

## General

The switchgear must be suitable for 36 kV rated voltage and specifically conceived for the secondary distribution substations in M.V. with either ring or radial type networks.

The switchgear must have the following general features:

- Rated voltage up to 36kV
- Rated current for single functions of 630A
- Available both in compact and modular versions, extensible or not.
- Compact design with up to 5 functions
- Capable of withstanding immersion for 24 hours.
- Availability of reduced height versions
- Easy installation and operation
- Reduced dimensions
- Internal arc containment 16kA 1s, both in live tanks and cable compartment.
- Internal arc proof classification AF and AFL (acc. to IEC 62271-200) as option with rear or side duct
- Service continuity LSC2A (acc. to IEC 62271-200)
- Simplicity of inspection and maintenance
- Long operational life
- Modularity & Versatility
- Remote operation possible
- External enclosure made of stainless steel AISI 304
- Mechanical interlocks which ensure the exact sequence of operations
- Circuit breaker of vacuum type
- Direct earthing of the switchgear whole structure;
- Total segregation of the live parts, which are contained inside a stainless steel housing, hermetically sealed and filled with gas SF<sub>6</sub>;
- Accessibility to the fuses without any danger, with preventive earthing of the two ends;
- Availability of earthing switches with making capacity;
- Mechanical interlocks, granting the exact sequence of the operations.

The basic units which can be combined together in the modular version are:

- Incoming/outgoing unit with switch disconnector (C)
- Transformer protection unit with fuses (T1)
- Incoming/outgoing unit with circuit-breaker (CB)
- Direct incoming/outgoing unit (R).

It must be also be possible to further extend the configurations by externally connecting with purposed bus-bars several basic units the one to the other, provided that they were initially bought in the extensible version.

The switchgear consists of a stainless steel metal housing, suitably welded in order to assure the sealing of the gas SF<sub>6</sub>.

The switchgear must fully comply with the IEC 62271-100, IEC 62271-200 and IEC 60694 Standards.

The following Degree of protection against accidental contact and ingress of foreign objects must be assured:

Main electric circuits	IP67
Fuses compartment	IP3X
Operating mechanisms	IP2XC
Cables connection compartment	IP2XC

The switchgear must have the following ratings:

**Common:**

<b>Rated voltage</b>	<b>Ur[kV]</b>	<b>36</b>
Rated power frequency withstand voltage (50/60 Hz 1 min.): towards the ground and between phases across the isolating distance	Ud[kV]	a) 70 b) 80
Rated lightning impulse withstand voltage: a) towards the ground and between phases b) across the isolating distance	Up[kV]	a) 170 b) 195
Internal arc withstand current 1 s	[kA]	16 / 20
Continuity of service		LSC2A (according to IEC 62271 – 200)
Rated current	Ir[A]	630
Breaking capacity of active circuits (cos. φ 0.7) and ring circuits at 0.3 Vn	I1-I2a[A]	630
Breaking capacity of no-load transformers	I3[A]	25
Breaking capacity of no-load lines/cables	I4a-I4b[A]	25
Short time withstand current 1 s on main circuits and earth circuits	Ik[kA]	16/20/25
Switch disconnecter making capacity and earthing switch making capacity	I <sub>ma</sub> [kA]	40/50/62.5
Water proof test 0,3 bar	[kV]	70 kV x 1 min. – Vn x 24 hours
Electrical life test	-	100 operations CO at 630 A
Rated filling pressure P <sub>me3</sub> )		130 kPa (absolute at 20 °C)
Ambient temperature		-25°C/+40 °C

**Transformer protection unit with fuses:**

Transfer current	I4[A]	800
Normal current of the fuse	[A]	63
Short circuit making current	[kA]	78.75
Short circuit breaking current	[kA]	31.5
Short time current on earthing switch downstream of fuses	Ik[kA]	-

**Circuit-breaker unit:**

Breaking capacity of Circuit-Breaker	[kA]	16/25
Circuit-Breaker rated switching sequence	O - 0,3 s - CO - 3 min CO - 3 min - CO	
Number of mechanical operations of switch disconnecter and earthing switch	n	1000
Number of mechanical operations of Circuit-Breaker	n	2000

**Modular version****C Unit**

The line unit (C) consists of a switch-disconnector and an earthing switch.

The switch-disconnector, consists of three poles mounted on a steel structure and connected to a common shaft, which, on its turn, is connected to the operating mechanism. The pole consists of an upper part and of a lower one, in epoxy resin. The upper part houses the fixed contacts and the connection to the bus-bars, while the lower part houses the sliding contacts, the moving contacts and the piston for the blowing action.

The control can be either manual or motorized (upon request). In the manual control, the only possible action is performed by means of the purposed operating lever supplied in the delivery, while in the motorized control the operation can be executed either by local or by remote control.

**T1 Unit**

The transformer protection unit consists of a switch-disconnector and an earthing switch, equal to those present in the line unit. Besides, three fuses, having dimensions complying with the DIN Standards, are installed.

Every fuse is inserted inside a fuse-holder, from which it can be frontally extracted after having opened the protection dust proof enclosure. The insulation between fuse and fuse-holder is of the solid-air type. The fuse-holders, manufactured in epoxy resin, are tight. Positioned the one on the other inside the switchgear hermetic housing, they are fully immersed in the gas SF6. The fuses' position assures an easy replacement and a sure intervention by means of the striker. The extraction of a fuse is possible only if the same one is isolated and earthed both on the supply side and on the opposite one. A device makes the automatic opening of the switch disconnecter when one or more fuses get blown; such device is actuated by the fuse striker. On the fuses protection dust proof enclosure, the mechanical signalling of blown fuse is foreseen

The fuse rated current depends on the transformer power.

The fuse rated current depends on the following characteristics:

- service voltage,
- transformer power.

The installed fuses must comply with the IEC 60282-1 Standards and be dimensioned according with the DIN 43625 Standards. When the elimination of a fault corresponds to the blowing of either one or two fuses, it is recommended to replace all the three of them

## **CB Unit**

The CB unit consists of a vacuum circuit-breaker connected in series with a three position disconnectors.

The disconnector's positions are:

- a - service position
- b - neutral position
- c earthed

The operations of the disconnector are only possible provided that the circuit-breaker is open.

The circuit-breaker operating mechanism is of mechanical type, with energy accumulation and trip-free. It can be customized with a wide range of accessories, to be easily and quickly installed on a purposed accessory plate.

Such plate, realized in a single block and positioned on the circuit-breaker front side, allows to easily dismount/mount the accessories, so facilitating the possible replacement or maintenance interventions.

Upon request, the circuit-breaker unit can be equipped with a protection relay.

## **Riser Unit**

The riser unit is used to translate in safety conditions a line from a point situated at a certain height to another point having a different height.

### **Safety**

In order to grant the operator's safety and to prevent the risk of wrong operations, the switchgear is equipped with the following safety devices:

- controls and fuses protective boxes, which protect the operator from the moving parts and from the auxiliary voltages present inside;
- lower protective boxes, for protecting the cables and the bushings;
- pressure relief valves, installed in the lower part of the stainless steel housing, which assure the gas flow-off in case of a possible "internal arc", without causing breaks on the front part, where the personnel charged with the electric operations could be possibly operating.

Besides these basic features, these additional safety devices are provided:

- key lock (optional), for preventing wrong operations when using the apparatus
- door interlock device, allowing to open the switchgear protective boxes only when the earthing switch is positioned on "closed earth";
- interlock on the fuse-holder cover, preventing to place the cover itself on the fuse-holder when the fuse is not mounted inside it, so preventing to put the apparatus into service
- device on the fuses compartment door, signalling the fuse blown condition through a coloured indicator (white for fuse ok, red for fuse blown) and preventing the door itself to get closed when it was opened by blown fuse;
- interlock device on the operation of the disconnector control in the motorized switchgear, providing to cut out the power supply to the gear motor, so preventing its electric movement, in case the manual operating lever would get inserted
- mechanical interlocks which prevent any wrong operation, so granting the utmost safety for the operator.

The interlocks are the following ones:

- interlock between switch-disconnector and earthing switch. It prevents the earthing switch to get closed when the switch-disconnector is closed. In the same way, the switch-disconnector closing operation is prevented when the earthing switch is closed;
- interlock between circuit-breaker and disconnector in the CB unit. When the interlock is shifted to the left, the circuit-breaker closing is prevented. When the interlock is shifted to the right, the disconnector operation is prevented;
- interlock between disconnector of the transformer protection unit and fuses compartment door. It prevents the opening of the fuses compartment door when the switch-disconnector is on closed position and the earthing switch is on open position

### **Switchgear**

Using modular version, the switchgear is composed putting one close to the other the modules, which are connected on top by means of suitable busbars. Busbars must be able to carry 1250A.

### **Compact Version**

In the compact version, the required functions are contained within the same SF6 compartment.

For all the switchgear, the maximum allowed depth is 1072mm. The maximum allowed height is 1720mm (extension bushings excluded).

The following switchgear must be available:

C-C-C	max width 1200mm
C-C-C-C	max width 1550mm
C-CB	max width 930mm
CB-CB-CB	max width 1670
C-C-CB	max width 1280mm
C-CB-CB	max width mm 1490
C-C-CB-CB	max width mm 1840
CB-R	max width mm 930
CB-C-R	max width mm 1280
CB-C-C-C	max width mm 1630
CB-C-C-R	max width mm 1630
T1-C	max width 930mm
T1-R	max width 930mm
T1-C-R	max width 1280mm
T1-C-C	max width 1280mm
T1-C-C-C	max width 1630mm
T1-C-C-C-C	max width 1980mm
T1-T1-C-C-C	max width 2200mm