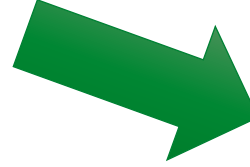




TGOOD Presentation Switchgear Standards

- Primary Switchgear
- Secondary Switchgear
- HV Gas Insulated Switchgear
- HV Hybrid switchgear

Medium Voltage Trends



From brick and mortar cell substations



to compact metal enclosed switchgear



What changes in the switchgear industry?

- Technology, companies taking advantage of changes in technology, i.e. Vacuum switching
- Environmental impacts, global warming and concerns for the environment.
- Safety, growing litigation against companies for not acting on preventable accidents
- Cost, the need for reduced life cycle cost with increased reliability

Medium voltage

IEC 62271 Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

High voltage

IEC 62271 Part 203: AC High-voltage switchgear and controlgear Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV

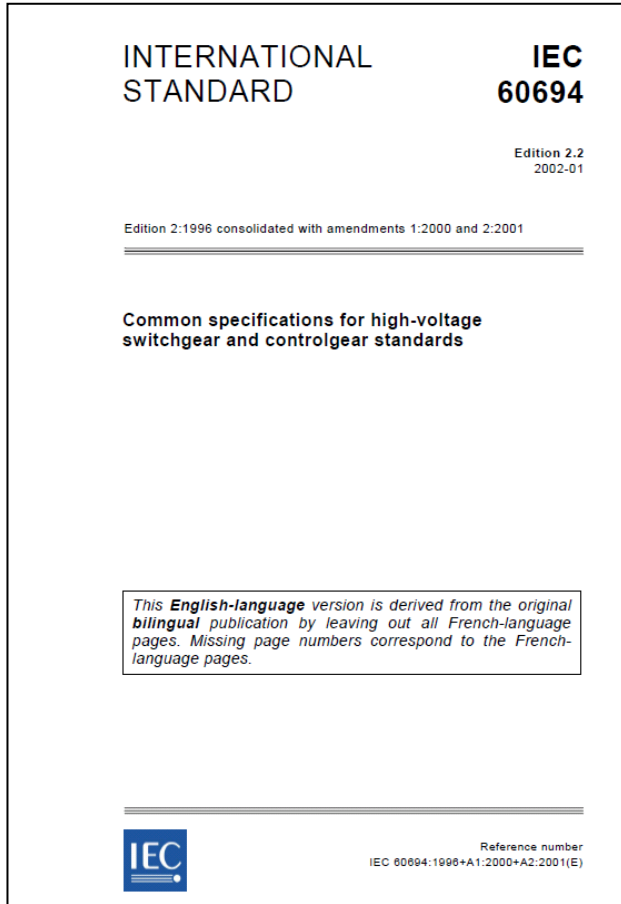


TAP 17

Air-insulated switchgear

Up to 17.5kV

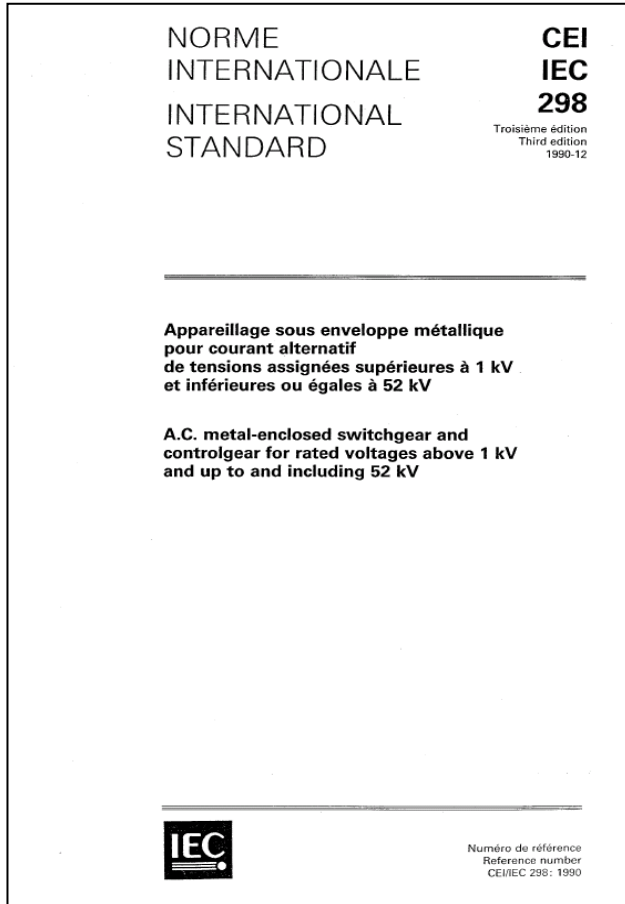
TG00D



IEC 60694 Common Specifications for switchgear

Certification achieved by passing:

- Short time current withstand
- Dielectric withstand
- Temperature rise
- IP rating



IEC 60298 Additional standard for switchgear

Standard in addition to the established IEC60694 standard where safety from internal arc is then considered:

Type testing consisted of:

- Internal arc testing for operator safety
- Short time current withstand
- Dielectric withstand
- Temperature rise
- IP rating

First edition 1990

NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC
62271-200

Première édition
First edition
2003-11

Appareillage à haute tension –

Partie 200:
Appareillage sous enveloppe métallique
pour courant alternatif de tensions assignées
supérieures à 1 kV et inférieures ou égales
à 52 kV

High-voltage switchgear and controlgear –

Part 200:
AC metal-enclosed switchgear and controlgear
for rated voltages above 1 kV and up to
and including 52 kV



Numéro de référence
Reference number
CEI/IEC 62271-200:2003

IEC 62271-200 New Classifications for Switchgear (Replaced IEC 60298)

Broader definition “Metal Enclosed” with specific definitions to cover all types of switchgear

- Partitioning – (PM, PI)
- Interlocking – (Tool / Interlock based)
- Loss of service continuity (LSC)
- Internal arc classified IAC AFLR according to the new IEC 62271-200 Annex A

First edition of standard 2003

ICS 29.130.10

ISBN 0-626-15176-7

SANS 1885:2004

Edition 1.1

Any reference to SABS 1885 is deemed
to be a reference to this standard
(Government Notice No. 1373 of 8 November 2002)

SOUTH AFRICAN NATIONAL STANDARD

**Metal-clad switchgear for rated a.c. voltages
above 1 kV and up to and including 36 kV —
General requirements and methods of test**

Published by Standards South Africa
1 dr Itegan road groenkloof private bag x191 pretoria 0001
tel: 012 428 7911 fax: 012 344 1568 international code + 27 12
www.sansa.co.za
© Standards South Africa 2004

standards
South Africa
(a division of SABS)

SANS 1885 South African standard for switchgear

Standard based on IEC 62271-200 with local
requirements to suite utility applications.

Inclusion of:

- Current transformers
- LV wiring
- Cable clearances for MV cables
- Detailed A / B Schedules

Medium Voltage

IEC 62271 series Part	HIGH-VOLTAGE SWITCHGEAR AND CONTROLGER	Old IEC number
1	Common specifications	IEC 60694
2	Seismic qualification for rated voltages of 72,5 kV and above	-
100	High-voltage alternating current circuit-breakers	IEC 60056
101	Synthetic testing	IEC 60427
102	High-voltage alternating current disconnectors and earthing switches	IEC 60129
103	Switches for rated voltages above 1 kV and less than 52 kV	IEC 60265-1
104	Switches for rated voltages of 52 kV and above	IEC 60265-2
105	Alternating current switch-fuse combinations	IEC 60420
106	Alternating current contactors and contactor-based motor-starters	IEC 60470
200	AC metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV	IEC 60298

Medium Voltage



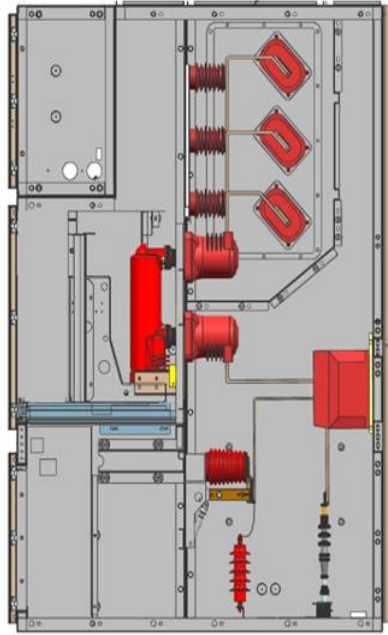
TAP17 PM Segregation and
busbar segregation on every panel

PM enclosed switchgear

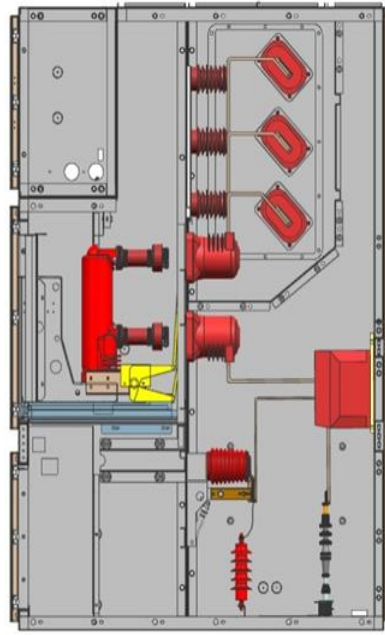
- Metallic segregation of all the compartments
- Metallic shutters operated by the apparatus movement
- Closed door apparatus racking

PI Other than metal segregation

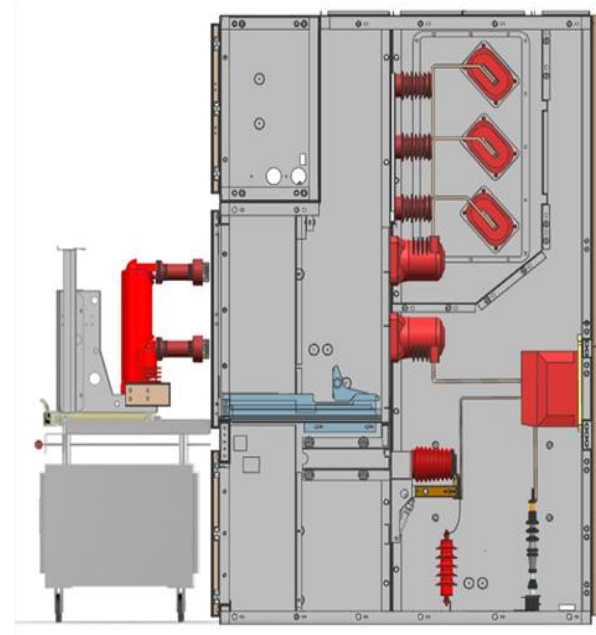
Closed door racking of circuit breakers



In Service
Position

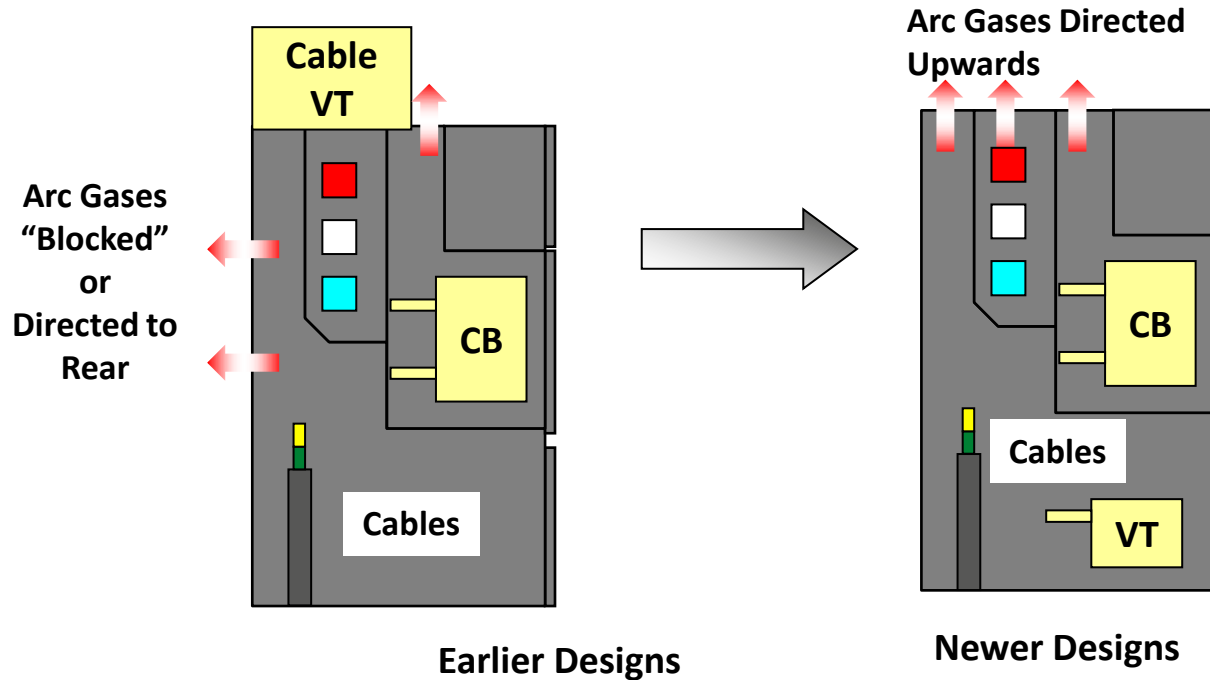


Test /
Disconnected



CB Maintenance
position

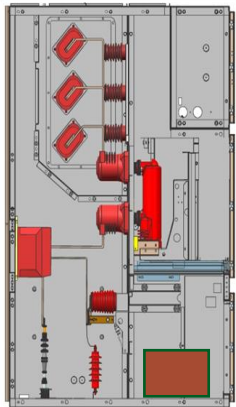
CABLE VT's, Compliance to IEC62271-200



CABLE VT's

TGOOD TAP17

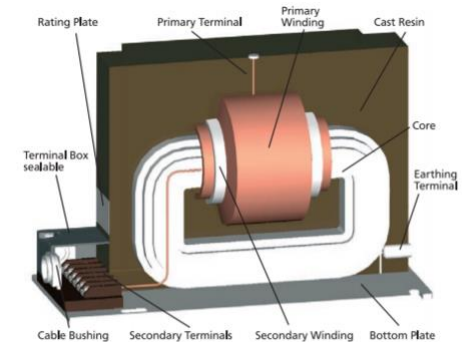
- TAP17 offers VT's mounted within the arc proof enclosure, in feeder or incomer cubicles
- IEC 61869-3 tested and approved single phase withdrawable VT's,
- VT's are fitted with fuses inside the MV switchgear enclosure



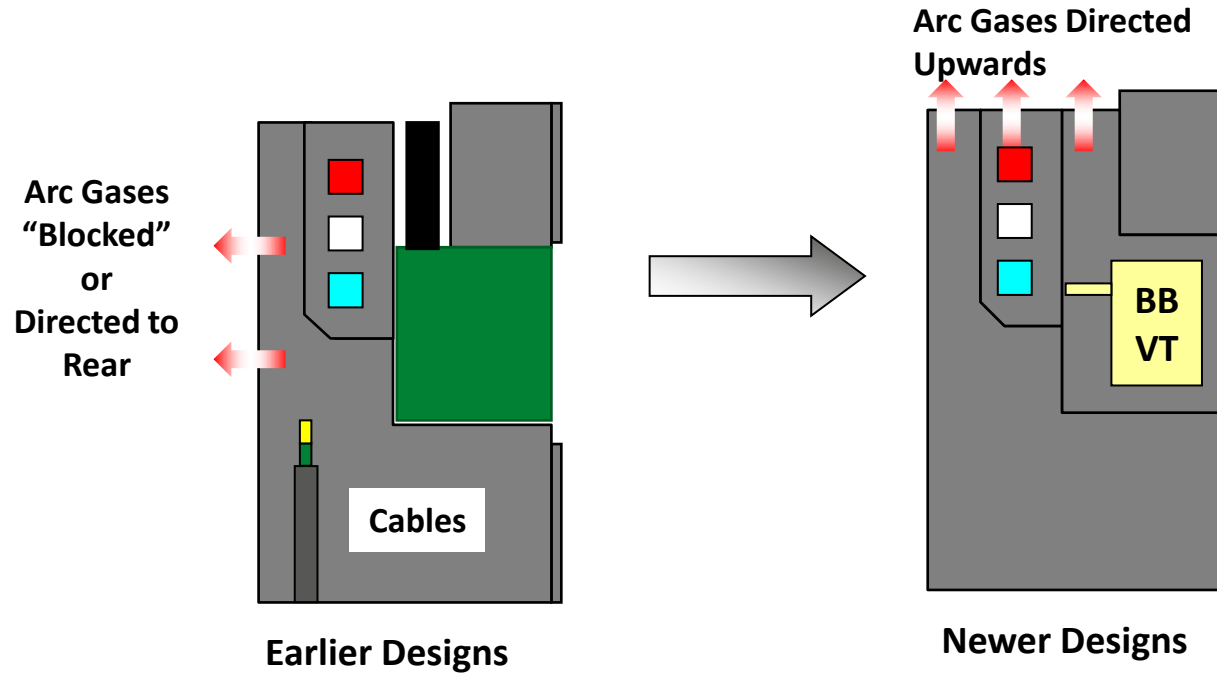
Note: Cable VT's are fully interlocked. Access to this compartment is controlled by an interlock between the switching device and the cable earth switch. Access is only gained once the switching device is removed and the cable earth switch is applied.



Cable VT inside enclosure



Busbar VT's, Compliance to IEC62271-200 IAF



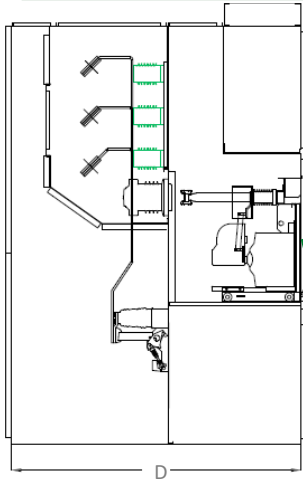
TGOOD TAP 17

TAP17 offers IEC 61869-3 tested and approved single phase withdrawable VT's, mounted in a separate cubicle (CB compartment)

VT's are fitted with HRC fuses inside the VT bushing, using standard MV fuses to DIN standards.

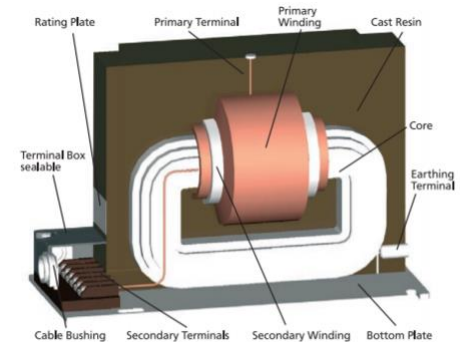
Note: Busbar VT's are fitted within the arc proof enclosure using the CB compartment complete with shutters on the busbar connections. The VT can be racked behind a closed door while the busbars are live. Access can only be gained to compartment once the VT is fully withdrawn.

VT's are type tested according to 61869-3.switchgear.

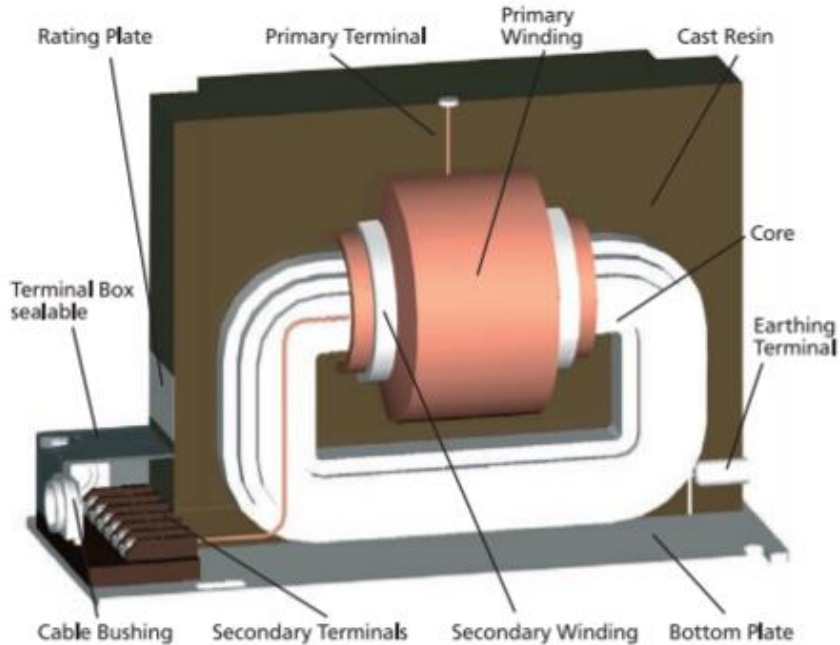


Busbar VT inside CB compartment

Busbar VT's

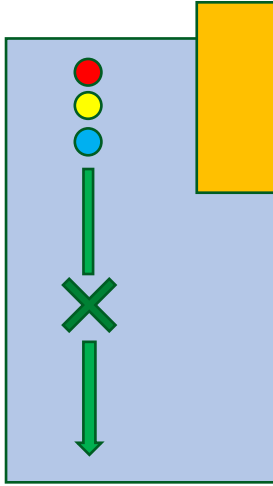


Resin cast VT's



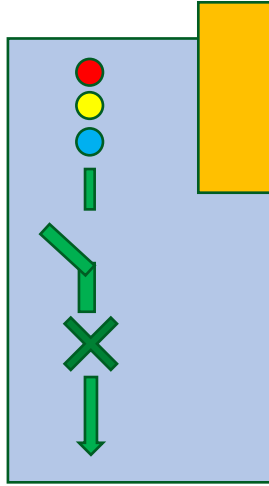
VT's Based on DIN Standard and resin cast are fully tested to IEC 61869-3 and do not fail from surface or internal partial discharges.

Medium Voltage



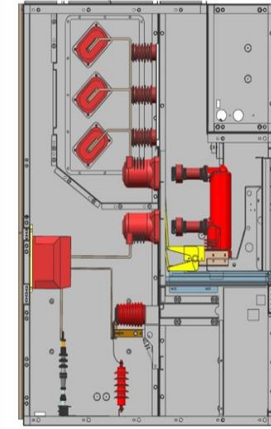
LSC1

Switchboard must be de-energised to work on any part



LSC 2A

Adjacent units can remain in service while maintenance is carried out on one unit.



LSC 2B

Same as LSC2A, but cables can remain energised

TAP17 LSC 2B

IAC: Internal Arc Classification

A, B, C distinction made between:

A – Operator safety

B – Public Safety

C – Out of reach

FLR Front lateral and rear sides tested

I: Test in kA / t: time in seconds



TAP17 tested to AFLR 31.5kA / 1 second

TGS tested to AFLR 20kA / 1 sec

Criteria for switchgear to comply with IEC 62271- 200 Annexure A



1. Correctly secured doors and cover do not open
2. No fragmentation of the enclosure occurs within the test time
3. Arcing do not cause holes in the accessible sides, up to height of 2m
4. Indicators do not ignite due to effect of hot gases
5. The enclosure remains connected to its earthing point

A.1 Introduction

This annex applies to metal-enclosed switchgear and controlgear of classification IAC. This classification is intended to offer a tested level of protection to persons in the vicinity of the equipment in normal operating conditions and with the switchgear and controlgear in normal service position, in the event of internal arc.

For the purpose of this annex, normal operating conditions means the conditions of metal-enclosed switchgear and controlgear required to carry out operations such as opening or closing HV switching devices, connecting and disconnecting withdrawable parts, reading of measuring instruments and monitoring equipment, etc. Therefore, if to perform any of such operations any cover has to be removed and/or any door has to be opened, the test described below shall be carried out with the cover and/or door removed.

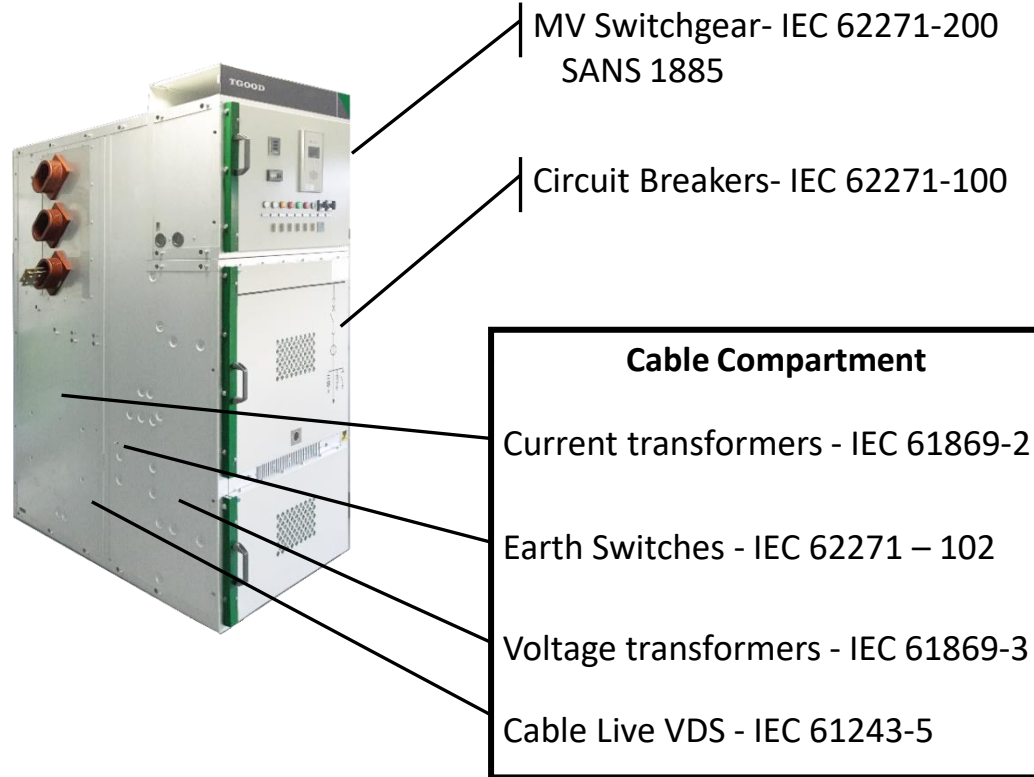
Medium Voltage

Arc Ducting

Busbar Segregation

Closed door racking

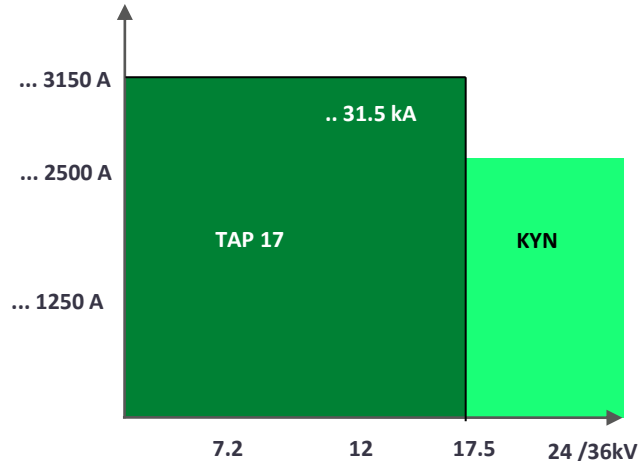
VT's inside arc
withstand area



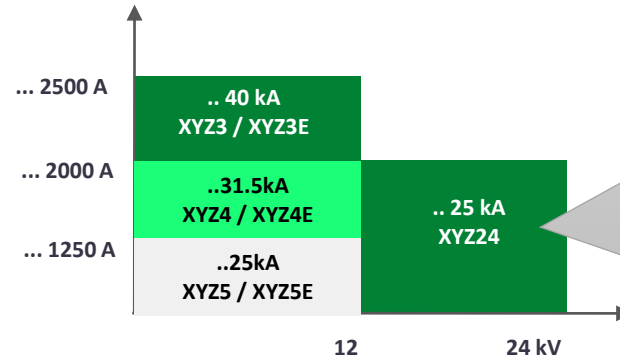
Medium Voltage Comparison with local “older” switchgear designs



TAP17 / KYN Arc
tested to 31.5kA / 1S



Arc tested to AFL / 25kA/ 200ms to IEC 60298?
Tested with CB racked in, what about traverse position?
Remote operation required?



Confusion of which ratings apply to which product.
Close attention to detail is required, Need to examine test certificates closely for each range and each configuration, I.e, Bus section, Incomer, VT cubicles?

Medium Voltage TAP17 Comparison with local “older” switchgear designs

TGOOD TAP17

- CT tested according to IEC 61869-2
- VT tested according to IEC 61869-3
- IT's based on DIN standard

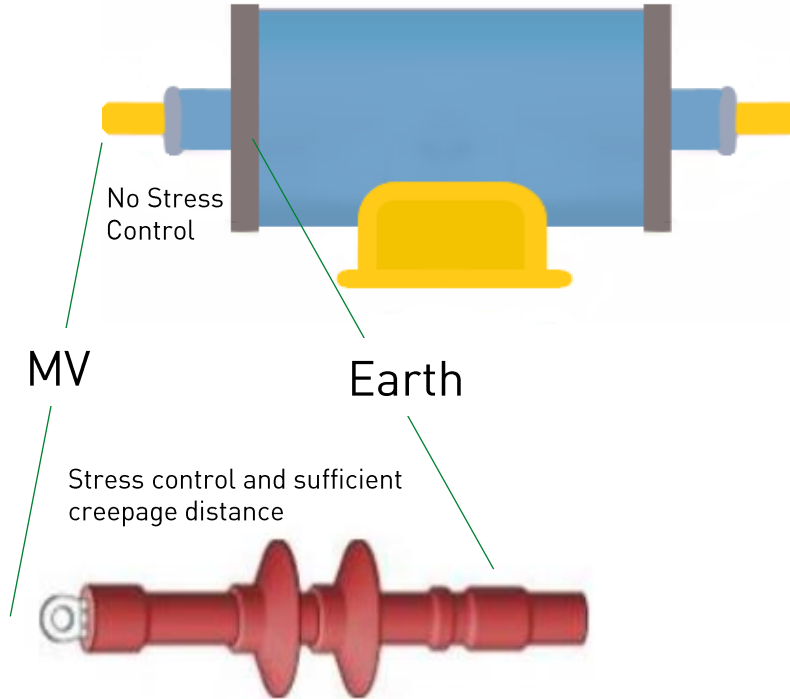
CT / VT manufactured using resin cast in autoclave, good quality design, very low partial discharge rating < 5pC



CT's manufactured using PVC materials and low-quality resin. Result partial discharge rating, > 50pC



Current Transformers

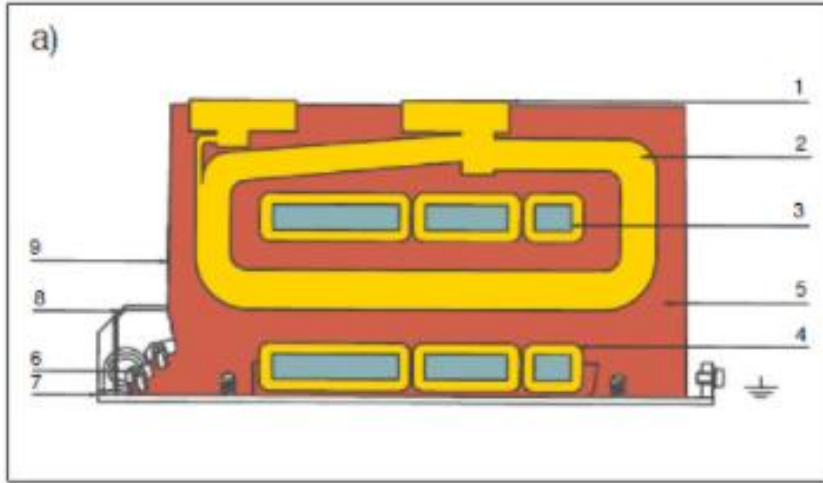


Bar primary CT's are susceptible to failure caused by surface discharges.

Compared with a cable there is little room or no stress control between HV and earth side.

Note: The CT secondary winding is always earthed and therefore considered as earth.

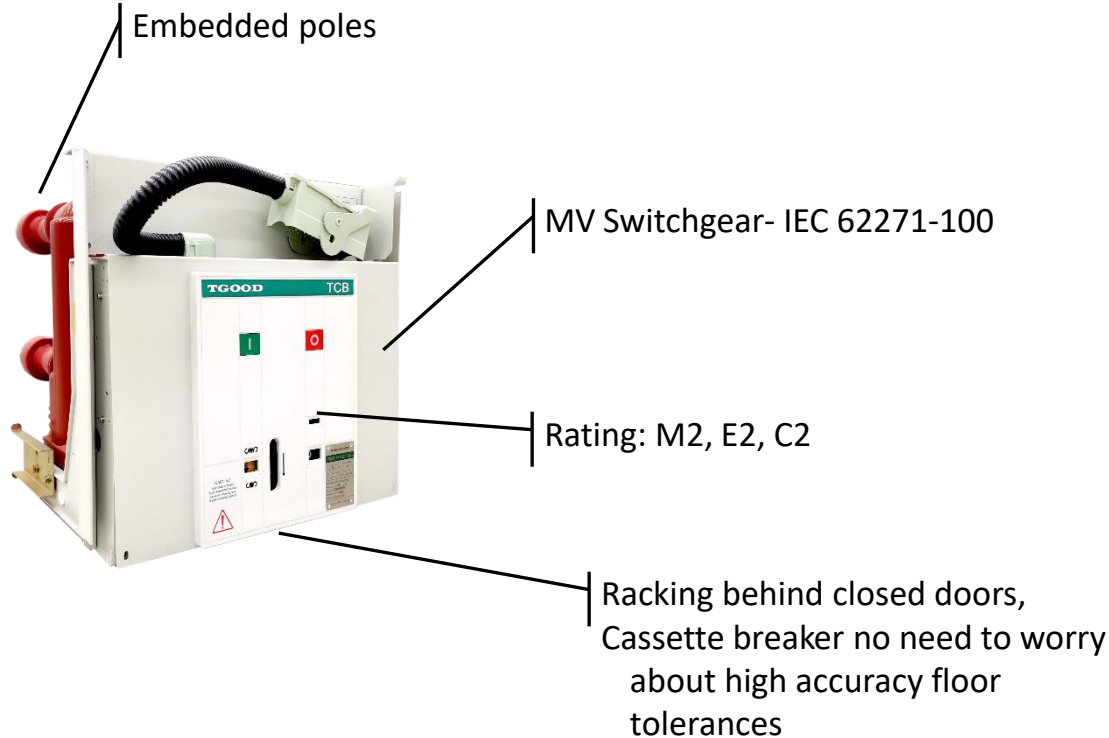
Current Transformers



1. Primary terminals P1/P2
2. Primary Winding
3. CT Iron cores
4. Secondary winding
5. Resin
6. Secondary terminals
7. Mounting plate
8. Secondary terminal box
9. Rating plate

CT Based on DIN Standard, resin cast, are fully tested to IEC 61869-2 do not fail from surface or internal partial discharges.

Medium Voltage TAP17 Comparison with local “older” switchgear designs



Check list for MV Switchgear, to ensure Safety, Endurance, High Quality and Certification compliance	TGOOD TAP17
Are all the applicable switchgear variants type tested for Internal arc classification to IEC 62271-200 according to the correct predetermined classification i.e. AFLR 31.5kA / 1 second.	AFLR
Are exhaust gas ducts available to vent arc gasses to safe area?	Yes
Is busbar segregation available, to prevent the spread of faults through the busbar compartment?	Yes
Are VT's inside arc proof enclosure, and not mounted on top of switchgear?	Yes
Are VT's type tested? Standard to 61869-3. ?	Yes
Are CT's type tested? Standard to 61869-2. ?	Yes
Is cable live indicating devices type tested for VDS? Standard to IEC 61243-5. ?	Yes
Are Circuit Breakers type tested? Standard to IEC 62271-100. ?	Yes
Do Circuit Breakers have suitable electrical & mechanical ratings E2, M2, C2	Yes
Do Circuit breakers have fully encapsulated interrupter poles?	Yes
Can Circuit breakers be racked, closed and opened both electrically and mechanically while the compartment door is closed?	Yes
Are Circuit breakers the cassette type which is not dependent on floor tolerances to ensure smooth and error free racking operations?	Yes
Are separate cable and busbar earth switches available and tested according to IEC 62271-102 so that safety earths can be achieved without using the circuit breaker?	Yes

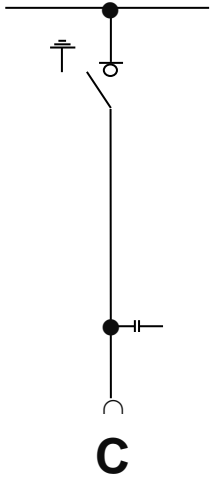
MV Compact switchgear



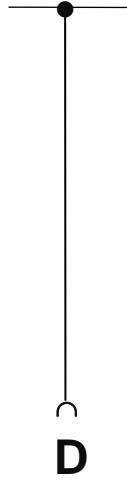
Compact switchgear is fast replacing traditional AIS withdrawable switchgear

- 70% of switchgear required <24kV / 630A
- Really compact < 400 mm
- Standardisation of solutions
- Very simple and effective protection systems
- Can be customised to suite requirements
- Very economical, can be half the cost of traditional AIS

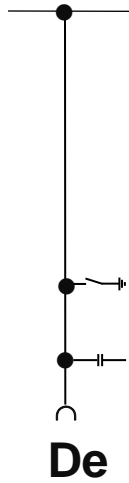
MV Compact switchgear



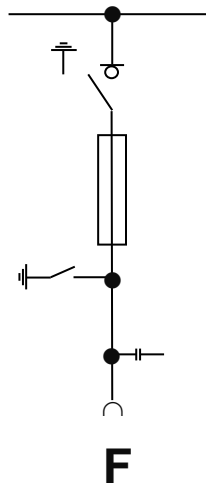
Cable
switch



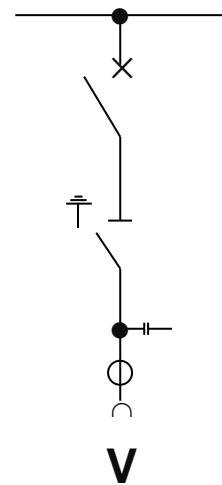
Direct



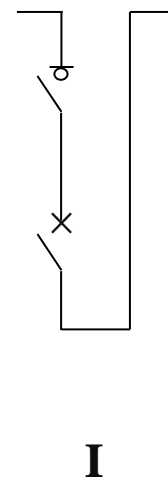
Direct + ES



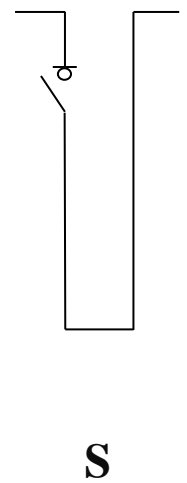
Fuse
switch



Vacuum
CB

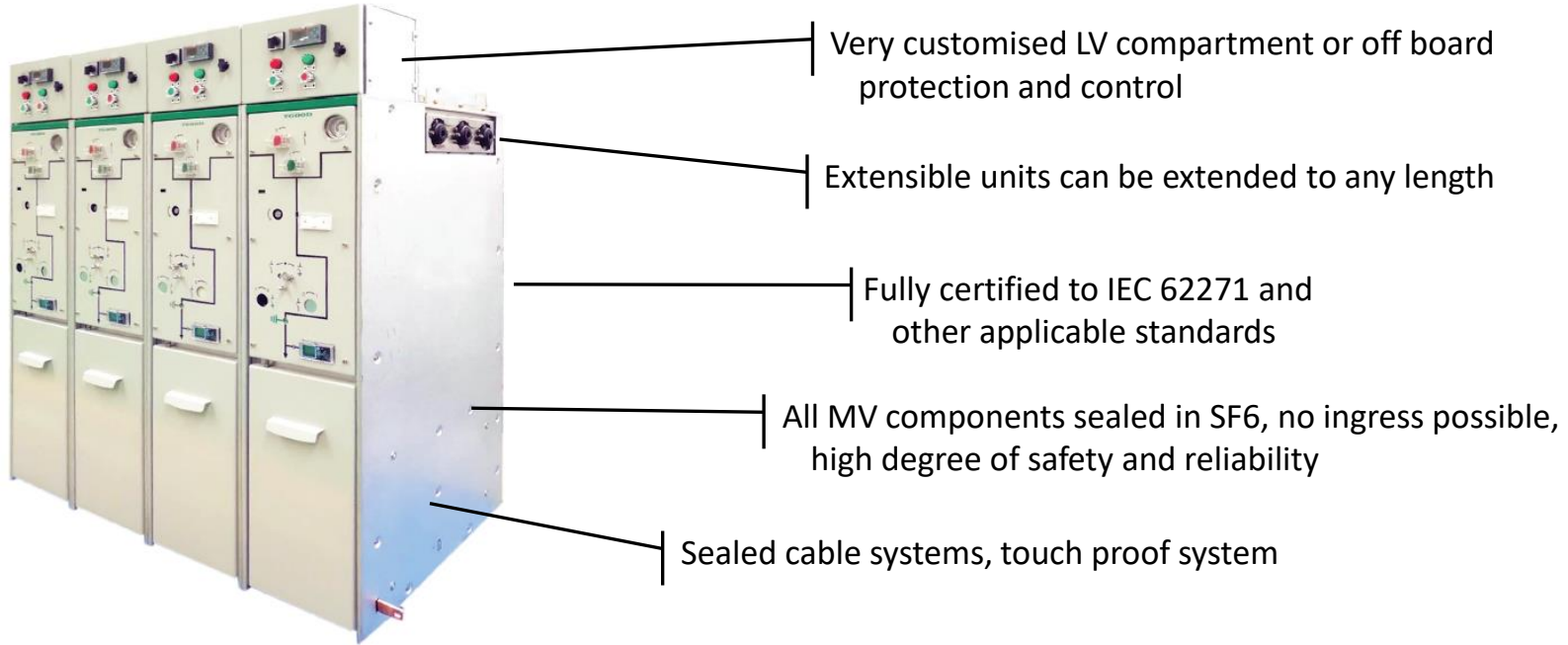


BS
VCB



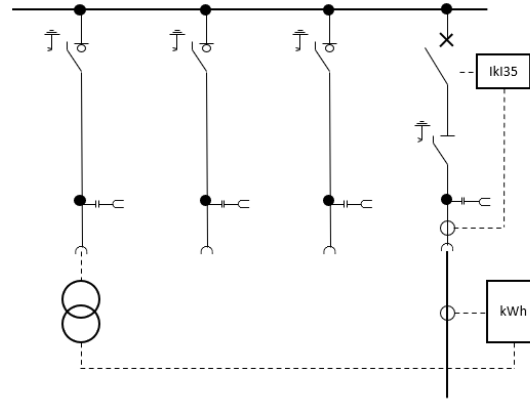
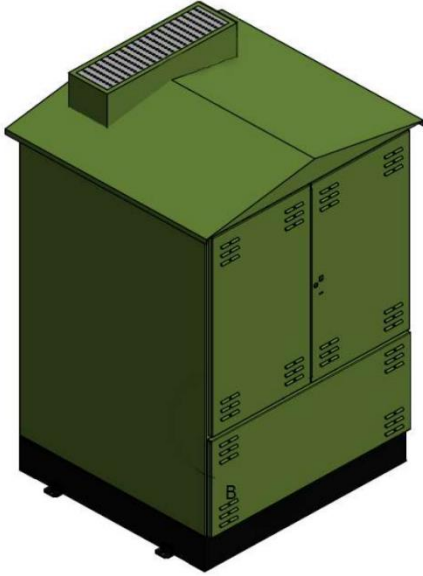
BS
LBS

MV Compact switchgear



MV Compact switchgear

Ring main unit solutions



CpCCV

Standardised solutions for many applications:

- Bulk metering units
- Ring main units
- Pad mount sub stations
- Kiosk / Skid sub stations

High Voltage Trends



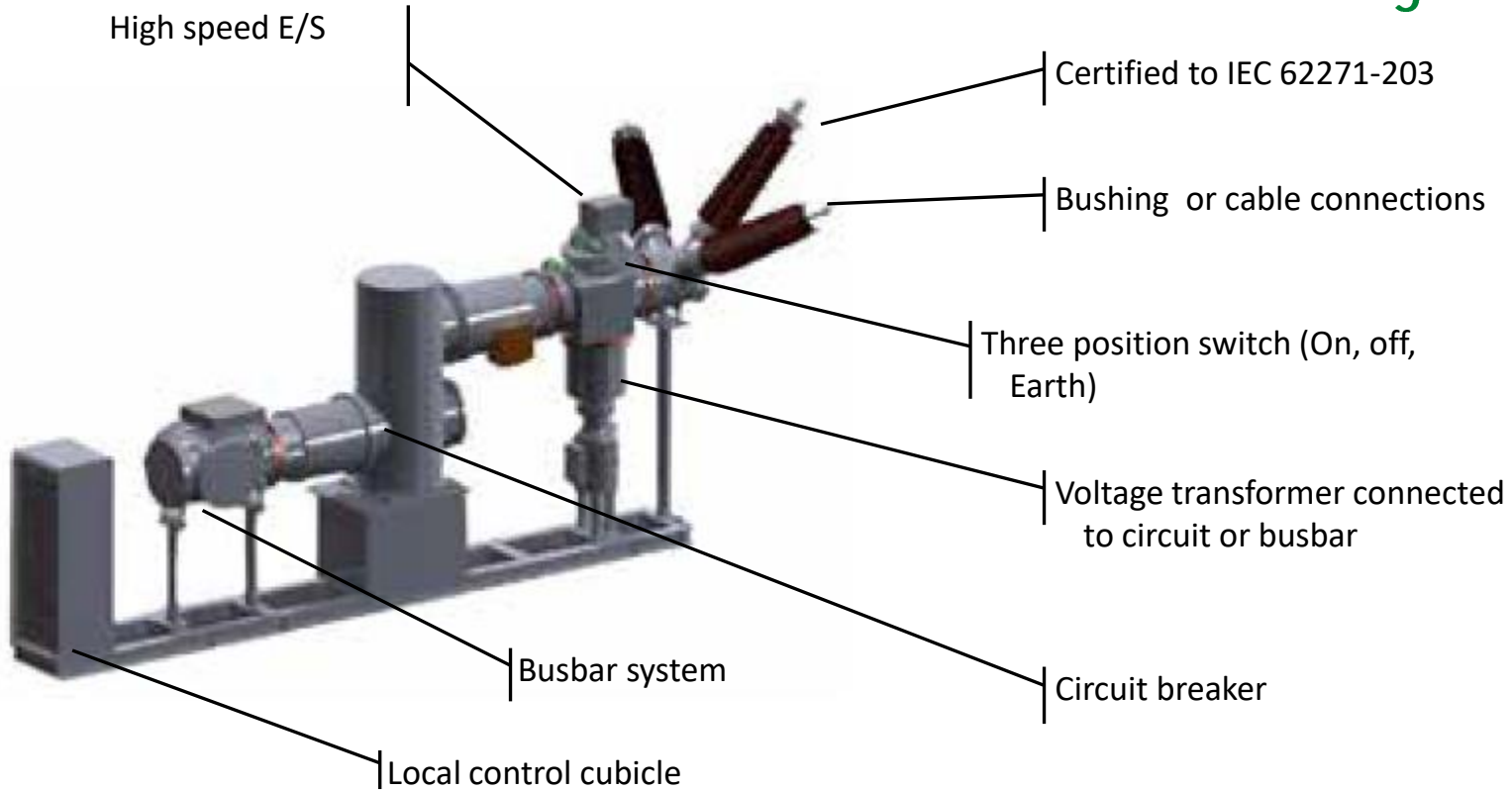
HV Switchgear



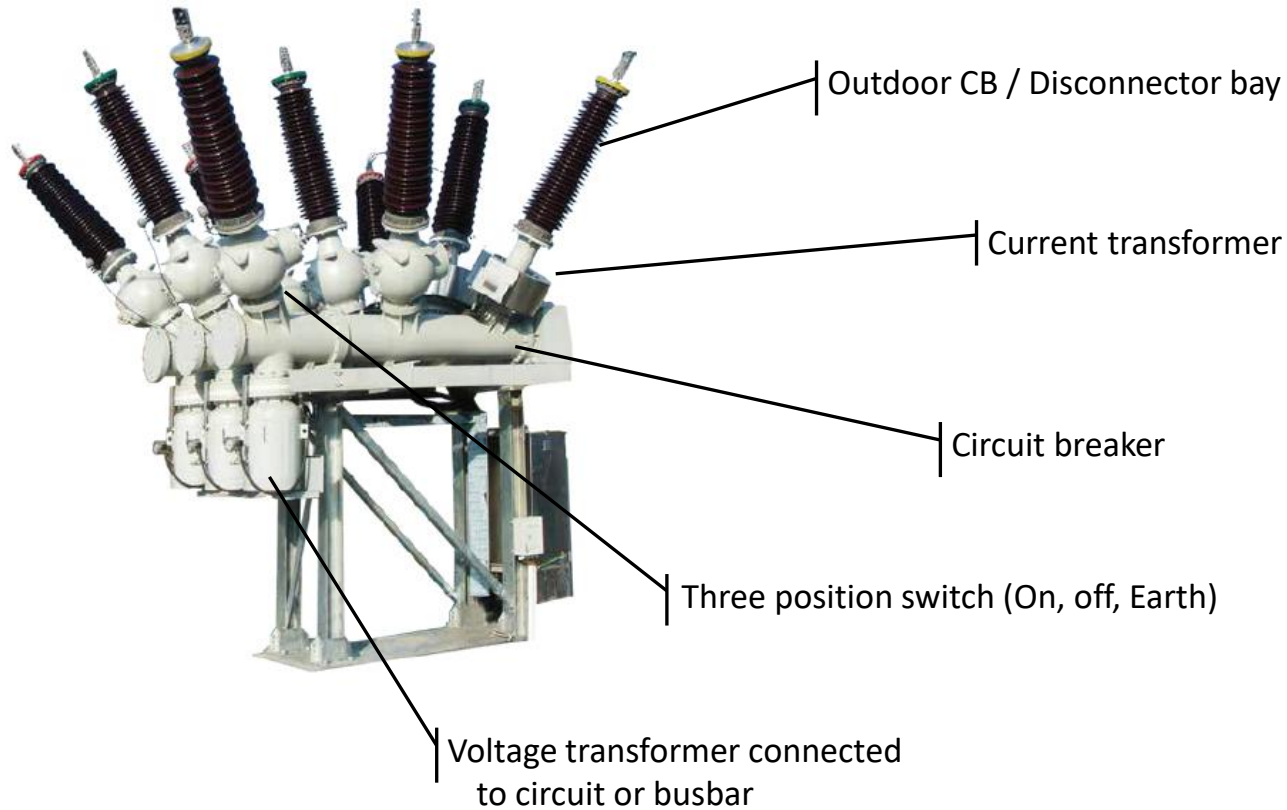
Gas Insulated TGP:

- Double busbar
- Single busbar
- Pad mount sub stations
- Kiosk / Skid sub stations

HV Switchgear



HV Switchgear



Electrical House

New concept for substation designs



Thank you