence.
- CAHORS positions itself as close as possible to its customers.

Offering advice and technical assistance in managing projects to customers



Training about operation and maintenance of the products and applicable standards provided by our two certified training organisations





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