



TAP

Up to 17.5kV Air Insulated Switchgear

Catalogue

2020

TGOOD

tgood.com

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For over 10 years, TGOOD has provided medium voltage electrical network protection, monitoring and control solutions in the public distribution, industry and building sectors.

TAP air insulated switchgear

TAP is indoor, metal-enclosed switchgear designed for the MV section of HV/MV and MV/MV substations.

TAP is a medium voltage equipment comprising of cubicles with breaking devices, sensors, medium voltage connections and auxiliaries.

For all your applications:

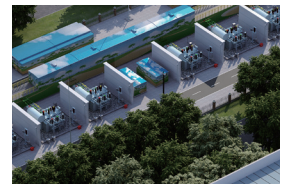
- Industrial substations
- Infrastructure supply substations

TAP offers you:

- Flexible and adapted solutions
- The experience of a major electrical manufacturer
- Dedicated engineering



Application in 12kV prefabricated substation



Application in 145kV compact substation



An enhanced offer with vacuum circuit-breaker

The TAP offer is further enhanced to include a vacuum type circuit breaker (TCB range).

This switchgear offers you:

- High mechanical and electrical endurance
- A comprehensive range of performance levels
- Optimal operating safety
- Environmental protection



TAP solution is based on extensive experience acquired throughout the world and provides your networks with a high level of dependability and safety. TAP integrates a host of innovative solutions designed around proven techniques: high performance switchgear, digital protection, monitoring and control systems, enclosures capable of withstanding internal arcing. From its very conception, TAP has taken account of three key user requirements:

Reliability

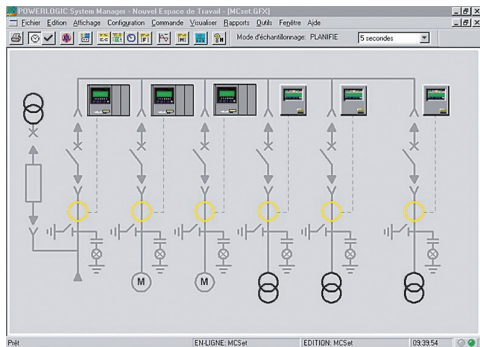
- Type testing was carried out for each performance level in the TAP range.
- The design, manufacturing and testing of TAP was carried out according to IEC 62271.100 & IEC62271.200
- Three-dimensional computer modeling techniques were used to study the electrical fields

Simplicity

- A user interface which is easily understood by everybody
- Interlocks and padlocks preventing operator errors
- Protection units enabling on-site information retrieval without any additional devices
- Preventive maintenance limited to simple, routine operating checks and cleaning and greasing every 5 to 10 years
- Easy installation due to identical civil engineering dimensions for all cubicles and installation being possible against a wall

Safety

- Earth switch mechanical indication from the front, with interlocked access to connections and busbars
- Racking in and out of the VCB is only possible with the door closed
- The power-on indicator (VPS) is situated on the front of the functional unit
- The earthing switch has making capacity
- Remote operation is optional to avoid operator standing in front of cubicles
- Internal arc withstand developed for all functional units



TAP provides the most efficient means to control and protect a wide range of applications.

Due to the devices it comprises, TAP can be easily integrated into a monitoring and control system. It provides all the necessary functions:

- Effective protection of people and property
- Accurate measurements and detailed diagnosis
- Integral equipment control
- Local or remote indication and operation.

Monitoring and control

TAP can be easily:

- Integrated into an existing monitoring and control system: communication of selected digital relay or power meter/circuit Monitor metering device through a standard protocol (Modbus)
- Integrated into a SMS electrical installation monitoring system

Microcomputer Comprehensive Protection and Monitoring Device

Overall Operation

The digital multi-functional protection relay is equipped with a high-performance microprocessor. This provides fully numerical processing of all functions in the device, from the acquisition of the measured values up to the output of commands to the circuit breakers.

Application Scope

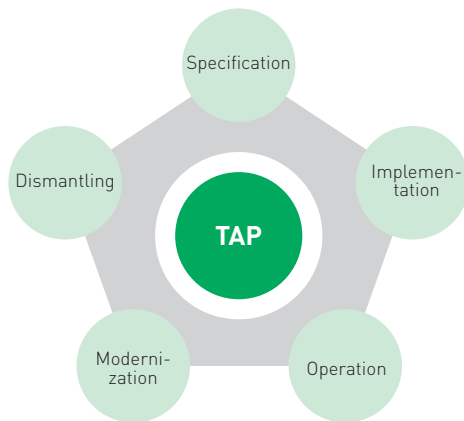
Microcomputer Comprehensive Protection and Monitoring Device is a versatile devices designed for protection, control and monitoring of the entire switchgear. For line protection, the device can be used in networks with grounded, low resistance grounded, isolated or compensated neutral point. It is suited for radial systems with single end infeed, for open or closed ring systems and for networks that are radial or looped, and for lines with double-end infeed. The device is equipped with motor protection for asynchronous machines of all sizes if required.

The device includes the functions that are necessary to protect and monitor circuit breaker positions and control the switchgear providing universally applicable protection schemes. The devices also provide excellent backup facilities of differential protective schemes of lines, transformers, generators, motors, and bus-bars of all voltage levels.

Functions Overview

The relay features protective functions and additional functions. The hardware and firmware is tailored to these functions. Moreover, the command functions can be adjusted to the system conditions. The user can also enable or disable individual functions during configuration or modify how the functions interact.

- Protective Functions
- Control Functions
- Messages and Measured Values; Recording of Event and Fault Data
- Communication



TGOOD Services, by your side throughout the life of your installation

Specifying

We help you to define your solutions: selection guide, technical assistance, and advice...

Implementing

We oversee the completion and commissioning of your installation: design, cost optimization, guaranteed performances and dependability, with final commissioning tests.

Operating

We help run your daily operations in real time: maintenance contract, technical assistance, supply of replacement parts, corrective and preventive maintenance, operation and maintenance training.

Modernizing

We can bring the performance of your installation up to date: installation audit, switchgear diagnosis, adaptation, modification and end of life recycling.

Dismantling

We can dismantle your complete switchgear at the end of its service life: disassembly with environmentally-compatible recycling.



Circuit-breaker diagnosis

Examples of services provided

Warranty extension

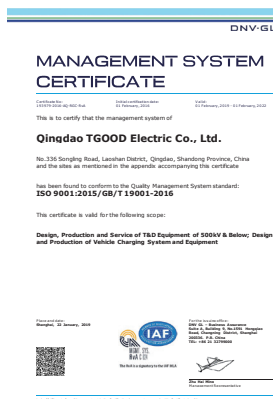
A warranty extension is proposed if your installation is checked by ourselves before being commissioned.

Circuit-breaker diagnosis

Throughout the life of the equipment, it is possible to carry out routine measurement of its characteristics in order to optimize maintenance. This service may be part of a global installation maintenance contract.

End-of-life recycling

TGOOD Service has an operational subsidiary supporting you to recycle your medium voltage switchgear if required.



Quality assurance

Certified quality: ISO 9001

A major asset

TGOOD integrates a functional organization whose main role is to check quality and monitor compliance with standards. This procedure is:

- uniform throughout all departments
- recognized by many customers and approved organizations. But above all, it is its strict application that has allowed us to obtain the recognition of an independent organization:

The International Accreditation Forum (IAF). The quality system for the design and manufacture of TAP is certified to be in conformity with the requirements of ISO 9001: 2008 quality assurance standard.

Strict and systematic checks

During manufacture, each TAP functional unit is subject to systematic routine testing with the aim of checking the quality and conformity of the following features:

- measuring of opening and closing speeds
- dielectric test
- testing of safety systems and interlocks
- testing of low voltage components
- conformity with drawings and diagrams.

The results obtained are recorded and approved by the quality control department on each device's test certificate. This therefore guarantees product traceability. Control of vacuum interrupters Each vacuum interrupter, sealed and airtight, is checked for the quality of the vacuum obtained. This pressure measurement is based on the proven "magnetron discharge" method. Using this sophisticated procedure, measurement is very precise and does not require access to the inside of the vacuum interrupter, thus not affecting the airtight seal.



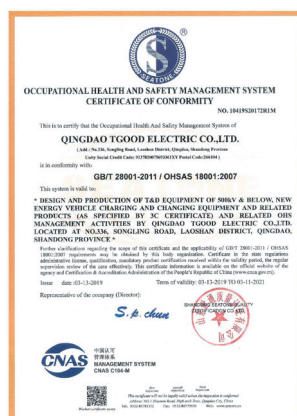
Environment protection

As part of the group's environmental policy, TGOOD offers to recover your high voltage switchgear and thus eliminate any discharge to the atmosphere. In order to help you protect the environment and to relieve you of any concerns in terms of stock or dismantling, TGOOD service offers to take back your equipment at the end of its life. TAP has been designed with environmental protection in mind:

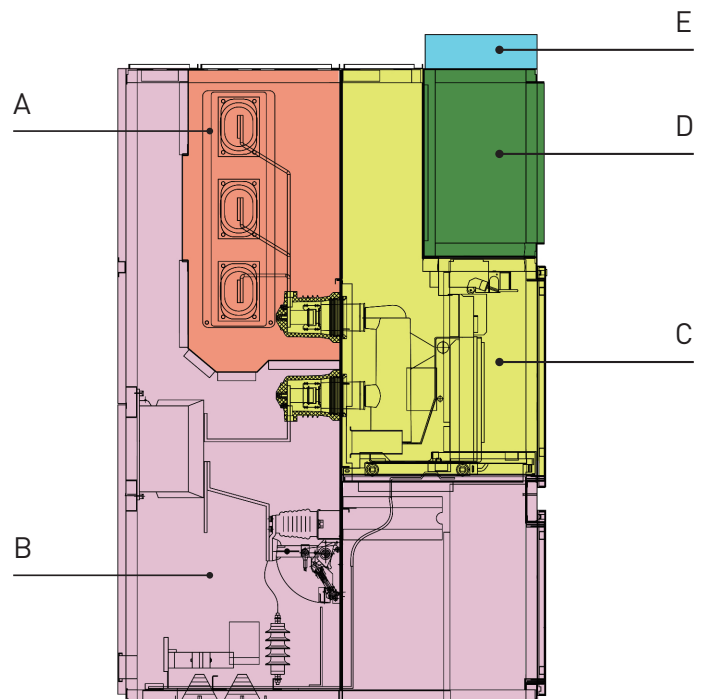
- all materials used, for instance insulators and conductors, are identified, and easily separable and recyclable.
- SF6 is not used in the manufacture of the TAP product.
- production sites are certified to ISO 14001.

Occupational health and safety

Occupational Health and Safety (OH&S) bears the highest importance at TGOOD. TGOOD demonstrates its commitment towards control of the risks and improvement in performance of OH&S by complying to OHSAS 18001:2007 certified by China National Accreditation Service (CNAS). TGOOD management believes in process approach and its policy is based on PDCA methodology that focuses on elimination or minimizing risks to personnel and other interested parties who could be exposed to OH&S hazards associated with its activities. Strong mechanisms are in place to assure that TGOOD performance on OH&S not only meets, but will continue to meet, its legal and policy requirements.



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- A** Busbar compartment
- B** Cable connection compartment
- C** Switching device compartment
- D** Low-voltage compartment
- E** Optional LV extension compartment

Make up of a TAP switchgear

TAP switchgears are made up of several interconnected functional units. Power connections are made between functional units within a switchgear via a single busbar.

The electrical continuity of all metal frames is provided by the connection of each functional unit's earthing busbar to the switchgear's main earthing circuit. Low voltage wiring trays are provided in the switchgear above the LV control cabinets.

LV cables can enter the switchgear through the top or bottom of each functional unit.

Description of a functional unit

A functional unit comprises all equipment in the main and auxiliary circuits which together provide a protection function. Each functional unit combines all the components which are required to fulfil this function:

- The cubicle
- The protection, monitoring and control system
- The withdrawable part

The cubicle

The cubicle is of LSC2B (Loss of Service Continuity category) type as defined by IEC standard 62271-200. The medium voltage parts are compartmented using metallic partitions and shutters which are connected to earth and which separate:

- The busbars
- The withdrawable part (circuit-breaker, disconnector truck or earthing truck)
- MV connections, earthing switch, current sensors and voltage transformers as required

TAP guarantees a high level of protection of people; when a compartment containing a main circuit is open, the other compartments and/or functional units may remain energised.

The low voltage auxiliaries and monitoring unit are in a control cabinet separated from the medium voltage section.

Six basic cubicle layouts are offered:

- | | |
|-------------------------------------|----|
| • Incomer or Feeder | IF |
| • Incomer Direct to busbar | ID |
| • Bus Coupler | BC |
| • Bus Riser | RF |
| • Bus riser with withdrawable parts | RW |
| • Busbar Voltage Transformer | VT |

More layouts such as measurements consult TGOOD.

The protection, monitoring and control system

This includes:

- Voltage transformers
- Protection, monitoring and control unit
- Current sensors, which may be of 3 types:
 - Conventional MV current transformers
 - Low voltage toroid type current transformers (max. 1250 A)
 - LPCT (Low Power Current Transducer) MV block type (max. 1250 A)

The withdrawable part

This includes:

- The circuit-breaker, the earthing truck, the voltage transformer truck or the disconnector truck
- Interlocks to fix the withdrawable part onto the fixed contacts either in service position or disconnected position



Technical data

Rated voltage (kV)

7.2	12	17.5
-----	----	------

Rated insulation level

Power frequency withstand voltage 50/60 Hz - 1 min	(rms kV)	20	28	38
Lightning impulse withstand voltage 1.2/50 μ s	(rms kV)	60	75	95

Nominal current and maximum short time withstand current

Functional unit with circuit-breaker

Short time withstand current	Ith. max	(kA/3 s)	25	25	25
			31.5	31.5	31.5

Rated current	In max busbars	(A)	3150	3150	3150
			630	630	630
	In CB	(A)	1250	1250	1250
			2000	2000	2000
			2500	2500	2500
			3150	3150	3150

Internal arc withstand

IAC-AFLR	(kA/1 s)	31.5	31.5	31.5
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IAC (internal arc classification):

The metal enclosed switchgear may have different types of accessibility on the various sides of its enclosure.

For identify purpose of different sides of the enclosure, the following code shall be used (according to IEC 62271-200 standard).

A: restricted access to authorized personnel only
 F: access to the front side
 L: access to the lateral side
 R: access to the rear side.

LSC2B (Loss of service continuity):
 this category defines the possibility to keep other compartments energised when opening a main circuit compartment.

Protection index

- IP4X for the enclosure
- IP2X between each compartment

Construction

- Internal arc withstand (classification IAC): AFLR
- 3 compartments (classification LSC2B according to IEC 62271-200)
- All the metal surfaces in the panels are corrosion proof
- Panels are produced using electro zinc coated steel sheet in accordance to ISO 5002
- Busbar: insulated up to 17.5 kV

Connections

- Front and/or rear access
- Cable entry from below or from top.



Make up of a TAP switchgear

Normal operating conditions, according to IEC 62271-1 for indoor switchgear

- Ambient air temperature:
 - Less than or equal to 40°C
 - Less than or equal to 35°C on average over 24 hours
 - Greater than or equal to - 5°C
- Altitude:
 - Less than or equal to 1000 m,
 - Above 1000 m, a derating coefficient is applied (please consult us)
- Atmosphere:
 - No dust, smoke or corrosive or inflammable gas and vapor, or salt (clean industrial air)
- Humidity:
 - Average relative humidity over a 24 hour period y 95%
 - Average relative humidity over a 1 month period y 90%
 - Average vapor pressure over a 24 hour period y 2.2 kPa
 - Average vapor pressure over a 1 month period y 1.8 kPa

Storage conditions

In order to retain all of the functional unit's qualities when stored for prolonged periods, we recommend that the equipment is stored in its original packaging, in dry conditions sheltered from the sun and rain at a temperature of between - 25°C and + 55°C.

Standards

The TAP 17 range meets the following international standards:

- IEC 62271-1: clauses common to high voltage switchgear
- IEC 62271-100: high voltage alternating current circuit-breakers
- IEC 62271-102: alternating current disconnectors and earthing switches
- IEC 62271-103: switches for rated voltages above 1 and less than 52 kV
- IEC 62271-200: metal-enclosed switchgear for alternating current at rated voltages of between 1 and 52 kV
- IEC 60282-2: high voltage fuses
- IEC 60255: measurement relay and protection unit
- IEC 61869-2: current transformers
- IEC 61869-3: voltage transformers
- IEC 60529 : defining the protection indices provided by the enclosures
- IEC 62271-206: Voltage Presence Indicating Systems (high voltage prefabricated switchgear and controlgear assemblies)

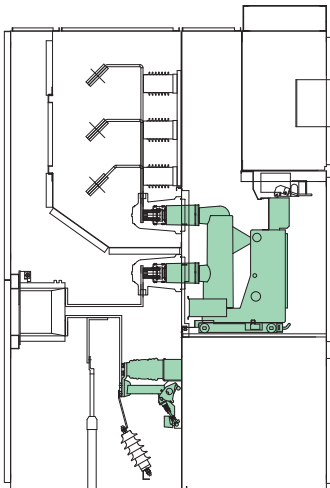
Services provided: help with preventive maintenance

TAP operation manual is available and gives the most important general instructions for:

- Reducing equipment wear and tear (and/or failure)
- Ensuring that the equipment is safe during all installation, repair and servicing operations

In the pages of this guide, all the information needed for:

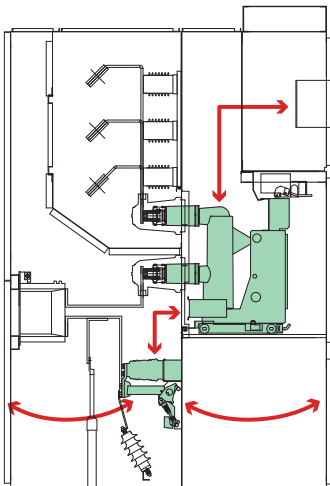
- Operations on: switchgear, removable devices, control mechanisms, insulating materials and vents, power circuits and control, and indication auxiliaries
- Recommended frequency according to operating conditions: normal or corrosive atmospheres



Withdrawable unit and earthing

Composed of:

- Withdrawable circuit-breaker
- Complete cradle equipped with metallic safety shutters and dedicated bushings
- Earthing switch with making capacity
- LV connector between LV control cabinet and CB auxiliaries

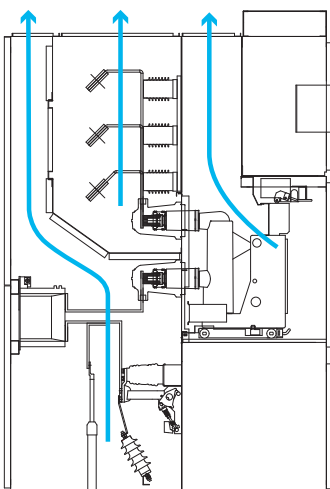


Interlocking

The cubicle integrates the different interlocking to prevent incorrect operation by the operator.

TAP secures operation to:

- Access the cable compartment
- Rack in and out the VCB
- Operate the earthing switch
- Open the CB door



Safety

- General structure that allows gas evacuation through pressure relief flaps
- Each compartment is designed with a specific chimney for upward gas evacuation



KEMA IAC test

Internal arc version

TAP is designed to withstand and protect operators in the case of failure due to an internal arc.

TAP has been successfully tested using type tests. Protection against internal arcing is available on 31.5 kA ratings.

TAP proposes one option to install an internal arc switchgear.

- Internal arc protection
- Internal arcing detection (please consult us)

TAP can have 2 systems that can detect internal arcing and switch off the power supply so as to limit the fault duration.

- electromechanical detector

This system employs a secure electromechanical tripping circuit, positioned on the cubicle roof flaps

This set transmits the information to the protection relay to give the opening order to the circuit-breaker located upstream of the fault

- Optic detector

Internal arcing is detected by optical sensors which will measure the light caused by the initiation of arcing. Based on this information, an electronic module, after processing the information, will give the opening order to the circuit-breaker located upstream of the fault

Dependable mechanical control devices

All operations are carried out from the front side.

The user is guided through mimic-diagrams on each front panel making it easy to understand the operating sequence and device status. Interlocks and padlocks prevent operator errors.

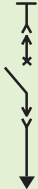

Several additional levels of security also protect operators:





- Racking in and out is only possible with the door closed
- The very extensive set of mechanical and electrical interlocks do not allow operator error. These can be added to by key locks or padlocks according to specific operating procedures. Each selector can be fitted with padlocks
- All operations are carried out from the front side
- The voltage present indicator is located on the front face of the functional unit

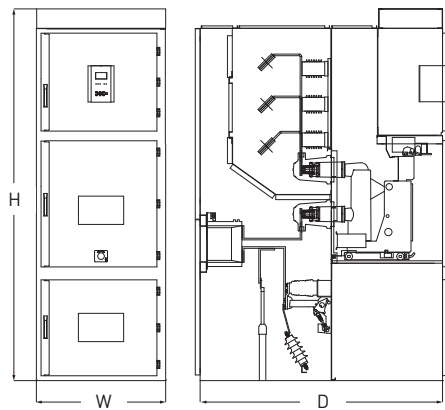
Choice of functional units	22
IF Incomer and Feeder	24
ID Incomer Direct to busbar	25
BC Bus Coupler	26
RF Bus Riser Fixed	27
VT Busbar Voltage Transformer	28
RW Bus Riser Withdrawable	28

Presentation

The TAP range comprises 6 functional applications.
The table below can be used to link requirements to functional units and gives basic information on the general composition of each unit.

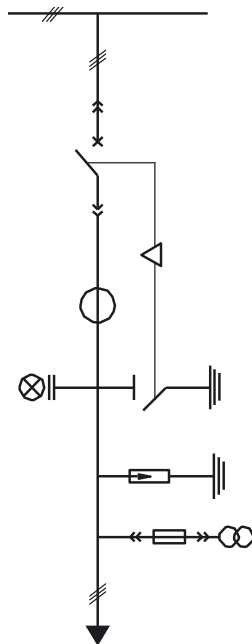
Function	Connection to incomer or feeder lines	Direct connection of supply to busbar
Designation	IF Incomer and Feeder	ID Incomer Direct to busbar
Single line diagrams		

Function	Coupling of two busbars systems	Solid busbar link to be used in association with a BC unit	Busbar link to disconnecter in association with a BC unit	Connect VT to the busbar for metering
Designation	BC Bus Coupler	RF Bus Riser- Fixed type	RW Busbar Riser- Withdrawable	VT Busbar Voltage Transformer
Single line diagrams				



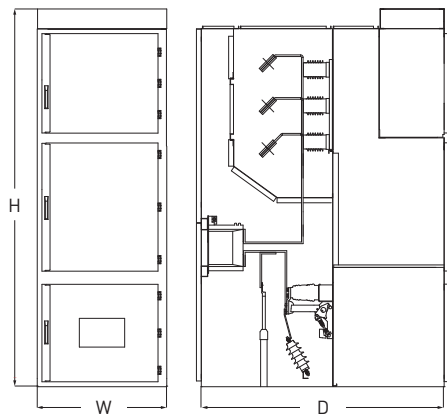
Note: upper equipment arrangement is only an example, for other arrangement with different dimensions please consult TGOOD.

Rated voltage (kV)											
			7.2			12			17.5		
Rated insulation level											
Power frequency withstand voltage 50 Hz - 1 min (rms kV)			20			28			38		
Lightning impulse withstand voltage 1.2/50 μs (kV peak)			60			75			95		
Rated current	(A)	630	■			■			■		
		1250		■			■			■	
		3150			■			■			■
Breaking capacity	(kA)	25	■	■		■	■		■	■	
		31.5	■	■	■	■	■	■	■	■	■
Short time withstand current	(kA/3 s)	25	■	■		■	■		■	■	
		31.5	■	■	■	■	■	■	■	■	■
Dimensions (mm)											
Width (W)			650	800	1000	650/800	1000	650	800	1000	
Height (H)			2300								
Depth (D)	top entry		1910								
	bottom entry		1500								



Functions

- Low voltage cabinet
 - standard height
- Circuit-breaker
 - TCB range - vacuum technology
- Voltage transformers
 - fused withdrawable
 - fused fixed
 - fixed without fuses
- Earthing switch
- Voltage Presence Indication (VPIS)
- MV cables connection
 - bottom entry
 - top entry
- Current transformers
 - 3 MV type
 - 6 MV type
 - 3 MV low powered CTs (up to 1250 A)
 - LV torroidal CTs on MV primary bar (up to 1250 A)
- Surge arresters
- Anticondensation heaters

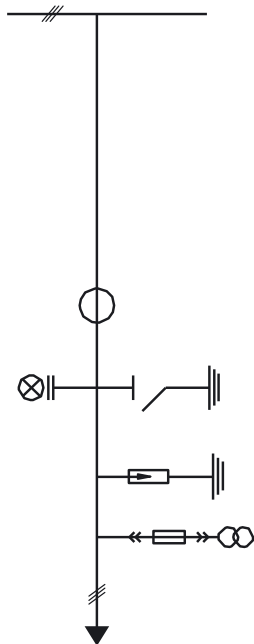


Rated voltage (kV)			
	7.2	12	17.5

Rated insulation level			
Power frequency withstand voltage 50 Hz - 1 min (rms kV)	20	28	38
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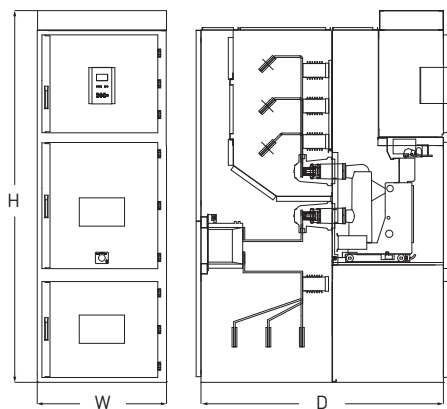
Rated current (A)	1250	■	■	■	■	■	■	■
	3150	■	■	■	■	■	■	■
Short time withstand current (kA/3 s)	25	■	■	■	■	■	■	■
	31.5	■	■	■	■	■	■	■

Dimensions (mm)									
Width (W)		650	800	1000	650	800	1000	800	1000
Height (H)		2300							
Depth (D)	top entry	1910							
	bottom entry	1500							



Functions

- Low voltage cabinet
 - standard height
- Voltage transformers
 - fused withdrawable
 - fused fixed
 - fixed without fuses
- Earthing switch
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 - bottom entry
 - top entry (consult us)
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	7.2	12	17.5

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Lightning impulse withstand voltage 1.2/50 μ s (kV peak)	60	75	95
--	----	----	----

Rated current (A)	1250	■	■	■	■
	3150	■	■	■	■

Breaking capacity (kA)	25	■	■	■	■
	31.5	■	■	■	■

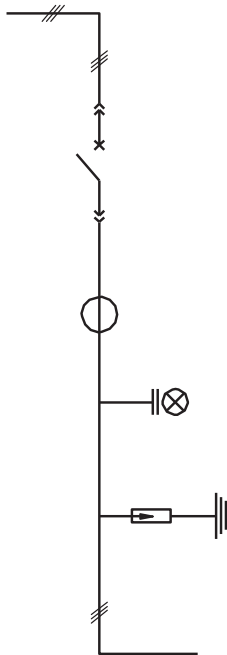
Short time withstand current (kA/3 s)	25	■	■	■	■
	31.5	■	■	■	■

Dimensions (mm)						
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Width (W)	800	1000	800	1000	800	1000
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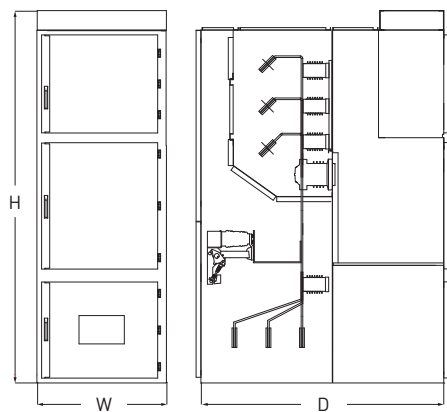
Height (H)	2300					
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Depth (D)	1500					
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Functions

- Low voltage cabinet
 - standard height
- Circuit-breaker
 - TCB range - vacuum technology
- Voltage Presence Indication (VPIS)
- Current transformers
 - 3 MV type
 - 6 MV type
 - 3 MV low powered CTs (up to 1250 A)
 - LV torroidal CTs on MV primary bar (up to 1250 A)
- Surge arresters(if required)
- Anticondensation heaters



Rated voltage (kV)			
	7.2	12	17.5

Rated insulation level			
------------------------	--	--	--

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Rated current (A)	1250	■	■	■	■
	3150	■	■	■	■

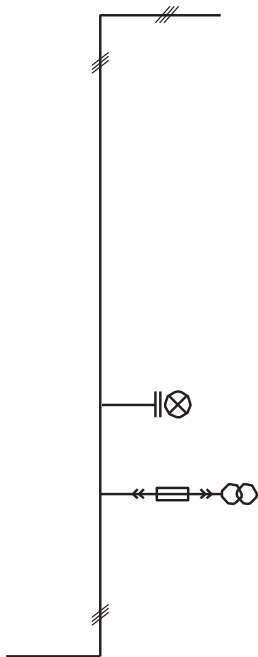
Short time withstand current (kA/3 s)	25	■	■	■	■
	31.5	■	■	■	■

Dimensions (mm)						
-----------------	--	--	--	--	--	--

Width (W)	800	1000	800	1000	800	1000
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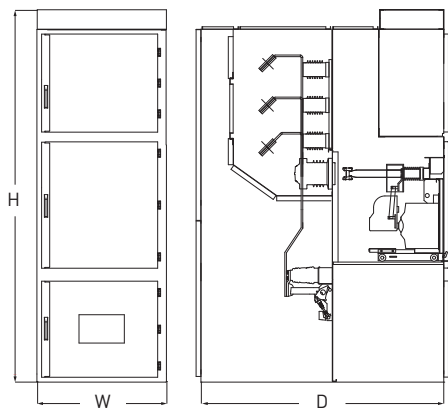
Height (H)	2300					
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Depth (D)	1500					
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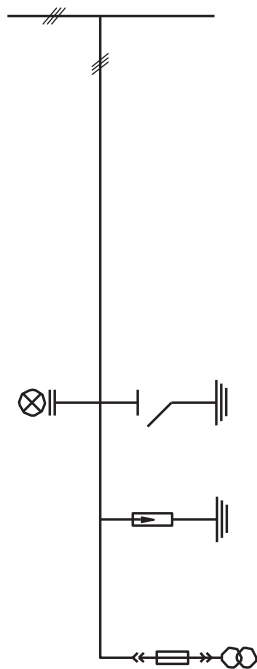


Functions

- Low voltage cabinet
 - standard height
- Voltage transformers
 - fused withdrawable
 - fused fixed
 - fixed without fuses
- Anticondensation heaters
- Voltage Presence Indication (VPIS)

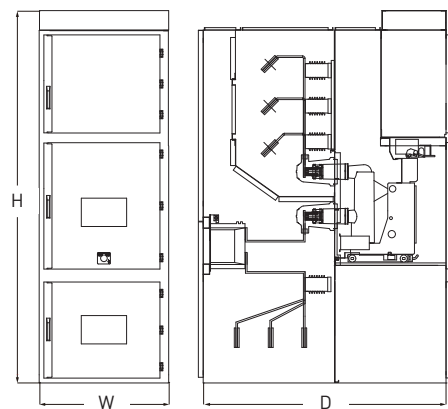


Rated voltage (kV)						
		7.2	12	17.5		
Rated insulation level						
Power frequency withstand voltage 50 Hz - 1 min (rms kV)		20	28	38		
Lightning impulse withstand voltage 1.2/50 μs (kV peak)		60	75	95		
Short time withstand current (kA/3 s)	25	■	■	■	■	■
	31.5	■	■	■	■	■
Dimensions (mm)						
Width (W)		800	1000	800	1000	800
Height (H)		2300				
Depth (D)		1500				



Functions

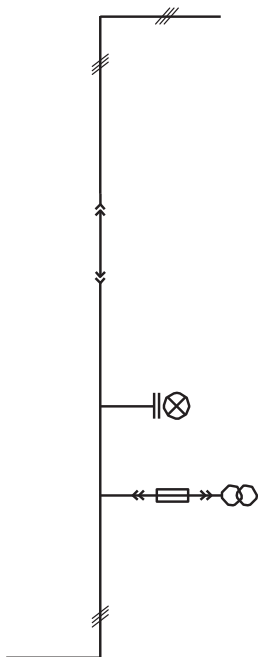
- Low voltage cabinet
 - standard height
- Voltage transformers
 - fused withdrawable
 - fused fixed
 - fixed without fuses
- Earthing switch
- Voltage Presence Indication (VPIS)
- Surge arresters(if required)
- Anticondensation heaters



Rated voltage (kV)			
	7.2	12	17.5

Rated insulation level			
Power frequency withstand voltage 50 Hz - 1 min (rms kV)			
	20	28	38
Lightning impulse withstand voltage 1.2/50 μ s (kV peak)			
	60	75	95
Rated current (A)			
1250	■	■	■
3150		■	■
Short time withstand current (kA/3 s)			
25	■	■	■
31.5	■	■	■

Dimensions (mm)						
Width (W)		800	1000	800	1000	1000
Height (H)		2300				
Depth (D)		1500				

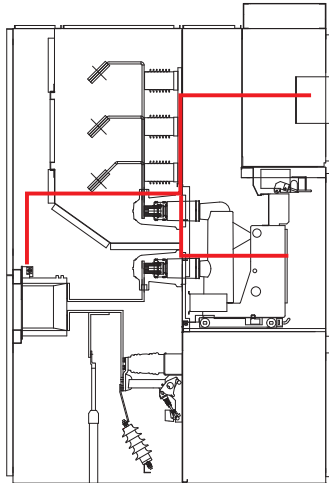


Functions

- Low voltage cabinet
 - standard height
- Disconnecter truck
- Earthing switch (optional)
- Voltage Presence Indication (VPIS)

Optional accessories

- Motor for operating mechanism
- Auxiliary contacts
- Key-type interlocks
- 50 W heating element



- Each TAP functional unit can be equipped with a comprehensive protection, monitoring and control system comprising:
 - Instrument transformers to measure the necessary electrical values (phase current, residual current, voltages, etc.)
 - Protection relays, providing functions adapted to the part of the network to be protected
 - Metering equipment, to inform operators,
 - Low voltage relaying, i.e. to provide control of the breaking device and of the withdrawable part
 - Various auxiliaries: secondary circuit test units, etc
- Nearby control assistant
 - Helps to enhance safety of people through simple and intuitive operation of MV switchgear
 - Operator operates the switchgear and components at safety distance, more than 10m away
 - Control of all operations : opening and closing of Circuit Breaker, Rack in/ out, Earthing Switch open and close
 - Assisted by mobile apps single line view, measurement and operation sequence shall be available
- Smart panel
 - Demand for smart panel is increasing in the market thanks to more sensors and software system maturity, TAP can be equipped with smart features based on customers' specification:
 - Monitoring and protection
 - Smart control
 - Asset online monitoring
 - Traceability and cloud application



Current transformers

Conventional current transformers are used to provide power to metering, measuring or control devices. They measure the value of primary current from 10 A to 3150 A. They are in conformity with standard IEC 60044-2. TGOOD has drawn up a list of current transformers which are appropriate for use with digital protection devices in order to make it easier to determine accuracy characteristics. They are installed in the rear part of the functional unit. The energized part is entirely encapsulated in an epoxy resin, which provides both electrical insulation and excellent mechanical strength.

LPCT low power current transducer

LPCT's are specific current sensors with a direct voltage output of the "Low Power Current Transducer" type, in conformity with standard IEC 60044-8. LPCT's provide metering and protection functions. They are defined by:

- The rated primary current
- The extended primary current
- The accuracy limit primary current or the accuracy limit factor

These have a linear response over a large current range and do not start to saturate until beyond the currents to be broken.

I _{ln} (A)	100 to 1250
I _{th} (kA)	40
t (s)	1
Accuracy class	0.5 - 5P



Toroid CT

Zero sequence core balance current transformers

This kind of current transformer provides more sensitive protection by direct measurement of earth fault currents. Specifically designed for some relay, they can be directly connected to the "residual current" input.

They are only different in terms of their diameter:

- 120 - 120 mm internal diameter
- 200 - 200 mm internal diameter



Voltage transformers

Voltage transformers measuring, metering and monitoring devices relays or protective devices auxiliary LV sources for various types of switchgear. All these devices are protected and insulated from the MV section.

They are in conformity with standard IEC 60044-1.

TGOOD has drawn up a list of voltage transformers which are appropriate for use with digital protection devices. They are installed at the bottom of the functional unit. The energized part is entirely encapsulated in an epoxy resin, which provides both electrical insulation and excellent mechanical strength.



Voltage Presence Indication System (VPIS)

The VPIS, combined with the capacitive divider insulators of the power circuit unit, provides an indication by lights of the voltage presence on each phase of the main circuit.

The Voltage Presence Indication unit is installed on the door of low voltage cabinet.

The Voltage Presence Indication unit covers five voltage ranges, in accordance with standard IEC 61958:

- 1.0 to 1.9 kV
- 2.0 to 3.0 kV
- 3.1 to 5.9 kV
- 6.0 to 8.9 kV
- 9.0 to 17.9 kV.



Power monitoring and control device

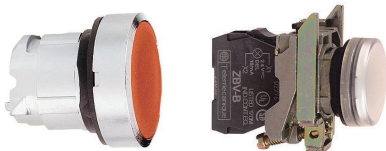
The power meter is a cost effective, high performance meter.

It can operate as a standalone device or as part of the power monitoring and control system, contact us for more information.

- **Essential power monitoring:**
 - Revenue-class; accuracy 0.2% current/voltage
 - On-board memory for energy consumption analysis
 - On-board clock/calendar for time/date stamping
- **Application flexibility:**
 - Separate meter and display modules
 - Direct-connect up to 600 V: higher voltages with VTs

Other devices, such as circuit monitor, are available for MV and LV networks.

Main functions include comprehensive power monitoring, power quality analysis and recording and optional input, output control.



Other components

Integration of standardize components in the TAP cubicle. Example:

- LV circuit-breakers cover all ratings from 1 to 100 A
- Push-button
- Rotary switch
- Light signal
- Sensors (thermal, arc, humid, partial discharge...)
- Communication box

TCB circuit-breaker	42
Description of functions	43
Withdrawable parts	44

The reliability and dependability of a cubicle is also assumed by the internal components, producing between them a coherent architecture.

This technology provides users with the best guarantee of continuity of service for their installations.



TCB vacuum circuit-breakers from 1 to 17.5 kV

TCB circuit-breaker is used to protect and control MV public or industrial distribution network.

- Rated voltage 12 kV and 17.5 kV.
- Short circuit breaking capacity up to 31.5 kA.
- Rated normal current from 630 A to 3150 A.
- Axial magnetic field (AMF) breaking technology.
- Withdrawable version.

The TCB circuit-breaker equips cubicles IF and BC at ratings of up to 17.5 kV.

High electrical endurance

A magnetic field is applied in the axis of the vacuum interrupter contacts. This process maintains the arc in diffused mode even at high current values. It ensures optimal dispersion of the energy over the contact surface and avoids localised temperature rise.

The advantages of this technique are:

- A very compact vacuum interrupter,
- Low energy dissipation of the arc in the vacuum interrupters. TCB is in conformity with the highest electrical endurance class (IEC 62271-100: class E2).
- High performance of capacitive current switching (IEC 62271-100: class C2).

An embedded pole

The TCB vacuum circuit breaker is equipped with embedded poles which brings you many advantages:

- Be suitable for application in harsh environment such as dust, salt mist, humid and higher altitude area
- Enhanced mechanical strength makes TCB more robust thanks to the PGA process, TCB is in conformity with the most demanding mechanical endurance class (IEC 62271-100: class M2)
- Increased dielectrical performance reinforce the continuity of service for their installation

A pre-assembled mechanism

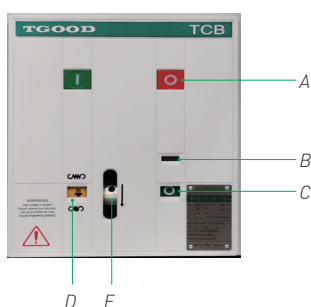
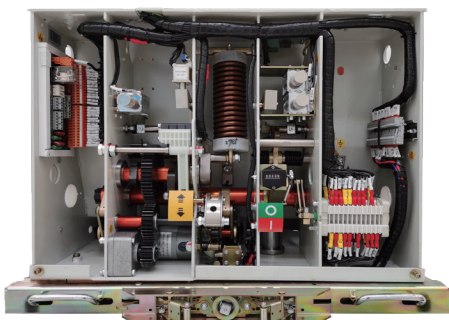
The modular designed and pre-assembled spring mechanism of TCB is proved by its excellent mechanical characteristics:

- Mechanical endurance: 10000 times
- Opening/closing time: less than 45ms/60ms
- Charging power: 120W/ 120VA

Universal interfaces

Those international interface make it easy to replace, maintain and retrofit, those what said interfaces include:

- Operation interface: open/close push button, indication position, racking point
- Installation interface: pole distance, phase distance, wheels distance, clutch location, interlocking to earthing switch
- Connection interface: low voltage plug including pin number and size of plug



Operation of the energy storage mechanism

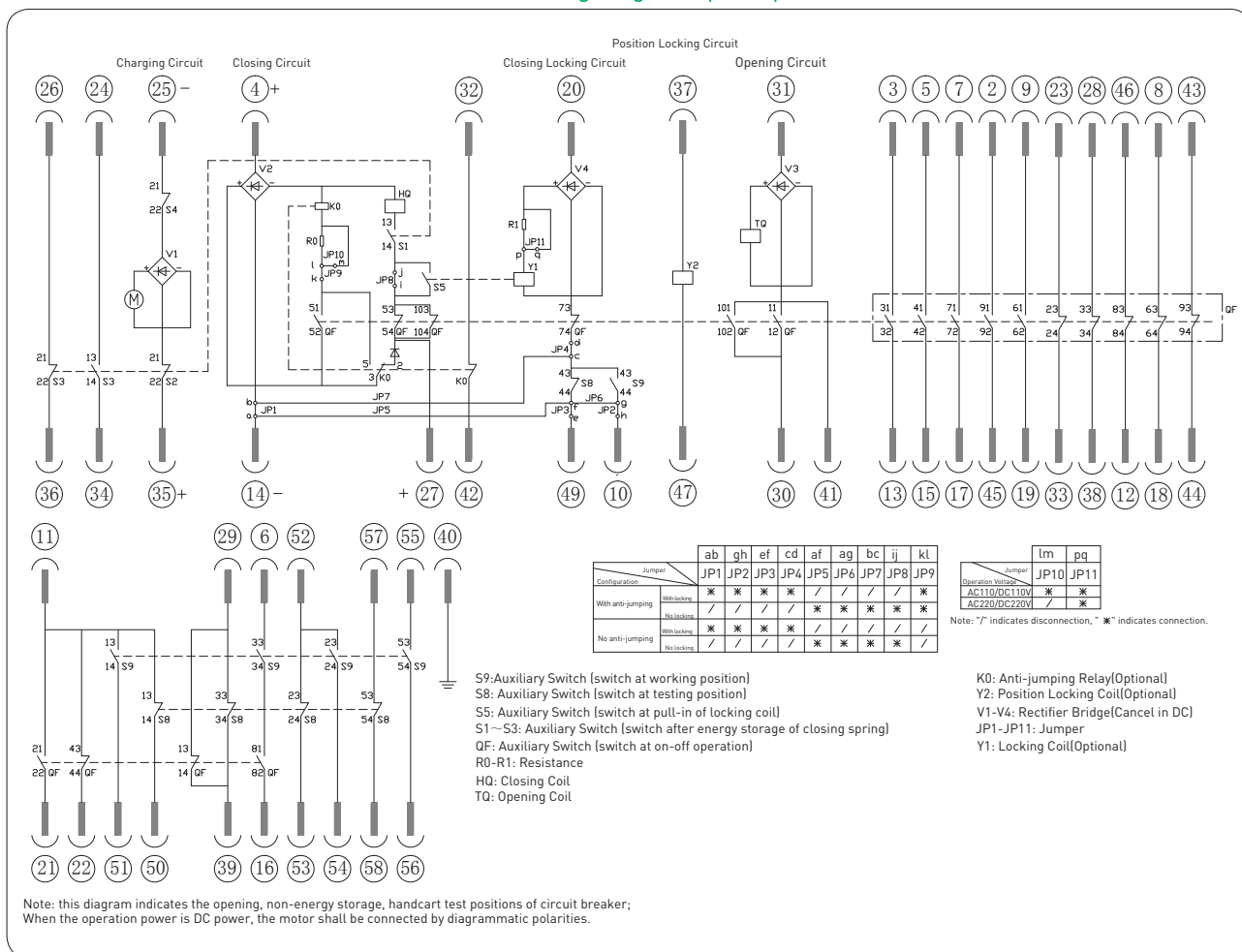
This gives the device an opening and closing speed that is independent of the operator whether the command is electrical or manual.

The electrical control mechanism carries out reclosing cycles and is automatically recharged by a geared motor each time after closing.

It consists of:

- The energy storage mechanism which stores the energy in springs required to open and close the device
- A electrical charging device with manual charging (*E*) by lever (useful on loss of auxiliary supply)
- Manual comand devices by push buttons (*A*) on the front panel of the device (accessible in test position)
- An electrical remote closing device containing a release with an antipumping relay
- An electrical opening device containing one or more releases, for example:
 - Shunt opening
 - Undervoltage release
- An operation counter (*B*)
- A circuit-breaker position indication device by mechanical indicator (*C*)
- And 3 modules of 4 auxiliary contacts whose availability varies according to the diagram used
- A device for indicating "charged" operating mechanism status (*D*) by mechanical indicator and electrical contact.

Wiring diagram (principle)



Electrical characteristics according to IEC 62271-100

Ur 17.5 kV	Isc	Ir		
Cubicle width (mm)			800	1000
Ud 50 kV 50 Hz, 1 min Up 125 kV peak	25 kA	630 A	■	
		1250 A	■	
		2500 A		■
	31.5 kA	630 A	■	
		1250 A	■	
		2500 A		■
		3150A		■

Additional characteristics according to IEC 62271-100

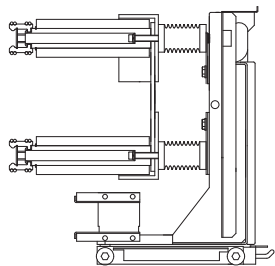
Rated values

Voltage	Ur	kV rms	17.5
Insulation voltage: - power frequency withstand - lightning impulse withstand (1.2/50 µs)	Ud	kV rms	38
	Up	kV peak	95
Frequency	fr	Hz	50-60
Short time withstand current	I _k /t _k	kA	I _{sc} /3 s
Peak withstand current	I _p	kA peak	2.5 I _{sc} (50 Hz)
			2.6 I _{sc} (60 Hz)
Short circuit making capacity		kA peak	2.5 I _{sc} (50 Hz)
			2.6 I _{sc} (60 Hz)

Other characteristics

Short circuit making capacity			0-0.3s-CO-3min-CO
			0-3min-CO-3min-CO
Open/closing time	Opening	ms	< 50
	Breaking	ms	< 60
	Closing	ms	< 71
Mechanical Endurance	Class	M2	
	Number of switching	10,000	
	operations		
Electrical endurance	Class	E2	
Capacitive current breaking capacity	Class	C2	
Operating conditions			-5°C to +40°C
Average relative humidity	Over 24 h	< 95%	
	Over 1 month	< 90%	

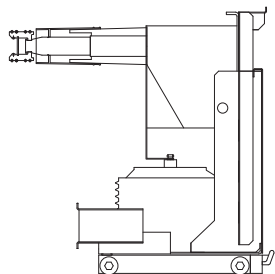
Service trucks



Disconnecting truck

This device allows disconnection of the upstream and downstream circuits in the cubicle. It is installed in the same location as the withdrawable circuit-breaker in the cradle.
It includes a device to lock it in the in-service position.

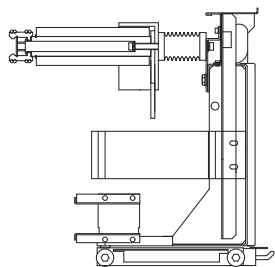
Electrical characteristics				
Rated voltage	Ur	kV	7.2 to 17.5	
Phase distance		mm	210	275
Rated normal current	Ir	A	1250	2500
Short-time withstand current (3 s)	I _k	kA	31.5	31.5



VT truck

This device is integrated MV voltage transformer and racking truck allowing voltage measurement of main busbar in the cubicle. It is installed in the same location as the withdrawable circuit-breaker.

Electrical characteristics				
Rated voltage	Ur	kV	7.2 to 17.5	
Phase distance		mm	210	275
Short-time withstand current (3 s)	I _k	kA	31.5	31.5



Earthing truck

This device is a safety accessory used in place of the withdrawable circuit-breaker in order to earth the busbars.
Possibility of locking by padlocks in the service position.

Electrical characteristics				
Rated voltage	Ur	kV rms	17.5	17.5
Phase distance		mm	210	275
Short-time withstand current (3 s)	I _k	kA	31.5	31.5
Making capacity		kA peak	2.5 I _k (50 Hz) & 2.6 I _k (60 Hz)	

Composition

The "racking in" function is carried out by:

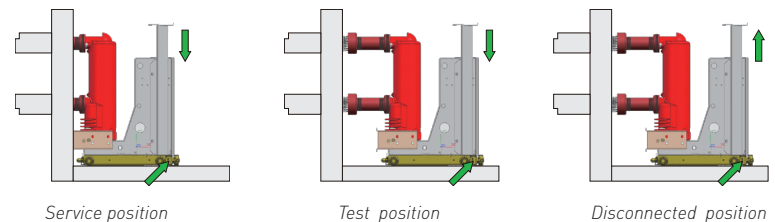
- The racking truck supporting the circuit-breaker (mobile part)
- The cradle with bushings (fixed part)
- LV plug

Operation

The circuit-breaker can be placed in 3 stable positions:

- Service position: circuit-breaker racked in and locked in position LV plugs connected
- Test position: circuit-breaker racked out and locked in position LV plug connected
- Disconnected position: circuit-breaker racked out and locked in position LV plug disconnected

The circuit-breaker can be unlocked and extracted from the cradle.



Note: The arrows show the "locked positions" for the circuit-breaker and the connection status of LV plug.

Functions

- A drive system combined with a threaded shaft gives easier racking in and out. The racking in mechanism must be operated with the door closed
- An interlock between the circuit-breaker status and the truck gives secure operation: racking in or out is only possible if the circuit-breaker is open
- An interlock also exists between the LV connector and the truck. It is only possible to rack in if the LV connector is connected
- The racking truck of TCB has robust mechanical interlocking with earthing switch
- Protective shutters stop fingers from touching the fixed contacts when the device is extracted (protection index: IP2X)
- For maintenance operations, it is possible to:
 - Padlock the shutters in the closed position
 - Unlock the shutter mechanism to access the fixed contacts

Accessories

- 4NO4NC position contacts in the racking truck
- 1 padlock system to lock the lever hub socket to prevent racking in
- Locking of the circuit-breaker compartment door




This device enables the circuit-breaker, full version, to only be operated when the door is closed.

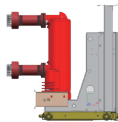
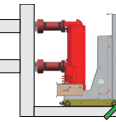
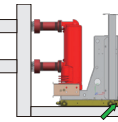
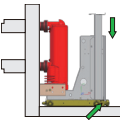
Extraction

This table describes the safety functions available on TAP .

How to use the table

Each of the boxes describes the functional status of each circuit-breaker position and the associated parts:

-  Possible status
-  Possible status, operation impossible
-  Impossible status

Parts		Circuit-breaker positions					
			Disconnected ← Extraction →			Disconnected ← Extraction →	
		Removed		Disconnected	Test position		Service
1-Cradle			Fool-proof protection (1)				
			Anti-drop (2)				
		No opening shutters					
		Shutters padlocking possible					
2-LV plug	Disconnected			No racking-in			
	Connected				No unplugging		
3-Circuit-breaker	Closed		Auto-discharge function (3)		No racking-in		No racking-out
	Open				No closing		
			Open position circuit-breaker locking available ⁽³⁾				
4-Switchgear door	Open				No racking-in		
	Closed				No door opening ⁽⁴⁾		
5-Earthing switch	Open					No earthing switch closing	
	Closed				No racking-in		

[1] This protection mechanism ensures that the performance levels of the circuit-breaker correspond with those of the cradle.

[2] Device that prevents the circuit-breaker from dropping when extracted from the cradle. The device can be either unlocked manually or when the extraction rig is put in position.

[3] Option.

[4] Interlocking device to be fitted to the cubicle door. If there is no interlocking, the circuit-breaker device should be inhibited.



Service truck

Enables the circuit-breaker to be taken out of the cubicle and handled during maintenance operations.

- A device using screws and bolts allows the height adjustment up to 250 mm
- A latching device is provided between the extraction table and the cradle



Racking handle

This handle enables:

- The withdrawable part to be racked in/out



Charging lever

This lever enables:

- The lever mechanism charged manually

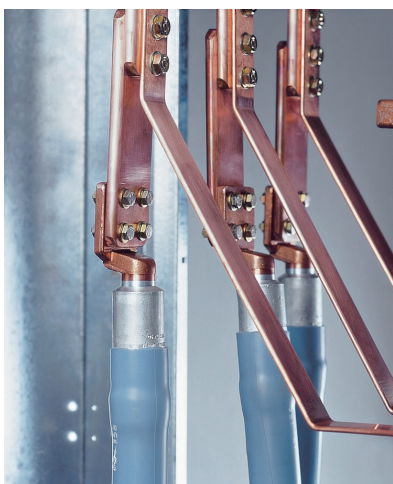


Earthing switch handle

This handle enables:

- Earthing switch open and closing operations.

Connections	50
<hr/>	
Implementation example	52
<hr/>	



Expected life time of switchgear depends on 3 key factors

- The need for correctly made connections

New cold connecting technologies offer easy installation and favor durability in time. Their design means they can be used in polluted environments with harsh atmospheres.

- The impact of relative humidity

The installing of a heating element is essential in climates with high relative humidities and significant temperature differentials.

- Ventilation control

The dimensions of air vents must be appropriate for the dissipated energy in the substation.

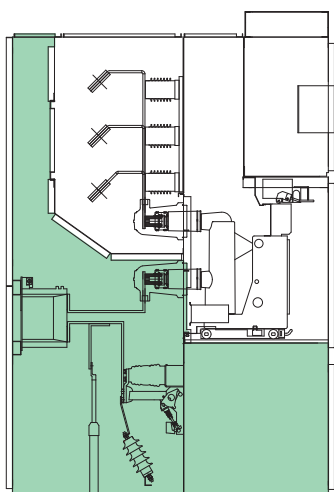
Cold connected terminals

TGOOD's experience has led it to favour this technology wherever possible for optimum durability.

The maximum acceptable cable cross-section for standard assemblies are:

- 630 mm² for incomer or feeder cubicles with single-core cables (for bigger cable size please contact us)
- 300 mm² for incomer or feeder cubicles with three-core cables

Access to the compartment is only possible when the earthing switch is closed. Tightening torques for cables will be attained using a dynamo wrench set to 50 mN.



Dry, single core cable

Short end piece, cold connectable

Performance	3 to 17.5 kV - 630 A - 3150 A
Cross section mm ²	50 to 630 mm ²
Supplier	all suppliers of cold connectable terminals: Silec, 3M, Pirelli, Raychem...
Number of cables	1 to 5 per phase
Comments	for greater cross section and number of cables, please consult us

Dry, three core cable

Short end piece, cold connectable

Performance	3 to 17.5 kV - 3150 A
Cross section mm ²	50 to 300 mm ²
Supplier	all suppliers of cold connectable terminals: Silec, 3M, Pirelli, Raychem...
Number of cables	1 to 5 per phase
Comments	for greater cross section and number of cables, please consult us

Connection possibilities using dry cables ID - IF

For bottom entry

	IF-630 A	IF-1250 A	IF-2500 A	IF-3150 A	ID-1250 A	ID-2500 A	ID-3150 A
1 single core per phase	■	■	■	■	■	■	■
2 single core per phase	■	■	■	■	■	■	■
3 single core per phase		■	■	■	■	■	■
4 single core per phase			■	■		■	■
5 single core per phase				■			■
1 three core	■	■	■	■	■	■	■
2 three core	■	■	■	■	■	■	■
3 three core		■	■	■	■	■	■
4 three core			■	■		■	■
5 three core				■			■

For top entry

	IF-630 A	IF-1250 A	IF-2500 A	IF-3150 A	ID-1250 A	ID-2500 A	ID-3150 A
1 single core per phase	■	■	■	■	NA	NA	NA
2 single core per phase	■	■	■	■	NA	NA	NA
3 single core per phase		■	■	■	NA	NA	NA
4 single core per phase			■	■		NA	NA
5 single core per phase				■			NA
1 three core	■	■	■	■	NA	NA	NA
2 three core	■	■	■	■	NA	NA	NA
3 three core		■	■	■	NA	NA	NA
4 three core			■	■		NA	NA
5 three core				■			NA

NA = Not Available

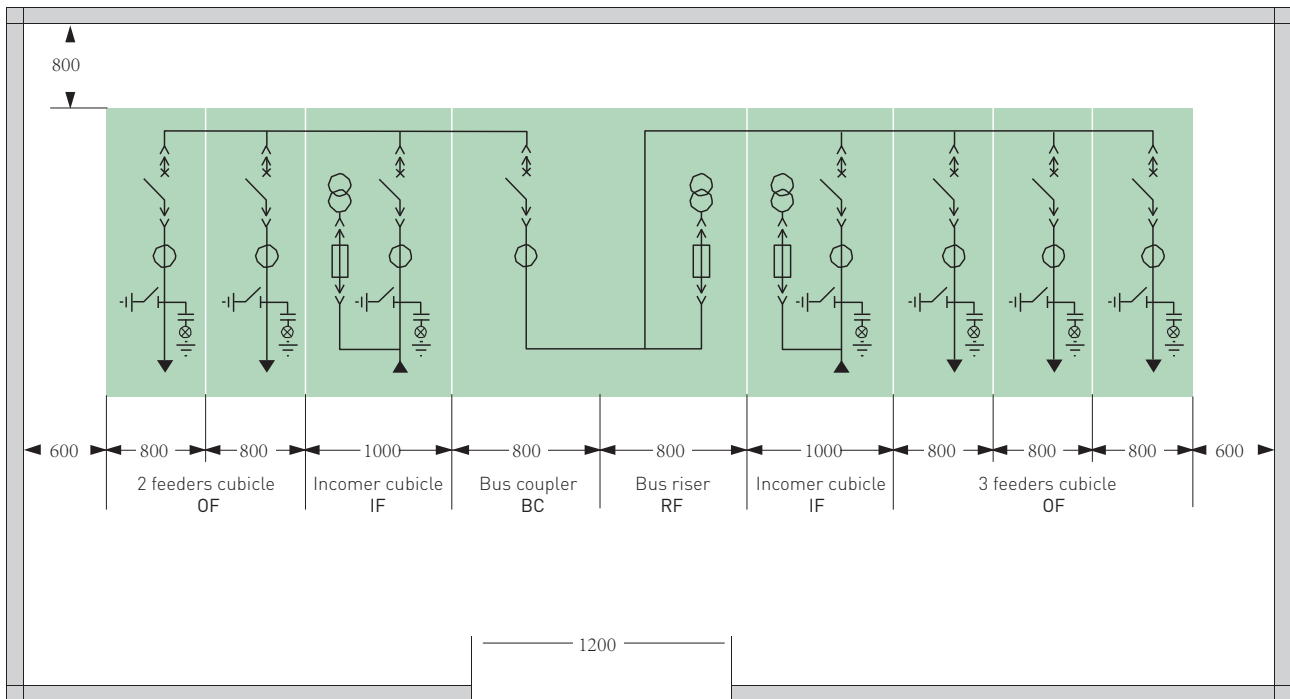
Bottom cable connection

Cable connection height

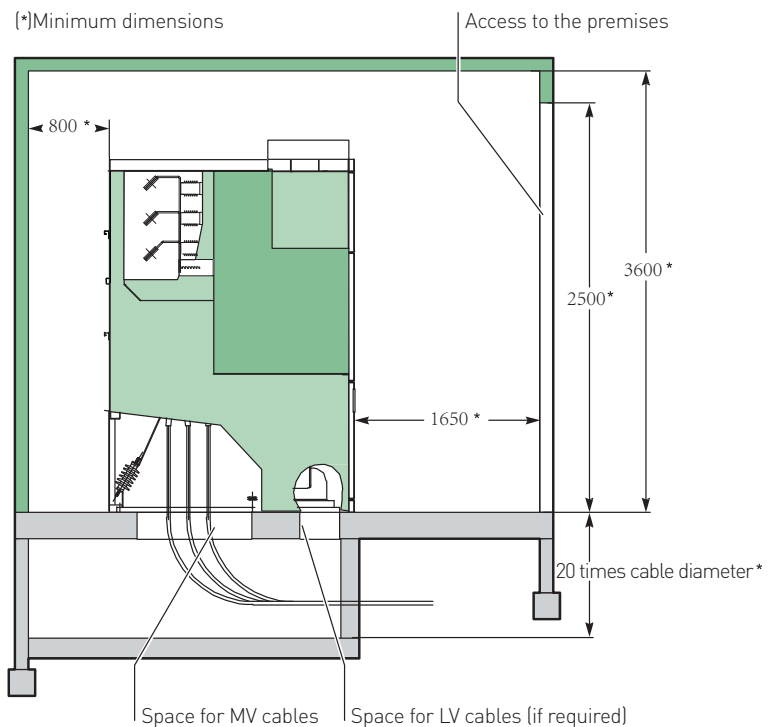
Type of cubicle	Configuration	H (mm)
IF	630 to 1250 A 1 set of CTs	650
IF	2500 A	430
IF	3150 A	430

Note: Drop box is available if required.

Typical switchgear line up



Civil engineering with utility space



Note: For further information, refer to the civil engineering guide, user and instruction manual.

Equipment			Type of cubicle					
			IF	ID	BC	RF	VT	RW
Switchgear								
Circuit-breaker			■		■			
VT truck							■	
Disconnecter truck			□		□			■
Earthing truck			□		□			□
Fixed connections				■		■		
Racking position indication contact for the withdrawable part		4 NO + 4 NC	□		□			
Padlocking of isolating shutters for withdrawable parts			■		■		■	■
Voltage Presence Indication (VPIS)			□	□	□	□	□	□
Locking of mechanical racking of the withdrawable part (padlock)			□		□		□	□
Locking of mechanical racking of the withdrawable part (keylock)			□		□			
Locking of the electromagnetic racking of the withdrawable part			□		□			
Earthing switch (SMALT)								
Earthing switch			□	□		□	□	□
Earthing switch position indication contacts		5 NO + 5 NC	□	□		□	□	□
Earthing switch padlocking			□	□		□	□	□
Electromagnetic earthing switch position locking			□	□		□	□	□
Transformers								
Voltage transformers (1 per phase) phase-earth	Unfused fixed		□	□			□	□
	Fused fixed		□	□		□	□	□
Current transformer	Set of 3 CT's		□	□	□			
	Set of 6 CT's		□	□				
	Set of LPCT's		□		□			
Cubicle								
Protection index	Enclosure	IP3X	■	■	■	■	■	■
		IP4X	■	■	■	■	■	■
	Compartments	IP2X	■	■	■	■	■	■
Anti-arcing protection	31.5 kA - 1 s		□	□	□	□	□	□
	Internal arc flap signalling contact (consult us)		□	□	□	□	□	□
LV control cabinet key locking			□	□	□	□	□	□
LV control cabinet lighting			□	□	□	□	□	□
Anti-condensation heating element			□	□	□	□	□	□

■ : Basic equipment

□ : Option

Contact us

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