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SEL
MADE IN ITALY

"Experience and Innovations at Your Service"

Totally Designed, Developed and Manufactured in Italy

www.sel-electric.com

TPR6

up to
24kV - 25kA 3s - 1250A

Medium Voltage Switchgear

Gas Insulated Switchgear

Outec Controls SA

www.outec.co.za

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TPR6 24kV Series

Expanding Range Solutions and Performances

C+ unit

+U+ unit

+R+ unit

+N[4] unit

INDEX

General Presentation

Experience, Reliability and Continue Innovation

SEL S.p.A. has over fifty years of experience in the construction of medium voltage switchgears.
Today SEL S.p.A. offers a comprehensive range of products for medium voltage up to 40.5kV.

SEL S.p.A. offers advanced products that ensure maximum personal safety according to IEC-EN standards, providing internal arc protection as standard.

The TPR6 series, thanks to the various functional units, allow a wide modularity applicable to all types of requests in MV distribution, with ease of use and compactness.

"Experience and Innovation at Your Service"

General Description

Introduction

TPR6 is an SF6 insulated ring main unit for the secondary distribution network. TPR6 uses the latest developments in switchgear technology providing an extremely compact medium voltage switchgear solution and ensuring maximum personnel safety.

Construction Characteristics

TPR6 is a completely “sealed for life” system with a stainless steel tank containing all live parts and switching devices. This tank protects from the outside environment and ensures a high level of reliability as well as personal safety. The structure can withstand the electrodynamics stresses during the operation.
The operating mechanism, movable mimic and voltage signaling lamps are positioned in the front panel. Switches are operated by means of spring-operated mechanisms.
Movable mimic gives the position of the switch whereas the voltage signaling lamp indicates the presence of voltage. Fuses and cable compartment are easily accessible through the front door which is interlocked with the earth switch. If present, the low voltage auxiliary compartment is situated above the ring main unit.

Safety Characteristics

The personnel safety is obtained by using mechanical interlocks:

- When the switch disconnector is closed the earth switch can't be closed simultaneously and the access to MV cables is prevented.
- When the earth switch is closed there is a free access to MV cables but it is impossible to close the switch.
- When the access door to MV cables and fuses is opened it is impossible to close the switch.

Metal screens prevent access to electrical parts during maintenance operations. It is possible to block the switch in three positions with key locks.

Internal Arc Classification

The robust design of the metal enclosure prevents deformations and ensures protection against fault. TPR6 is designed to withstand an internal arc caused by a rated short-circuit current up to 25kA for 1s preventing every danger to the operator.

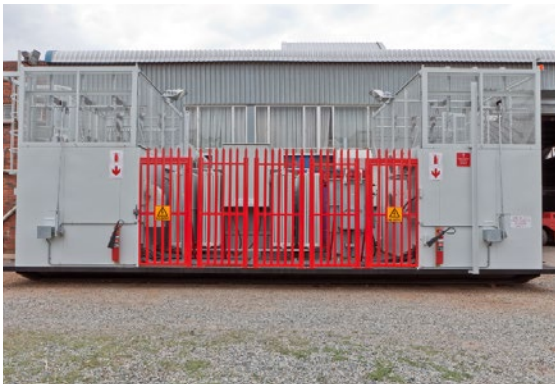
The TPR6 Range Consists of all of the Necessary MV Functions Enabling:

- Connection and power supply on a open or closed ring network.
- Power supply and protection of transformers with circuit breaker or combined fuse-switches up to 200A.
- Power supply and protection of lines by a 1250A circuit breaker
- Busbar coupling.
- MV metering.
- Earth switch for cable connection.

Applications

TPR6 is a complete ring main unit range suitable for all the switching operations in 7.2kV, 12kV, 17.5kV, 24kV, secondary distribution network.
Operating safely in a distribution network requires different switching points to obtain maximum service continuity in case of fault on the network.

- Power supply companies.
- Power stations.
- Cement industry.
- Automotive industry.
- Iron and steel works.
- Windmills.
- Solar plant.
- Textile, paper and food industries.
- Chemical industry.
- Petroleum industry.
- Pipeline installations.
- Offshore installations.
- Electrochemical plants.
- Petrochemical plants.
- Seaport and shipbuilding industry.
- Diesel power plants.
- Emergency power supply installations.
- Traction power supply systems.
- Stadium and sport center.



TPR6 Features

Flexibility
01

A wide range of products covering your present and future requirements.

Modular cubicles adapted to future extensions.

Possibility to mount auxiliary components under voltage.

Options to anticipate the telecontrol.

Compact Dimensions
02

Small dimensions and reduced weights for easier handling and installation.

Reduced civil works costs.

Easy Operations and Mainteinance
03

TPR6 has long service life.

Maintenance free live parts which are integrated in vacuum or in a sealed tank of stainless steal.

Control mechanisms are intended to function with reduced maintenance under normal operating conditions.

High level of electrical endurance when breaking.

Easy Installation
04

Small dimensions and reduced weights facilitate easy installation.

Solutions adapted to cable connection.

Simple operations.

All the control operations are carried out from the front by means of a simple devices.

Safety
05

During the testing cable operation it is not needed to break the earthing busbar system of the switchgear.

Interlock operated by earthing switch prevents unsafe operations. Additional interlocks to prevent incorrect operations.

All active parts of the TPR6 are contained in a sealed tank of stainless steel making it deal for installation in difficult ambient conditions.

Quality

All the manufacturing process follows a quality procedure certified by TÜV in accordance with ISO 9001:2015.
The production conforms with the specific quality manual which is updated regularly so that it reflects the most recent applicable quality control procedures.

Systematic tests
Each TPR6 undergoes a thorough check before leaving the factory. The following routine tests are performed according to IEC 62271-200 standard in order to guarantee the quality, reliability and safety of the product:

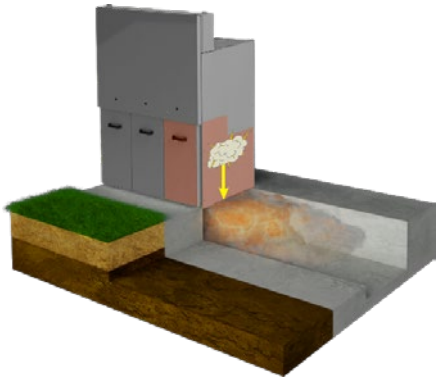
- Measurement of the resistance of the main circuits.
- Opening and closing speed measurement on switch, earth switch and circuit-breaker.
- Operating torque measurement.
- Filling pressure and tightness test.
- Dielectric test.
- Conformity with drawings and diagrams.
- Electrical function test on auxiliary circuits.

The gas enclosure is manufactured with stainless steel and fabricated using automatic “robot welding” technique to produce consistent leak-free equipment.

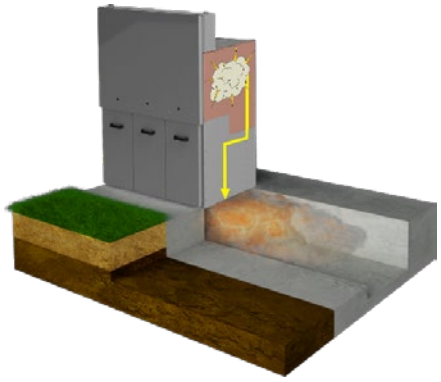
Internal Arc Proof up to 25kA 1s

All SEL's Switchgears series have Internal Arc test proof on the four sides (A-FLR) including cable box, in accordance with IEC62271-200

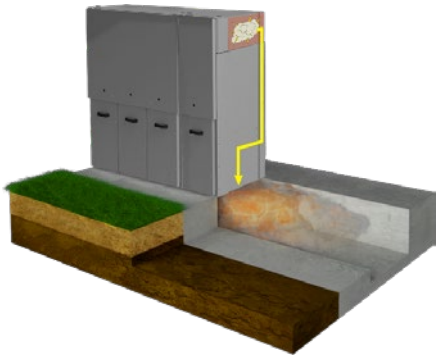
Concerning Internal arc capability, SEL designed and tested the MV switchgears in manner to drive the exhaust gas towards the bottom because it is the best solution for safety of operators.



Fault in Cables compartment



Fault in SF6 gas tank



Fault in busbar duct

SEL is able to meet customer's request for upward exhaust gas duct supplying a rear chimney that drives the gases outside. This chimney has been internal arc proof tested in C.E.S.I. Laboratory in Milan, at a fault current of 25kA 1s.
During switchgear installation a suitable channel has to be arranged in order to collect the exhaust gas in a safe area.

Outdoor Version IP54 up to IP56

Rated current of the RMU is guaranteed with no derating up to 55°C ambient temperature.

The protection against severe weather conditions, rain, humidity and dust is guaranteed by TPR6 robust design. The protection degree of the switchgear is IP54.

The enclosure is fitted with a front door and padlock. The gas piston facilitates the opening operation and maintains the door lifted in order to allow the normal operations or maintenance.

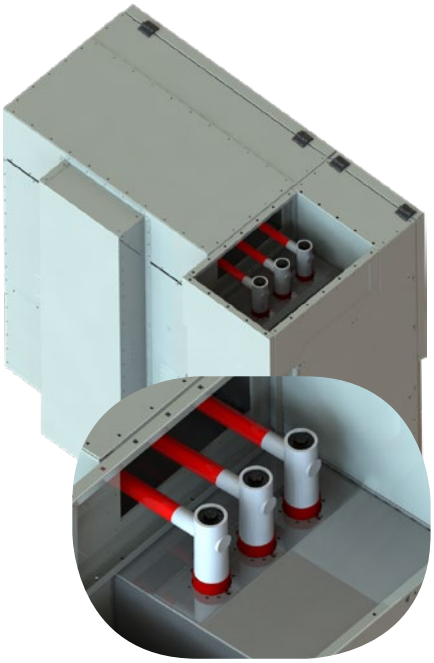
Ck-Ck-kMk-LLk composition

Indoor Version

R unit

LLCC unit

Top Busbar Extensibility for outdoor and indoor versions

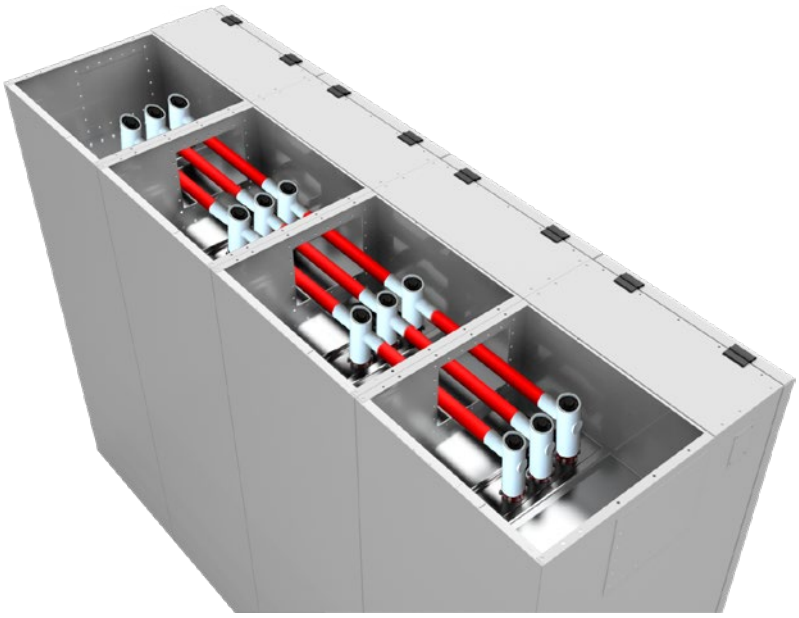


Extensible version type "K" for busbars.

"K" Extensibility connection is realized with bushing interface tipe "C" on the top of RMU.
Both indoor/outdoor versions of TPR6 are suitable with this connection.

Connection with pre-mouled unshielded busbar system UP TO 17,5KV

Realized with premoulded busbar system, no additional insulating belt is required.

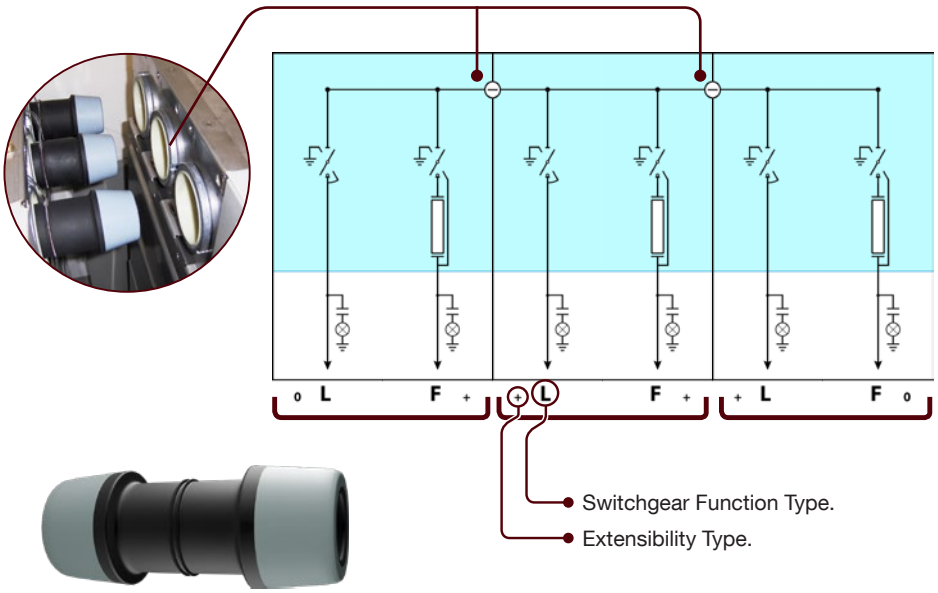


Connection with pre-mouled shielded busbar system UP TO 24KV

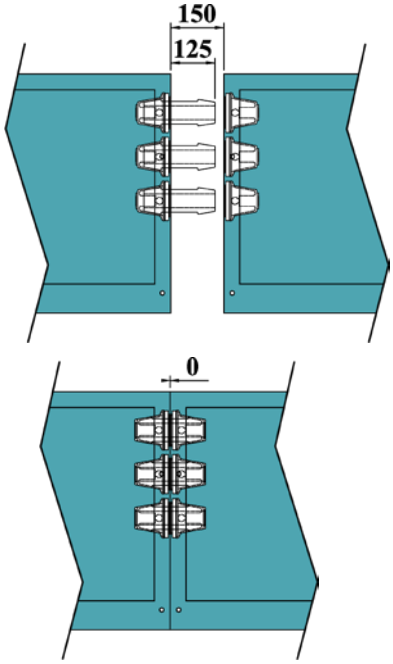
Indoor Lateral Extensibility

Extensible version type "+"

Bus-bar coupling system of SF_6 insulated switchgears (match-makers).



Extensible version type "+" with only the prearrangement for future extension.

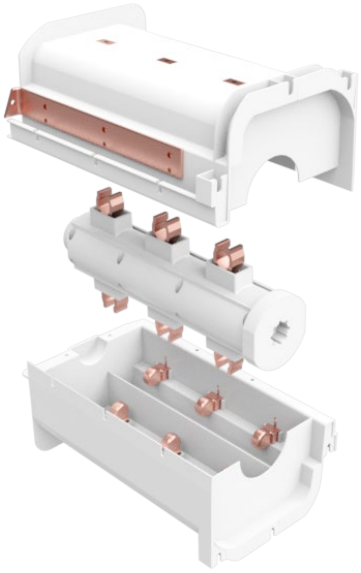


Coupling Space type "+"

In case the switchboard is prearranged for further expansions on the left, on the right or both sides, provide at least 150mm space between the switchboards and a suitable lateral space for coupling operations.

TPR6 Main Characteristics

Switch Disconnector



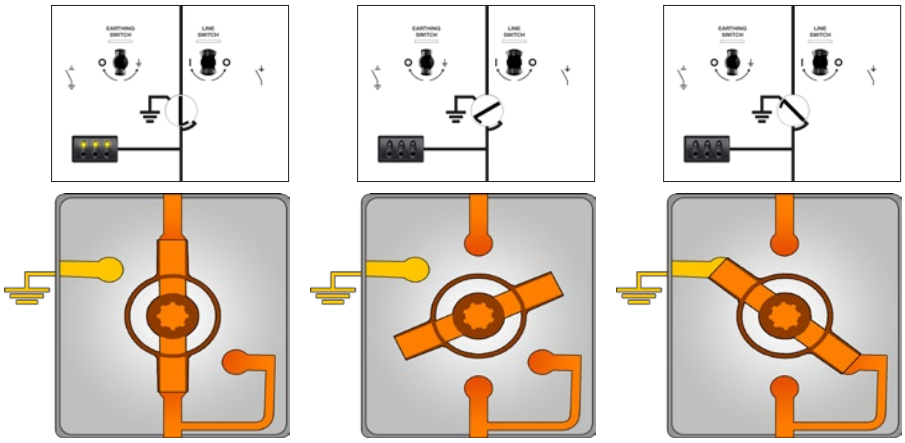
Switch Disconnector

The insulation level inside the TPR6 modules has been obtained by means of sulphur hexafluoride (SF6). This gas has a double function: it increases dielectric rigidity in comparison with air and aids electric arc extinction. The modules with the equipment insulated in SF6, have the following advantages:

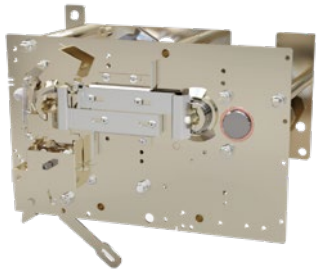
- General and electrical long life.
- Maintenance-free.
- Secure and stable operation.
- Reduced sizes.

This switchgear is made of a rotating part (movable-contacts) which opens and closes the electric circuit.

Positions: The switch disconnector has three positions:
A) Closed
B) Opened
C) Earthed



CLOSED OPENED EARTHED



TPR6 switch disconnector can be provided with two kind of operating mechanisms:

LT: Dead Point over-ride, operator indipendent operating mechanism capable of making, carrying and breaking load currents.

3D: Energy Stored, operator indipendent operating mechanism capable of making, carrying and breaking load currents.
Operation in two steps:

- Mechanism charging by lever or motor.
- Stored energy released by opening/closing knob.

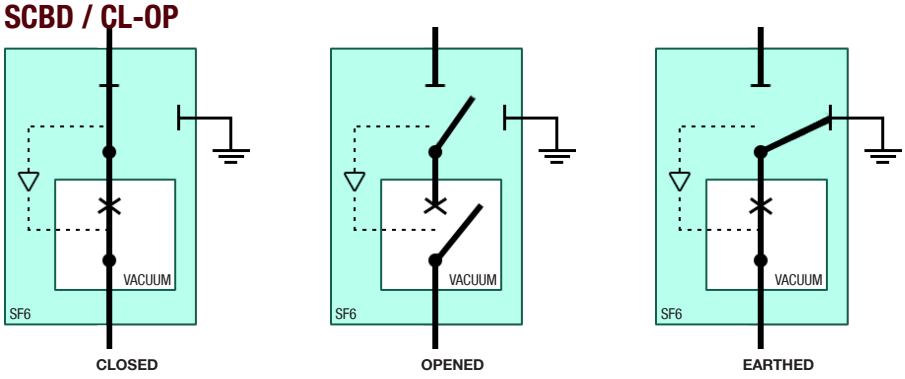
Possible Operating Mechanism Accessories	LT	3D
Padlock holder for switch	●	
Padlock holder for earth switch	●	●
Switch keylock (key removable in open position)	●	●
Earth switch keylock (key removable in open position)	●	●
Earth switch keylock (key removable in closed position)	●	●
Switch auxiliary contacts	●	●
Earth switch auxiliary contacts	●	●
Shunt opening release		●
Shunt closing Release		●
Motor mechanism	●	●
Door locking when earth switch is open	●	●

Circuit Breaker

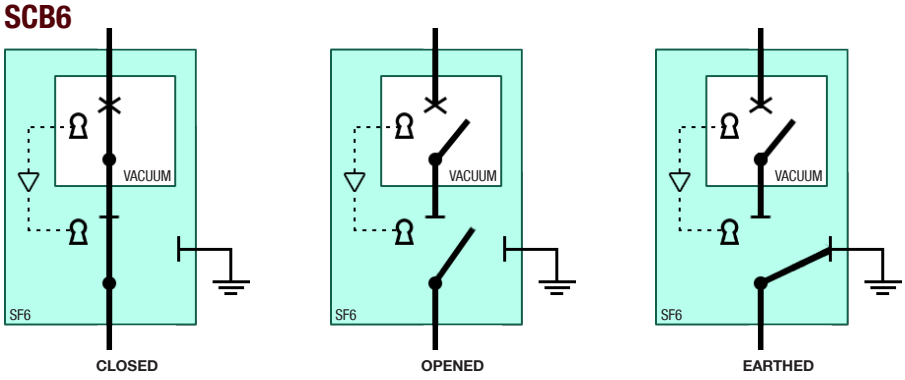
Vacuum Circuit Breaker

Our circuit breaker introduces the new concept of super-compact Disconnector + Vacuum CB combined device. It comprises of three vacuum interrupters, which have a fault-make, fault-break rating.
Earthing of the outgoing cable is achieved by the use of the circuit breaker in series with the off-load earth disconnector.

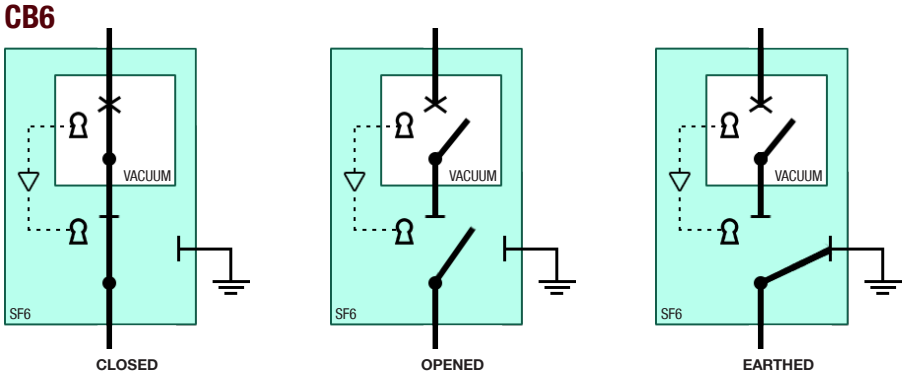
SCBD / CL-OP

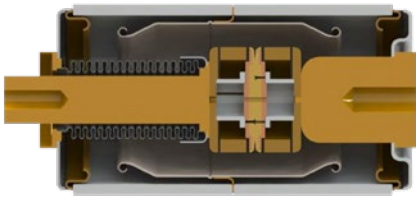


SCB6



CB6





Vacuum Technology

Nowadays the interruption of current in vacuum is recognised as the dominant technology in medium voltage and as a consequence its use is continuously increasing. It is possible to have highly efficient vacuum circuit-breakers with electrical life which is longer than mechanical life, with total respect of environment; but in particular, vacuum circuit-breakers offer enhanced performances thanks to the reduction of arc energy, fast opening time, insulation recovery after overvoltage and reduction of mechanical energy needed for operating mechanism.

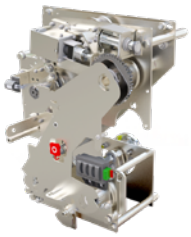
Circuit Breaker Operating Mechanism

The circuit breaker module operating mechanism SCB6 is composed of three different functional parts:

1. Circuit Breaker Operating Mechanism Operator independent energy stored operating mechanism with free release makes possible to carry out a complete cycle O-C-O with only one spring charging; besides it is suitable for the rapid auto-reclosing (**O-0,3s-CO–3min-CO**). The circuit-breaker can be remote controlled by installation of some electrical accessories.
2. Operator dependent line disconnector manual operating mechanism which operates in the absence of load.
3. Operator independent earth switch operating mechanism which operates under load.

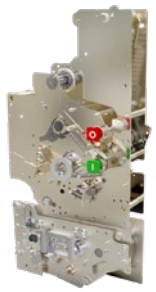
The circuit breaker module operating mechanism SCBD is composed of three different functional parts:

1. Circuit Breaker Operating Mechanism Operator independent energy stored operating mechanism with free release makes possible to carry out a complete cycle O-C-O without spring charging; besides it is suitable for the rapid auto-reclosing (**O-0,3s-CO–3min-CO**). The circuit-breaker can be remote controlled by installation of some electrical accessories.
2. Operator dependent line disconnector manual operating mechanism which operates in the absence of load.
3. Operator dependent earth disconnector operating mechanism which operates in the absence of load.



The circuit breaker module operating mechanism CL-OP is composed of three different functional parts:

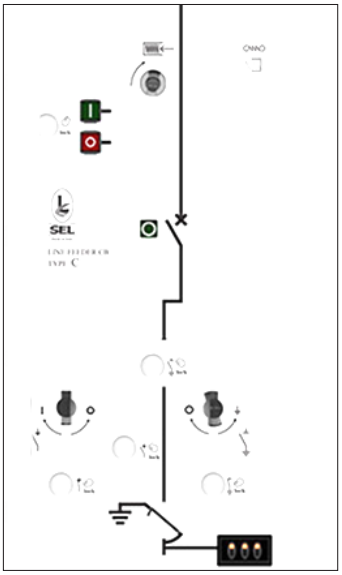
1. Circuit Breaker Operating Mechanism Operator independent operating mechanism with simplified closing system not intended for rapid auto-reclosing (**CO–15s-CO**). The circuit-breaker can be remote controlled by installation of some electrical accessories.
2. Operator dependent line disconnector manual operating mechanism which operates in the absence of load.
3. Operator dependent earth disconnector operating mechanism which operates in the absence of load.



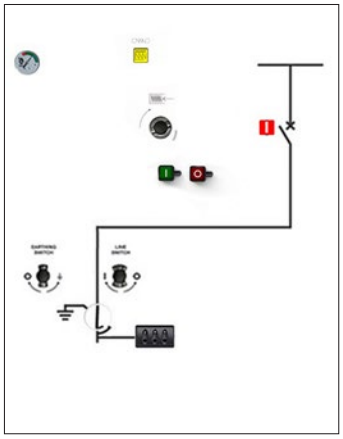
The circuit breaker module operating mechanism CB6 installed in the modules P is composed of three different functional parts:

1. Circuit Breaker Operating Mechanism Operator independent energy stored operating mechanism with free release makes possible to carry out a complete cycle O-C-O without spring charging; besides it is suitable for the rapid (**O-0,3s-CO–3min-CO**) reclosing cycle. The circuit-breaker can be remote controlled by means of some electrical accessories .
2. Operator dependent switch disconnector manual operating mechanism which operates in the absence of load.
3. Operator independent earth switch operating mechanism which operates under load.

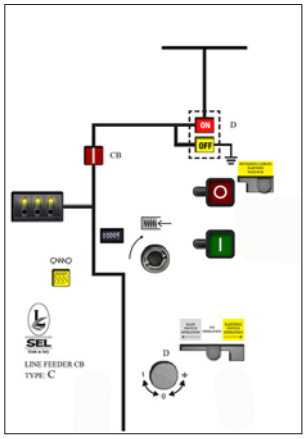
CB6 Frontal Cover



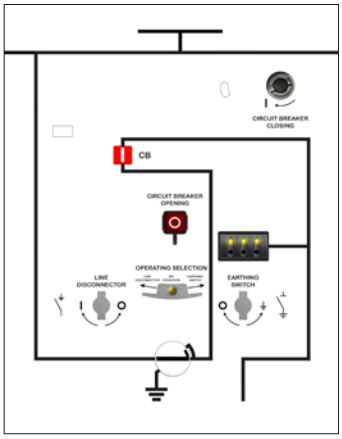
SCB6 Frontal Cover



SCBD Frontal Cover



CL-OP Frontal Cover



Standards

IEC Standards
TPR6 is manufactured and tested in conformity with the latest issues of the following IEC standards.

IEC 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear
IEC 62271-200	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
IEC 62271-100	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers
IEC 62271-103	High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV
IEC 62271-102	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
IEC 62271-105	High-voltage switchgear and controlgear - Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV
IEC 62271-206	High-voltage switchgear and controlgear - Part 206: Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV
IEC 61243-5	This part of IEC 61243 is applicable to voltage detecting systems that are single-pole and are capacitively-coupled to live parts. They are used to detect the presence or absence of operating voltage on a.c. electrical systems for voltages from 1 kV to 52 kV, and for frequencies from 162/3 Hz to 60 Hz.
IEC 62271-304	High-voltage switchgear and controlgear - Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and includuing 52 kV to be used in severe climatic conditions
IEC 62271-307	High-voltage switchgear and controlgear - Part 307: Guidance for the extension of validity of type tests of AC metal and solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60060-1	High-voltage test techniques - Part 1: General definitions and test requirements
IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC 62271-4	Handling procedures for sulphur hexafluoride (SF_6) and its mixtures
IEC 60255	Measuring relays and protection equipment
IEC 61869-2	Instrument transformers - Part 2: Additional requirements for current transformers
IEC 61869-3	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
IEC 60044-8	Instrument transformers - Part 8: Electronic current transformers
IEC 60282-1	High-voltage fuses - Part 1: Current-limiting fuses
DIN 43625	High-voltage fuses; Rated voltage 3,6 to 36 kV; Fuse-Links
EN 50181	Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformer
CEI 0-16	Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution Company

Technical Data

Design and costruction	
Partition Class (switchghear classification)	PM (partition metallic)
Loss of service continuity classes	LSC2
Loss of service continuity classes without switch device	LSC1
Accessibility to compartments	
Internal Busbar compartment	Non Accessible
External Busbar compartment (extensibility)	Accessible by Tool
Low voltage compartment	Accessible by Tool
Cable Compratment	Accessible Interlock controlled
Cable Feeder	Accessible by Tool
Metering Unit without Switch device	Accessible by Tool

Internal Arc Classification				
	7.2kV	12kV	17.5kV	24kV
Arc test Current	up to 25kA			
Test Duration	1s			
IAC class including cable box compartment and external busbar compartment	IAC A F - FL - FLR			
Type of accessibility A	Switchgear in closed electrical service location, access " for authorized personnel only" (according to IEC/EN 62271-200)			
- F	Front			
- L	Lateral			
- R	Rear			

Technical Data

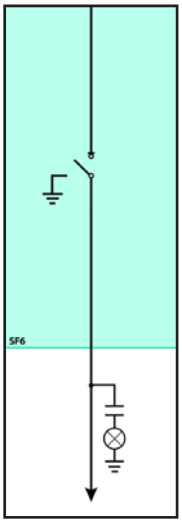
Switchgears Main Characteristics						
		kV	**7,2**	**12**	**17,5**	**24**
Altitude	**IEC 62271-1**	m	<1000 (for different value contact SEL)			
Ambient air temperature	**IEC 62271-1**	°C	-25 ÷ 55			
Relative humidity		%	95			
Insulation Rated Voltage		kV	7,2	12	17,5	24
Rated Voltage		kV	7,2	12	17,5	24
Lightning impulse withstand voltage between phases and towards the ground		kV	60	75	95	125
Lightning impulse withstand voltage across the isolating distance		kV	70	85	110	145
Power frequency withstand voltage between the phases		kV	20	28	38	50
Power frequency withstand voltage across the isolating distance		kV	23	32	45	60
Rated Frequency		Hz	50 - 60			
Rated Current	Switch disconnector		200 - 400 - 630			
Rated Current	Vacuum Circuit Breaker		200 - 400 - 630 - 1250			
Rated short time withstand current I_k		kA	up to 25			
Rated peak withstand current I_p (making capacity)		kA	50Hz 2,5 x I_k - 60Hz 2,6 I_k			
Rated duration of short circuit t_k		s	1 - 3			
Degree of protection on front face		IP	3X - 41 - 54 -56 (outdoor version)			
Degree of protection on electrical MV circuits		IP	67			

Main Characteristics (Switch Disconnector - Disconnector - Circuit Breaker)						
		kV	**7,2**	**12**	**17,5**	**24**
Mechanical operation	Switch disconnector **IEC 62271-103**		1.000 operations / Class M1 5.000 operations / Class M2			
Electrical operation	Switch disconnector **IEC 62271-103**		100 breaks at In p.f.=0,7 / Class E3			
Electrical operation	Switch disconnector **IEC 62271-103**		making capacity 5 / Class E3			
Mechanical operation	Disconnector **IEC 62271-102**		1.000 operations / Class M1			
Mechanical operation	Earthing switch **IEC 62271-102**		1.000 operations / Class M0			
Electrical operation	Earthing switch **IEC 62271-102**		making capacity 5 / Class E2			
Mechanical operation	Circuit breaker **IEC 62271-100** C / P / D unit		2000 operations / Class M1 10.000 operations / Class M2			
Electrical operation	Circuit breaker **IEC 62271-100** C / P / D unit		E1 / E2			
Mechanical operation	Circuit breaker **IEC 62271-100** T unit		2000 operations / Class M1			
Electrical operation	Circuit breaker **IEC 62271-100** T unit		E1			
Breaking Capacity	Circuit breaker **IEC 62271-100**	kA	25			21
Making Capacity	Circuit breaker **IEC 62271-100**	kA	50Hz 2,5 x I_k - 60Hz 2,6 I_k			
Break Time Vacuum Circuit Breaker	Circuit breaker **IEC 62271-100**	ms	≤ 70			
Rated operating sequence	Circuit breaker **IEC 62271-100**		O - 0,3s - CO - 15sec - CO O - 0,3s - CO - 3min - CO CO - 15s - CO			
Making & breaking on fuse-switch	**IEC 62271-105** F unit	kA rms	25			20
Breaking at rated transfer current $I_{transfer}$	**IEC 62271-105** F unit	A	2100	1800	1600	1400
Mainly active load breaking current	Switch disconnector **IEC 62271-103**	A	630			
Close loop breaking current	Switch disconnector **IEC 62271-103**	A	630			
Cable charging breaking current	Switch disconnector **IEC 62271-103**	A	32			
Line charging breaking current	Switch disconnector **IEC 62271-103**	A	32			
Earth fault breaking current	Switch disconnector **IEC 62271-103**	A	57			

Due to the continuous development of the range, characteristics are not binding. SEL s.p.a reserves the right to modify according with the design updating. Binding characteristics shall be consider only when executive documents are issued by SEL.

TPR6 units Functions

L unit Details

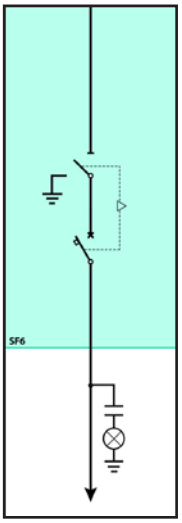


Unit Name:
L

Unit Function:
Network Switch Disconnector

Device:
630A Switch Disconnector
with Earthing Switch

C unit Details

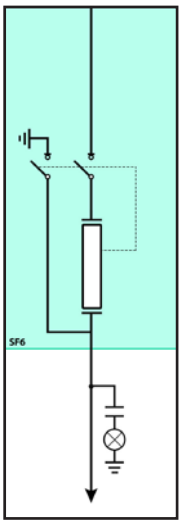


Unit Name:
C

Unit Function:
Line Feeder with CB

Device:
630A Circuit Breaker + Disconnector with
Earth Disconnector

F unit Details

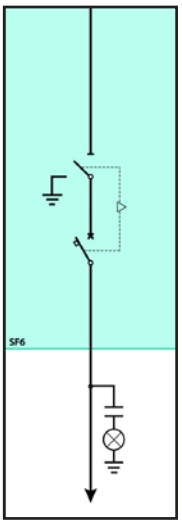


Unit Name:
F

Unit Function:
Transformer Feeder with
Fuse-Switch Disconnector

Device:
200A Combined
Fuse-Switch Disconnector
with Earthing Switch

T unit Details

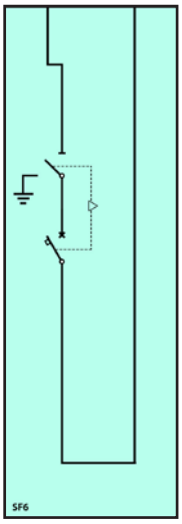


Unit Name:
T

Unit Function:
Transformer Feeder with CB

Device:
200A Circuit Breaker + Disconnector with
Earth Disconnector

G unit Details

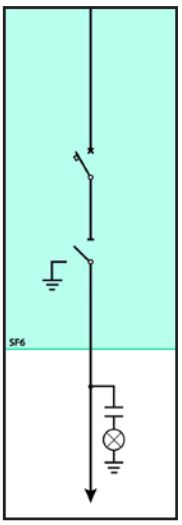


Unit Name:
G

Unit Function:
Network Coupling
with Circuit Breaker + Disconnector

Device:
630A Circuit Breaker + Disconnector with
Earth Disconnector

D unit Details



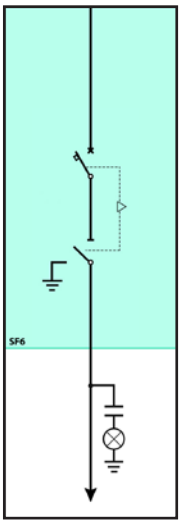
Unit Name:
D

Unit Function:
Line Feeder with CB

Device:
1250A Circuit Breaker + Disconnector with
Earthing Switch-Disconnector

TPR6 units Functions

P unit Details

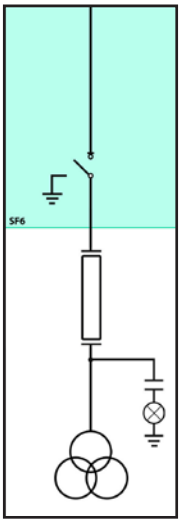


Unit Name:
P

Unit Function:
Line Feeder with CB

Device:
630A Circuit Breaker + Disconnector with Earth Disconnector

MF unit Details

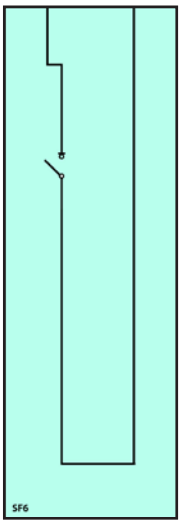


Unit Name:
MF

Unit Function:
VT's unit + Disconnector and Fuses

Device:
630A Disconnector with Earthing Disconnector

S unit Details

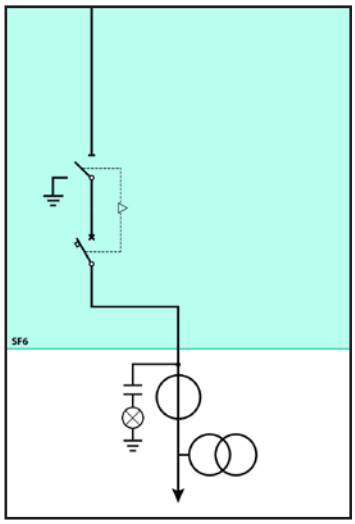


Unit Name:
S

Unit Function:
Network Coupling with Switch Disconnector

Device:
630A Switch-Disconnector

Q unit Details

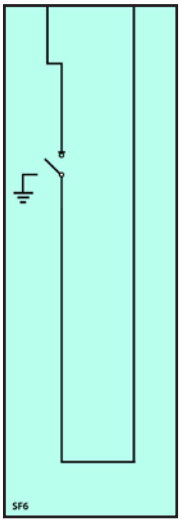


Unit Name:
Q

Unit Function:
Circuit Breaker + Metering

Device:
630A Circuit Breaker + Disconnector with Earthing Dinsconnector

U unit Details

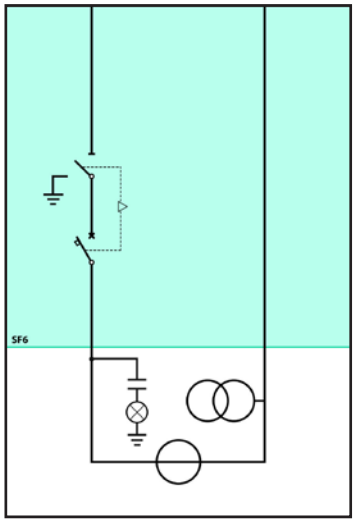


Unit Name:
U

Unit Function:
Network Coupling with Switch Disconnector

Device:
630A Switch-Disconnector with Earthing Switch

R unit Details



Unit Name:
R

Unit Function:
Metering Network Coupling with CB + Switch Disconnector

Device:
630A Circuit Breaker + Disconnector with Earthing Disconnector

TPR6 units Functions

I_1 - I_2 - I_3 units Details

Unit Name:
I1 - I2 - I3

Unit Function:
Cable Connection

Device:
-

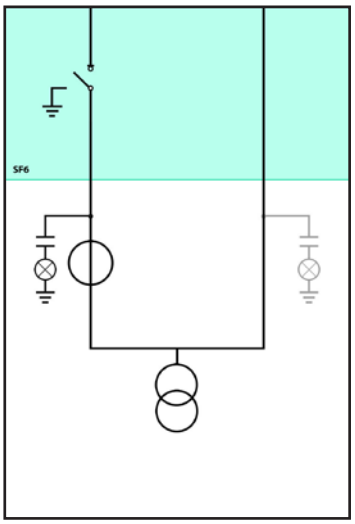
The "I" unit is ONLY available in combination with another unit, for example "I1C" or "I1LC"

I unit is divided into 3 typologies:

"I1" = 3 bushings
"I2" = 6 bushings
"I3" = 9 bushings

Example of "I3C" unit

N^1 unit Details

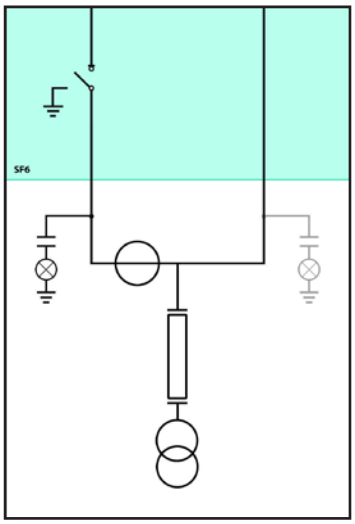


Unit Name:
N^1

Unit Function:
Metering Unit + Switch Disconnector

Device:
630A Switch-Disconnector with Earthing Switch

N^2 unit Details

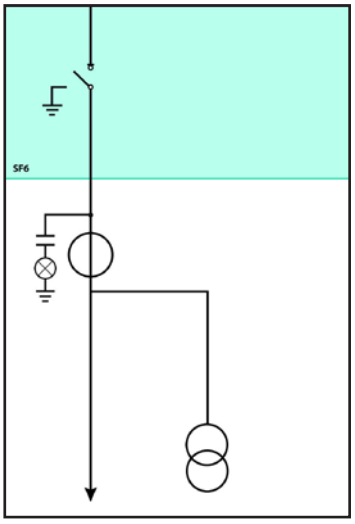


Unit Name:
N^2

Unit Function:
Metering Unit + Switch Disconnector

Device:
630A Switch-Disconnector with Earthing Switch

N^3 unit Details

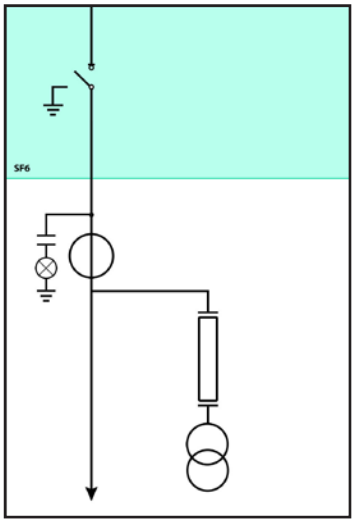


Unit Name:
N^3

Unit Function:
Metering Unit + Switch Disconnector

Device:
630A Switch-Disconnector with Earthing Switch

N^4 unit Details



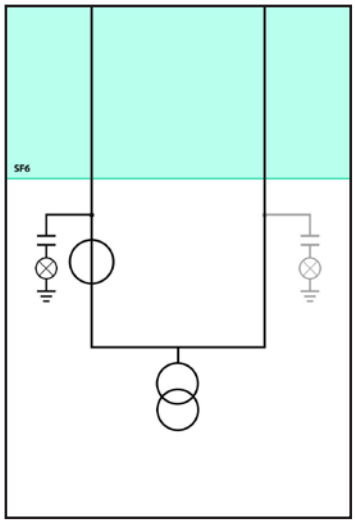
Unit Name:
N^4

Unit Function:
Metering Unit + Switch Disconnector

Device:
630A Switch-Disconnector with Earthing Switch

TPR6 units Functions

M¹ unit



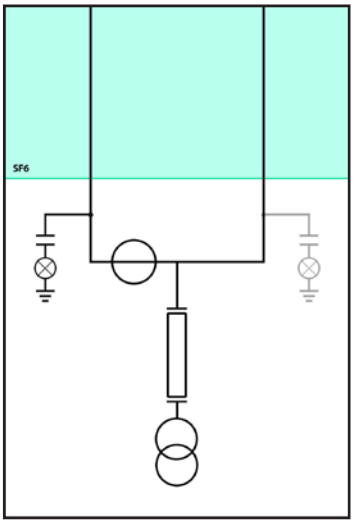
Details

Unit Name:
M¹

Unit Function:
Metering Unit

Device:
-

M² unit



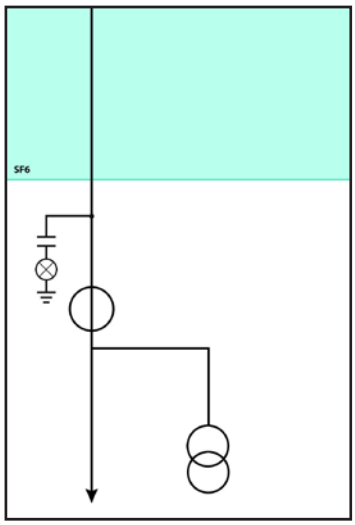
Details

Unit Name:
M²

Unit Function:
Metering Unit

Device:
-

M³ unit



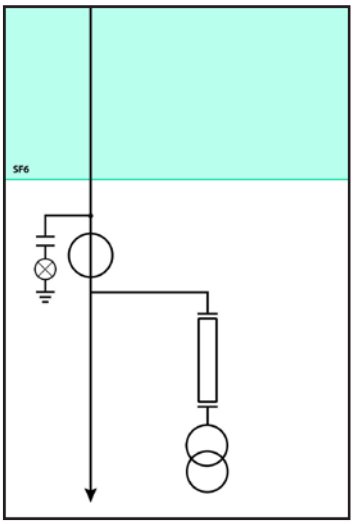
Details

Unit Name:
M³

Unit Function:
Metering Unit

Device:
-

M⁴ unit



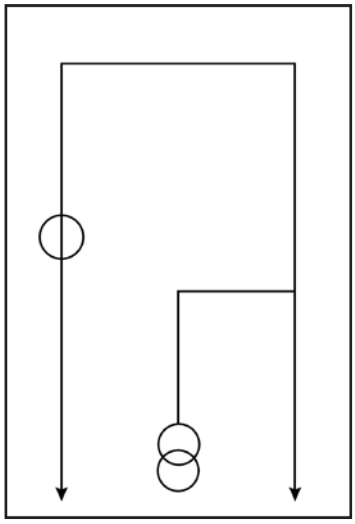
Details

Unit Name:
M⁴

Unit Function:
Metering Unit

Device:
-

M⁵ unit



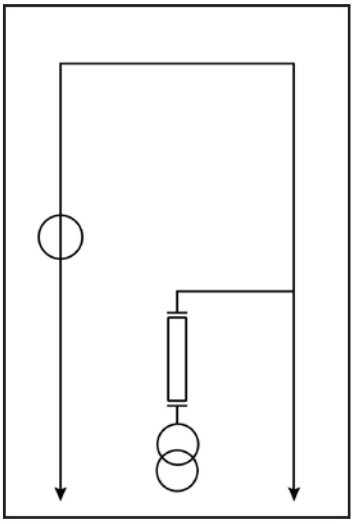
Details

Unit Name:
M⁵

Unit Function:
Metering Unit

Device:
-

M⁶ unit



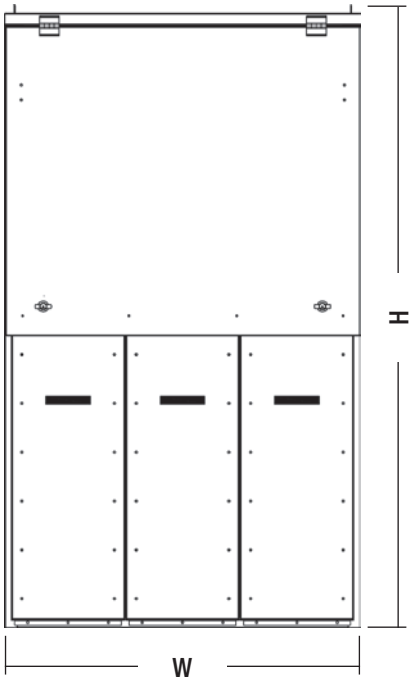
Details

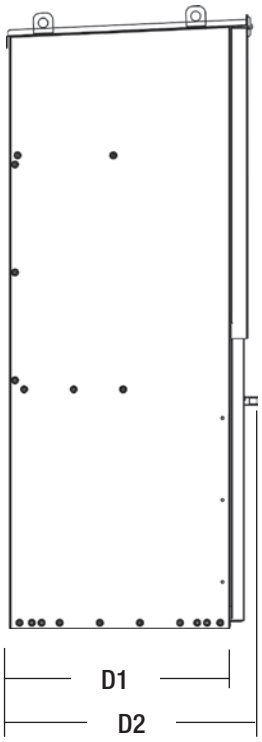
Unit Name:
M⁶

Unit Function:
Metering Unit

Device:
-

Outdoor Configurations





Due to the continuous development of the range, dimension are not binding. SEL s.p.a. reserves the right to modify according with the design updating. Binding dimensions shall be consider only when executive drawing are issued by SEL.
Dimensions are given in mm - Tolerance ±5mm.

1 Function Unit	W	H + Marshalling Box	D1*	D2*
L	390	1915	675	760
G	470	1915	675	760
C	470	1915	675	760
T	470	1915	675	760
S	470	1915	675	760
U	470	1915	675	760
M[1-2-3-4-5-6]	840	1915	675	760
Q	840	1915	675	760
R	840	1915	675	760
N[1-2-3-4]	840	1915	675	760

2 Functions Units	W	H + Marshalling Box	D1*	D2*
LL	740	1915	675	760
LT ⊙	740	1915	675	760
LC ⊙	740	1915	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST				

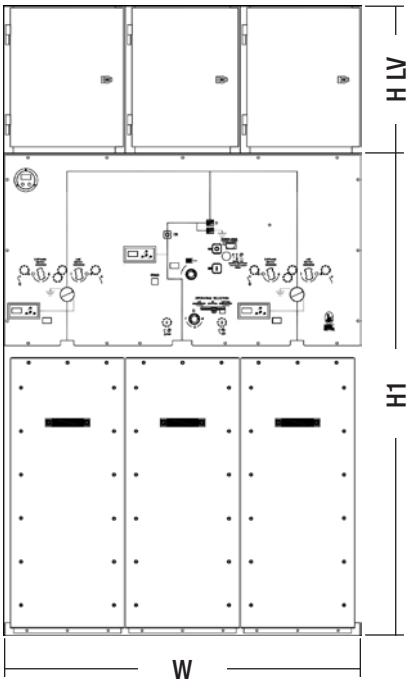
3 Functions Units	W	H + Marshalling Box	D1*	D2*
LLL	1090	1915	675	760
LCL	1090	1915	675	760
LTL	1090	1915	675	760
LTT	1090	1915	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST				

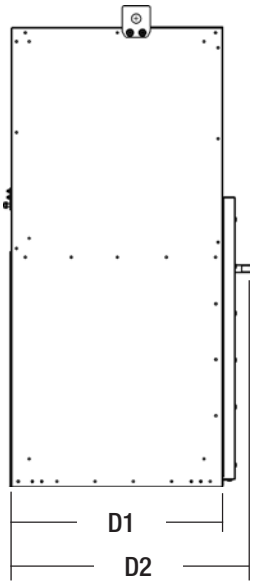
4 Functions Units	W	H + Marshalling Box	D1*	D2*
LLLL	1440	1915	675	760
LLTL	1440	1915	675	760
LTTL	1440	1915	675	760
LLCL	1440	1915	675	760
LCCL	1440	1915	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST				

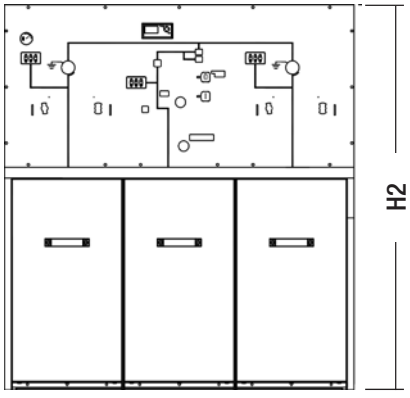
5 Functions Units	W	H + Marshalling Box	D1*	D2*
LLLLL	1790	1915	675	760
LLLLT	1790	1915	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST				

* When a rear chimney is installed depth increases by 150 mm.
⊙ The first "L" function of the switchgear can be replaced with "I" function, for other configuration contact SEL S.p.A.

Indoor Configurations







Not Extensible

Due to the continuous development of the range, dimension are not binding. SEL s.p.a. reserves the right to modify according with the design updating. Binding dimensions shall be consider only when executive drawing are issued by SEL.
Dimensions are given in mm - Tolerance ±5mm.

1 Function Unit	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
L	390	1470	-	120 - 300 - 450	675	760
F	390	1470	-	120 - 300 - 450	675	760
G	470	1470	-	120 - 300 - 450	675	760
C	470	1470	-	120 - 300 - 450	675	760
T	470	1470	-	120 - 300 - 450	675	760
S	470	1470	-	120 - 300 - 450	675	760
U	470	1470	-	120 - 300 - 450	675	760
M 1-2-3-4-5-6	840	1470	-	120 - 300 - 450	675	760
Q	840	1470	-	120 - 300 - 450	675	760
R	840	1470	-	120 - 300 - 450	675	760
N 1-2-3-4	840	1470	-	120 - 300 - 450	675	760
D	600	1470	-	120 - 300 - 450	675	760
P	470	1470	-	120 - 300 - 450	675	760
MF	390	1470	-	120 - 300 - 450	675	760
EYEBOLTS ARE REMOVABLE						

2 Functions Units	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
LL	740	1470	1200	120 - 300 - 450	675	760
LT ⊙	740	1470	1200	120 - 300 - 450	675	760
LF	740	1470	-	120 - 300 - 450	675	760
LC ⊙	740	1470	-	120 - 300 - 450	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST - EYEBOLTS ARE REMOVABLE						

3 Functions Units	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
LLL	1090	1470	1200	120 - 300 - 450	675	760
LCL	1090	1470	-	120 - 300 - 450	675	760
LTL	1090	1470	1200	120 - 300 - 450	675	760
LLF	1090	1470	-	120 - 300 - 450	675	760
LTT	1090	1470	-	120 - 300 - 450	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST - EYEBOLTS ARE REMOVABLE						

4 Functions Units	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
LLLL	1440	1470	1200	120 - 300 - 450	675	760
LLTL	1440	1470	1200	120 - 300 - 450	675	760
LLLF	1440	1470	-	120 - 300 - 450	675	760
LTTL	1440	1470	-	120 - 300 - 450	675	760
LLCL	1440	1470	-	120 - 300 - 450	675	760
LCCL	1440	1470	-	120 - 300 - 450	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST - EYEBOLTS ARE REMOVABLE						

5 Functions Units	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
LLLLL	1790	1470	1200	120 - 300 - 450	675	760
LLLLT	1790	1470	1200	120 - 300 - 450	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST - EYEBOLTS ARE REMOVABLE						

6 Functions Units	W	H1	H2 Not Extensible	H LV Marshalling Box	D1*	D2*
LLLLLL	2140	1470	1200	120 - 300 - 450	675	760
LLLLLT	2140	1470	1200	120 - 300 - 450	675	760
LLLLLC	2140	1470	-	120 - 300 - 450	675	760
MORE CONFIGURATIONS ARE AVAILABLE ON REQUEST - EYEBOLTS ARE REMOVABLE						

* When a rear chimney is installed depth increases by 150 mm.
⊙ The first "L" function of the switchgear can be replaced with "I" function, for other configuration contact SEL S.p.A.

Components

Voltage Indicator - HVSensor

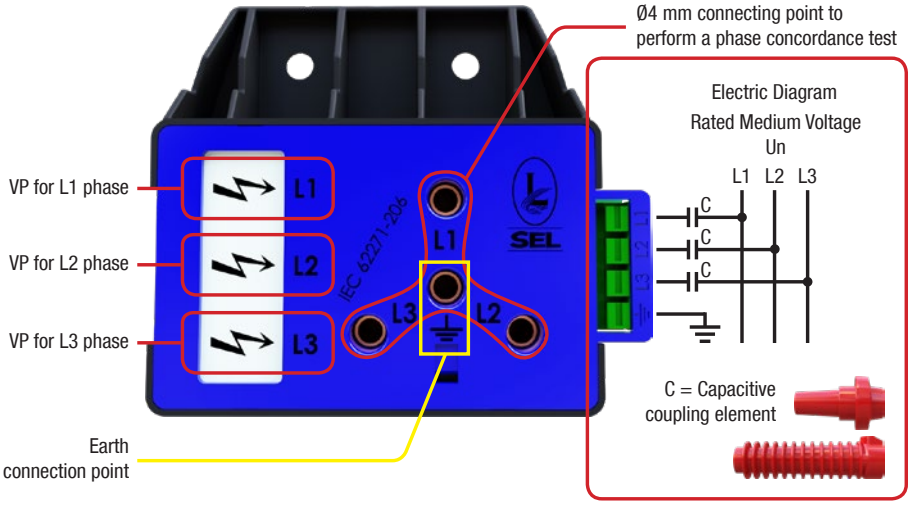
Voltage Indicator

Voltage presence indicating system. Integrated 3-phase test point for phase comparison test.

The Voltage Presence Indicating System (VPIS) SEL
Compliant with the standard IEC 62271-206, allows to display the voltage presence of the three phases by means an LCD, and to do a phase-concordance test between two lines, on all the SEL S.p.A. switchboards indoor and outdoor.

The voltage presence is indicated by the appearance on the display of the symbol

According to the standard IEC 62271-206, the indication will appear for voltages (line-to-earth) greater than 45% of the minimum rated voltage $U_n$min, and will completely disappear for voltages (line-to-earth) less than 10% of the maximum rated voltage $U_n$max. By U_n we mean the line voltage (phase-to-phase) applied to the switchboard.



HVSensor Voltage Detector

Voltage detector with relay output. Use in combination with Voltage Indicator.

Voltage Detecting system according to IEC 61243-5

Integrated voltage indicator VOIS+, VOIS R+

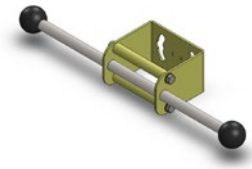
Phase comparison test unit make Pfisterer, type EPV

as combined test unit (HR and LRM) for:
– Voltage detection
– Phase comparison
– Interface test
– Integrated self-test
– Indication via LED.

Operating Handle - Keylocks and Padlock Holder

Operating Handle

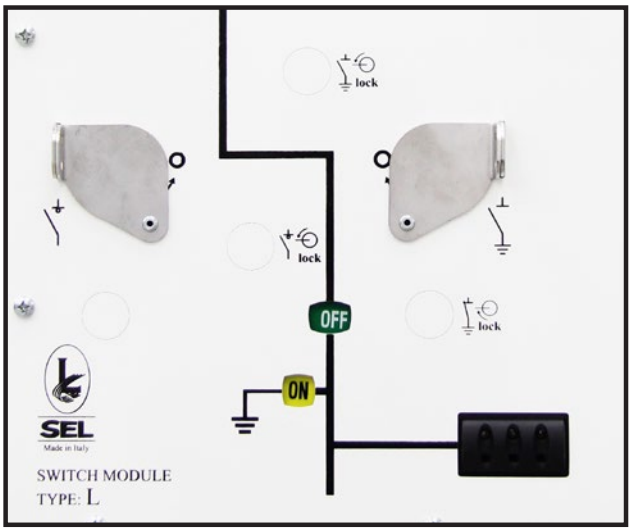
In the TPR6 switchgear there is a single operating handle for all mechanism.



For F unit there is a special operating handle only to remove the fuses.

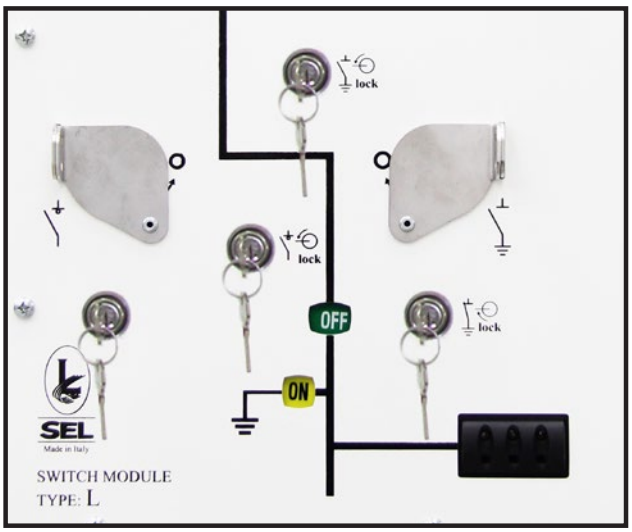
Padlock Holder

Padlock holders can be installed in both switch disconnectors and earthing switches as optionals.

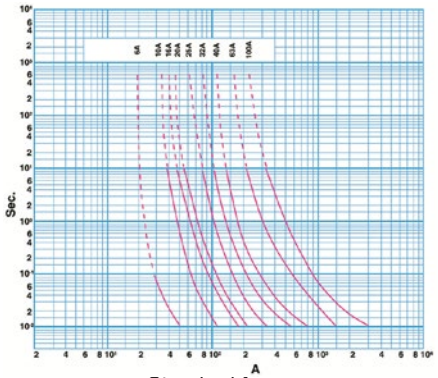


Keylock

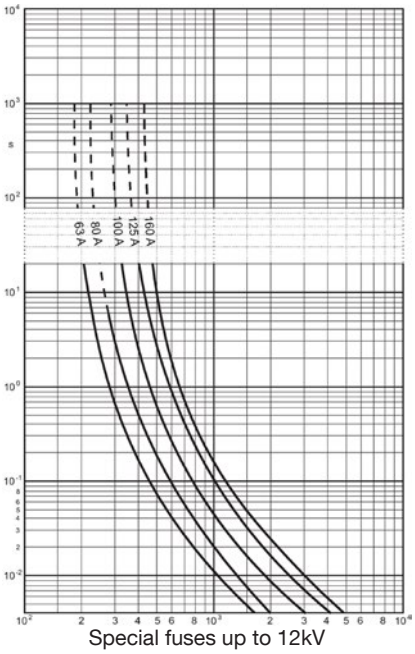
Keylock can be installed in both switch disconnectors and earthing switches as optionals.



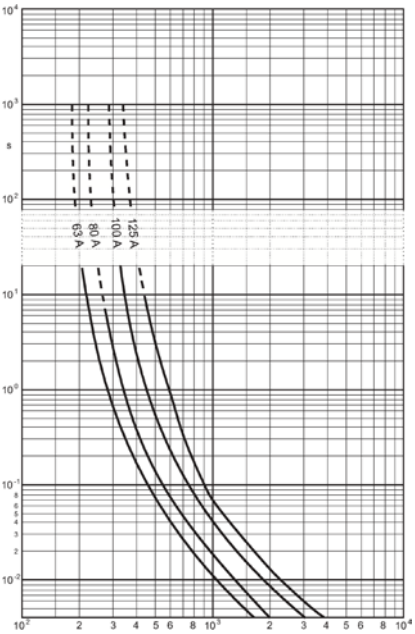
Fuses



Standard fuses



Special fuses up to 12kV



Special fuses up to 24kV

Fuse selection

Some important transformer and fuse features have to be known to select the right fuse for power transformer protection:

Transformer:

Rated power	P_n [kVA]
Short circuit voltage	U_{cc} [%]
Service rated voltage	U_n [kV]
Rated current	I_{nt} [A]
Inrush maximum current	I_i [A] (usually 12xInt)
Overload current	I_s [A] (usually 1,5xInt)
Short circuit current	I_{CCt} [A]
Maximum time withstand short circuit	t_m [s] (usually 2s for transformer up to 630kVA, 3s for bigger transformer)

Fuse

Rated insulation voltage	V_i [kV]
Rated current	I_n [A]
Maximum breaking current	I_1 [kA]
Minimum breaking current	I_3 [A]
Power losses at I_{nt}	P_W [W]

Time/current characteristic to get follow values:

Pre-arcing current at 0,1s	I_f (t=0,1s)[A]
Pre-arcing current at t_m	I_f (t=t_m)[A]
Pre-arcing current at 0,05s	I_f (t=0,05s)[A]

Verify following conditions:

- The rated insulation voltage of the fuse has to be higher than the service rated voltage of the transformer $V_i > U_n$
- The fuse has to be able to break the maximum short circuit current of the plant $I_1 > I_{CCt}$ (in case of fault before the transformer)
- The fuse melts in case of fault on LV wiring of the transformer $I_3 < I_{CCt}$
- The fuse protects the transformer in case of short circuit $I_f (t_m) < I_{CCt}$
- The fuse does not melt at the transformer withstand overload $I_n > I_S$
- The fuse does not melt at the transformer inrush current $I_f(0,1s) > I_i$
- The fuse power dissipation does not compromise the temperature inside the switchboard $P_W < 150W$
- The transfer current has to be lower then the maximum admissible value for the switchboard If (0,05s) < $I_{transfer}$

Standard

Striker pin fuses (1 ± 0.25 Joule) in accordance with:

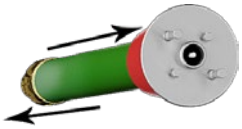
- IEC 60 282-1/VDE 0670-4
- IEC 60 787/VDE 0670-402
- DIN 43 625

Selection table helps to select the fuses for generic MV/LV power transformers; it is valid for ambient air temperature up to 40°C and it has to be verified with all above parameters.

FUSES SELECTION TABLE - TABELLA SCELTA FUSIBILI

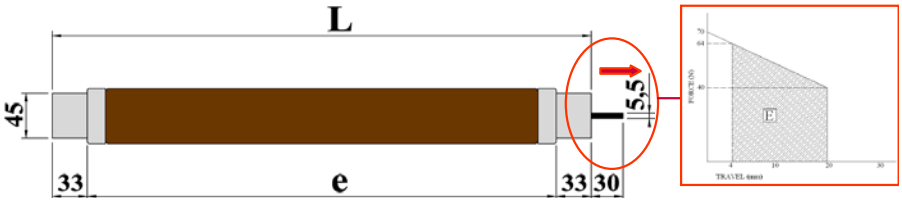
Vs	Vi	PN [kVA]													
[kV]	[kV]	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000
6	12	20	25	31,5	40	50	63	80	100	125	160	-	-	-	-
6,6	12	16	20	25	31,5	40	50	63	80	100	125	160	-	-	-
10	12	16	16	20	25	31,5	40	50	63	80	100	125	160	-	-
11	12	16	16	16	20	25	31,5	40	50	63	80	100	125	160	-
15	24	10	10	16	16	20	25	31,5	40	50	63	80	100	125	-
20	24	6	10	10	16	16	20	25	31,5	40	50	63	80	100	125
23	24	6	6	10	10	16	16	20	25	31,5	40	50	63	80	100
33	36	4	6	6	10	10	10	16	20	25	31,5	40	40	50	63
36	36	4	6	6	10	10	10	16	16	20	25	31,5	40	50	63

Fuses



Frontal
Fuses Extraction.

Insulation Voltage	Transfer Current
V_i = 12 kV (Not Standard Adaptor)	$I_{Transfer}$ = 1800 A
V_i = 24 kV (Standard Adaptor)	$I_{Transfer}$ = 1400 A



Type	e (mm)	L (mm)	
12 kV	292	358	Order the adapter kit for fuses with "e" = 292 mm
24 kV	442	508	

Protection Relay - Marshalling Box Low voltage Panel

TPR6 range can be provided with self-powered protection relays with ring core CTs on cables or protection relays with power supply. All the relays used are well-known brands with high level of safety and reliability.
In some cases the protection relay is installed directly on board of the circuit breaker, in other cases when the protection relay dimensions are bigger or when the wiring diagram is more complex, the protection relay is installed in the LV compartment located on the top or in front of the switchgear.

Relay installed in white frontal panel

Small LV marshalling box installed on top of RMU

Relay installed in LV marshalling box indoor version

Relay installed in LV marshalling box outdoor version

In case of big dimensions of the auxiliary equipment or complex wiring diagram, TPR6 can be provided with the auxiliary modules located in the lateral side of the switchgear.

NOTE

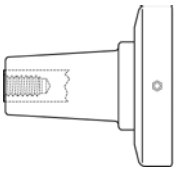
Cable Connections

Bushings - Cable Compartment - Termination Point

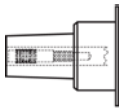
Bushings

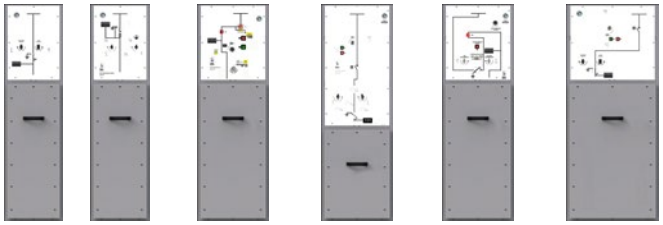
Epoxy resin bushings installed on TPR6 are according to DIN EN 50181.

Type C 630A



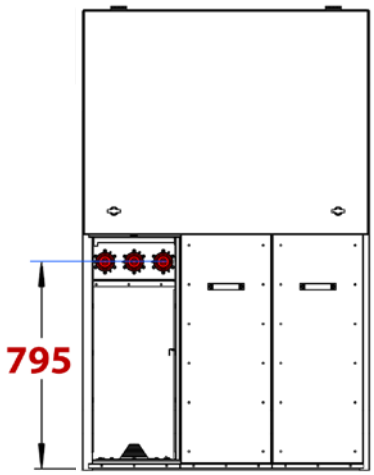
Type A 250A



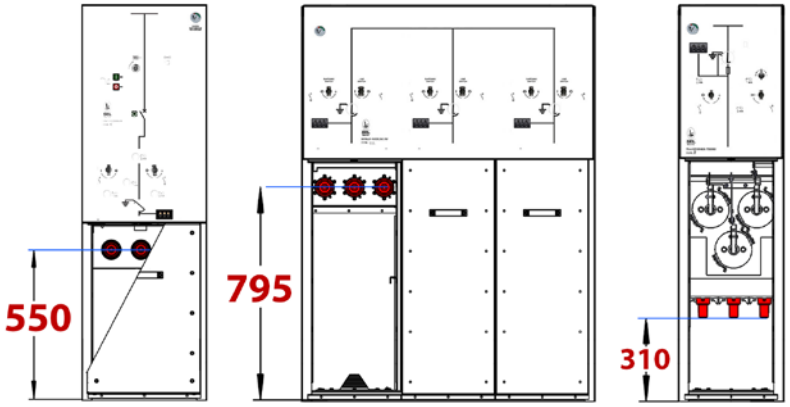


Unit Function	L	F	C	P	T	D
Bushing Type	C	A	C	C	C	C

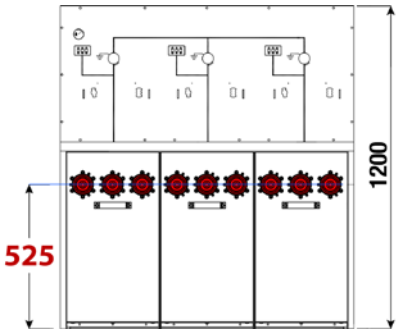
Cable Bushings Height Outdoor



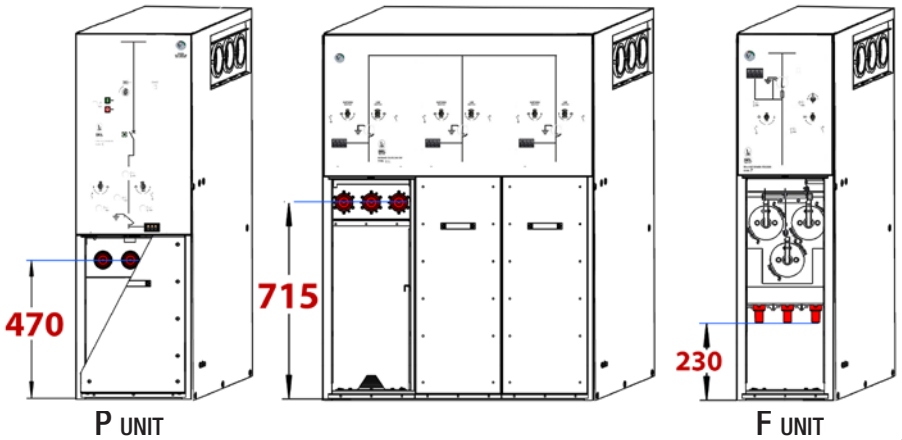
Cable Bushings Height Indoor (Not Extensible and Upper extensible version "K")



Cable Bushings Height Indoor H1200 type (Not Extensible)

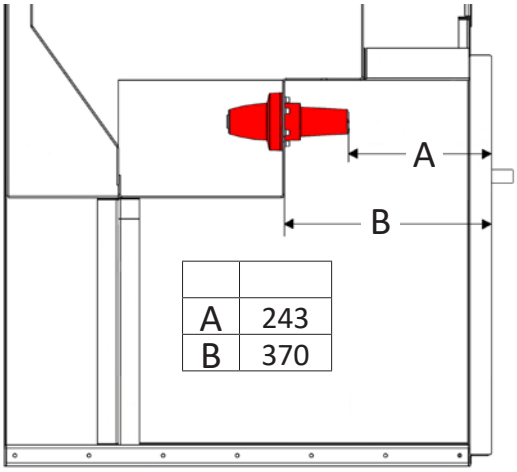


Cable Bushings Height Indoor (Extensible version Type "+")



Cable Connection - Cable Terminal

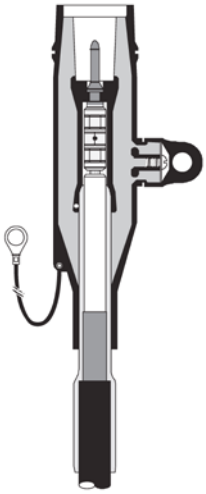
Cable Connection



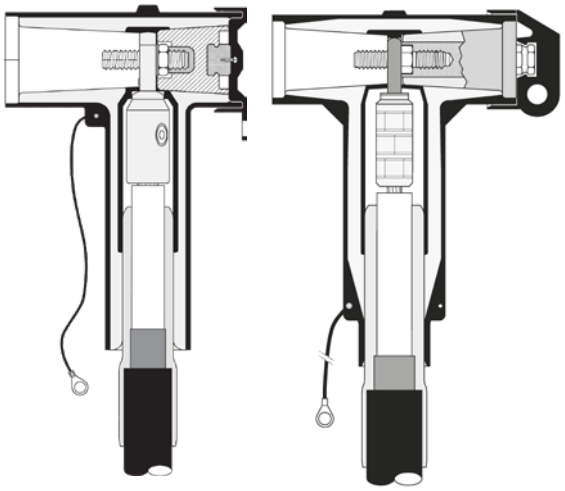
A	243
B	370

Cables Terminal

Pre-mouled shielded type termination for interface “C” bushing (according with DIN EN 50181 standard) are suitable cable termination.

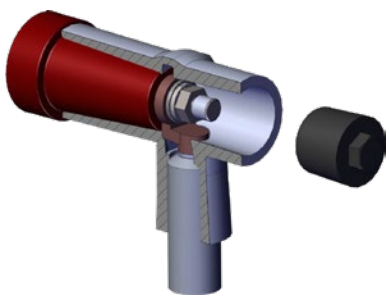


250A
Straight Cable
Connector
Bushing type A



630A Disconnectable and bolted
socket Connector Bushing type C

For "F" unit is possible to
install only this connector.



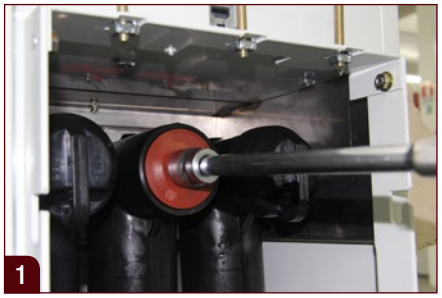
Standard air insulated heat/cold shrinkable indoor termination can be used in combination with silicon cover caps (premoulded boots) placed on the “C” bushing sealed and fixed by cast resin bolts. It allows access for cable test purpose. Using our own production silicon pre-mouled boots, this solution has been tested by C.E.S.I. Laboratory in Milan Italy.

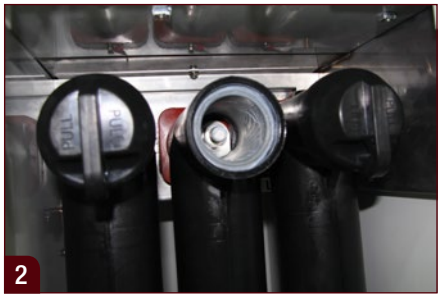
Testing Cables Facilities

Tewsting Cable Faciliies

The TPR6 has fully interlocked integrated ring switch and tee-off cable test facilities. To perform the testing cable remove the insulating cap from the cable connector and install the testing probe.

With Pre-mouled Shielded Cable Connector





With Pre-mouled Not Screened Cable Connector (made by SEL S.p.A.)

UNITS OPERATING SEQUENCES

Qr Code usage istructions:
Download the right application from your device store to read QR-Code marks.
Start Application.
Point your device camera to the QR Code.
Multimedia information will be downloaded direcly to your device.

TPR6 - LT Operating Mechanism

The video shows the switch operations sequences of the LT Operating Mechanism mounted on a L - S - U - N units.

TPR6 - 3D Operating Mechanism

The video shows the switch operations sequences of the 3D Operating Mechanism mounted on a F units.

TPR6 - CB6/SCB6 Op. Mechanism

The video shows the switch operations sequences of the CB6 and SCB6 Operating Mechanism mounted on a P and D unit.

TPR6 - SCBD Operating Mechanism

The video shows the switch operations sequences of the SCBD Operating Mechanism mounted on a C - Q - R - G units.

TPR6 - CLOP Operating Mechanism

The video shows the switch operations sequences of the CLOP Operating Mechanism mounted on a C - T units.
In the video there is a LTL operating sequences

TPR6 - LT Testing Cables

The video shows the switch operations sequences for testing cables of the LT Operating Mechanism mounted on a L - S - U - N units.

TPR6 - SCBD Testing Cables

The video shows the switch operations sequences for testing cables of the SCBD Operating Mechanism mounted on a C - Q - R - G units.

TPR6 - CLOP Testing Cables

The video shows the switch operations sequences for testing cables of the CLO Operating Mechanism mounted on a C - T units.

Compatibility

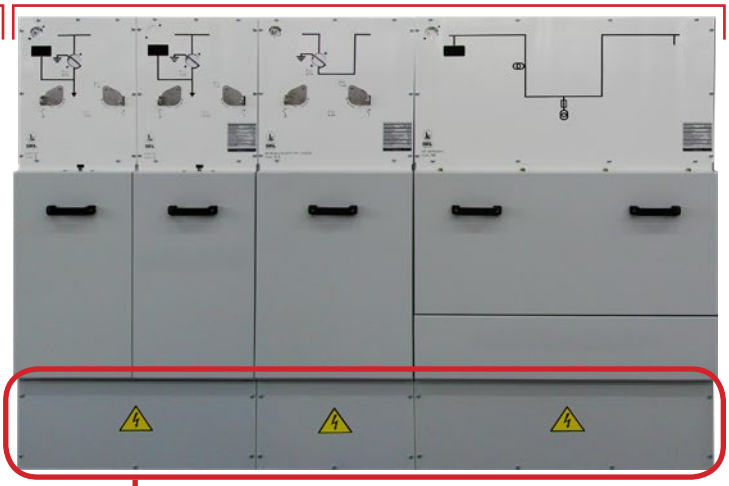
ALL INDOOR VERSIONS ARE FULLY COMPATIBLE WITH PREVIOUS VERSION OF TPR6 24KV

Compatible with previous TPR6 24kV Coupling

The new indoor version is compatible with the previus TPR6 line.

TPR6 24kV 25kA

Previous TPR6 24kV



Base to align the two versions of TPR6 24kV at the same height

Note

Note

Note

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