



TGOOD Presentation Switchgear Standards

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

What drives change



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

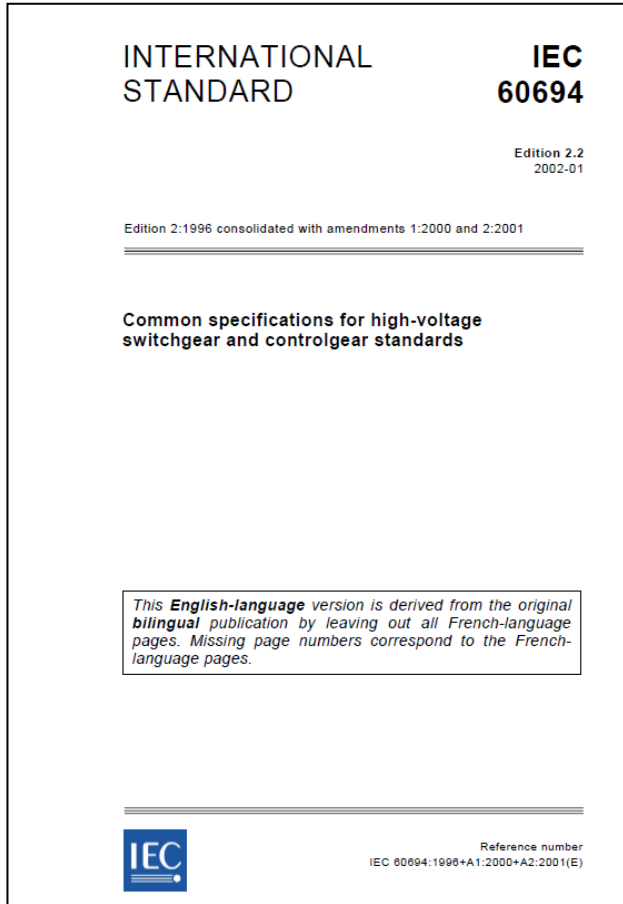


TAP 17

Air-insulated switchgear

Up to 17.5kV

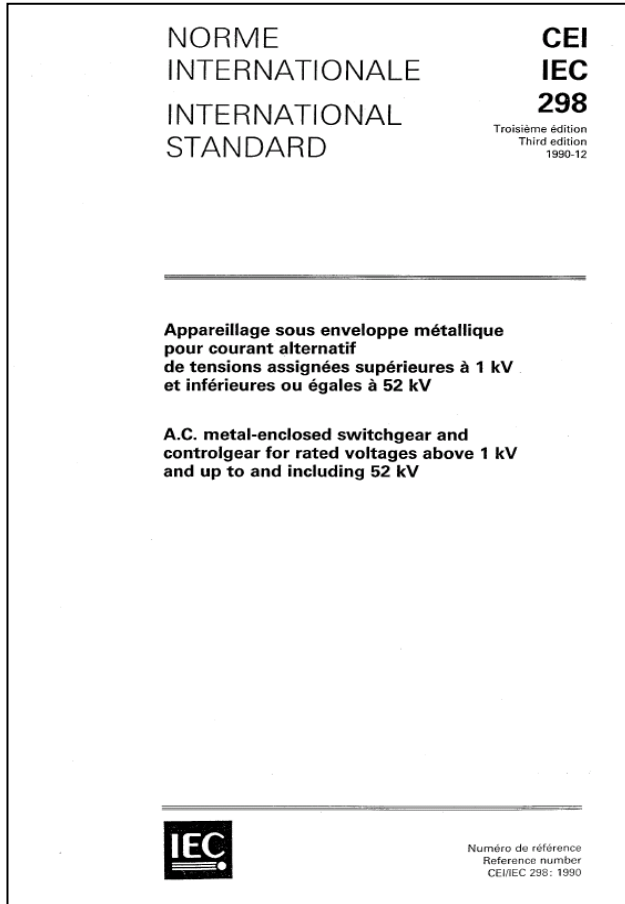
TG00D



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

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

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

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**

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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.

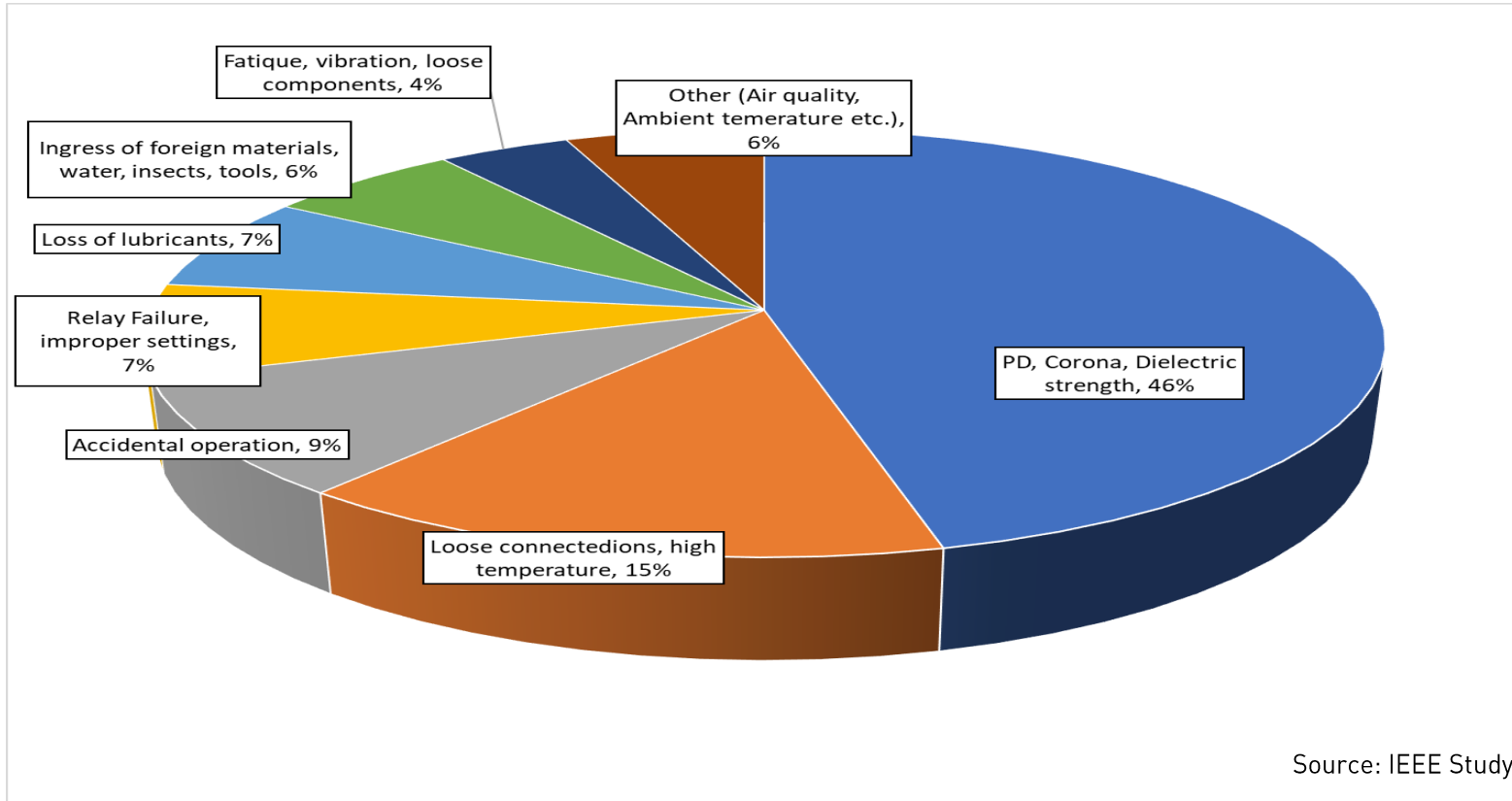
Inclusion of:

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

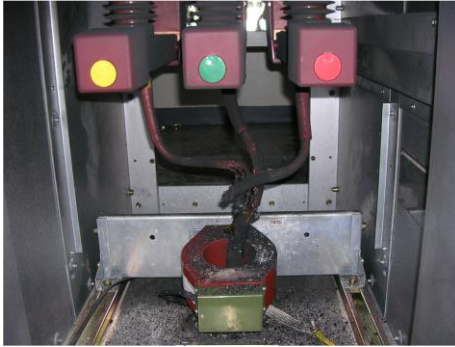
Medium Voltage

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

Statistically speaking “Causes of Catastrophic failures”



Heat failure, loose connections, overload



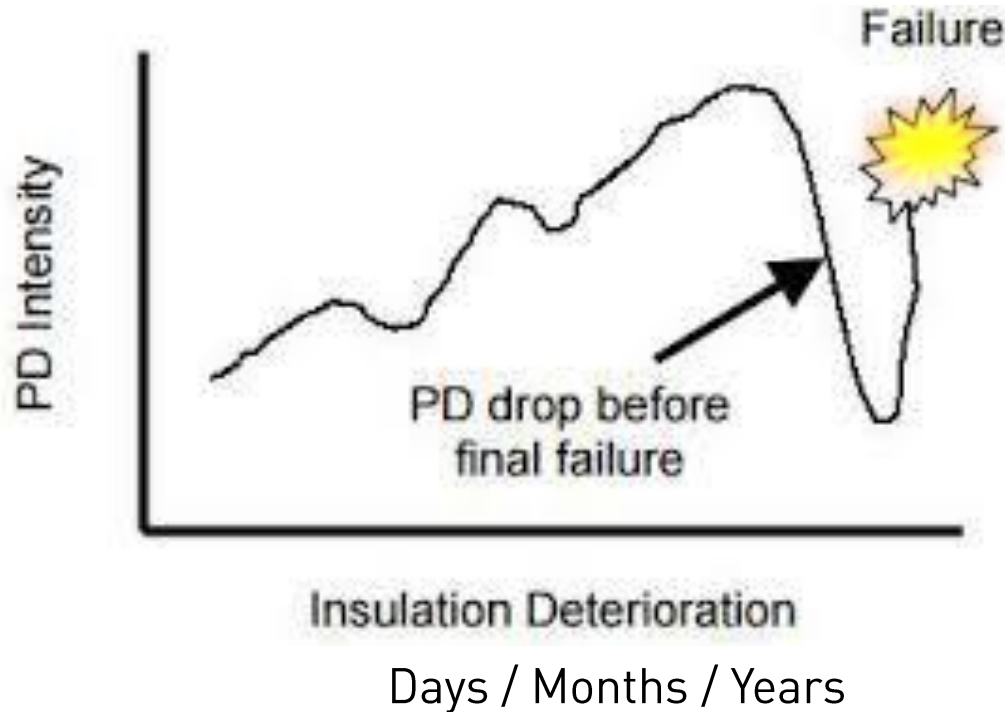
Condition 1. Most obvious failures:
Fast build up of heat over short time, i.e.
broken connections, loose connections,
short circuits, pd failure



Condition 2. Less obvious failures:
Gradual build up of heat over long time, i.e.
pd failure, overloading, loose connections,
aging or premature aging

Source: IEEE Study

Dielectric failure, PD, insulation breakdown



PD activity once it starts always increases over time until failure.

Early detection especially during manufacturing stage is key to making successful interventions and preventing failure.

Medium Voltage



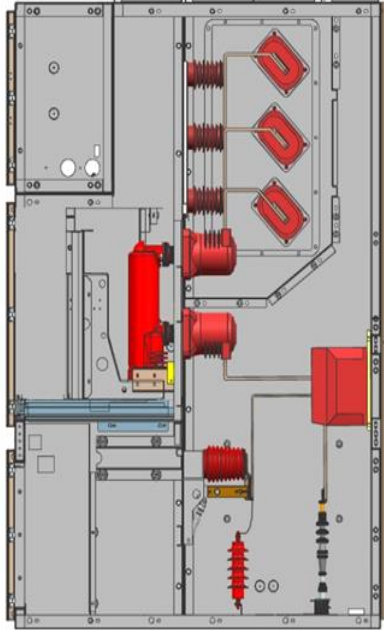
TAP17 PM Segregation and
busbar segregation on every panel

PM enclosed switchgear

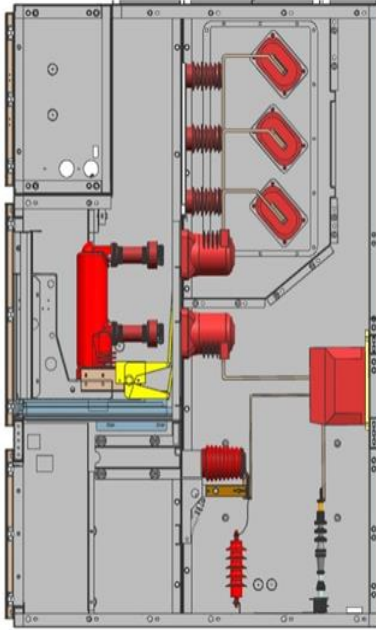
- Metallic segregation of all the compartments
- Metallic shutters operated by the apparatus movement
- Closed door apparatus racking

PI Other than metal segregation

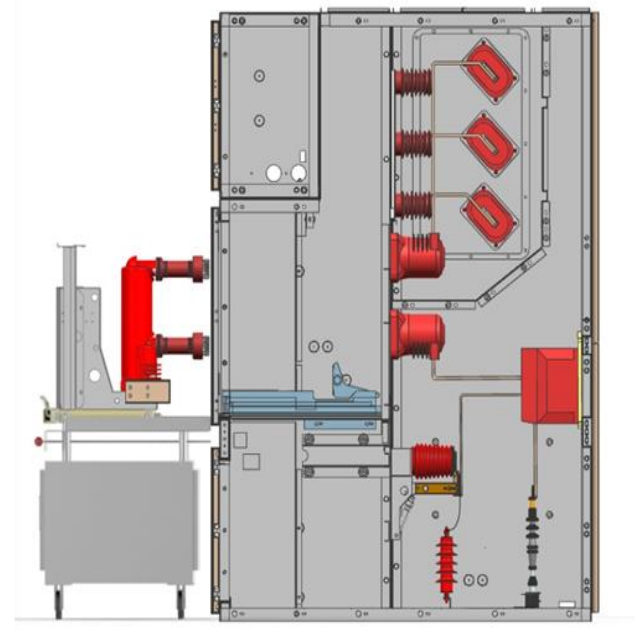
Closed door racking of circuit breakers



In Service
Position

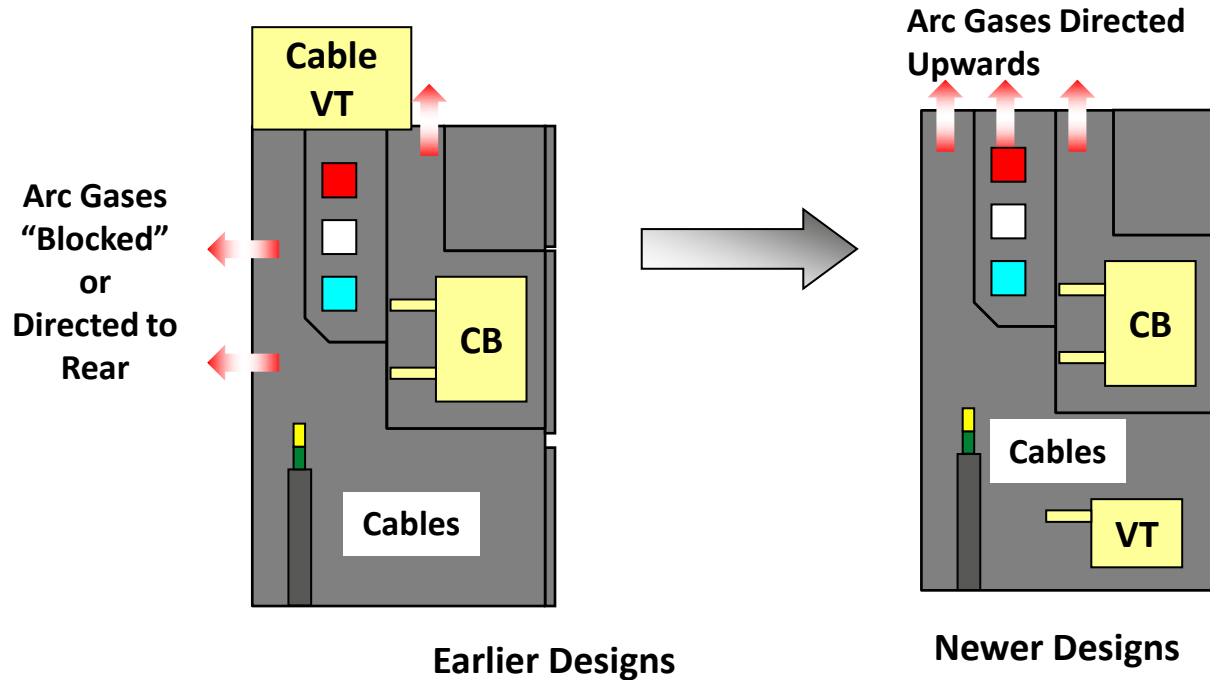


Test /
Disconnected

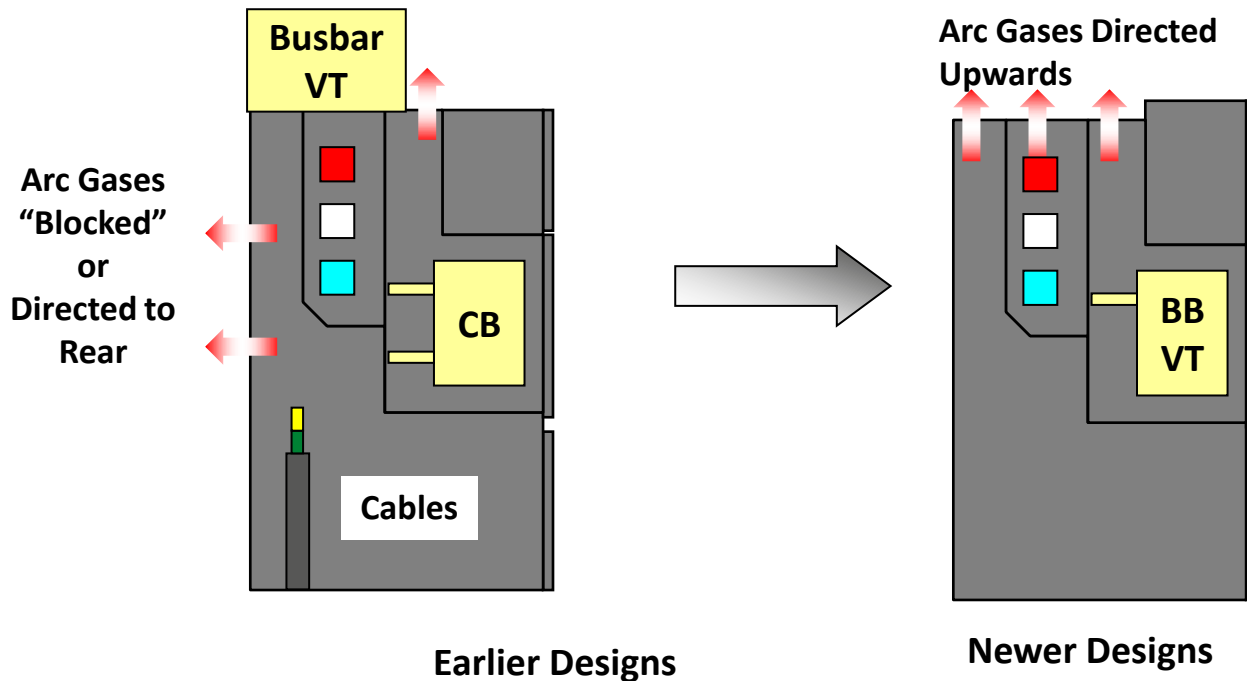


CB Maintenance
position

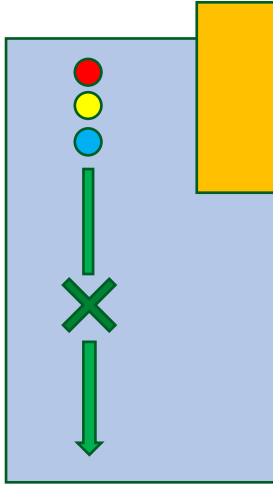
CABLE VT's, Compliance to IEC62271-200



Busbar VT's, Compliance to IEC62271-200

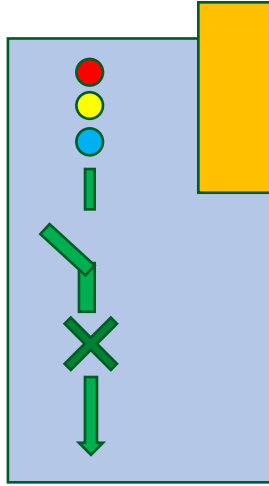


Medium Voltage



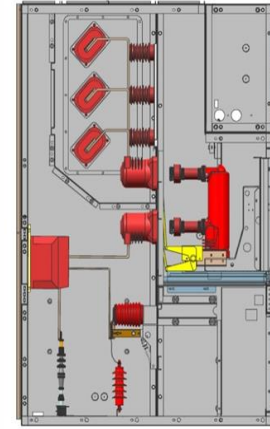
LSC1

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 KEMA tested to AFLR 31.5kA / 1 second

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

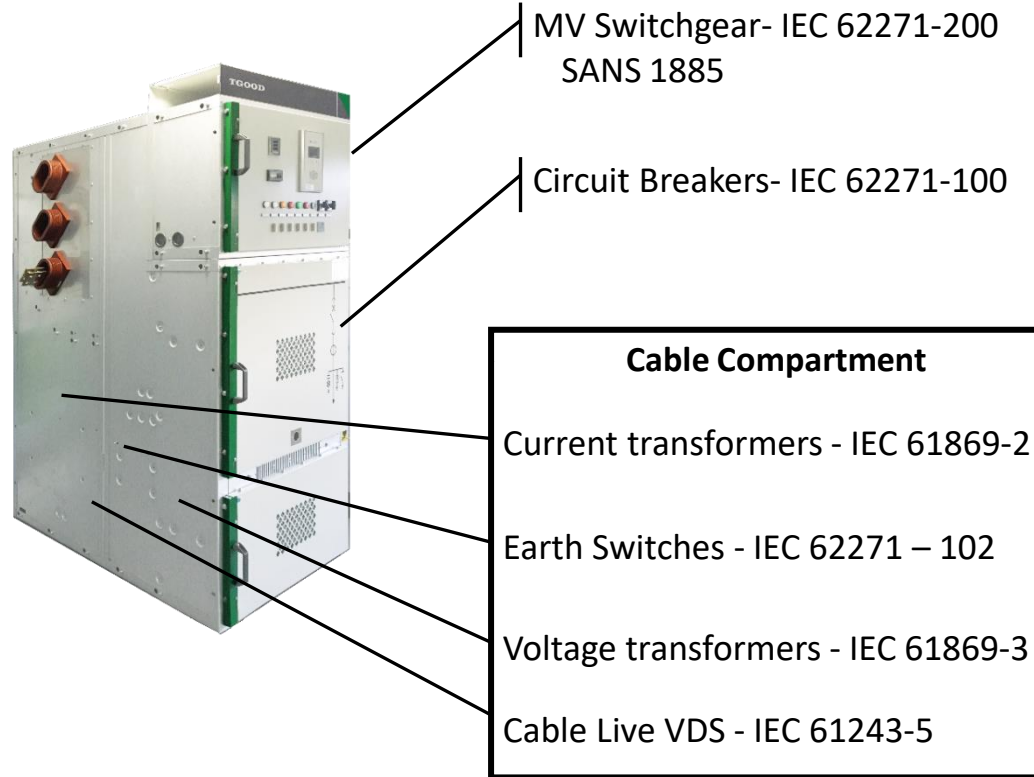
Medium Voltage

Arc Ducting

Busbar Segregation

Closed door racking

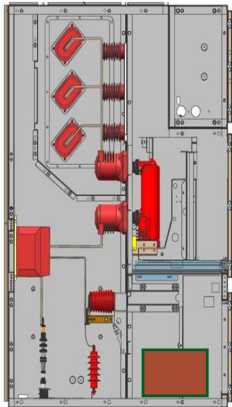
VT's inside arc
withstand area



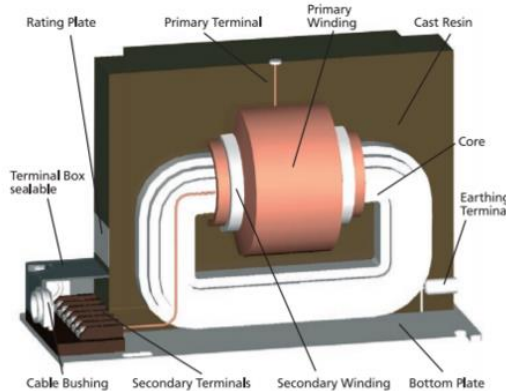
Voltage Transformers

TGOOD TAP17

- TAP17 provides VT's mounted in the arc proof enclosure, for cable or busbar connected VT's
- IEC 61869-3 tested and approved Star connected withdrawable VT's,
- Ferro resonance "broken delta" windings with loading resistors and harmonic filters connected in the neutral to earth connection are highly recommended protection devices for VT's



Cable VT inside enclosure



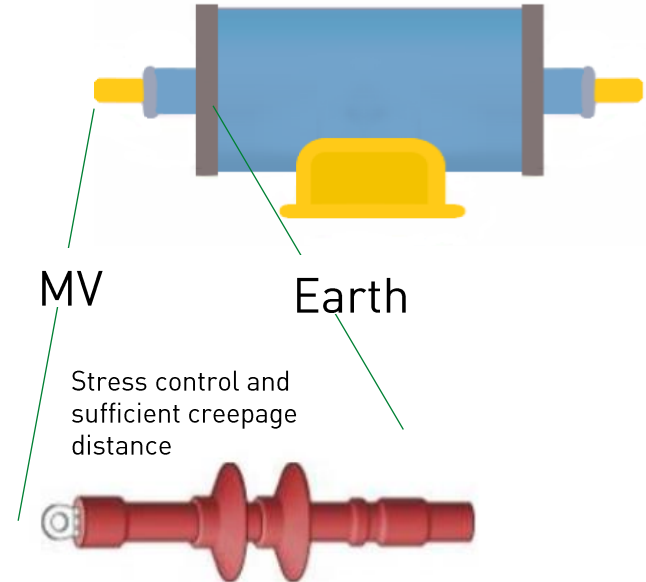
Note: VT's access should be controlled. Access to this VT compartment is controlled by an interlocks, earthing switch, closed-door racking, and/or bolted covers.

Current Transformers

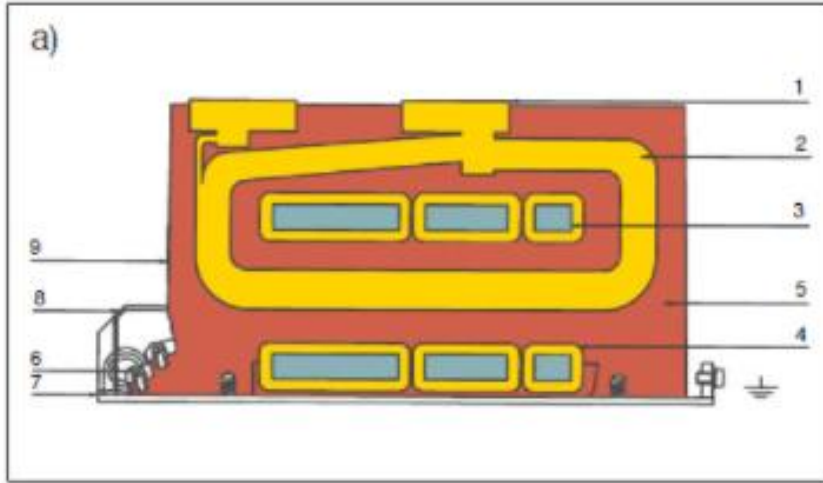
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- CT tested according to IEC 61869-2
- IT's based on DIN standard

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



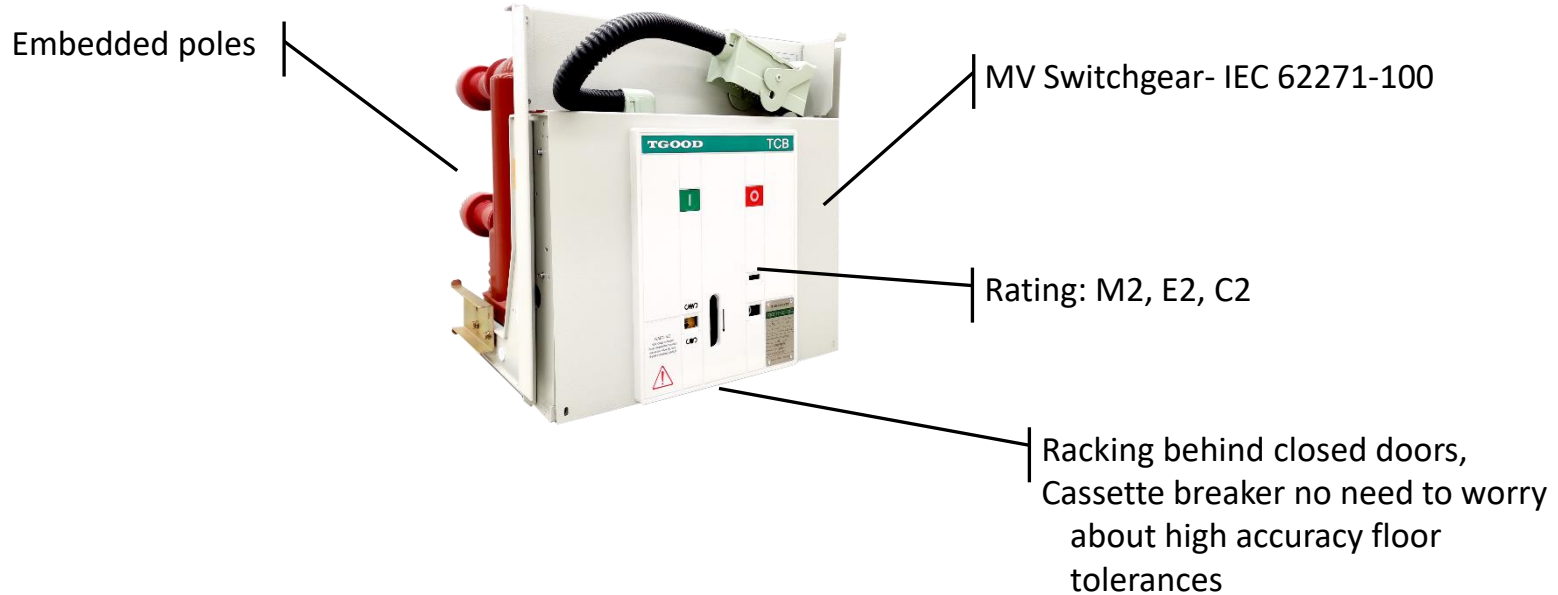
Current Transformers



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.

Circuit Breakers



MV Compact switchgear



- Compact switchgear is fast replacing traditional AIS withdrawable switchgear
- 70% of switchgear required <24kV / 630A
 - Compact width < 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

TGS17 KEMA tested to AFLR 20kA / 1 second

Check list for MV Switchgear, to ensure Safety, Endurance, High Quality and Certification compliance	
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

Electrical House

New concept for substation designs



Thank you