NHP Electrical Engineering Products

Medium Voltage Solutions

Transformers, switchgear and customised kiosk solutions that are built to last

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NHP medium voltage products and manufactured solutions

Modern protection system

Improved safety and functionality

Increased system reliability

Serviceability

	Medium voltage switchgear			Medium voltage transformers (Tx)		Medium voltage enclosed solutions for outdoor use			Motor control MV drives	
	SGC SwitchGear Company			TRAFO ELETTRO		NHP MV SOLUTIONS			Rockwell Automation	
	Air insulated switchgear	**Gas insulated switchgear**		**Cast resin transformers**	**Oil immersed transformers**	**Enclosed transformers**	**Enclosed switchgear**	**MV/LV kiosk substations**	**All purpose drives**	**Special purpose drives**
										
Model type	DF-2 / DF-2+	DR/DT-6-C / DR/DT-6-C +	DR/DT-6-E / DR/DT-6-E +	TES-R	TES-OM	DFT	DFS	DFX	PowerFlex 6000T	PowerFlex 7000
Construction design [4]	Modular	Compact	Extensible	Cast resin	Hermetically sealed	Cast resin in MS, SS	MS, SS or Al	MS, SS or Al	Air cooled	Air or liquid cooled
IP rating [5]	IP4X	IP6X	IP6X	IP00	IP66	IP43	IP54	IP54/33D and IP54/23D	IP31 or IP42	IP21/NEMA Type 1 or IP42
Arc fault performance	**Internal arc classification for switchgear [7]**			**Arc flash mitigation**		**Arc flash mitigation**	**Internal arc slassification for kiosk [6]**		**Arc flash resistant enclosure**	
	A-FL(R) 16kA/1s /B-FLR 20kA/1s	A-FL(R) 16kA/1s /B-FLR 20kA/1s	A-FL(R) 16kA/1s /B-FLR 20kA/1s	Arc mitigation by design [2]	Arc mitigation by design [2]	Arc mitigation by design [2]	IAC-AB Classification AS62271.202 [3]	IAC-AB Classification AS62271.202 [2] [3]	No	Yes, ArcShield option available
Max. rated voltage [1]	24kV	24 kV	24 kV	36kV	36kV	36kV	24kV	24kV	11kV	6.6kV
	Switchgear max. rated current [1]			**Tx rated power**		**Tx rated power**	**Max. rated current [1]**	**Maximum rated power**	**Max. rated power output**	
	1250A	630A	630A	50kVA – 6MVA	50kVA – 7MVA	50kVA – 6MVA	1250A	200kVA – 2.5MVA smaller 200kVA kiosks are required sometimes	10.650kW	6000kW / 5595kW
	Switchgear max. rated short circuit current [1]			**Tx partial discharge**		**Tx partial discharge**	**Switchgear max. rated short circuit current [1]**		**Drives max. input voltage rating**	
	25kA	25kA	25kA	<5 pC	<10 pC	<5 pC	25kA	25kA	13.8kV	6.6kV

Aviation power supplies

FCX SYSTEMS

AC frequency converters

- 400 Hz output
- Pulse width modulation
- Step wave
- 50/60 Hz low frequency conversion

Pre-conditioned air (PCA) Diesel ground power (GPU)

- Freqeuncy 400 Hz8
- VDC and 270 VDC

DC power supplies

- 28 VDC through 600
- FLA converters
- 270 VDC power converters and military
- Precision power converters

Combination converters

- 00 Hz/ 28 VDC/ 270 VDC

1) For switchgear, maximum voltage and currents will vary depending on the specific customer selected VCB
2) Cast resin transformer 'arc mitigation design' is achieved with 'plug in bushings with earth screened HV terminations installed as per NHP recommendations
3) When installed with DF-2+/DR-6+ (Arc-Killer) switchgear. Published DF2+/DR-6+ B-FLR IAC applies.
4) For enclosed solutions, an enclosure can be made from either SS = Stainless Steel, MS = Mild Steel, Al = Aluminium
5) For cast resin Tx - IP54 applies to the MV/LV compartment, IP33D applies to the cast resin Tx compartment
   for oil immersed Tx - IP54 applies to the MV/LV compartment, IP23D applies to the oil Tx compartment
   For LRS Tank construction is IP42, control and switchgear panel is IP54
6) IAC-AB for kiosks are by design
7) A-FLR is achieved using an arc duct. Without an arc duct the DF2 achieves an IAC of A-FL 16kA/1s.

NHP Medium Voltage switchgear overview

- DF-2 and DF-2+ (with Arc-Killer) series of switchgear
- DR-6 and DR-6+ (with Arc-Killer) series of ring main units (RMUs)
- Suitable for 3.3kV, 6.6kV, 11kV and 22kV

Air insulated switchgear (AIS) with visual earthing - DF-2/DF-2+ series
AIS up to 24kV and 25kA 1 sec
See page 20 for more information

Gas insulated switchgear (GIS) ring main units (RMUs) - DR-6/DR-6+ series
GIS RMUs up to 24kV and 25kA 1 sec
See page 68 for more information

NHP Medium Voltage transformer overview

Cast resin transformer
50kVA - 6MVA, with voltages up to 36kV
See page 132 for more information

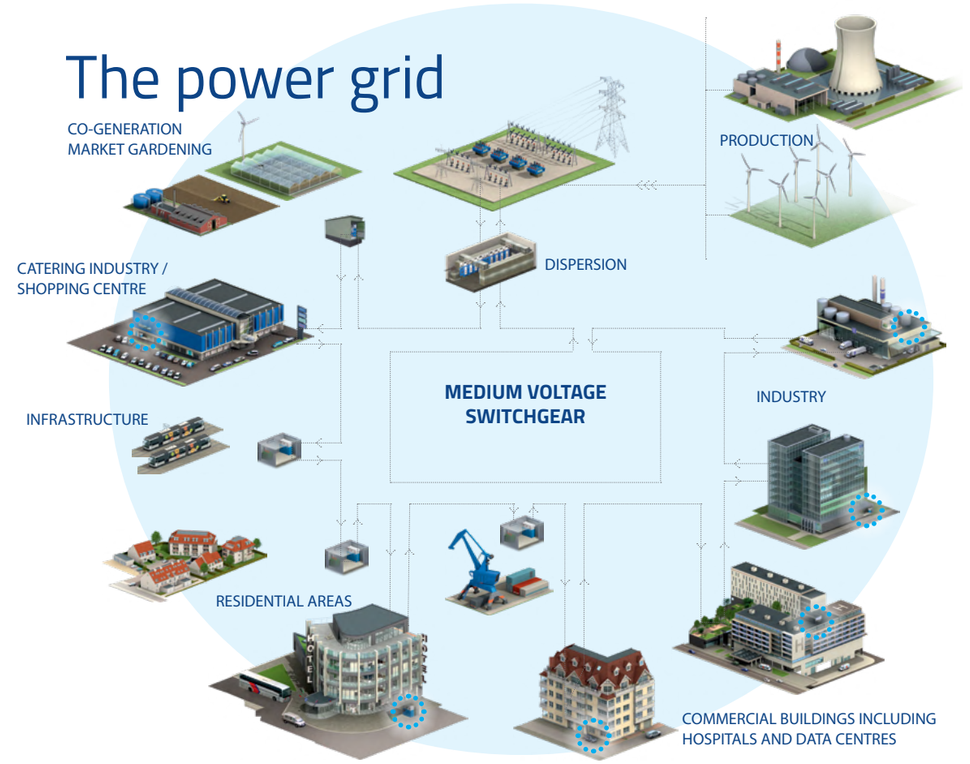
Oil immersed transformers
50kVA - 7MVA, with voltages up to 36kV
See page 152 for more information

Customised DFX series MV/LV kiosks and enclosed switchgear with transformer solutions

DFX series of MV/LV kiosks
200kVA - 2.5MVA, with voltages up to 36kV
See page 170 for more information

MV enclosed switchgear and transformers
50kVA - 6MVA, with voltages up to 36kV
See page 188 for more information

NHP Medium Voltage solutions - your number one choice!



NHP MV products and solutions

NHP's MV products and solutions include a range of switchgear manufactured in Belgium by Switchgear Company transformers manufactured in Italy by Trafo Elettro and our customised kiosk solutions manufactured in Australia by NHP.

NHP's MV switchgear is high quality and packed with safety features demanded by:

- Australian defence bases:
- Water and wastewater authorities:
- Australian correctional facilities:
- Food industry:
- Oil and gas industry:
- Mining and cement quarries:
- Heavy steel fabrication industry:
- Major infrastructure: and
- Many more industries..

The range consists of the 'DF-2' and 'DF-2+' air insulated panels and the 'DR-6' and 'DR-6+' gas insulated RMUs. Our transformers include both cast resin and oil immersed types, which can be supplied enclosed or unenclosed.

NHP can also create customised kiosk solutions including full MV/LV kiosks, outdoor enclosed MV switchgear sub stations and outdoor rated enclosed transformer.

Coupled with a local, experienced, customer centric team of MV experts, NHP excels at providing project solutions that focus on:

- Safety for people
- Compliance to standards
- Reliability of product
- Customisation of solutions to meet customer needs
- Availability of power

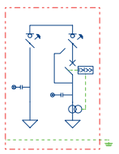
New MV product releases

‘SF_6 ZERO’ RV-44 loadbreak switch for the DF-2 switchgear

SGC can now offer the RV-44 load break in a ‘disconnector version that contains zero SF_6 gas for 11kV applications. While the standard RV-44 LBS contains only a minute amount of SF_6 gas and has a class leading service life of almost 200 years, the SF_6 zero RV-44 disconnector version will suit applications that mandate exceptionally high environmental specifications. Note the zero SF_6 RV-44 disconnector is key interlocked with the in-line VCB, therefore motorisation of the VCB is not possible.

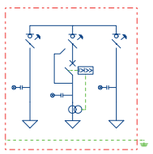
Enclosed ring main unit (RMU) with mechanical vacuum circuit breaker (VCB)

SGC has launched an economical enclosed GIS RMU featuring the VA-3 mechanical drive vacuum circuit breaker. This new RMU is available in three versions:



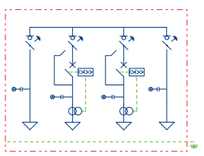
DR-6C KD RMU

- DR-6C KD (one load break switch and one circuit breaker)



DR-6C 2KD RMU

- DR-6C 2KD (two load break switches and one circuit breaker)



DR-6C 2K2D RMU

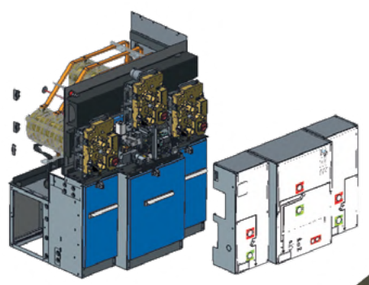
- DR-6C 2K2D (two load break switches and two circuit breakers)

The RMU can be supplied enclosed or unenclosed.

24kV ratings available for DF-2+ Arc-Killer switchgear

In 2021, SGC undertook third party testing to verify 24kV ratings for the DF-2+ switchgear. This means the DF-2+ switchgear panels featuring the patented Arc-Killer technology are fully rated for the higher system voltage. The DF-2+ with 24kV ratings is currently being procured for use on one of the Australian Defence Force’s largest bases.

KEMA Labs testing of the DF2+ switchgear at 24kV



Exploded view of DR-6C 2KD RMU

Enclosed DR-6C 2KD RMU

DT-6 switchgear motor control retrofit solution

For motor control applications that utilise MV contactors, NHP and SGC can provide a very compact DT-6 RMU solution that minimises the footprint, making it ideal for retrofitting.

Industrial sites that use MV fuse contactor technology for motor starting typically have an operating frequency of three close / open operation per day, resulting in approximately 22,000 switchings over twenty years.

The DT6 compact motor starting solution utilises a magnetically actuated VCB, which is rated to 50,000 operations and more than sufficient to replace the existing fuse / contactor arrangement.

The DT6 compact motor starting solution is perfect to replace existing fuse / contactor arrangements typically feeding:

- DOL starters
- Soft starters
- Variable speed drives (VSDs)

SEL-3350 MV substation automation controller – Ethernet/IP enabled

The SEL-3350 automation controller is a powerful device that is perfect to concentrate data from multiple sources such as in an MV kiosk and serve this data to a multitude of networks. The SEL-3350 can now be configured to seamlessly integrate data from an NHP MV kiosk into an Ethernet/IP network. For more information see **page 42.**

VAS2-SafeLift

The VAS2-Safelift is a purpose built material handling trolley used to safely remove and transport the VA2 / VAS2 VCBs from the DF2 switchgear panels. Featuring vertical movement, the VAS2-Safelift allows the VA2 / VAS2 VCB to be easily set to ground level and safely removed.

New SMART MV solutions

SMART technologies for MV switchboards and kiosks

GE Agile or SEL protection relays

GE or SEL protection relays provide an integrated solution for the complete protection, control and monitoring of electrical power systems.

- Powerful logic, protection functions
- IEC 61850 DNP3 and Modbus communications options
- NERC compliant cyber security
- Fully withdrawable case.

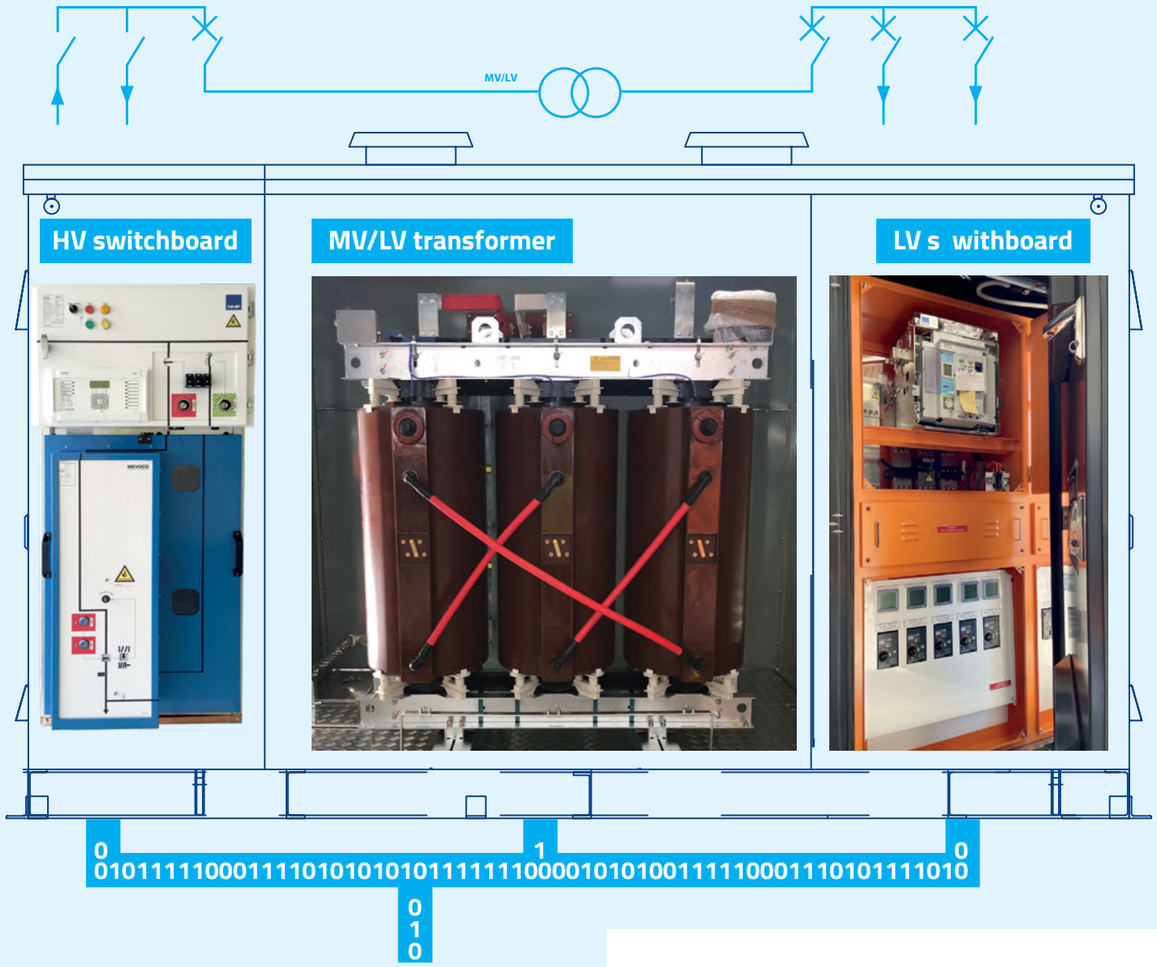
SEL – 3350 substation automation controller

- Substation SCADA data concentrator application
- Event recording and relay data access
- Remote access to SEL relay settings
- Networking ports and digital I/O
- Local and remote visualisation and control
- Set up HMI dashboards
- Combine and display data from the MV switchboard, transformer and LV switchboard in one device.

Arc LogiX optical arc flash relays

Arc LogiXTM optical relays use fibre optic light sensors to rapidly detect an arc fault event and trip a circuit breaker. Commonly used with DF-DT panels (without Arc-Killer) and the LV switchboard..

NHP Arc Logix™ ARC FAULT PROTECTION

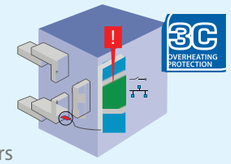


NHP 3C LV air circuitb breaker (ACB) temperature monitoring

Continual temperature monitoring of the and LV ACB and associated areas of the LV switchboard, which can be monitored via a SCADA or BMS.

Helps avoid catastrophic failure typically caused by:

- inadequate connections to terminals
- poorly maintained contacts and clusters
- poor switchboard ventilation.

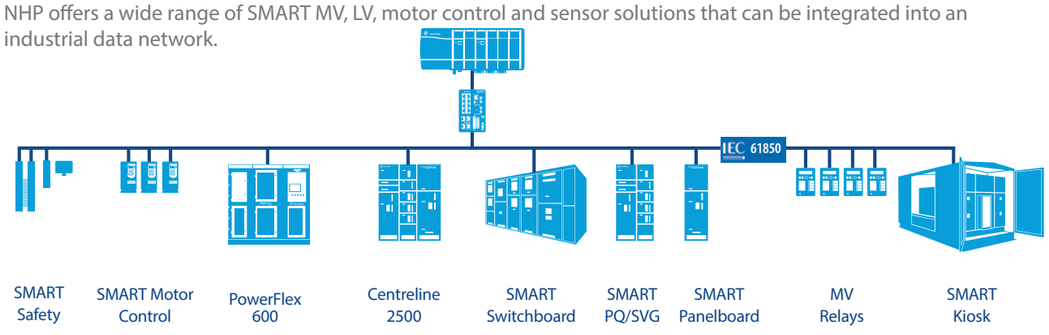


NHP FTX MV switchgear temperature monitoring

NHP's FTX fibre optic temperature sensors provide continuous monitoring of electrical hot spots in medium voltage switchgear rated up to 38kV.

SMART technologies for MV switchboards and kiosks

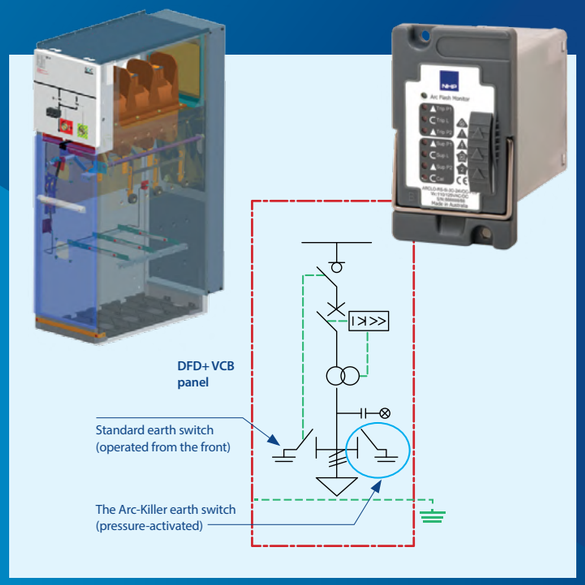
NHP offers a wide range of SMART MV, LV, motor control and sensor solutions that can be integrated into an industrial data network.



Presentation

Safety

Putting people's safety first - MV switchgear, cast resin transformers and kiosks



Arc quenching system - Arc-Killer

Reduce PPE requirements to Category 0

The Arc-Killer is a unique worldwide patented, fast acting earthing switch system which diverts a high energy arcing fault into the low energy short circuit, which is finally cleared by an upstream circuit breaker.

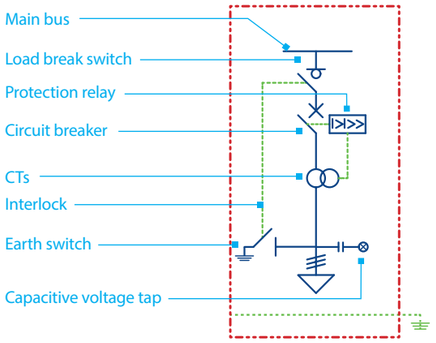
Arc quenching is achieved within 48ms for the DF-2+ switchgear and 25ms for the DR-6+ RMU, protecting people from significant injury. **20kA 1s BFLR arc fault tested, reducing PPE requirements to cat. 0.**

For panel types that do not have the Arc-Killer system available, fast arc fault protection can be implemented using the **NHP Arc LogiXTM optical arc flash relay range*.**

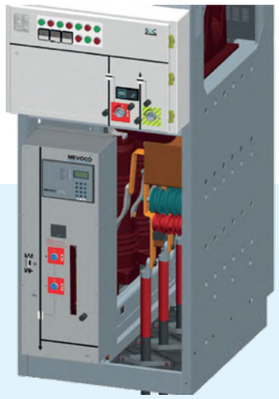
Visible earth switch and in line isolation

NHP's DF-2+ MV switchgear uses a RV-44 fully rated load break switch in line with the circuit breaker providing two points of isolation for addition safety.

Furthermore, the panel contains a mechanically interlocked **visible earth switch,** providing safety and certainty for HV switching and maintenance staff by preventing any access to live parts.



Easily test cables without disconnecting conductors

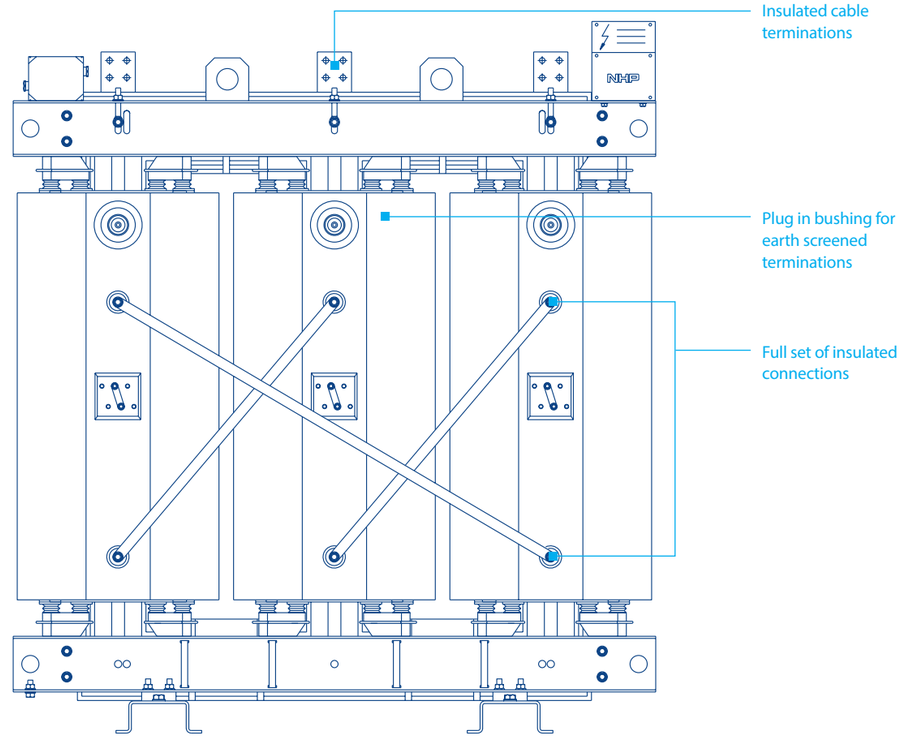


The highest levels of safety when testing cables

The DF-2+ provides an extremely fast and safe way to undertake cable testing and maintenance!

Connected power cables can be easily and safely tested with the DF-2. Robust inbuilt mechanical interlocks make safety the priority, while still enabling cable testing to be performed without unbolting the cables.

The demountable VCB can also be partially removed by a single person, providing additional space inside the cubical for HV cables connection, inspection and maintenance work.



Cast resin transformers with arc mitigation by design

Cutting edge monoblock transformer fabrication technology

NHP's cast resin transformers offer arc mitigation by design, reducing the potential arc flash risk and improving safety. This is achieved by using:

- a high dielectric strength resin film monoblock
- limiting the inter-winding voltages to not more than 15VAC
- using extensive insulation and shrouding on all terminations and connections.

Cast resin transformers reduce fire risk

F1

NHP's cast resin transformers are constructed using flame resistant and self-extinguishing materials, which provide an enhanced level of safety. This makes NHP cast resin transformers perfect for critical indoor applications such as hospitals, data centres, rail, high-rise buildings and highly ecological environments.

Furthermore, NHP cast resin transformers have achieved a market standard 'fire behavioural class' of 'F1', which requires not only minimal flammability of materials but also the minimisation of toxic substance emissions and opaque smokes.

No need to externally vent arc fault gasses

When the DF-2+/DR-6+ (Arc-Killer) switchgear is used in an NHP kiosk, there is no need to design and install chimney systems to expel dangerous arc fault gases externally to the kiosk. This improves the safety for electrical operators who may be working inside or outside the kiosk.

Presentation

Reliability

Reliability built to last - MV switchgear, cast resin transformers and kiosks

Switchgear with a 50 year design life

Meeting the Australian Defence Standard Manual of Infrastructure Engineering-Electrical (MIEE)

NHP's DF-2 MV switchgear is made for the most harsh environments, with high pollution and frequent condensation as outlined in IEC62271.304. NHP and SGC's special version of the DF-2+ boasts a 50 year design life to satisfy the 'built to last' requirements of the MIEE Australian Defence specification.

Modern vacuum switching and load break technology

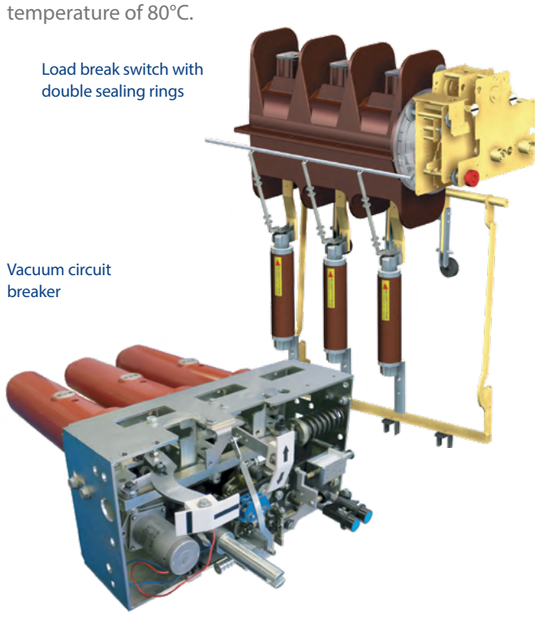
Ensure long lasting performance

NHP/SGC vacuum switching technology has been validated to provide 75 trip operations at a full short circuit fault current of 25kA.

The RV-44 load break switch contains two sealing rings, delivering a class leading ultra low leakage rate equivalent to more than 200 years of service life in an ambient temperature of 80°C.

Load break switch with double sealing rings

Vacuum circuit breaker



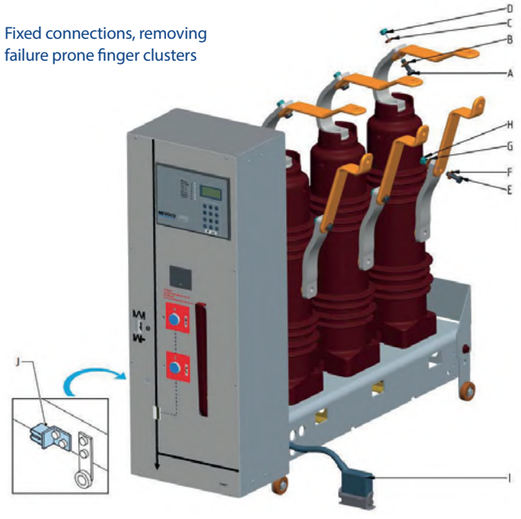
Proven performance

A global install base with a very high MTBF

The DF-2 uses the demountable circuit breaker concept, which removes the failure prone finger clusters, racking mechanism and mechanical shutters that are common issues in traditional fully withdrawable switchgear.

With over 80,000 panels installed globally being in service for more than 20 years, the DF-2 has demonstrated a very high **Mean Time Between Failure (MTBF).**

Fixed connections, removing failure prone finger clusters



Reduced partial discharge

Going beyond the standard

NHP's cast resin transformers are constructed using quality materials and highly refined technological processes, resulting in a partial discharge level of <5 pc. This is a 50% improvement over the IEC/AS 60076.11 requirement.

The industry standard is <10pc, so NHP is setting a new standard! Having a lower partial discharge level indicates the high quality of the cast resin material used and results in a 3-5 year increase in service life.

E3 and E2

C2

Environmental and climate class tested

Type tested for the most arduous conditions

NHP's cast resin transformers have undergone the highest levels of performance testing and have achieved a combined Class E3 and E2 (environmental class) and Class C2 (climatic class) in accordance with IEC 60076-11/16.

This makes NHP cast resin transformer ideal for applications in industrial heavy polluted and most humid environments (e.g. tropics) and environments with high air salinity (e.g. coastal areas).

The most advanced method in HV winding fabrication

Cutting edge manufacturing

NHP cast resin transformers have a HV winding that is fully cast in a resin mono block under vacuum.

This is the gold standard for transformer fabrication and provides the ultimate protection against dust and moisture. Furthermore, it is proven to provide the highest reliability and longest service life.

High voltage terminals

Vacuum casting process allows uniform distance between windings

Presentation

Availability

Maximising uptime with MV switchgear, cast resin transformers and kiosks

Modular design

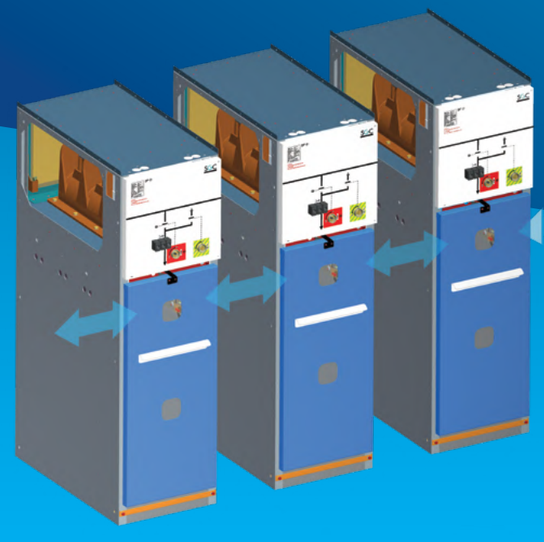
Repair or extend panels quickly

All panels use the same load break switch, vacuum circuit breakers and earth switches.

The DF-2 uses a demountable circuit breaker on wheels, supporting quick replacement, while the switchboard is still operating, reducing the MTTR.

Finally, it is easy to extend the size of the MV switchboard because:

- no special tools are required, panels are a simple bolt-on installation
- arc gases are fully contained thanks to the Arc-Killer system, so no need for additional ducting



Minimum moving parts and maintenance

Less points of possible failure

Wear and tear is minimised by reducing the number of moving mechanical parts. The 'fixed' conductor design simplifies and reduces maintenance to periodic inspections and basic cleaning.

When maintenance is required, the clear and easy to read synoptic ensures operators can confidentially switch the devices.

Without Arc-Killer

With Arc-Killer

Significantly reduce downtime after an arc fault

Restore power quickly - DF-2 has a very low MTTR
2mm thick side walls ensures arc faults do not damage adjacent panels. Furthermore, the internal arcing fault is quenched within 48ms for the DF-2+ switchgear and 25ms for the DR-6+ RMU, protecting the assembly from significant arcing damage. Panels can therefore be restored to a serviceable condition, often in a matter of hours - not weeks.

Assemble or repair on site

Servicing is simple with cast resin transformers

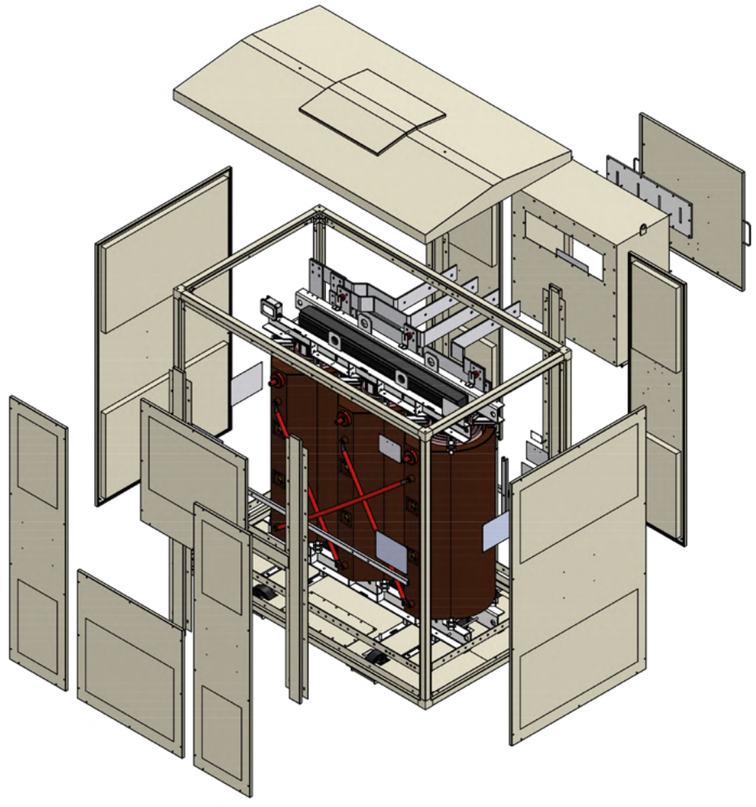
NHP's cast resin transformers can be assembled and repaired on site by our trained technicians, making them perfect for installation in skyscrapers or any multilevel building, because large transformers can be moved upstairs in parts by the lift, reducing the required number of transformers. No messy oil eliminates the chance of spillage during transport or maintenance.

Designed for retrofit with customised, compact designs

Smaller dimensions allow for easy retrofit of obsolete transformers reducing MTTR

NHP's cast resin transformers can be custom manufactured, including voltages, impedances, efficiency, vector group and tapping ratios, with options of HV plug-in bushings, top or bottom LV connections, physical proportions and more.

This allows a custom designed transformer's dimensions to be tailored to the available space, allowing ease of replacement for retrofit applications..



Presentation

Compliance

Compliance 'meeting and exceeding global standards' - MV switchgear, cast resin transformers and kiosks

Switchgear tested to the global standards

The DF-2 switchgear has been tested to and complies with the relevant local and global MV switchgear standards:

- AS 62271-1 HV switchgear and control gear – Common Specifications
- AS 62271-102 HV AC disconnectors and earthing switches
- AS 62271-100 HV AC circuit breakers
- AS 62271-200 MV metal-enclosed switchgear and control gear
- IEC 62271-103 switches for rated voltage from 1kV to 52kV
- IEC 62271-105 AC switchfuse combinations
- IEC 60529 degrees of protection provided by enclosures (IP code)

Beyond the standards (50 year design life for the MIEE)

The DF-2 switchgear's testing goes beyond the relevant standards, allowing NHP to claim a 50 year life span under normal service conditions as required by the MIEE Australian Defence specification.

To verify the 50 year service life, the DF-2 was subjected to and passed additional non-mandatory environmental IEC standards type tests to the highest criteria.

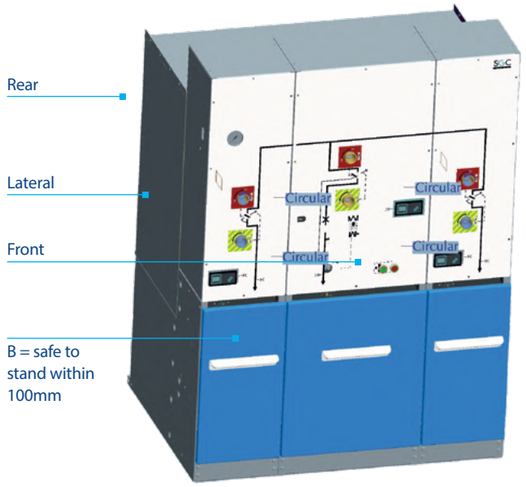
- IEC 60068-2-17 Gas Tightness test on DF2 load break switch, which verifies the ability of the load break switch not to leak gas (over 800 years service life in an ambient temperature of 80°C achieved)
- IEC 62271-304 Damp Heat Ageing test on DF2 parts, which verifies the corrosion resistance and the insulation integrity over time (design Class 2 achieved)
- IEC 60068-2-11 Salt Mist test on DF2 Driving Mechanisms parts, which verifies the corrosion resistance over time (<0.05% rusted area after 168 hour test achieved)
- IEC 60587 Tracking Current test on DF2 insulating parts which verifies the insulation integrity over time (Class 1A4,5 achieved).

Australian Government
Department of Defence

Switchgear with a B-FLR classification

Internal arc classification standards

The DF-2+ and the DR-6+ with Arc-Killer provides an internal arc classification of B-FLR 20kA,1s as per IEC62271-200, which ensures protection for the operator as well as general public from all four sides of the cubicle.



Arc-Killer provides a B-FLR classification

Transformers tested to the global standards

Relevant MV transformer standards

NHP cast resin and oil immersed transformers have been tested to and comply with the relevant local and global MV transformer standards:

- AS 60076-1 Power Transformers – Part 1: General
- AS 60076-2 Power Transformers – Part 2: Temperature rise
- AS 60076-3 Power Transformers – Part 3: Insulation, dielectric, external clearances
- AS 60076-5 Power Transformers – Part 5: Ability to withstand short circuit
- AS 60076-10 Power Transformers – Part 10: Determination of sound levels
- AS 60076.11 Power Transformers – Part 11: Dry type
- IEC 60076-16 Power Transformers - Part 16: Transformers for wind turbine applications
- AS 1767.1 Insulating Liquids – Specification for unused mineral insulating oils for transformers
- AS 2374.1.2 Power Transformers – Minimum Energy Performance Standard (MEPS)

Kiosks designed to meet the arc fault standards

NHP's DFX kiosk is designed to comply with IAC-AB internal arc classification and includes the Arc-Killer technology as standard.

Transformers tested for use in harsh environments

Class C2 and a combined Class E3 / E2 Certification

NHP's cast resin transformers have undergone arduous testing to achieve a Class C2 climatic certification and a combined Class E3 and Class E2 certification in accordance with IEC 60076-11/16.

Class E3 (Environmental class) – suitable for heavy pollution area with humidity above 95% and water conductivity of 3.6 4s/m (close to sea water conductivity). Class E2 includes a water penetration test which is run over 144 hours.

Class C2 (Climatic class) – suitable for operation, transport and storage with ambient temperatures down to -25°C.

Presentation

Customisation

Customised solutions from a trusted partner

Local solutions for local customers

NHP has been supplying customised SMART MV/LV substation solutions into the Australian and New Zealand markets since 2012.

NHP DFX prefabricated kiosk substations are engineered to suit customer specification and application requirements and can house a variety of HV and LV equipment.

2 MVA kiosk substation (Oil Tx and DF-2+ switchgear)

NHP can tailor your MV kiosk

Customised NHP DFX MV/LV kiosk solutions are available up to 2.5MVA at 11kV or 22kV.

Typical specification:

- MV modular AIS switchgear (DF2+) or RMU
- Cast resin or oil immersed transformer
- SMART Cubic LV switchboard with Terasaki circuit breakers and other LV equipment as required (UPS, HMI, Metering, etc)

22kV kiosk substation (Cast resin Tx and DR-6+ RMU)

1MVA kiosk substation (oil Tx and DF-2+ switchgear)

Industries already using NHP customised solutions when quality and safety count!

Defence · Airports · Hotels · Utilities · Water · Processing · Tunnels

Mining · Rail · Educational centres · Commercial buildings · Hospitals and health centres · Intensive farming · Data centres

Outdoor enclosed switchgear solutions

The DF-2 switchgear can be provided pre-installed into an outdoor rated enclosure, providing a more economical solution when compared to a full switchroom or substation building.

Outdoor enclosed 24kV DF-2 switchgear

Outdoor enclosed DF-2+ switchgear with Arc-Killer

Outdoor and indoor enclosed transformer solutions

Cast resin and oil immersed transformers can be provided pre-installed into an outdoor rated or indoor rated enclosure.

Outdoor enclosed oil transformer

Outdoor enclosed cast resin transformer

DF-2/DF-2+

MEDIUM VOLTAGE SWITCHGEAR

DF-2 is a modular concept combining all medium voltage functions

- Air insulated switchgear (AIS)
- Applicable service voltage is 3.3-24kV
- Maximum current is 1250A
- Ideal for Defence applications requiring MIEE compliance

MV switchgear

Modular design

2-position load break switch

Arc-killer option

DF-2 and DF-2+ AIS with visual earthing

The DF-2's modular design allows you to create simple and custom-made combinations of medium-voltage cubicles with a rated voltage of up to 24kV. DF-2+ is a special DF-2 model that features Arc-Killer technology.

Key characteristics:

- Air insulated switchgear - cubicles with galvanised steel sheets 2mm and between the compartments 4 mm
- Built to withstand extreme weather conditions
- Suits both primary and secondary switchgear applications
- Maximum service voltage is 24kV with a maximum current of 1250A
- Rated short time current of 25kA for 3 seconds
- Demountable VCB design for fast replacement
- 50 year design life meeting the Australian Defence specification MIEE
- Switching in SF_6 for load break switch or vacuum for the vacuum circuit breaker
- DF-2+ internal arc classification is B-FLR 20kA,1s for ultimate safety
- GE Agile or SEL protection relays.

Applications:

- Suitable for most industrial and commercial installations.
- Distribution switchgear within electrical substations, wind generation, cogeneration and much more
- Replace obsolete installations and expand existing installations.

Applicable standards:

- AS 62271-1
- AS 62271-100
- AS 62271-102
- AS 62271-200
- IEC 62271-103
- IEC 62271-105
- IEC 60529

Technical specification

Air insulated switchgear with visual earthing (model DF-2)

Rated voltage	kV	12	12	17.5	17.5 (SF_6 free switchgear)	24	24
Applicable circuit breaker device type(s)		Magnetic vacuum type CB: model ISM LD (2)	Magnetic vacuum type CB: model ISM HD (3)	Mechanical vacuum type CB: model VA2/VAS2 (1)	Mechanical vacuum type CB: model VA2/VAS2 (1)	Mechanical vacuum type CB: model VA2/VAS2 (1)	Magnetic vacuum type CB: model ISM LD (2)
General specifications							
Impulse withstand voltage 1,2 / 50 µs							
To earth and between phases	kV	75	75	95	95	125	125
Over the insulation distance	kV	85	85	110	110	145	145
Power frequency voltage test 1min.							
To earth and between phases	kV	28	28	38	38	50	50
Over the insulation distance	kV	32	32	45	45	60	60
Rated frequency	Hz	50/60					
Rated current	A	630/800	800/1250*	800/1250*	800/1250*	630/800	630/800
Rated short time current 3s	kA	16/20***	25	25	25	20	16/20
Rated peak value of the current	kA	50	63	63	63	50	40
Internal arc current for 1 s. IEC 62271-200 (5 criteria)							
DF-2 internal arc classification (A-FL) / (A-FLR)	kA	16	16	16	16	16	16
DF-2+ internal arc classification (B-FLR)	kA	20/-***	N/A	20	20	20	N/A
Degree of protection		IP4X	IP4X	IP4X	IP4X	IP4X	IP4X
LBS/ESW mechanical durability (close/open)		1000	1000	1000	1000	1000	1000
VCB short circuit breaking current	kA	16/20***	25	25	25	20	16/20
VCB electrical C/O operations		50000	30000	10000/5000	10000/5000	10000/5000	30000
VCB operating cycles at rated short circuit breaking current		100	50	75	75	75	50
Maximum cable terminations	mm^2	400/630**	400/630**	400/630**	400/630**	400/630**	400/630**
Standards		IEC 62271-100, IEC 62271-1, 62271-102, -103, -105, 62271-200 and IEC 61243-5		IEC 62271-100, IEC 62271-1, 62271-102, -103, -105, 62271-200 and IEC 61243-5			
Certificates		KEMA/IPH		KEMA/IPH			
Breaking capacity of load break switch (RV-44)							
Breaking capacity (IEC 62271-103)		Class E3*	Class E3*	Class E3*	Off-load Isolator****	Class E3*	Class E3*
Mainly active load	A	800/1250*	800/1250*	800/1250*	N/A	630/800	630/800
Closed loop current (Iloop)	A	800	800	800	N/A	630/800	630/800
Cable charging current (Icc)	A	18	18	18	N/A	18	18
Short-circuit making current (Ima)	kA	63	63	63	N/A	50	50
Earth fault current (Ief1)	A	100	100	100	N/A	100	100
Earth fault cable charging	A	30	30	30	N/A	30	30
Rapid earth fault current limiter (REFCL) compliance ratings							
Continuous withstand power frequency voltage phase-to-earth	kV	N/A	N/A	N/A	N/A	24.13	24.13
Power frequency withstand voltage (1 minute)	kV	N/A	N/A	N/A	N/A	50	50
BIL level	kV	N/A	N/A	N/A	N/A	125	125

Notes:
* According to IEC 62271-103, Class E1
**A standard connection is possible up to 400mm^2 for a single core cable per phase. Upon request, single core cables up to 630mm^2 or 2 parallel cables up to 630mm^2 per phase can be connected to the DF-2 switchgear with the use of a special adapter.
***Rated fault current

1) Mechanical VCB is self-powered. When used in a MV panel that has no auxiliary power available, a self-powered protection relay like the GE P15D must be used with the mechanical VCB.
2) LD = low duty
3) HD = heavy duty

Notes:
* According to IEC 62271-103, Class E1
**A standard connection is possible up to 400mm^2 for a single core cable per phase. Upon request, single core cables up to 630mm^2 or 2 parallel cables up to 630mm^2 per phase can be connected to the DF-2 switchgear with the use of a special adapter.
***Rated fault current
**** SF_6-free DF2 switchgear

1) Mechanical VCB is self-powered. When used in a MV panel that has no auxiliary power available, a self-powered protection relay like the GE P15D must be used with the mechanical VCB.
2) LD = low duty
3) HD = heavy duty

DF-2 series MV switchgear

Air insulated switchgear with visual earthing (model DF-2 and DF-2+)

The DF-2 series of MV switchgear is manufactured in Belgium by SwitchGear Company (or SGC) and distributed within Australia and New Zealand by NHP.

DF-2 has a modular design allows simple and custom-made combinations of medium-voltage cubicles to be created that are suitable for primary and secondary MV applications. The DF-2+ is a special DF-2 model that features Arc-Killer technology.

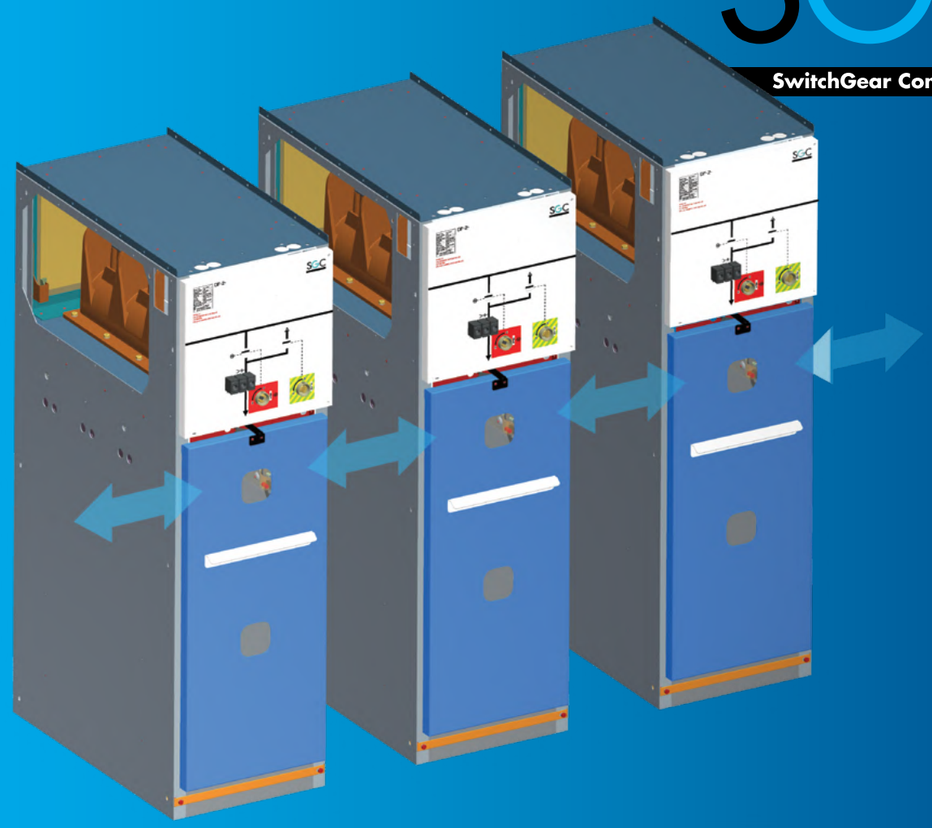
As a result, the modular DF-2 concept meets the highest technical standards and provides manufacturing efficiencies.

The combination of cubicles is unlimited. Very complex diagrams of distribution and transformer switchgear can be compiled through this extensive spectrum of possibilities.

Cubicles also contain all functional interlocks, which allows for effortless application according to all current standards and allowing installation in consumer workspaces.

Additionally, the cubicles have been fitted with a system for pressure release, which shields the user from the consequences of an internal arc.

SGC
SwitchGear Company



DF-2 functional unit part number description

The DF-2/DF-2+ specification part numbers consist of **4** elements that indicate all the key parameters.

DF-	A	-	+
DF-2 = AIS switchgear panel	Panel function	Special design characteristic (left blank for standard panels)	+ = with Arc-Killer - = without Arc-Killer

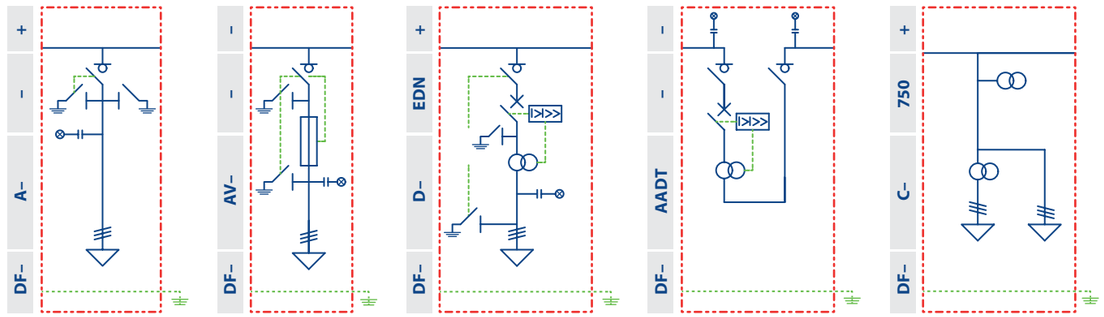
Panel functions

A	Switching cubicle with 1 x load break switch and earthing switch
P –	Transformer protection cubicle with 1 x load break switch/ fuse combination
AV	Bus voltage transformer or auxiliary MV/LV transformer cubicle with 1 x load break switch/fuse combination
D	Protection cubicle with 1 x mechanical vacuum circuit breaker with protection relay
DT	Protection cubicle with 1 x magnetically actuated vacuum circuit breaker with protection relay
AAD	Protection cubicle with 2 x load break switches and 1 x mechanical vacuum circuit breaker with protection relay
AADT	Protection cubicle with 2 x load break switches and 1 x magnetically actuated vacuum circuit breaker with protection relay
LK	Busbar coupling cubicle with double interruption 2 x load break switches
LKB	Busbar coupling cubicle with 1 x load break switch
C	Current and/or voltage metering cubicle with no switching devices
K	Incoming cable-connection cubicle with optional earthing switch
BESW	A panel that contains an earth switch that is mounted on top of the main panel to earth the main bus during maintenance

Special design characteristics

EDN	Indicates that the panel cover is designed for easy opening and includes a hinged door and a lockable handle
EDNTM	Indicates a top mount LV compartment having a door is for easy opening using hinged and a lockable handle
750	Used with the 'C' metering cubicle and indicates a panel width of 750mm
HM	A panel that is designed to be orientated horizontally and is installed on top of the other DF-2 panels for space saving

DF-2 panel examples



DF-2 series MV switchgear

Internal arc resistance

The DF-2 is designed to resist internal arcs, protecting both the operator and the installation. Through a strategic pressure release system, the internal arc is restricted to the compartment where it originated and it does not propagate towards the operator or to other compartments. The side walls are made using 2mm thick sheet metal, further stopping the damage between panels.

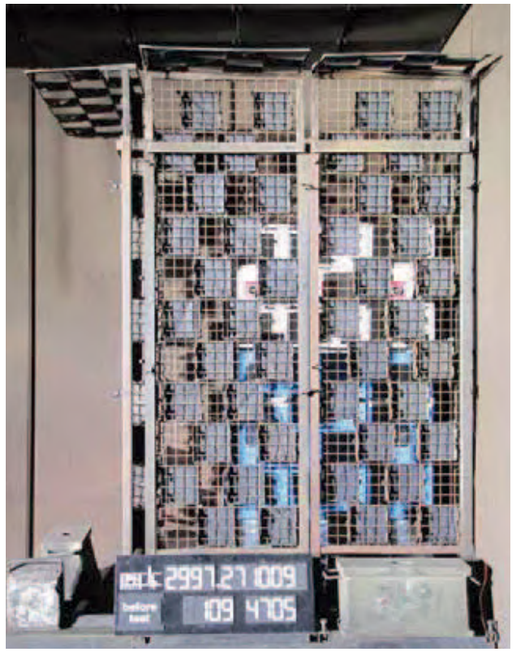
The anti-arc kit of DF-2 cubicles consists of four relief valves that are specifically designed to minimise the consequences of an internal arc in the busbar and cable compartments.

By default, all provided cubicles are fitted on the rear side with overpressure valves pointing downward.

For rear venting, reinforced side plates can be used to create a closed expansion space. Options are available for venting into cable trenches.

DF-2 cubicles have been Kema tested and are certified with an A-FL internal arc classification for 16kA/1s. at a rated voltage of 17.5 kV/24 kV according to IEC 62271- 200, Appendix A and met the 5 criteria.

Consequently, all DF-2 cubicles are internal arc resistant.



Before test
(IAC 20kA/1 sec. (17,5kV))

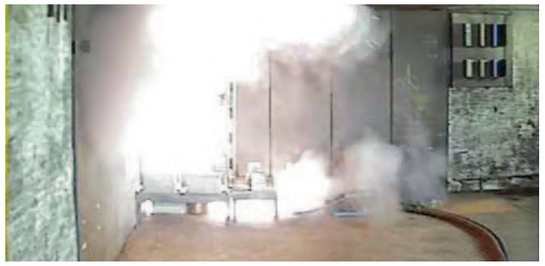
After test
(IAC 20kA/1 sec. (17,5kV))

DF-2+ with Arc-Killer series MV switchgear

AIS with visual earthing (model DF-2+)

SV-25
Arc-Killer

The DF-2+ is a special version of the standard DF-2 cubicle, which has a built-in arc extinguishment system called the SV-25 Arc-Killer. The Arc-Killer can clear an arc fault in less than 50 ms, therefore protecting the cubicles, surrounding infrastructure and especially people against the negative consequences of an internal arc.

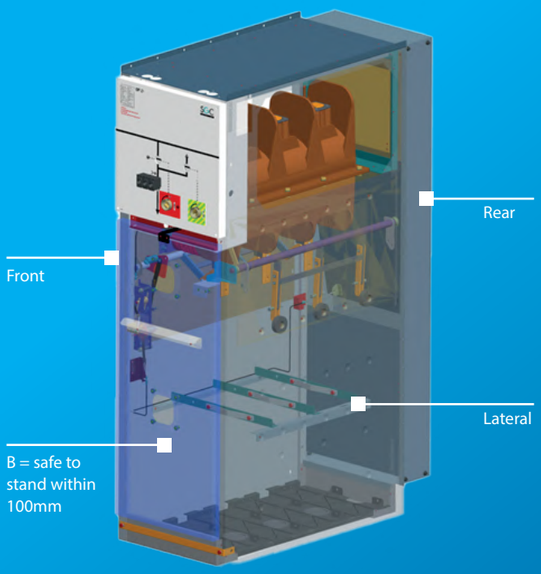


Without Arc-Killer

With Arc-Killer

In the case of an internal arc, the expansion of hot gasses in a room can be reduced to an absolute minimum. This upgrades the internal arc classification (IAC) to category B, FLR 20kA 1 s. (F = frontal, L = lateral, R = rear).

As a result, the operator is protected against the negative consequences of an arc, whether they stand in front of the switchboard, next to it or behind it.



DF-2+ with Arc-Killer provides a B-FLR classification

DF-2+ with Arc-Killer saves space

Optimise installation

Remove the need for expensive, space consuming arc gas ducting

When the DF-2+/DR-6+ (Arc-Killer) switchgear is used in an NHP kiosk, there is no need to design and install chimney systems to expel dangerous arc fault gases externally to the kiosk. This improves the safety for electrical operators who may be working inside or outside the kiosk.

The need for gas chimneys is eliminated with DF2+, saving cost, space and simplifying installation

Configure the switchgear to fit into smaller spaces

To allow a complete MV switchboard to fit into a smaller switchroom, it is possible to configure the DF-2 panels to use the typically empty vertical space above the panels. Here are examples where the total width of the MV switchboard was significantly reduced by configuring functional panels to mount horizontally or to fit devices such as protection relays into separate top mount panels.

The example to the left shows a DF-D-EDN panel with a hinged door front mounted protection relay compartment. Above it is a horizontally mounted DF-LKB bus tie panel.

The example above shows a DF-DT-EDN panel with an additional top mounted protection relay compartment with a hinged door.

DF-2 installation guidelines to meet IEC recommendations

Room height

An unobstructed height of at least 2300 mm is required.

Access door dimensions

The minimal door height of the room should be 2000 mm for standard panels and 2300mm for top mount panels. The width should be widest cubicle + 100 mm for a standard passageway.

Minimum free passage for the cubicles

To comply with AS 2067 requirements, the minimum free passage in front of the cubicles shall be as follows:

- 700 mm for cubicles without hinged door and without de-mountable VCB (e.g. DF-A, DF-P)
- 1400mm for cubicles with hinged door but without demountable VCB (e.g. DF-DT/EDN)
- 1700mm for cubicles with demountable VCB (e.g. DF-D, DF-AAD)

However, a passage of 2500 mm is preferable because of the internal arc resistance. The cubicles need to be positioned at a distance of 150 mm from the back wall because of the internal arc resistance.

Room ventilation

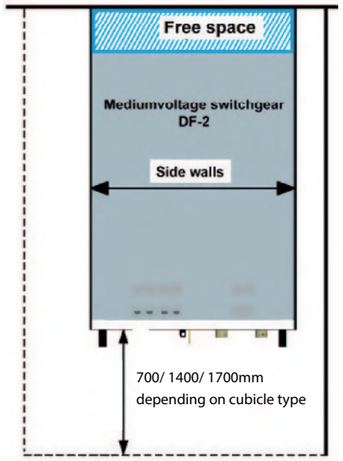
Please ventilate the room sufficiently and keep the average room temperature to 25°C or less.

General remarks

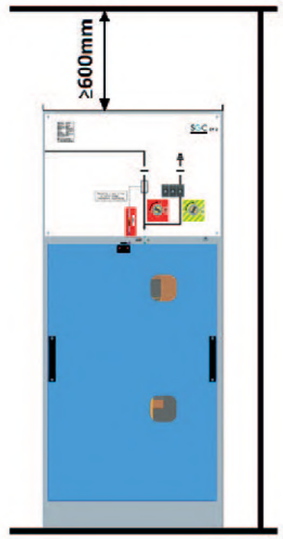
The DF-2 cubicles are designed for indoor use and the room should have a normal ambient temperature (a maximum of 45°C) and a normal humidity level. The cubicles are suited for placement at elevated levels < 1000 m. Derating will apply for higher temperatures.

Internal arc resistance

To mitigate the effects from an internal arc, side plates need to be installed, which creates a closed off free space. Consequently, a possible internal arc will trigger the overpressure system of the rear plates and vent into the closed off free space.

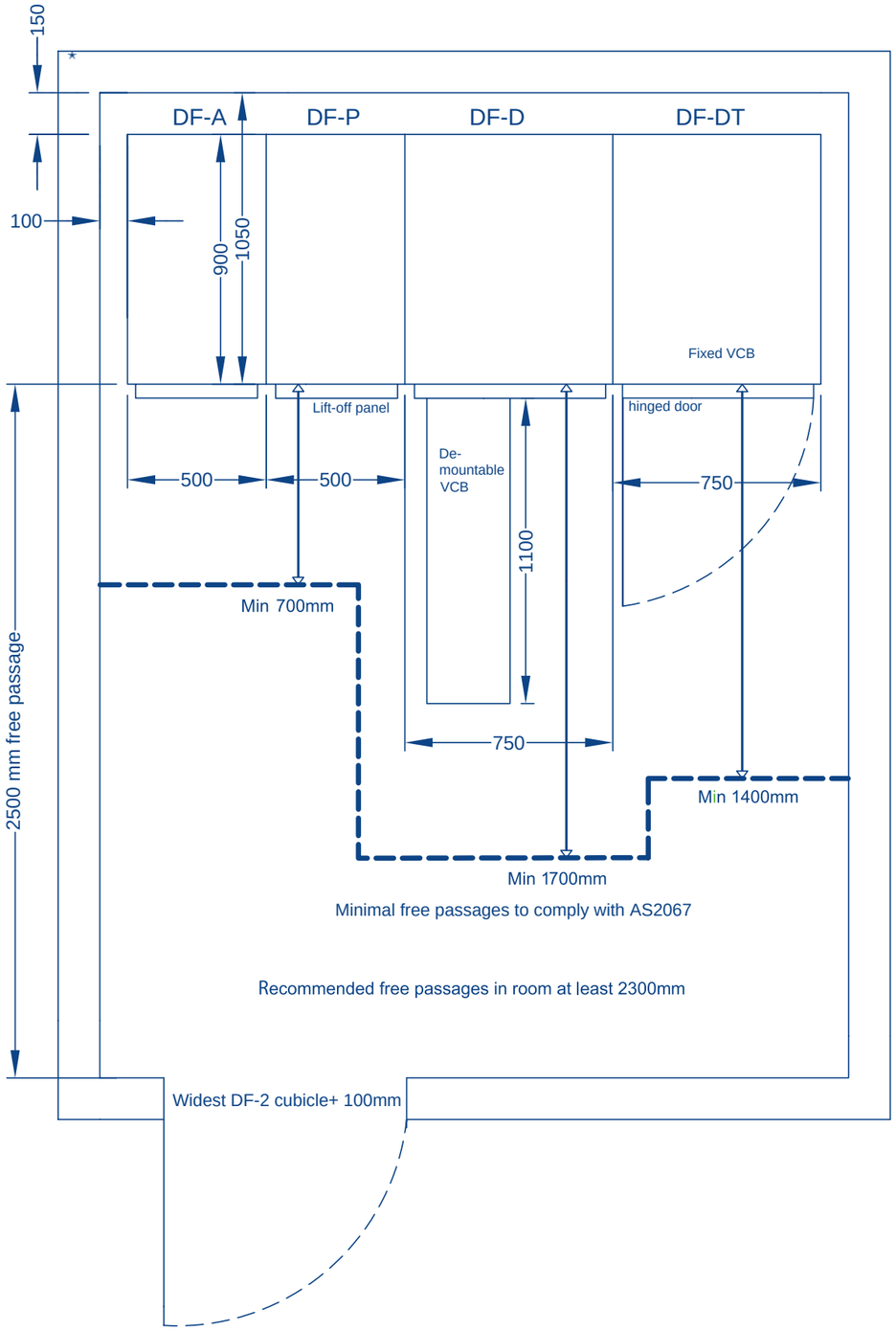


Side plates must be installed running to the wall to create an enclosed free space



Minimal free height

Example of MV room layout



DF-2 series MV switchgear

Typical panel layout with vacuum circuit breaker

Local remote operation selector switch and protection relay trip indicator, local electrical control and position indication lights for switching devices

Short circuit indicators can be fitted

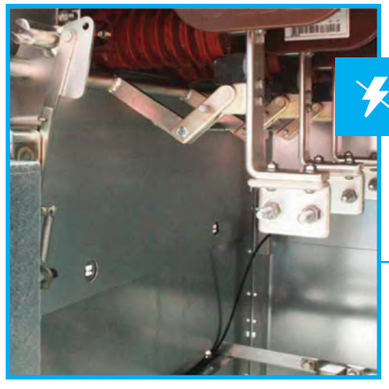
Clear status indicators for LBS and ES

Cable side live line capacitive light indicator options

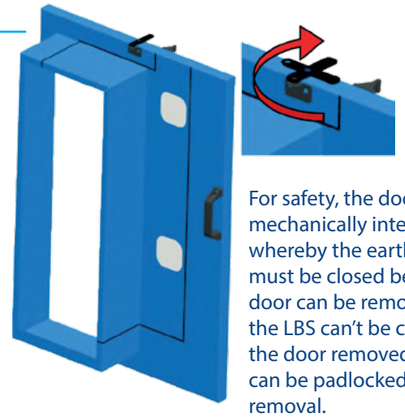
Fuses can also be used for protection instead of the VCB

GE and SEL Agile protection relay

RV-44 load break switch (LBS) and earth switch, which can both be padlocked in the open or closed position



Internal Arc-Killer mechanism on the DF2+



For safety, the door is mechanically interlocked whereby the earth switch must be closed before the door can be removed and the LBS can't be closed with the door removed. The door can be padlocked to stop removal.

VCB manual spring charging handle

VCB open and close buttons

VCB contacts status indicator

VCB spring charge indicator

Demountable VCB (VAS2 model shown, ISM type also available)

Inspection windows for earth switch contacts position

2mm thick steel walls ensuring internal arc fault containment within the compartment where it has originated

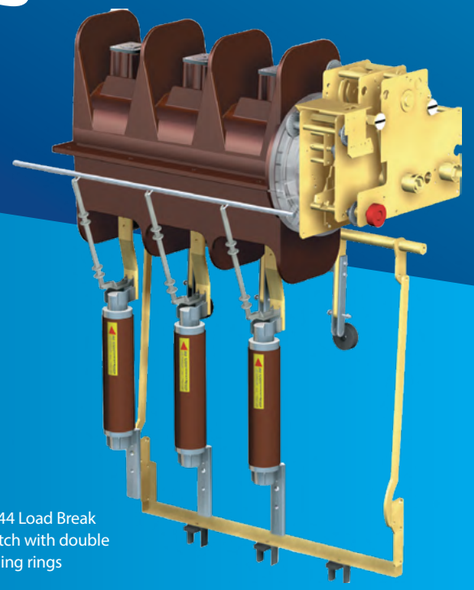
DF-2 series MV switchgear - core components

Vacuum circuit breakers, load break switches and earth switches

RV-44 load break switch

The RV-44 load break switch (LBS) is a two-position switch that has exceptional isolating and arc extinguishing capabilities. It has options for manual or motor operation and is used as the first point of isolation in the DF-2 panel.

All non-ferrous components of the switch are free of halogen, resistant to UV and ozone and is reinforced with fibreglass. The RV-44 LBS contains SF_6 gas and its special double sealing ring design ensures it is 'sealed for life', having a 700 year design life at a 40°C ambient temperature. The RV-44 can be motorised.

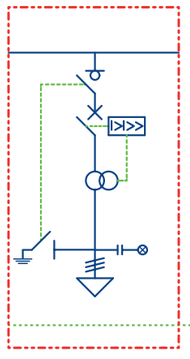


RV-44 Load Break Switch with double sealing rings

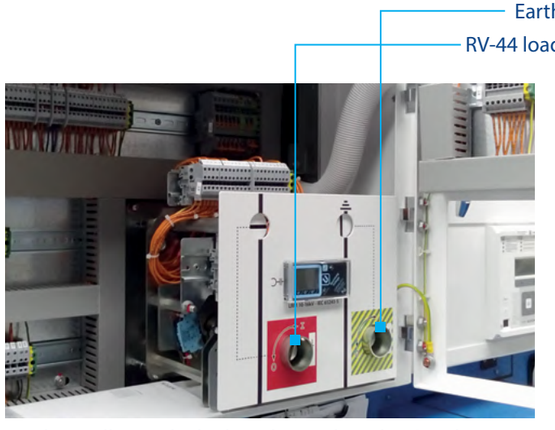
Earth switch

The DF-2 panels also contain a separate earth switch which - like the RV-44 - can also be motorised. The incoming RV-44 LBS and the earth switch are mechanically interlocked and mounted on a single metal plate (see diagram to the right). The earth switch is truly visible, allowing easy inspection of the contacts position.

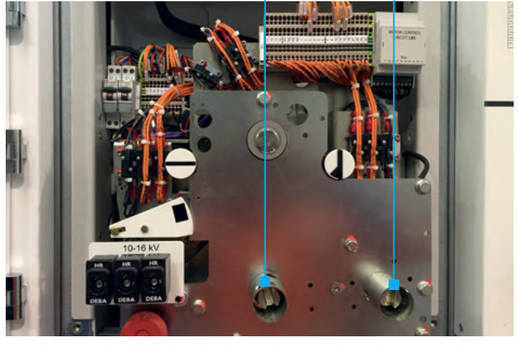
Therefore, the incoming LBS and earth switch are considered one functional mechanically interlocked device and is therefore labelled as a single device on mechanical drawings.



*A zero SF_6 gas RV-44 disconnector version is available for 11kV applications as an option



Mechanically interlocked earth switch and LBS with panel cover



Mechanically interlocked earth switch and LBS without panel cover

VA-2 and VAS-2 vacuum circuit breaker

the VA-2/VAS-2 series of vacuum circuit breakers are an extremely reliable, mechanically spring actuated general purpose device, suitable for most MV applications. The VA-2 is rated for 10,000 operations, while the VAS-2 is rated for 5,000 operations.

VA-2/VAS-2 VCBs can be manually switched (open / close cycle) by charging the operating springs using a charging handle or automatically via an optional electric motor. Remote open / close operation requires the inclusion of a charging motor, a closing coil and a shunt coil.

VAS-2 charging handle

VA-2 mechanical VCB

IKI-20 short circuit / earth fault indicator

The IKI-20 is used for the detection, indication and remote monitoring of short-circuits in high voltage networks.

Additionally, it indicates earth-faults* in networks with solidly, low resistive or shortly low resistive earthed termination.

* Please contact NHP regarding limitations for earth fault detection.

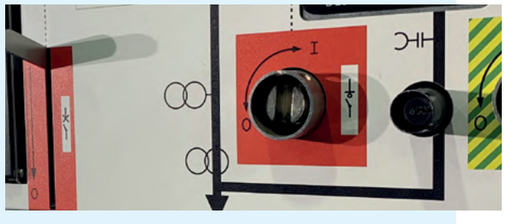
ISM magnetic vacuum circuit breaker

the ISM magnetically actuated vacuum circuit breaker is ideal for frequent switching applications providing either 30,000 or 50,000 electrical close-open operations depending on the current and fault ratings. It is not designed for self-powered applications, as it requires auxiliary supply for its normal operation. A manual generator accessory can be used for the first closing operation when the site auxiliary supply system has not yet been energised.

The ISM VCB can only be closed electrically - mechanical closing is not possible. Opening can be achieved t or mechanically via the manual trip lever.

The circuit breaker operates via the control module, which provides a controlled amount of energy to the VCB coils and a dry-type contact interface for the Trip/Close commands as well as extensive self-monitoring functions..

ISM VCB with control module and manual generator



DF-2 panel with ISM VCB showing manual VCB opening leaver

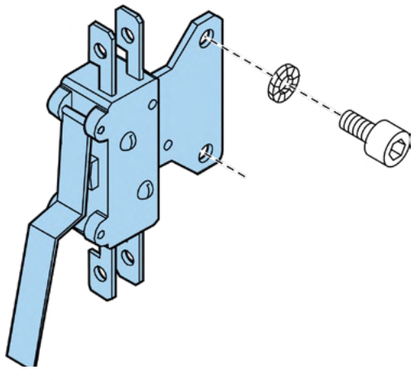
DF-2 options and accessories - range

Indication devices

A number of factory fit accessories are available.
Electrically operated accessory voltage ranges available are: VDC: 24, 48, 110 or VAC: 110, 220 (accessories are not multi voltage)

Auxiliary contacts options for remote indication

- 1x N(O/C) OR 2x N(O/C) on the switchgear door
- 2x N(O/C) on RV-44 load break switch
- 2x N(O/C) OR 4x N(O/C) on earth switch
- 1x N(O/C) ready to close indicator on ISM VCB
- 1x N(O/C) on ISM VCB control module in fault
- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 x N(O/C) block Aux. on VA-2/ VAS-2 VCB
- 1, 2, 3 x N(O/C) ready to close indicator on VCB VA-2 / VAS-2
- 1x N(O/C) on the Arc-Killer mechanism for VA-2 VCB



Auxiliary switch

N(O/C) = Normally open (N/O) and normally closed (N/C)

Maintenance indicator

- An operation cycle counter can be fitted to the VCB (not the LBS)

Lamp indications and resets

- Open/closed indication lamp (LBS and / or earth switch)
- Open/closed indication lamp (VCB)
- Closing spring on VCB is charged/armed lamp
- VCB protection relay trip status active lamp
- VCB protection relay trip status active remote reset
- Trip circuit healthy indication lamp
- Heating turned ON indication lamp

Voltage indicator options and lamp indicators

- HR2 plug in cable side live line capacitive light indicator

HR2 indicator

- CAPDIS S1+ integrated capacitive voltage detecting system

CAPDIS S1+

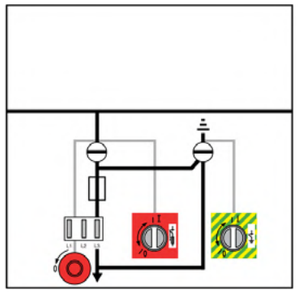
- CAPDIS S2+ integrated capacitive voltage detecting system + relay O/P

CAPDIS S2+

Opening / closing and motorisation

Manual operation Open / Closing using RV-44 LBS and ESW

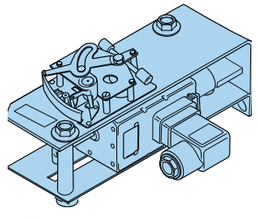
- For all panels (except DF-P), manual opening and closing is achieved using the loose mechanical handle.
- The DF-P LBS closing is achieved using the loose mechanical handle, however the DF-P has a switchgear panel door mounted red push button to trip open the LBS.



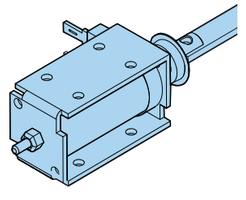
DF-P manual trip push button

Remote operation coils / under voltage trip coils (UVTs)

- Remote opening trip coil for DF-P (RV-44 LBS)
  * For DF-P auxiliary, contact on LBS is required
- Remote opening trip coil for VA-2/VAS-2 VCB
- ISM remote open / close achieved via electronic controller
- Low energy opening trip coil VA-2/VAS-2 VCB**
- Closing coil for the VA-2/VAS-2 VCB
- Mechanical type (delayed or instant operation) UVT coil for the VA-2/VAS-2 VCB or RV-44 in the transformer protection panel DF-P
- Under voltage relay for the ISM
- Electronic type UVT coil for the VA-2/VAS-2***



UVT coil

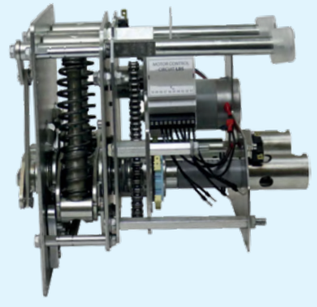


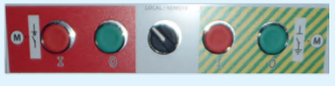
Shunt coil

*DF-P remote coil opening time is less than 100ms
**24VDC rating available only
***220VAC rating available only

Motorisation (RV-44 LBS, earth switch)

- Motor operation including local/remote switch and push buttons
  - 2 pole local / remote selector switch
  - 2 pole key operated local / remote selector switch
  - 2 pole padlockable local / remote selector switch
  - 3 pole local / off/ remote selector switch
- Motorisation allows for remote closing on all panels
- Closing time is 15 seconds (including spring charging time)
- Opening time is 15 seconds for the DF-A.
- LBS and earth switch can still be operated manually
- VA-2/VAS-2 can be motorised for the spring charging function only





LBS and ESW motorisation mechanism

ISM control module manual generator

- Hand held power supply for the ISM closing in the case of auxiliary power loss

Accessories

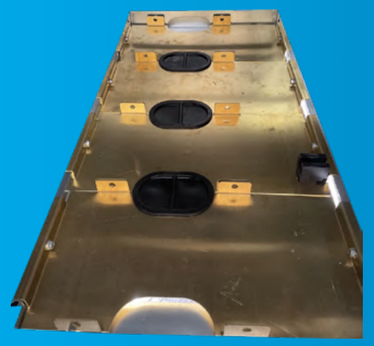
Key interlocking

- Both the RV-44 LBS and the earth switch can have a Ronis type key interlocking system fitted (open or closed position options available)
- Ronis type key interlock systems can be fitted to the VA-2/VAS-2 VCBs
- On request, Ronis key interlock an be substituted for Forterss MBM (Mini Bolt Module) type key interlock

Ronis key interlock fitted to LBS/ESW panel

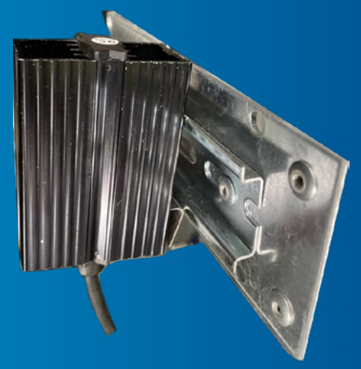
Gland plates

- Brass gland plates can be requested to replace the PVC gland plates



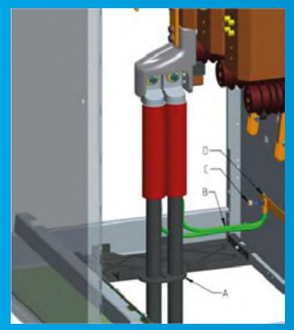
Anti-condensation heater

- Heater + thermostat, 30W/250VAC, thermostat 0-60°C



Cable connections

- Single core 630mm² cable termination
- Parallel, 2 x single core 630mm² cable termination



2 x 630mm² cable termination

Electrical interlock

- Electrical interlock between ISM VCB and RV-44 LBS.
- Electrical interlock between ESW and RV-44 LBS.

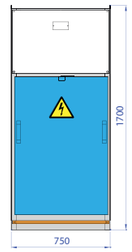
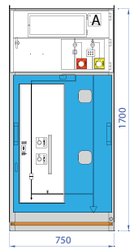
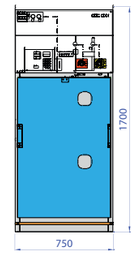
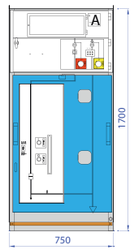
Current transformers (CTs) and voltage transformers (VTs)

Three types of CTs can be used with the DF2 VCB panels.

1) Block type
2) Toroidal type
3) Integrated type (only available with the VAS2 VCB)

*MTO = manufactured to order, typically 50/1,100/1,150/1, 400/1, 600/1, 800/1

Number of cores per CT will vary depending on the application

Technical specification		Block type								Toroidal type				Integrated type	
Current transformer data															
															
Core quantity		1 core CT		Up to 3 cores in one block type CT						Up to 2 cores in one CT				1 core CT	
Application		Revenue metering		Power metering		Protection				Power metering		Protection OC/EF		Protection OC/EF	
						OC/EF		Differential							
Accuracy class		0.2(S) and 0.5(S)		1		5P		PX		1M		5P		10P	
Buden (VA)		10-15		2.5		10-15 or 25		N/A		2.5		2.5		2.5	
*Ratio	Accuracy limit factor	MTO	N/A	MTO	N/A	MTO	20 or 25	MTO	N/A	MTO	N/A	MTO	20	50/1A	4
														150/1A	10
														200/1A	15
														400/1A	25
														600/1A	35
Voltage transformer data – block type design															
Application		Revenue metering						Protection							
Accuracy class		0.5						3P							
Buden (VA)		25													
Possible CT and VT configurations that will physically fit inside an MV panel															
Typical MV panels that house CT/VTs															
		DF-C750		DF-D						DF-DT				DF-D	
Typical number of possible sets of CTs and VTs per panel		1 set of NATA tested CTs and VTs		DF-D panel	Block CT sets	Toroid CT sets	Block VT sets			DF-DT panel	Block CT sets	Toroid CT sets	Block VT sets	1 set of small block VTs and CTs	
				Config 1	0	1	0			Config 1	1	0	0		
				Config 2	1	0	0			Config 2	1	0	1		
										Config 3	0	1	0		
										Config 4	0	1	1		
				Below is maximum combination of sets											
				Config 3	1	1	0			Config 5	1	1	2		
				Config 4	0	1	1			Config 6	2	1	1		

Surge arresters

Surge arresters can be added to the panel to limit the effect of over voltages

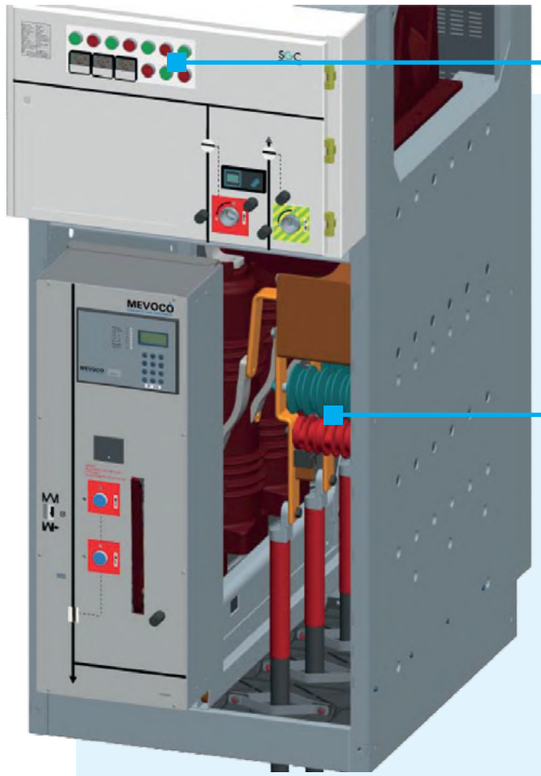
Overview

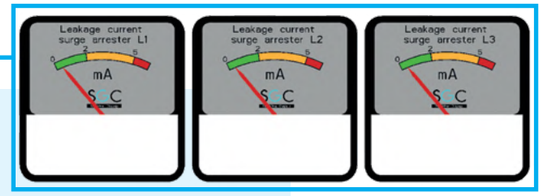
Surge arresters can be installed into the DF-2 panel in order to prevent potential flashovers in the event of a system overvoltage that exceeds the BIL rating of the MV installation.

Depending on the design of the reticulation network, installations that include diesel generators or back up system like DRUPS maybe lead to potential situations resulting in system over voltages. Specifically in these situations, NHP recommends the use of surge arresters.

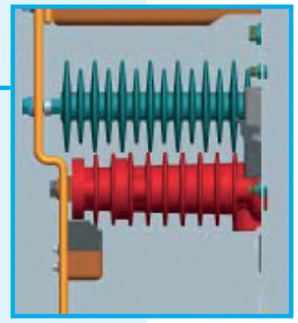
The surge arrester and the surge arrester monitor are both integrated in the corresponding cubicle. The surge arrester is mounted in the cable compartment, while the surge arrester monitor is integrated in the low voltage compartment of the cubicle.

The surge arrester and the surge arrester monitor are both integrated into the MV panel.





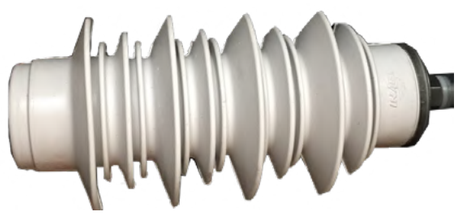
Surge arrester monitors indicate the level of condition



Surge arrester mounted inside the DF2 panel

Surge arresters

- 3 x surge arresters for MV panel on the cable side
- 3 x meter display surge arrestor monitor in LV compartment
- 1x N(O/C) OR 2 x N(O/C) on surge arrestor monitor



FTX temperature monitoring device for MV switchboards

Overview

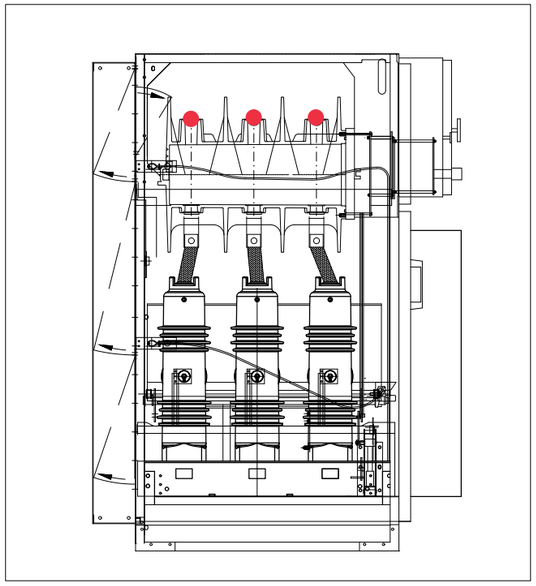
NHP's FTX medium voltage fiber optic temperature sensors install on switchgear contacts, busbars, cast resin transformers, motors and generator windings to provide reliable 24/7 thermal monitoring with noise-free performance.

The probes are constructed from durable, high dielectric strength materials and have been tested to safely operate on equipment rated up to 38kV (3 phase). They install quickly and can be ordered with optional probe-tip attachments which are suitable for various applications.

FTX-602-PWR+

Product specifications

Model name	FTX-602-PWR+
Number of channels	6
Analogue output	None
Measurement range	-40°C to +200°C
Resolution	0.1°C
System accuracy	±1.0°C
Update rate	30 Hz
Communication protocol	Modbus RTU, half duplex
Communication interface	Isolated RS-485 RTU
Status indication	3 color flashing and solid LEDs
Operating humidity	0 to 95% RH (non-condensing)
Operating environment	-40°C to +65°C
Power	12-24 VDC (2.5W max)
Dimensions	114mm Tall x 22.5mm Wide x 102mm Long
Mounting	35mm DIN rail
Configuration software	OSENSAView or OSENSAView Pro
Product compliance	CE c UL us



Substation automation

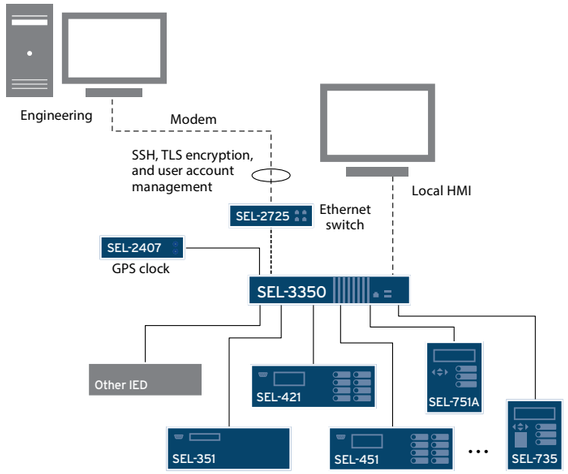
SEL-3350 real time automation controller

The SEL-3350 real time automation controller (RTAC) is a powerful multipurpose substation automation controller / communication device.

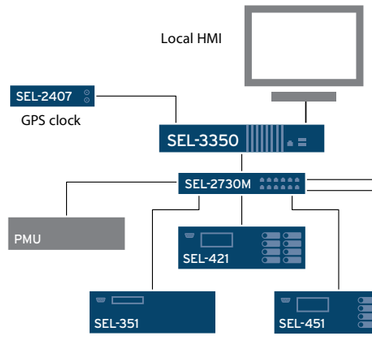
It can be used to fulfill many different tasks, such as data concentration, protocol conversion, data telemetry and device control – typically vacuum circuit breakers.

NHP use the SEL-3350 RTAC for applications that require a SMART MV switchboard or SMART MV kiosk substation solution. Furthermore, the SEL-3350 can natively communicate on a Ethernet/IP network, making it ideal for use in industrial sites that run networks containing Rockwell Automation devices.

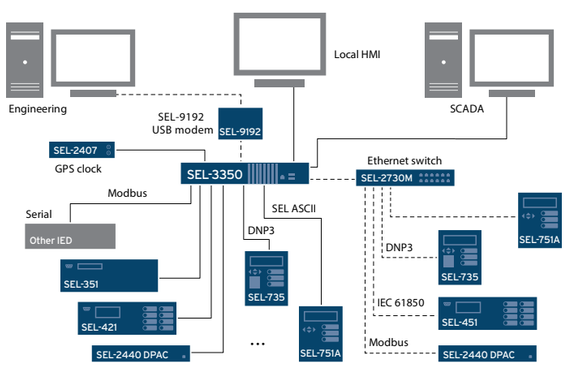
Typical application	Description
SCADA data concentrator	Monitors digital and analogue inputs to transmit to a central location with standard SCADA protocols.
Intelligent port switch	Connects a single serial port to multiple serial ports.
Network gateway	Port server network gateway connects a single network port to multiple serial ports.
Protocol gateway	Connects multiple systems that use different protocols.
Time-synchronization source	Selects the best time from different sources and provides either or both IRIG-B and Network Time Protocol outputs to connected devices.
Synchrophasor processor	Connects phasor measurement unit data to other devices and processes through protocol conversion.
Security gateway	Provides firewall protection to incoming Ethernet communication as well as encryption for individual Ethernet sessions.
Logic processor (automation)	Monitors digital and analogue inputs to transmit to a central location plus performs IEC 61131-3 logic.
Local or remote HMI	Provides visualisation and control via on-board video output ports and through remote web browser access.



Above: typical topology for a protocol converter or SCADA data concentrator



Above: typical topology for a time-synchronisation source



Above: typical topology for a synchrophasor processor

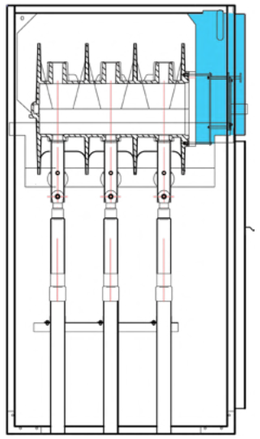
VCB lifting truck

VAS-2 SafeLift

The VAS-2 Safelift is a purpose built material handling trolley used to safely remove and transport the VA-2 / VAS-2 vacuum circuit breakers from the DF-2 switchgear panels. Both fixed height and adjustable height versions are available. The adjustable height version allows the VA-2 /VAS-2 VCB to be easily set to ground level and safely removed.

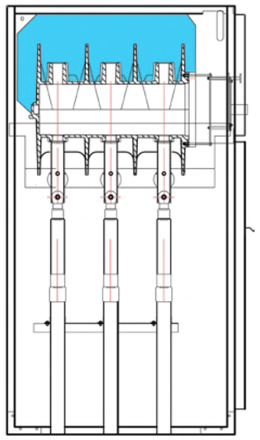
DF-2 series MV switchgear panel mechanical structure

Compartments



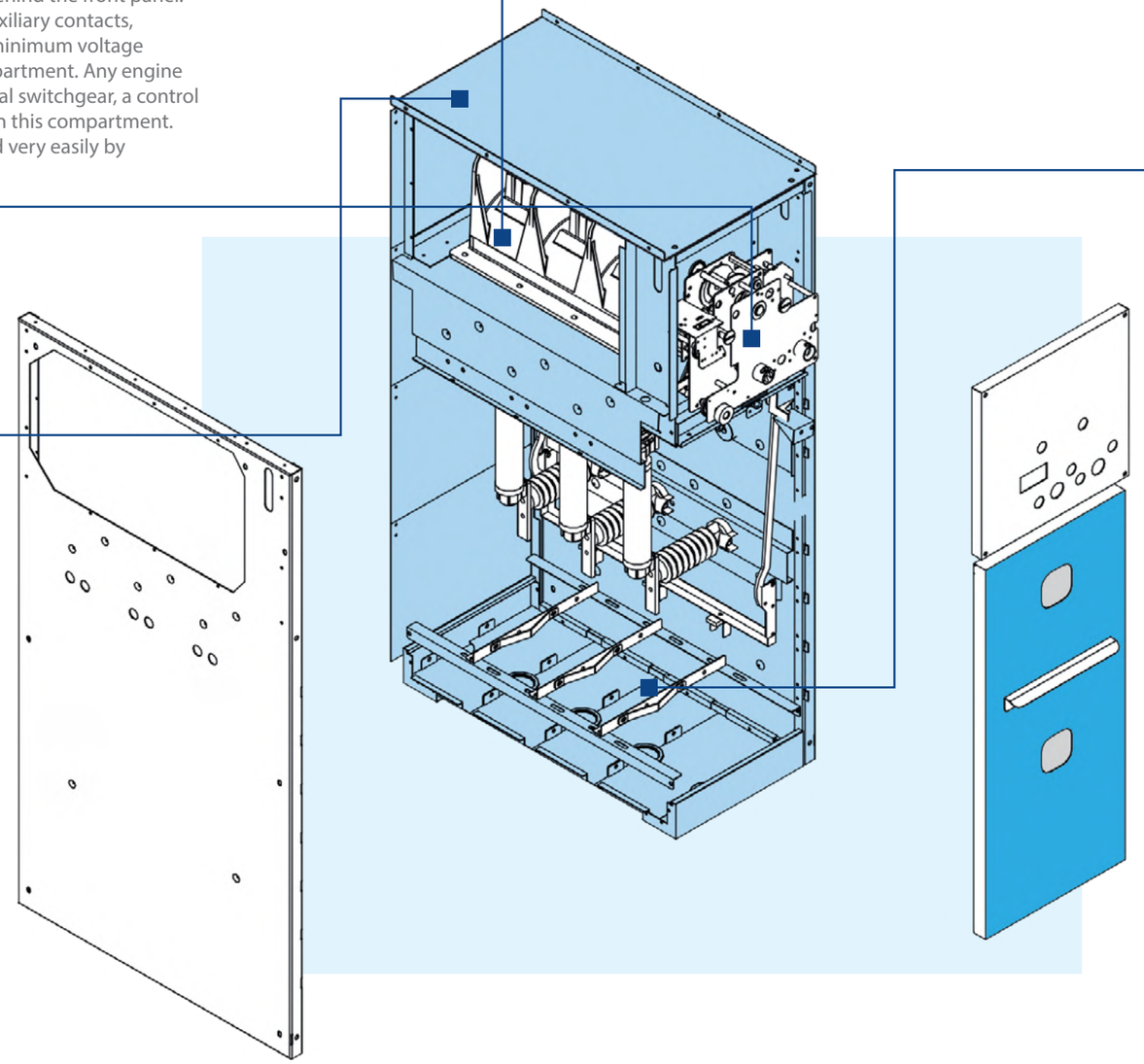
A) Low voltage compartment

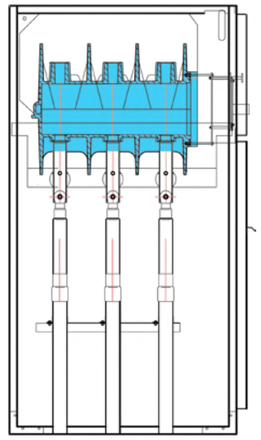
The drive mechanism that controls the RV-44 load break switch and the earthing switch EM 20 is fitted with the synoptic diagram and is located behind the front panel. Several accessories, such as the auxiliary contacts, switch-on or switch-off coils and minimum voltage relays are also located in this compartment. Any engine control with the necessary electrical switchgear, a control and clamp strip are also installed in this compartment. The compartment can be accessed very easily by disassembling the front panel.



B) Busbar compartment

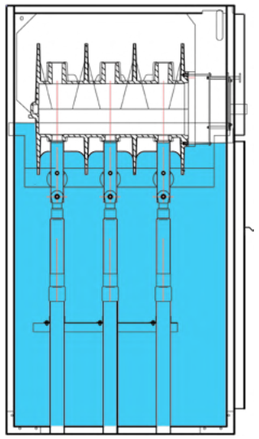
The busbar compartment is located in the upper part of the cubicle and behind the low voltage compartment. The modular busbar set is manufactured from specially provided electrolyte F25 copper of 60 x 10 mm (800A). Several cubicles are connected through the bar set compartments. Hexagonal bolts connect the busbars to the upper contact surfaces of the RV-44 load break switch.





C) Switchgear compartment

The RV-44 load break switch of the 'sealed for life' type acts as the physical separation between the busbar set and the cable compartment. The switch has two functions - it connects or interrupts the electrical current between the high voltage cables and the busbar.



D) Cable compartment

The cable compartment is located behind the interlocked removable door of the DF-2 cubicle. This part of the field receives the cable(s) and contains the necessary equipment to connect the cable(s).

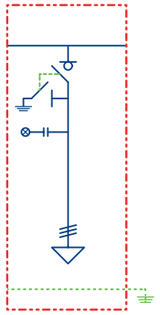
The earthing switch is installed below the load break switch on the right side, ensuring a 'visible earthing' when the earthing switch is closed. In a DF-A cubicle, the cables are connected to the contact points below the RV-44 load break switch.

The cables of the DF-P cubicles are connected to the lower fuse base side. This type of cubicle also has an additional auxiliary earthing switch to divert any residual current. DF-D types have the earthing switches located in the cable compartment below.

The removable door, the sectional floor panels which house the necessary conductive rubber for the cables and the cable supports all simplify the cable connection.

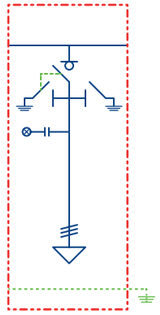
DF-2 series MV switchgear available modules

Specifications, dimensions and applications



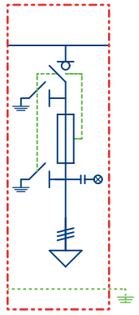
DF-A panel

An incoming cubicle or cable feeder with load break switch RV-44 and interlocked earthing switch



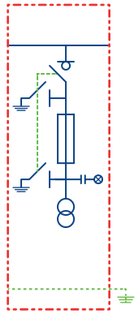
DF-A+ panel

A DF-A panel with the Arc-Killer and rear arc duct installed



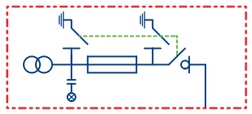
DF-P panel

A transformer protection cubicle with load break switch/fuse combination



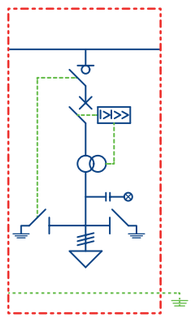
DF-AV panel

A main busbar voltage transformer panel



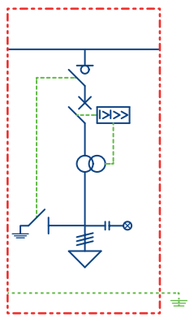
DF-AV/TM panel

A main busbar voltage transformer panel which can be mounted on top of the DF2 functional panels to greatly reduce the overall footprint



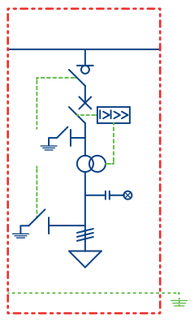
DF-BUS ESW panel

A top mount cubicle that contains an earth switch that is intended to earth the main busbar of DF2 functional panels



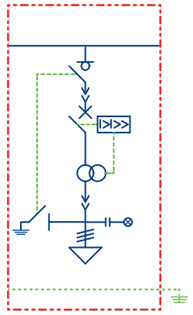
DF-D/EDN panel

A protection cubicle with vacuum circuit breaker with integrated protection relay mounted in a front mounted hinged door compartment



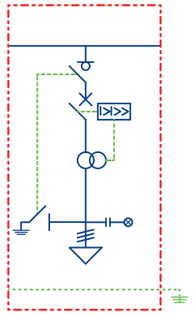
DF-D+/EDN panel

A DF-D/EDN panel with the Arc-Killer and arc duct at the rear of the panel installed



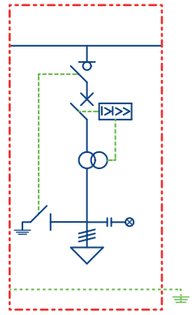
DF-D-500 panel

Protection cubicle with withdrawable vacuum circuit breaker with integrated protection relay



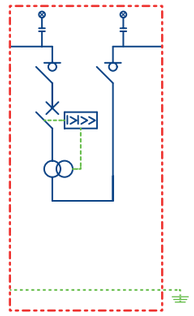
DF-DT panel

A protection cubicle with vacuum circuit breaker (ISM type) with integrated protection relay



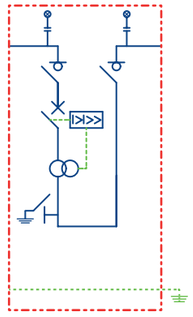
DF-DT/EDN panel

A protection cubicle with vacuum circuit breaker (ISM type) with a hinged door top mounted panel containing integrated protection relay



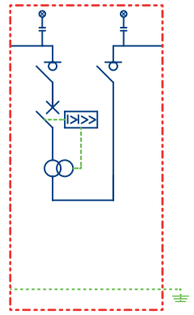
DF-AAD panel

A protection cubicle with double interruption



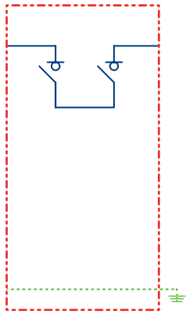
DF-AAD+ panel

A protection cubicle with double interruption with the Arc-Killer and arc duct at the rear of the panel installed



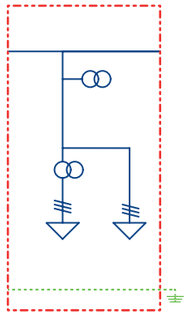
DF-AADT panel

A protection cubicle with double interruption



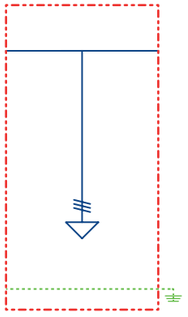
DF-LK panel

A busbar coupling panel



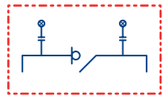
DF-C-750 panel

A metering panel



DF-K panel

A cable panel and/or rail shaft



DF-LKB panel

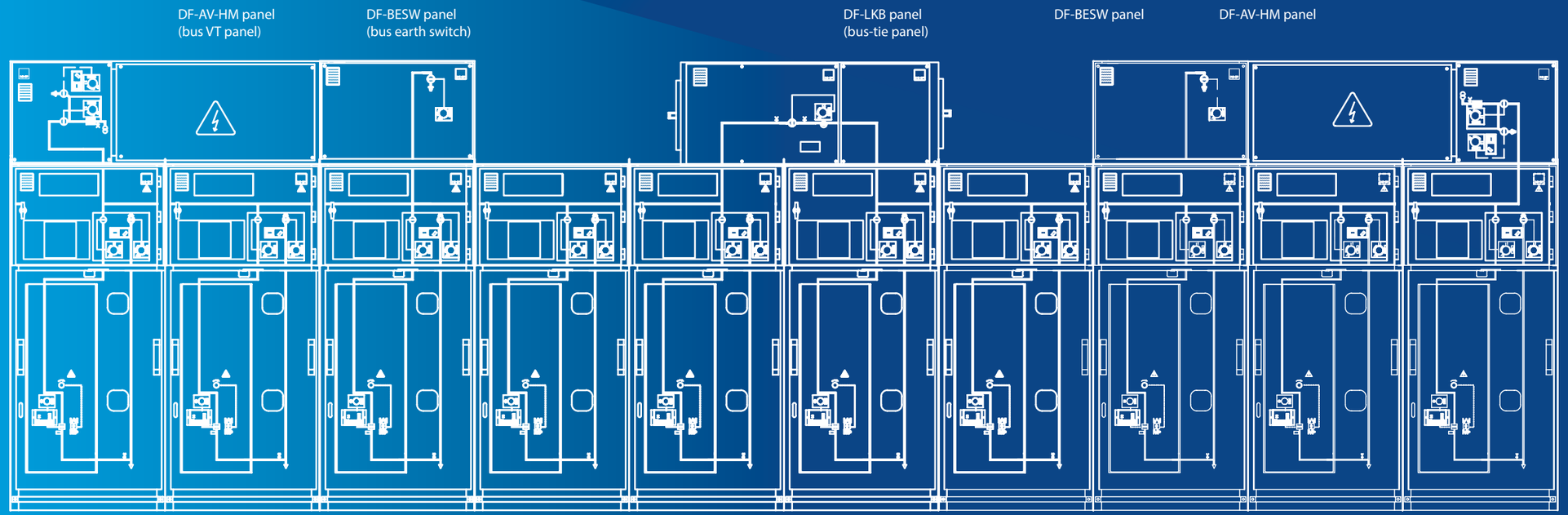
A coupling panel

DF-2 series MV switchgear general arrangement (GA)

Example of a DF-2+ MV switchboard featuring typical modules

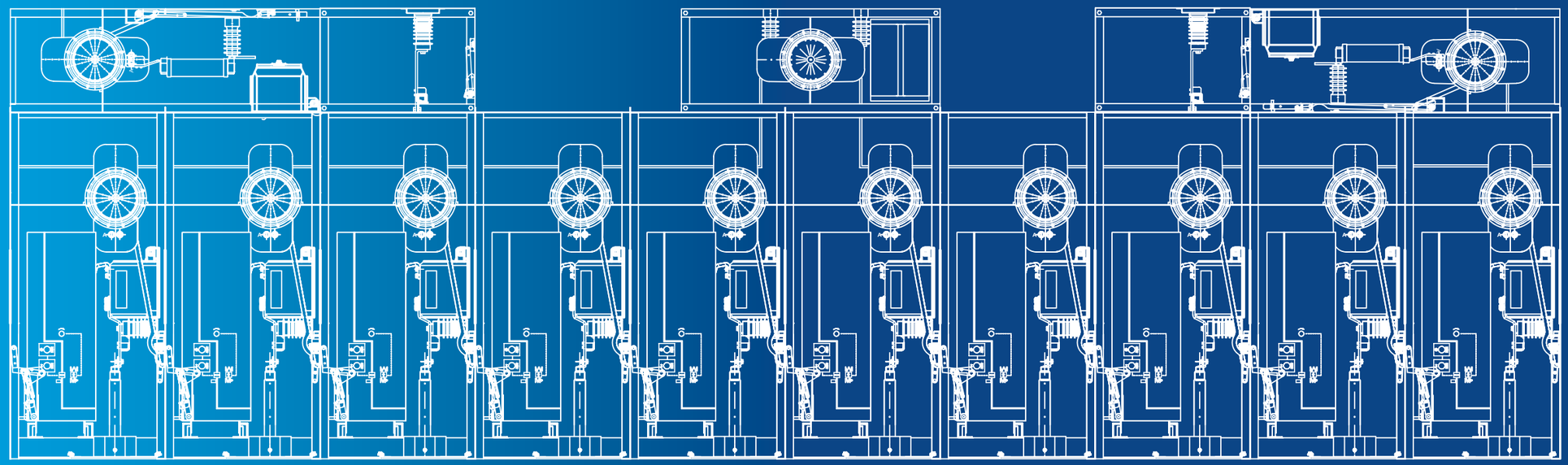
Arc-Killer option

Front view with covers



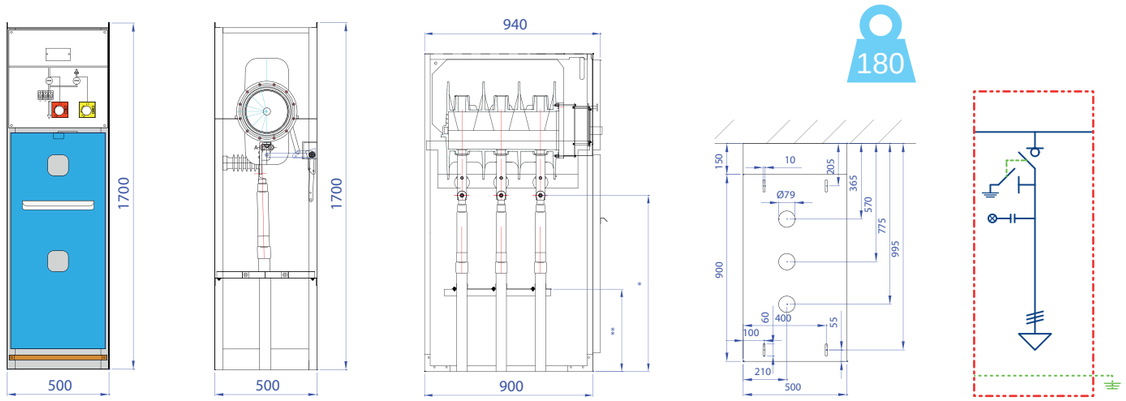
DF-D+ panels
(protection cubicle with VCB)

Front view without covers



DF-A panel

An incoming panel or cable feeder with load break switch RV-44 and interlocked earthing switch.



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Interlocked earthing switch with making capacity up to 63kA
- Cable support
- Door interlock
- Sockets for capacitive voltage detector with parallel testing possibility
- Low voltage compartment
- Gland plates

Panel factory fit options

- Set of auxiliary contacts on load break switch
- Set of auxiliary contacts on earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both
- No door interlock
- Motor operation on load break switch and/or earth switch: 24-48-110 V - AC/DC of 220 V AC
- Short-circuit indicator (customer to specify)
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button operation
- Remote control

Application

- Supply cable connection

Specification and dimensions

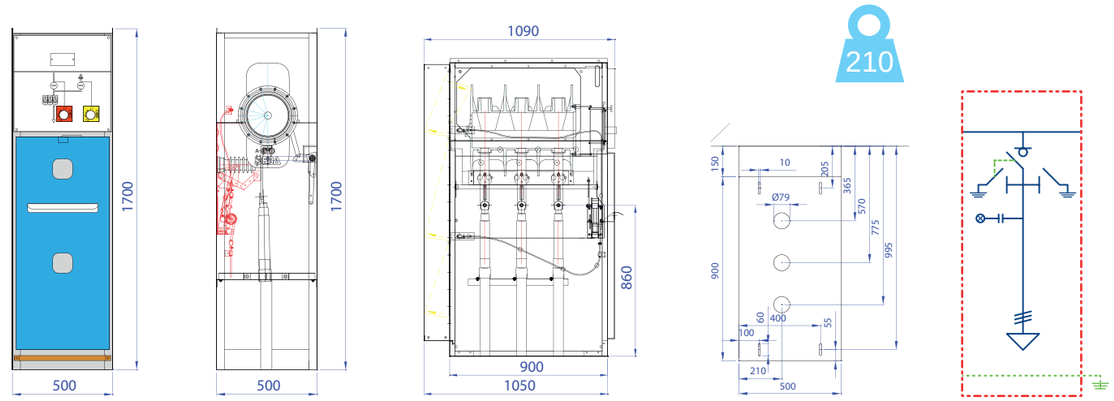
Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	KA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	500	500	500
Depth including side plate*	mm	1090	1090	1090
Depth* for motorised LBS version (includes LV compartment with hinged door)	mm	1260	1260	1260
Height	mm	1700	1700	1700
Height between ground and end socket	mm	945	945	835
Height between ground and cable support	mm	445	445	445
Weight	kg	180	180	180

*Panel overall depth includes extended side plates

DF-A+ panel

An incoming panel or cable feeder with load break switch RV-44 and interlocked earthing switch with Arc-Killer.

Arc-Killer option



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Interlocked earthing switch with making capacity up to 63kA
- Cable support
- Door interlock
- Sockets for capacitive voltage detector with parallel testing possibility
- Low voltage compartment
- Arc-Killer SV-25 built-in
- Arc duct at the rear of the panel
- Gland plates

Panel factory fit options

- Set of auxiliary contacts on load break switch
- Set of auxiliary contacts on earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both
- No door interlock
- Motor operation on load break switch and/or earth switch: 24-48-110 V - AC/DC of 220 V AC
- Short-circuit indicator (customer to specify)
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button operation
- Remote control

Application

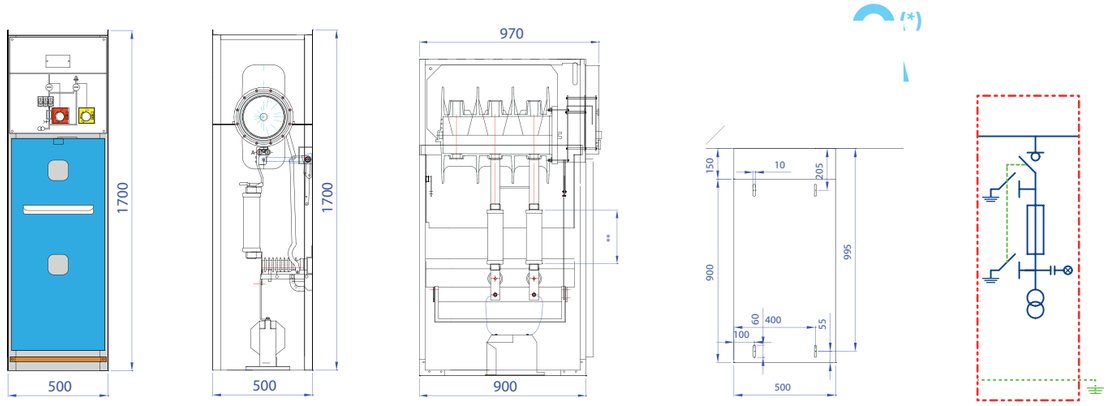
- Supply cable connection

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	800
Short term current	kA s	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	500	500	500
Depth including side plate	mm	1090	1090	1343
Height	mm	1700	1700	1700
Weight	kg	210	210	210

DF-AV panel

A main busbar voltage transformer panel



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Double earthing switch with mutual interlock
- Socket for HRC fuses:
  - e = 292 mm DIN 10 at 17.5 kV
  - e = 442 mm DIN 20 at 24 kV
  - UTE
- Door interlock
- Sockets for capacitive voltage detector
- Low voltage compartment
- Gland plates

Panel factory fit options

- Set of auxiliary contacts on load break switch
- Set of auxiliary contacts on earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both devices
- Motor operation on load break switch and/or earth switch*
- HRC fuses or spare fuses
- Auxiliary contact 'fuse link burned'
- Set of 1, 2 or 3 voltage transformers
- Voltage indicator(s)
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on demand)
- Push-button operation
- Remote control
- VT: xx kV/x V x VA CL.XX

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

Application

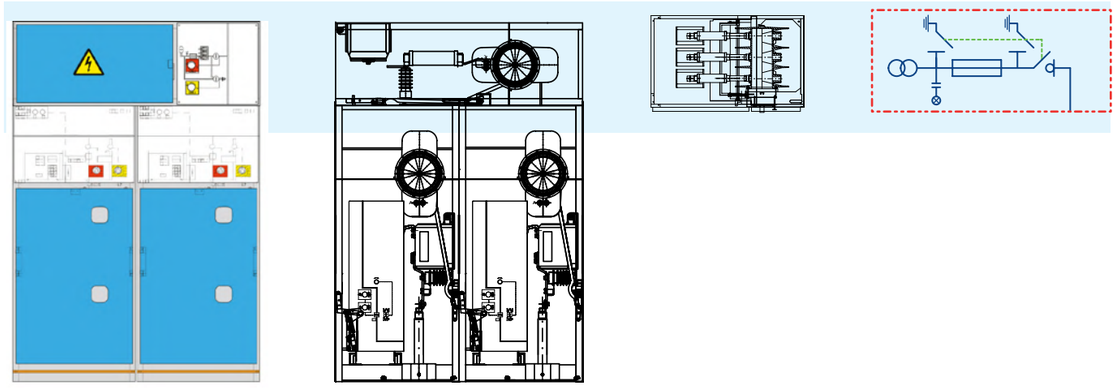
- Auxiliary voltage feeding or network survey

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	6,3	6,3	6,3
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	500	500	500
Depth including side plate	mm	1120	1120	1120
Height	mm	1700	1700	1700
Fuse size	mm	292 (DIN)	292 (DIN)	442 (DIN)/UTE
Weight	kg	210	210	210

DF-AV-HM panel

A main busbar voltage transformer panel mounted horizontally on top of the DF2 functional panels to greatly reduce the overall footprint



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Double earthing switch with mutual interlock
- Socket for HRC fuses:
  - e = 292 mm DIN 10 at 17.5 kV
  - e = 442 mm DIN 20 at 24 kV
  - UTE
- Door interlock
- Sockets for capacitive voltage detector
- Low voltage compartment
- Gland plates

Panel factory fit options

- Set of auxiliary contacts on load break switch
- Set of auxiliary contacts on earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both devices
- Motor operation on load break switch and/or earth switch*
- HRC fuses or spare fuses
- Auxiliary contact 'fuse link burned'
- Set of 1, 2 or 3 voltage transformers
- Voltage indicator(s)
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on demand)
- Push-button operation
- Remote control
- VT: xx kV/x V x VA CL.XX

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

Application

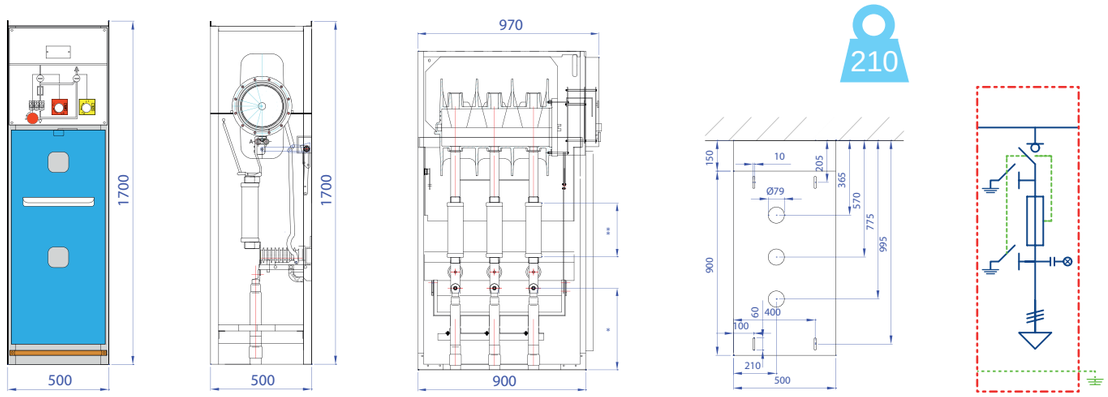
- Auxiliary voltage feeding or network survey

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	6,3	6,3	6,3
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	1500	1500	1500
Depth	mm	940	940	940
Height	mm	500	500	500
Fuse size	mm	292 (DIN)	292 (DIN)	442 (DIN)/UTE
Weight (*)	kg	210	210	210

DF-P panel

A transformer protection panel with load break switch/fuse combination



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Double earthing switch with mutual interlock
- Socket for HRC fuses:
  - e = 292 mm DIN 10 at 17.5 kV
  - e = 442 mm DIN 20 at 24 kV
  - UTE
- Triple-pole fuse trip
- Switch-off mechanism through hitting bolt
- Door interlock
- Sockets for capacitive voltage detector
- Low voltage compartment
- Floor panels

Panel factory fit options

- Set of auxiliary contacts on load break switch
- Set of auxiliary contacts on earthing switch
- Key interlock on load break switch
- Key interlock on the earthing switch
- Key interlock on both
- Shunt trip *
- Under voltage release *
- Closing release *
- Motor operation on load break switch and/or earth switch *
- HRC fuses and/or spare fuses
- Contact 'fuse blown'
- Automatic recloser
- Set of 2 or 3 voltage transformers
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on demand)
- Push-button operation
- Remote control

Application

- Auxiliary voltage feeding or network survey

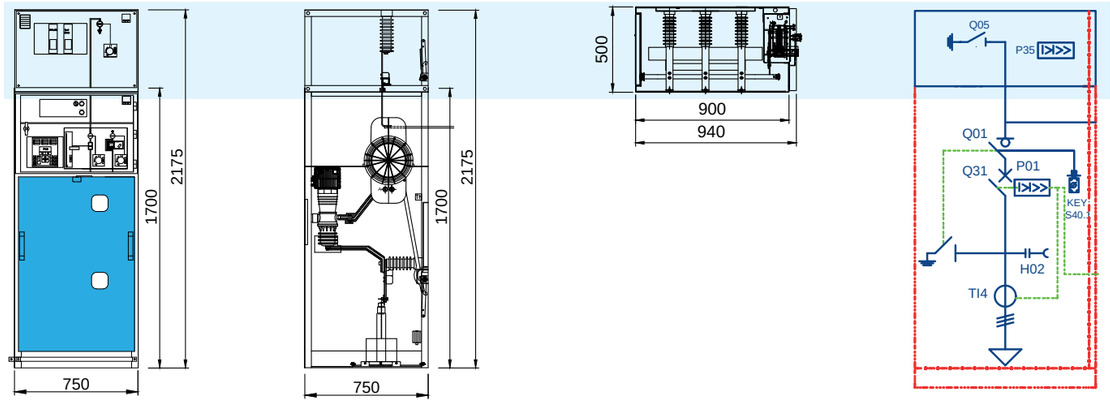
Specification and dimensions

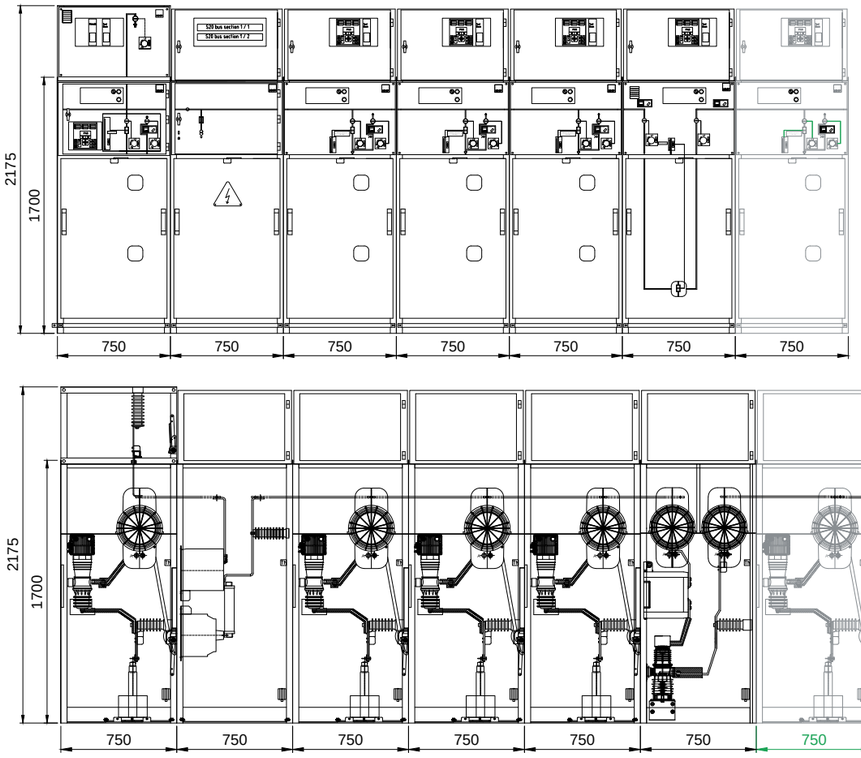
Rated voltage	kV	12	17,5	24
Rated current	A	800/1250(*)	800/1250(*)	630/800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	500	500	500
Depth including side plate	mm	1120	1120	1120
Depth* for motorised LBS version (includes LV compartment with hinged door)	mm	1260	1260	1260
Height	mm	1700	1700	1700
Height between ground and end socket	mm	460	460	415
Fuse size	mm	292 (DIN)	292 (DIN)	442 (DIN)/UTE
Weight	kg	210	210	210

(*) Max current through fusecontacts: 63A

DF-BUS ESW panel

A top mount panel that contains an earth switch that is intended to earth the main busbar of DF-2 functional panels





Front view with covers fitted

Front view without covers fitted

Standard equipment

- Earthing switch with making capacity up to 63kA
- Earthing switch can be locked off with a padlock

Panel factory fit options

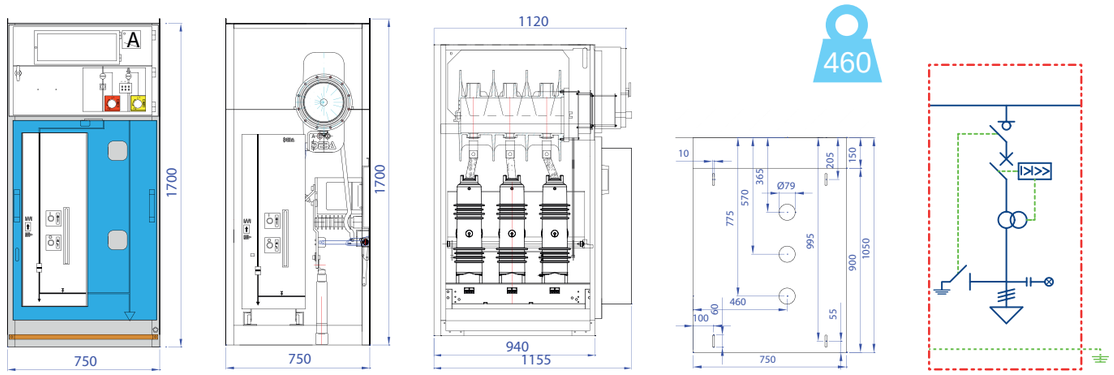
- Set of auxiliary contacts on earthing switch
- Key interlock on the earthing switch
- Voltage indicators

Application

- Allows earthing of the main bus for maintenance purposes independently of the switching devices in the main panel

DF-D-EDN panel

A protection panel with vacuum circuit breaker with protection relay mounted in a front mounted hinged door compartment.



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Mechanical vacuum circuit breaker (VAS-2 or VA-2)
- Interlocked earthing switch with rated making
- Capacity up to 63kA downstream of the capacity switch
- External protection relay
- Cable support
- Door interlock
- Sockets for capacitive voltage detector
- Voltage indicators
- Low voltage compartment
- Gland plates

Panel factory fit options

- Protection relay (to be specified by the customer)
- Current transformer (to be specified by the customer)
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both
- No door interlock
- Motor operation on load break switch and/or earth switch: 24-48-110 V AC/DC and 220 V AC
- Short-circuit indicator (to be specified by the customer)
- Earthing connections upwards from the circuit breaker
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on demand)
- Push-button control on switch-disconnector
- Remote control on switch-disconnector

Application

- Protection of outgoing feeders with circuit breaker, current and voltage transformers and MV protection relay

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1265	1265	1265
Height	mm	1700	1700	1700
Height between ground and socket	mm	445	445	445
Weight	kg	460	460	460

Circuit breaker options

- Motor spring charging*
- Shunt closing coil
- Shunt trip coil*
- Delayed/instantaneous under voltage release
- Set of auxiliary contacts
- Switch counter
- Automatic recloser
- Remote control on circuit breaker
- Key interlock

Specifications to be indicated for circuit-breaker VA-2/VAS-2:

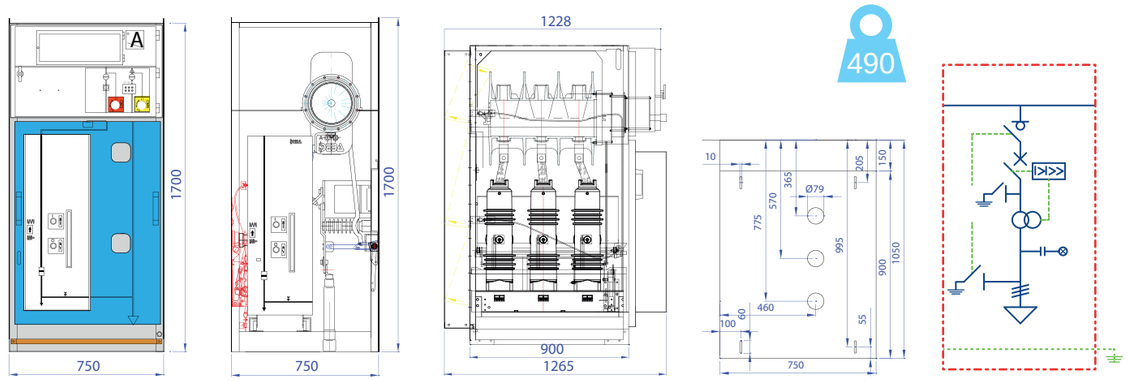
Short-circuit capacity, rated current, rated voltage and capacity to be secured

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

DF-D+-EDN panel

A DF-D/EDN panel with the Arc-Killer and shaft installed.

Arc-Killer option



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Mechanical vacuum circuit breaker (VAS-2 or VA-2)
- Interlocked earthing switch with rated making
- Capacity up to 63kA downstream of the capacity switch
- External protection relay
- Cable support
- Door interlock
- Sockets for capacitive voltage detector
- Voltage indicators
- Low voltage compartment
- Arc-Killer SV-25 inside
- Arc duct at the rear of the panel
- Gland plates

Panel factory fit options

- Protection relay (to be specified by the customer)
- Current transformer (to be specified by the customer)
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both
- No door interlock
- Motor operation on load break switch and/or earth switch: 24-48-110 V AC/DC and 220 V AC
- Short-circuit indicator (to be specified by the customer)
- Earthing connections upwards from the circuit breaker
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on demand)
- Push-button control on switch-disconnector
- Remote control on switch-disconnector

Application

- Protection of outgoing feeders with circuit breaker, current and voltage transformers and MV protection relay

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	25	25	25
Time of the short duration of current	S	3	3	3
Width	mm	750	750	800
Depth including side plate	mm	1265	1265	1345
Height	mm	1700	1700	2100
Height between ground and socket	mm	445	445	765
Weight	kg	490	490	550

Circuit breaker options

- Motor spring charging*
- Shunt closing coil
- Shunt trip coil*
- Delayed/instantaneous under voltage release
- Set of auxiliary contacts
- Switch counter
- Automatic recloser
- Remote control on circuit breaker
- Key interlock

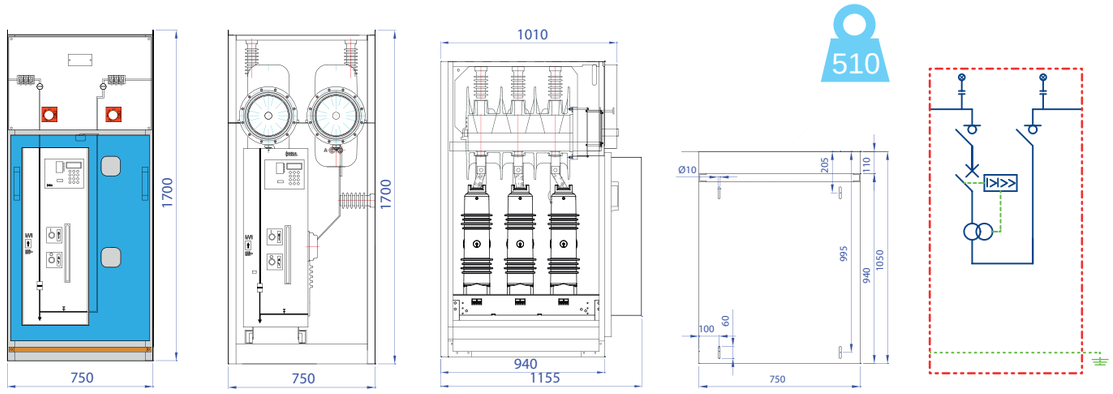
Specifications to be indicated for circuit-breaker VA-2/VAS-2:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

DF-AAD panel

A protection panel with double interruption and a vacuum circuit breaker



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Mechanical vacuum circuit breaker (VAS-2 or VA-2)
- External protection relay
- Door interlock
- Low voltage compartment
- Holder for capacitive voltage indicators load break switch 1 and/or 2
- Gland plates

Panel factory fit options

- Current transformer (to be specified by the customer)
- Set of auxiliary contacts on load break switch 1 and/or 2
- Key interlock on load break switch 1 and/or 2
- Key interlock on earthing switch
- Mechanical interlock between the load break switches
- No door interlock
- Motor operation on load break switch 1 and/or 2: 24-48-110 V AC/DC and 220 V AC
- Earthing switch
- Earthing connections on load break switch 1 and/or 2
- Earthing connections outside of cubicle
- Capacitive voltage indicators load break switch 1 and/or 2
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button control on load break switch 1 and/or 2
- Remote control on load break switch 1 and/or 2

Application

- Protection of outgoing feeders with circuit breaker, current transformers and MV protection relay, with double separation of busbar upstream and down stream. Typically used as a bus-tie.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1265	1265	1265
Height	mm	1700	1700	1700
Weight	kg	510	510	510

Circuit breaker options

- Motor operation on load break switch and/or earth switch
- Shunt closing coil
- Shunt trip coil*
- Current transformer shunt trip
- Delayed/Instantaneous under voltage release
- Set of auxiliary contacts
- Error contact
- Switch counter
- Supply for test protective relay (battery block)
- Automatic recloser
- Remote control on circuit breaker
- Key interlock

Specifications to be indicated for circuit-breaker VA-2/VAS-2:

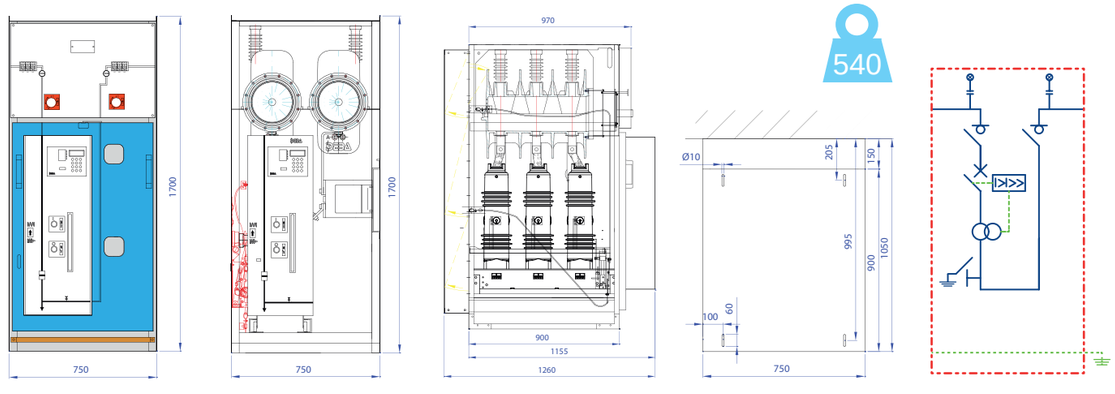
Short-circuit capacity, rated current, rated voltage and capacity to be secured

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

DF-AAD+ panel

A protection panel with double interruption featuring the VAS2 VCB with the Arc-Killer and shaft installed

Arc-Killer option



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Mechanical vacuum circuit breaker (VAS-2 or VA-2)
- External protection relay
- Door interlock
- Low voltage compartment
- Holder for capacitive voltage indicators load break switch 1 and/or 2
- Arc duct at the rear of the panel
- Gland plates

Panel factory fit options

- Current transformer (to be specified by the customer)
- Set of auxiliary contacts on load break switch 1 and/or 2
- Key interlock on load break switch 1 and/or 2
- Key interlock on earthing switch
- Mechanical interlock between the load break switches
- No door interlock
- Motor operation on load break switch 1 and/or 2: 24-48-110 V AC/DC and 220 V AC
- Earthing switch
- Earthing connections on load break switch 1 and/or 2
- Earthing connections outside of cubicle
- Capacitive voltage indicators load break switch 1 and/or 2
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button control on load break switch 1 and/or 2
- Remote control on load break switch 1 and/or 2

Application

- Protection of outgoing feeders with circuit breaker, current transformers and MV protection relay, with double separation of busbar upstream and down stream. Typically used as a bus-tie.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	–
Short term current	kA	25	25	–
Time of the short duration of current	S	3	3	–
Width	mm	750	750	–
Depth including side plate	mm	1200	1200	–
Height	mm	1700	1700	–
Weight	kg	540	540	–

Circuit breaker options

- Motor operation on load break switch and/or earth switch
- Shunt closing coil
- Shunt trip coil*
- Current transformer shunt trip
- Delay/instant Under voltage release*
- Set of auxiliary contacts
- Error contact
- Switch counter
- Supply for test protective relay (battery block)
- Automatic recloser
- Remote control on circuit breaker
- Key interlock

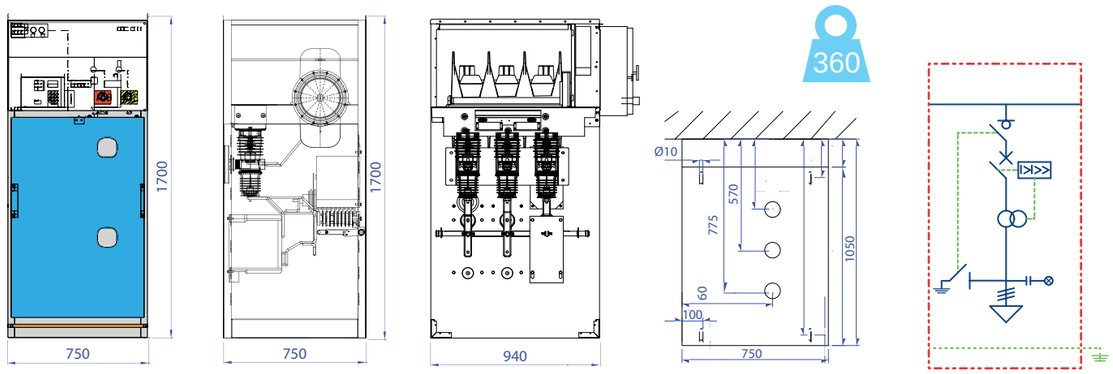
Specifications to be indicated for circuit breaker VA-2/VAS-2:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

DF-DT-EDN panel

A protection panel with vacuum circuit breaker (ISM type) with a hinged door front mounted panel containing a protection relay.



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- ISM magnetic vacuum circuit breaker
- Interlocked earthing switch with rated making
- Capacity up to 63kA downstream of the circuit breaker
- Cable support
- Door interlock
- Sockets for capacitive voltage detector
- Voltage indicators
- Low voltage compartment
- Shaft at the rear of the panel
- Gland plates

Panel factory fit options

- Current transformer (to be specified by the customer)
- Voltage transformer (to be specified by the customer)
- Auxiliary contacts on the load break switch
- Auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both
- No door interlock
- Choice of auxiliary voltage: 24-48-110 VDC or 110-220 VAC
- Short circuit indicator (to be specified by the customer)
- Earthing connection upstream from the circuit breaker
- Voltage indication
- Cubicle base: 200, 300, 400 mm height (other dimensions on demand)
- Push-button control on the load break switch
- Remote control of the load break switch
- Arc-Killer SV-25 inside

Application

- Protection of feeders with circuit breaker, voltage and current transformer and MV protection (max 1250 A). LV compartment door has a handle and hinges for easy access.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	16/20/25	16/20/25	16/20
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1090	1090	1090
Height	mm	1700	1700	1700
Height between ground and socket	mm	450	450	450
Weight	kg	360	360	360

Circuit breaker options

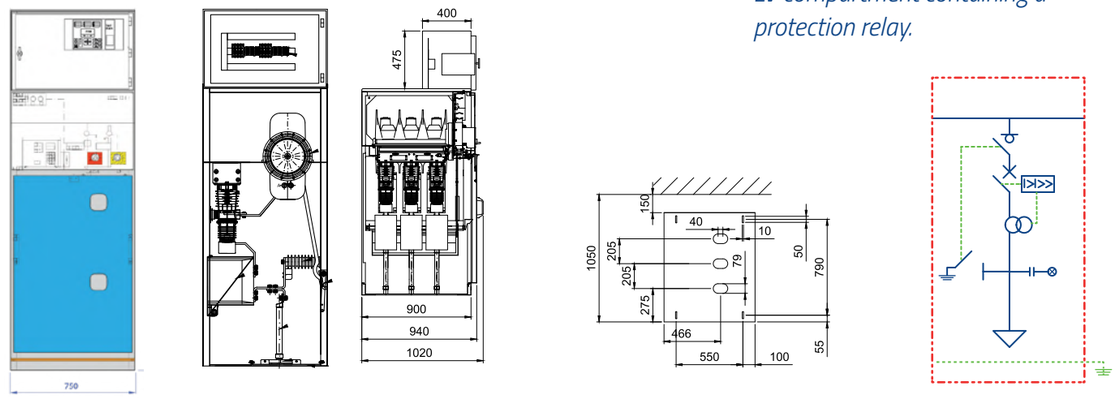
- Electronic under voltage release
- Block auxiliary contacts
- Operation counter
- Automatic recloser
- Remote control on circuit breaker
- Interlock

Specifications to be indicated for circuit-breaker:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

DF-DT-EDN-TM panel

A protection panel with vacuum circuit breaker (ISM type) with a separate hinged door top mounted LV compartment containing a protection relay.



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- ISM magnetic vacuum circuit breaker
- Interlocked earthing switch with rated making
- Capacity up to 63kA downstream of the circuit breaker
- Cable support
- Door interlock
- Sockets for capacitive voltage detector
- Voltage indicators
- Low voltage compartment
- Shaft at the rear of the panel
- Gland plates

Panel factory fit options

- Current transformer (to be specified by the customer)
- Voltage transformer (to be specified by the customer)
- Auxiliary contacts on the load break switch
- Auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both
- No door interlock
- Choice of auxiliary voltage: 24-48-110 VDC or 110-220 VAC
- Short circuit indicator (to be specified by the customer)
- Earthing connection upstream from the circuit breaker
- Voltage indication
- Cubicle base: 200, 300, 400 mm height (other dimensions on demand)
- Button press control on the load break switch
- Remote control of the load break switch
- Arc-Killer SV-25 inside

Application

- Protection of feeders with circuit breaker, voltage and current transformer and MV protection (max 1250 A). Has a separate top mounted LV compartment allowing for additional devices. LV compartment door has a handle and hinges for easy access.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	16/20/25	16/20/25	16
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1090	1090	1090
Height	mm	1700	1700	1700
Height between ground and socket	mm	450	450	450
Weight	kg	360	360	360

Circuit breaker options

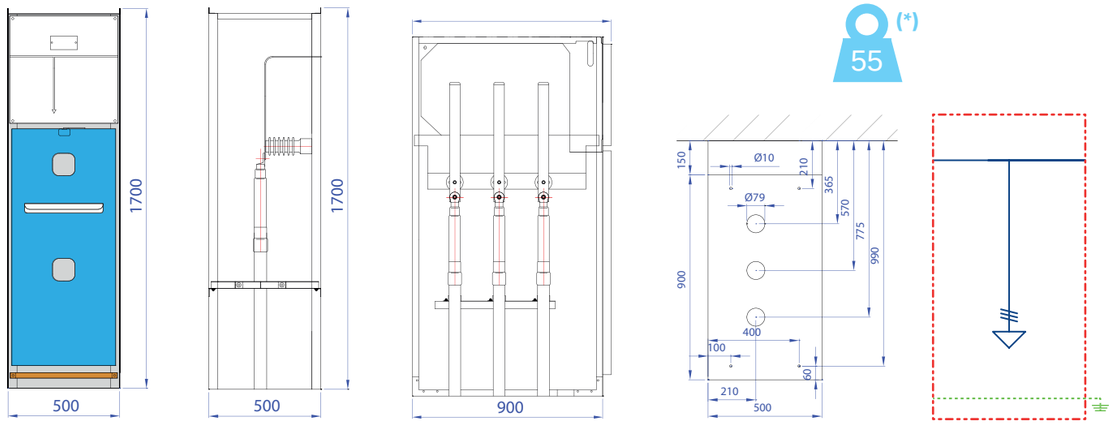
- Electronic under voltage release
- Block auxiliary contacts
- Operation counter
- Automatic recloser
- Remote control on circuit breaker
- Interlock

Specifications to be indicated for circuit-breaker:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

DF-K panel

A cable panel and / or rail shaft



Panel factory fit options

- Holder for capacitive voltage indicators
- Capacitive voltage indicators
- Short-circuit detectors (to be specified by the customer when ordering)
- Earthing switch
- Set of auxiliary contacts on earthing switch
- Key interlock on earthing switch
- Earthing ball clamps
- Current transformers in the busbar
- Voltage transformers with of without protection in the busbar
- Cubicle base: 200 mm, 300 mm of 400 mm height (other dimensions on request)
- Gland plate
- Door interlock

Application

- Cubicles of the DF-2 type equipped to bring in a supply cable. However, a DF-K cubicle can also contain a busbar and can be used as rising cubicle of the rail set.

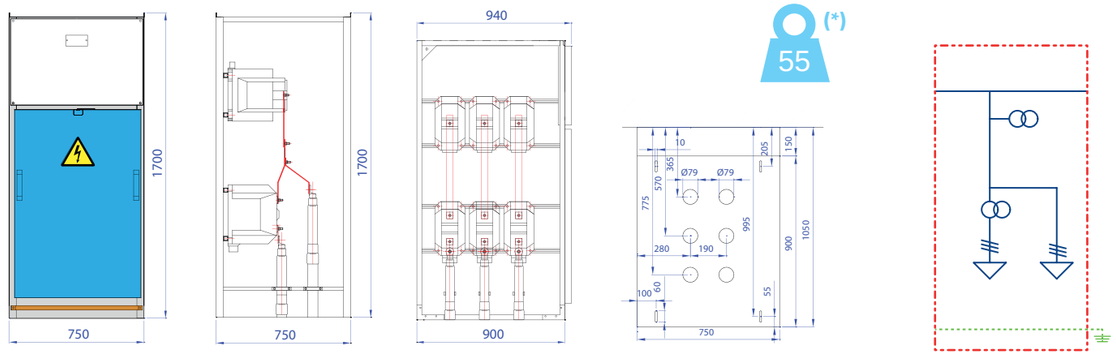
Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	800/1250
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	M	M	M
Depth including side plate	mm	1200	1200	1200
Height	mm	M	M	M
Weight (*)	mm	55	55	55

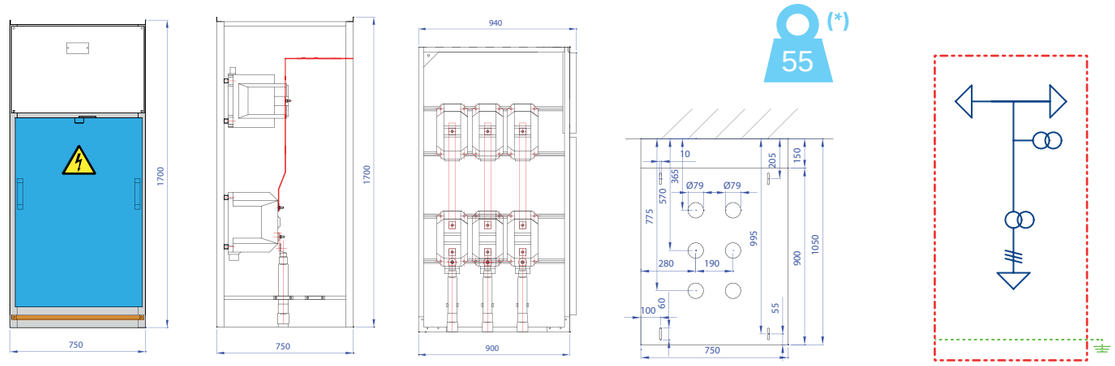
* Without equipment

DF-C-750 panel

A metering panel



This setup: bottom right in - bottom left out



This setup: bottom left in - top right out

Standard equipment

- 3 CTs xA => 5A
- 3 VT's xV => 110V, V3
- Floor panels
- Low voltage compartment safety box to secure voltage circuits

Application

- Housing current and voltage transformers for metering purposes

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	up to 1250	up to 1250	up to 800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1200	1200	1200
Height	mm	1700	1700	1700
Weight (*)	mm	55	55	55

* Without equipment

Possible connections

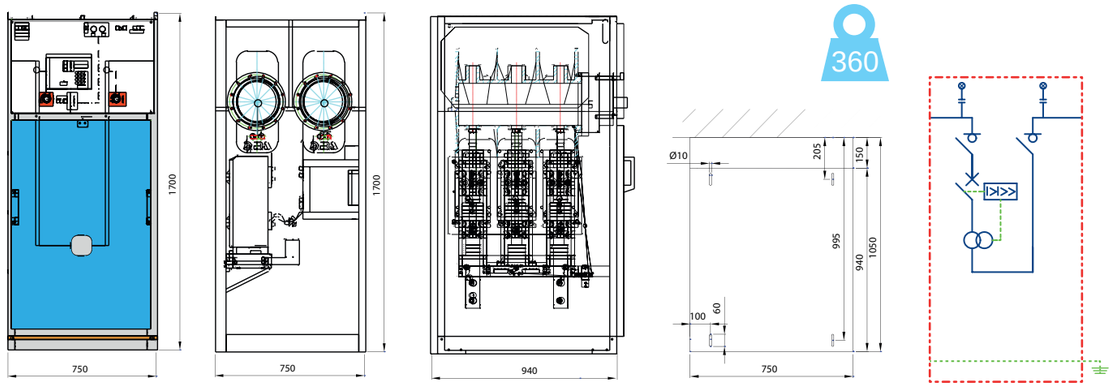
- Bottom left in - bottom right out; bottom right in - bottom left out; bottom left in - top right out; bottom right in - top left out; top right in - top left out; and top left in - top right out.
- HV and LV fuses on the VTs

Panel factory fit options

- Additional current transformers (customer to specify primary current, secondary current, capacity, precision class, insulation class, rated short time current)
- Additional voltage transformer with MV and LV fuses (customer to specify primary voltage, secondary voltage, capacity, precision class and insulation class)
- Support for the positioning of measuring transformers
- Measuring system with 3 CTs and 3 VTs
- Measuring system with kWh metering (requirements to be specified by the customer)
- Current measurement system
- Voltage measurement system
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Protection VT's with HRC-fuses

DF-AADT panel

A protection panel with double interruption featuring the ISM VCB



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- ISM magnetic vacuum circuit breaker
- Cable support
- Door interlock
- Sockets for capacitive voltage detector
- Voltage indicators
- Low voltage compartment
- Gland plates

Panel factory fit options

- Auxiliary contacts on load break switch 1 and/or 2 up to 3NO/NC
- Auxiliary contacts on the earthing switch up to 2NO/NC
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both
- No door interlock
- Choice of auxiliary voltage: 24-60-110 VDC or 110-220 VAC
- Short circuit indicator (to be specified by the customer)
- Current transformers (to be specified by the customer)
- Earthing connection upstream from the circuit breaker
- Voltage indication
- Cubicle base: 200, 300, 400 mm height (other dimensions on demand)
- Push-button control on the load break switch
- Remote control on the load break switch

Application

- Protection of descending feeders with transformer and MV equipment provided with circuit breaker and double separation of busbar upstream and downstream

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	16/20/25	16/20/25	16
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1090	1090	1090
Height	mm	1700	1700	1700
Weight	kg	360	360	360

Circuit breaker options

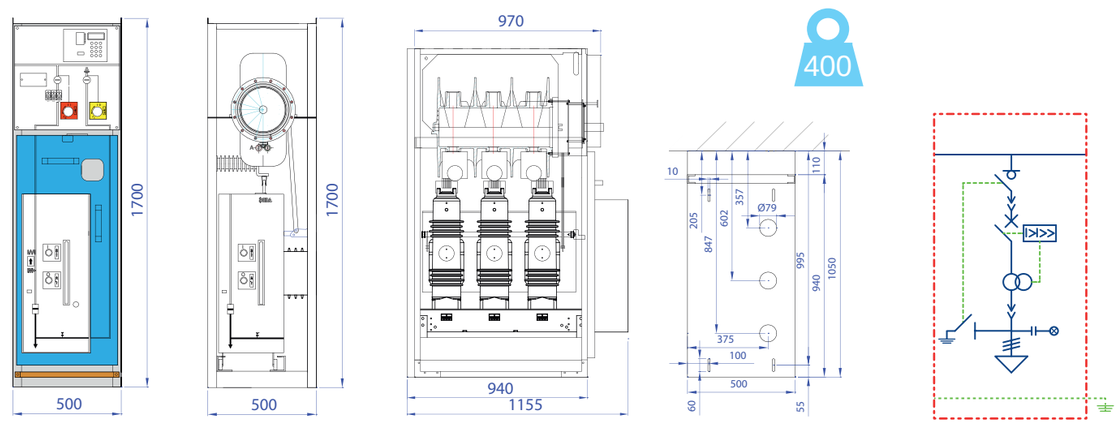
- Electronic under voltage release
- Block auxiliary contacts
- Operation counter
- Automatic recloser
- Remote control on circuit breaker
- Interlock

Specifications to be indicated for circuit-breaker:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

DF-D-500 panel

A protection panel with withdrawable vacuum circuit breaker with protection relay



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Interlocked earthing switch with rated making capacity up to 63kA downstream of the switch capacity
- Mechanical vacuum circuit breaker
- External protection relay
- Door interlock
- Sockets for capacitive voltage detector
- Low voltage compartment
- Draw-out circuit breaker
- Gland plates

Panel factory fit options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on load break switch
- Key interlock on earthing switch
- Key interlock on both
- No door interlock
- Motor operation on load break switch: 24-48-110 V AC/DC and 220 V AC
- Short-circuit indicator (to be specified by the customer)
- Voltage indicators
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button control on switch disconnector
- Remote control on switch disconnector

Application

- Securing of descending feeders with draw-out circuit breaker allowing fast exchange of the circuit breaker (minimal downtime)

Specification and dimensions

Rated voltage	kV	12	17,5
Rated current	A	630	630
Short term current	kA	25	25
Time of the short duration of current	S	1	1
Width	mm	500	500
Depth including side plate	mm	1200	1200
Height	mm	1700	1700
Height between ground and socket	mm	450	450
Weight	kg	400	400

Circuit breaker options

- Motor operation on load break switch and/or earth switch
- Shunt closing coil
- Shunt trip coil*
- Current transformer shunt trip
- Delay/instant under voltage release*
- Set of auxiliary contacts
- Error contact
- Switch counter
- Supply for test protective relay (battery block)
- Automatic recloser
- Remote control on circuit breaker
- Key interlock

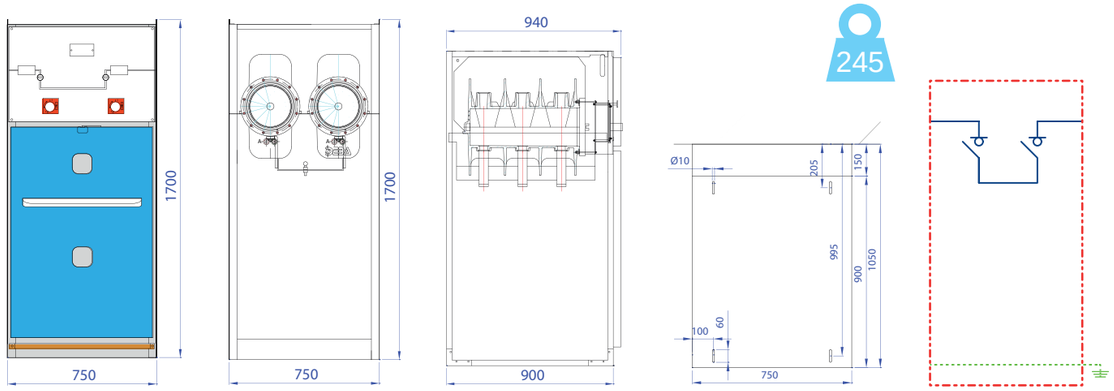
Specifications to be indicated for circuit-breaker VA-2/VAS-2:

Short-circuit capacity, rated current, rated voltage and capacity to be secured

* Available voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

DF-LK panel

A busbar coupling panel



Standard equipment

- Two x triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Door interlock
- Low voltage compartment
- Gland plate

Panel factory fit options

- Holder for capacitive voltage indicators load break switch 1 and/or 2
- Set of auxiliary contacts on load break switch 1 and/or 2
- Key interlock on load break switch 1 and/or 2
- Key interlock on earthing switch
- Mechanical interlock between the load break switches
- No door interlock
- Motor operation on load break switch 1 and/or 2: 24-48- 110 V AC/DC and 220 V AC
- Earthing-switch
- Earthing connections on load break switch 1 and/or 2
- Earthing connections outside of cubicle
- Capacitive voltage indicators load break switch 1 and/or 2
- Cubicle base: 200 mm, 300 mm or 400 mm height (other dimensions on request)
- Push-button control on load break switch 1 and/or 2
- Remote control on load break switch 1 and/or 2
- Current transformers

Application

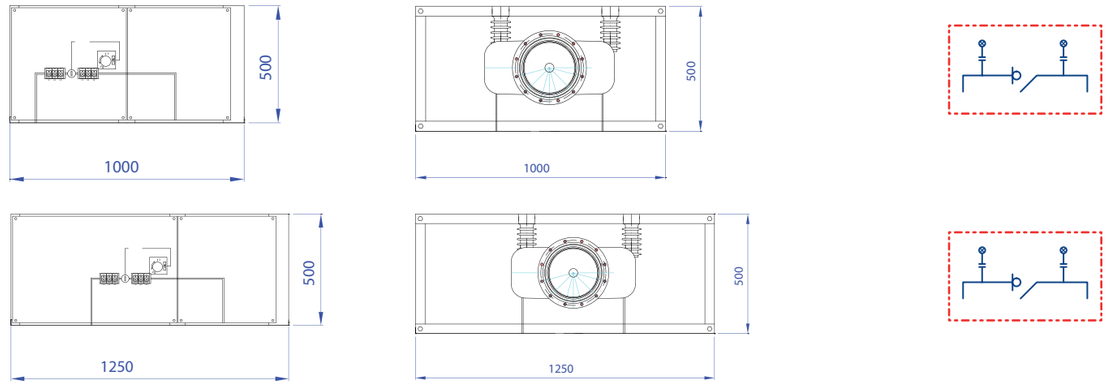
- Coupling between two parts of the MV panel.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	750	750	750
Depth including side plate	mm	1090	1090	1090
Height	mm	1700	1700	1700
Weight	kg	245	245	245

DF-LKB panel

A coupling panel



Standard equipment

- Triple-phase load break switch RV-44, class E3 according to IEC 62271-103, SF_6-insulation
- Low voltage compartment
- Holder for capacitive voltage indicators load break switch left/right
- In case of coupling between two cubicles of 750 mm, a final piece of 250 mm will be provided

Panel factory fit options

- Set of auxiliary contacts on the load break switch
- Key interlock on load break switch
- Motor operation on load break switch: 24-48-110 V AC/DC and 220 V AC
- Earthing ball clamps on load break switch left/right
- Earthing ball clamps outside of cubicle
- Capacitive voltage indicators on load break switch left/right
- Push-button control on load break switch
- Remote control on load break switch

Application

- Coupling between two parts of the MV panel.

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	800/1250	800/1250	630/800
Short term current	kA	25	25	20
Time of the short duration of current	S	3	3	3
Width	mm	1000/1250	1000/1250	1000/1250
Depth	mm	975	975	975
Height	mm	500	500	500
Weight	kg	162	176	176

DR-6/DR-6+ and DT-6/DT-6+

COMPACT AND EXTENSIBLE RING MAIN UNIT

DR-6 is a compact and extensible concept combining all medium voltage functions

- Gas insulated switchgear
- Applicable service voltage is 6-24kV
- Maximum current is 630A
- Ideal solution for arc fault mitigation

MV ring main units (RMUs)

Compact and extensible

3-position load break switch

Arc-Killer option

DR-6/DT-6 and DR-6+/DT-6+

The DR/DT-6 ring main unit provides a network switching function by load break/earth switch and protection functions by a fuse switch or a dedicated vacuum circuit breaker in applications with rated voltage up to 24kV.

DR-6+ is a special DR-6 model that features Arc-Killer technology.

Key characteristics:

- Gas insulated switchgear (GIS) (SF_6) RMU: metal enclosed GIS cubicles with galvanised steel sheets 2mm and between the compartments 4 mm
- Built to withstand extreme weather conditions
- Ease of use with a clear synoptic
- Maxium service voltage is 24kV with a maximum current of 630A
- Rated short time current of 20kA for 1 second
- Three position load break switch
- 30 year design life
- Compact or extensible concept
- Optional: easy to reach injection points (at the top)
- DR-6+ with built-in Arc-Killer has an internal arc classification of B-FLR 20kA, 1s for ultimate safety
- No emission of SF_6 in case of internal arc due to the patented Arc-Killer technology

Applications:

- Suitable for most industrial and commercial installations
- Distribution switchgear within electrical substations, wind generation, cogeneration and much more
- Replace obsolete installations and expand existing installations

Applicable standards:

- AS 62271-1
- AS 62271-102
- AS 62271-200
- IEC 62271-103
- IEC 62271-105
- IEC 61243-5

Technical specification

DR-6 gas insulated switchgear

Rated voltage	kV	12	12	17.5	24	24
Applicable circuit breaker device type(s)		Magnetic vacuum type CB: model ISM LD [2]	Mechanical vacuum type CB: model VA3 [1] [3]	Mechanical vacuum type CB: model VA3 [1] [3]	Magnetic vacuum type CB: model ISM LD [2]	Mechanical vacuum type CB: model VA3 [1] [3]
General specifications						
Impulse withstand voltage 1,2 / 50 µsec.						
To earth and between phases	kV	75	75	95	125	125
Over the insulation distance	kV	85	85	110	145	145
Power frequency voltage test 1min.						
To earth and between phases	kV	28	28	38	50	50
Over the insulation distance	kV	32	32	45	60	60
Rated frequency	Hz	50/60	50/60	50/60	50/60	50/60
Rated short time current 1 s	kA	20	20	20	12.5	12.5
Rated peak value of the current	kA	52.5	52.5	52.5	52.5	52.5
Internal arc current for 1 s. IEC 62271-200 (5 criteria)	kA	20	20	20	20	20
Internal arc classification		A-FL (B-FLR – with Arc-Killer option)	A-FL (B-FLR – with Arc-Killer option)	A-FL (B-FLR – with Arc-Killer option)	A-FL (B-FLR – with Arc-Killer option)	A-FL (B-FLR – with Arc-Killer option)
Degree of protection						
HV compartment		IP6X	IP6X	IP6X	IP6X	IP6X
LV and cable compartment		IP6X	IP6X	IP6X	IP6X	IP6X
Rated gas pressure at 20°C	Bar	0.5 bar overpressure	0.5 bar overpressure	0.5 bar overpressure	0.5 bar overpressure	0.5 bar overpressure
Line feeder (RV50 load break switch)						
Short-circuit making current (Ima)	kA	20	20	20	12.5	12.5
Breaking capacity (IEC 62271-103)		Class E3	Class E3	Class E3	Class E3	Class E3
Rated current (Iload)	A	630	630	630	630	630
Closed loop current (Iloop)	A	630	630	630	630	630
Cable charging current (Icc)	A	25	25	25	25	25
Earth fault current (Ief1)	A	180	180	180	180	180
Number of makings		5	5	5	5	5
Transformer feeder						
Rated current	A	63	63	63	63	63
Fuse switch						
Rated current	A	63	63	63	63	63
Short circuit breaking capacity (limited by the fuse)	kA	25	25	25	25	25
Making capacity	kA	63	63	63	63	63
Circuit breaker						
Short circuit breaking capacity	kA	20	25	20	16/20	20
Rated short time current 1 s	kA	20	25	20	16/20	20
Operational sequence at rated current		O-0.3s-CO-15s-CO	O-0.3s-CO-15s-CO	O-0.3s-CO-15s-CO	O-0.3s-CO-15s-CO	O-3min-CO-3min-CO
Making capacity	kA	50	62.5	50	40/50	50
VCB electrical C/O operations		50000	2000/10000	2000/10000	30000	2000/10000
VCB operating cycles at rated short circuit breaking current		100	As per class E1	As per class E1	50	As per class E1

Notes:
1) Mechanical VCB is self-powered. When used in an MV panel that has no auxiliary power available, a self-powered protection relay like the GE P15D must be used with the mechanical VCB.
2) Magnetic VCB requires an auxiliary power supply to be connected at all times to function. LD = low duty type
3) VA3 available in a standard type and a higher rating type as a special option

Notes:
1) Mechanical VCB is self-powered. When used in a MV panel that has no auxiliary power available, a self-powered protection relay like the GE P15D must be used with the mechanical VCB.
2) Magnetic VCB requires an auxiliary power supply to be connected at all times to function. LD = low duty type

DR/DT-6 series of MV RMUs

ISM magnetic VCB

VA-3 mechanical VCB

DR/DT-6E
extensible /
modular type

DR/DT-6C
compact type

Gas insulated switchgear (GIS)

The DR/DT-6 series of MV RMUs is manufactured in Belgium by Switchgear Company (or SGC) and distributed within Australia and New Zealand by NHP.

The DR-6 and DT-6 panel designs are very similar, but the key difference is the type of vacuum circuit breaker that is used. The DR-6 panels can offer many different functions, but it exclusively uses VA-3 mechanical vacuum circuit breaker technology when a circuit breaker panel is required. The DT-6 panels can also offer many different functions, but it exclusively uses 'ISM magnetic vacuum circuit breaker technology' when a circuit breaker panel is required.

Panels are available in a compact version called 'DR/DT-6C', which houses multiple functions in a sealed tank (typically not more than four functions in a single tank) or an extensible version called the DR/DT-6E which houses a single function within its tank. The optional Arc-Killer 'SV50' can be added to the compact version (DR/DT-6C+) or the extensible version (DR/DT-6E+).

In many cases it is possible to install side mount bushings to the DR-6C, allowing multiple panels to be electrically joined together. The DR-6E panels can be joined to DR-6C panels with bushings fitted to accommodate an extra function, or multiple DR-6E panels can be joined together creating a truly modular MV RMU design, allowing easy and fast replacement in the event of a damaged panel.

DR/DT-6 functional unit part number description

The DR/DT-6 specification part numbers consist of four elements that indicate all the key parameters.

DR-6

DR-6 = with or without mechanical VCB
DT-6 = with magnetic VCB

C

C = Compact type
E = Extensible with one bushing
2E = Extensible with dual bushings

2K

First character = quantity of a function*
Second character = function type

T

First character = quantity of next function*
Second character = function type

*Less than 2 of the same function then no number character is given (ie T = 1T function)

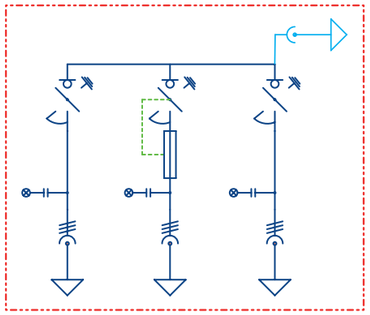
Function description

K	Incoming out going cubicle
D	Circuit breaker cubicle
T	Fuse protection cubicles (combined)
C	Metering cubicle gas insulated

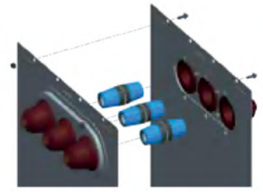
Example:

DR-6C 2K2T contains 2 x K function (incoming out going cubicle) and 2 x T function (fuse protection cubicles)

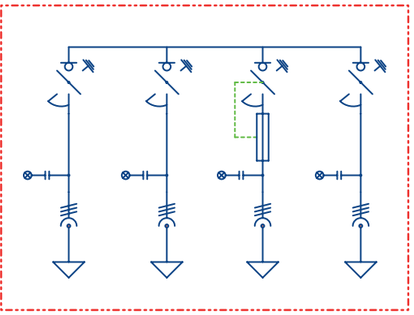
DR-6 C multiple functions per panel examples



DR-6 C 2KT

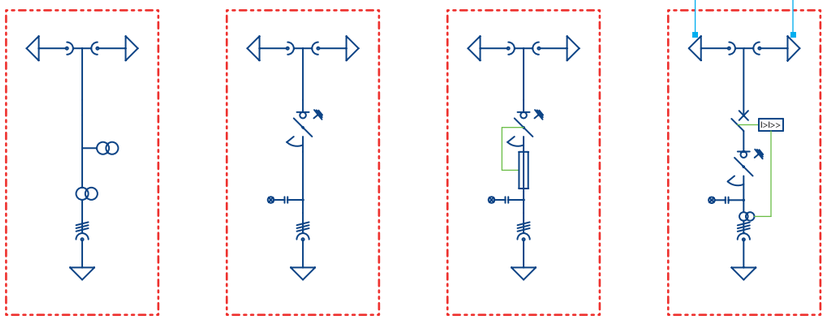


With bushing installed, the compact part number changes to DR-6 C 2KT, making the panel a 'compact extensible' concept



DR-6 C 3KT

DR-6 E single function per panel examples



DR-6 E single function in a panel have dual side bushings

DR-6 2E K | **DR-6 2E T** | **DR-6 2E D** | **DR-6 2E C**

DR-6/DT-6 series MV RMUs

Internal arc resistance

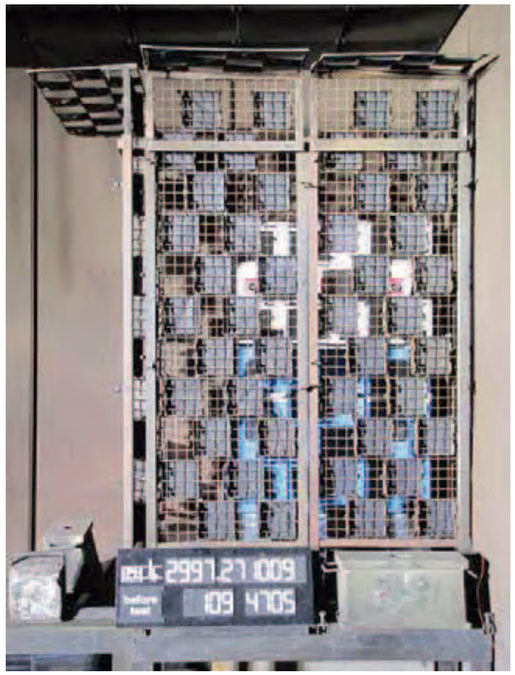
The DR-6/DT-6 is designed to resist internal arcs, protecting both the operator and the installation. Through a strategic pressure burst disc release system, the internal arc is restricted to the compartment where it originated and it does not propagate towards the operator or to other compartments.

The side walls are made using 2mm thick sheet metal, further stopping the damage between panels.

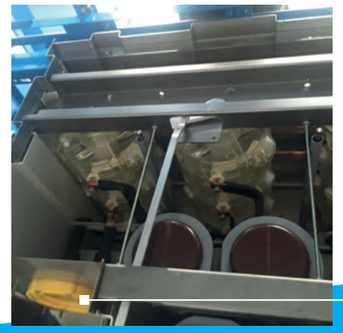
For rear venting, reinforced side plates can be used to create a closed expansion space. Options are available for venting into cable trenches.

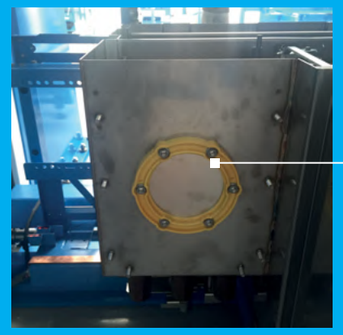
DR-6 cubicles have been independently tested and are certified with an A-FL internal arc classification for 20kA/1s at a rated voltage of 17.5 kV/24 kV according to IEC 62271-200, appendix A and met the 5 criteria.

Consequently, all DR-6 cubicles are internal arc resistant.



Before test
(IAC 20kA/1 sec. (17,5kV))





Pressure burst disc release system mounted at the bottom of the sealed tank

After test
(IAC 20kA/1 sec. (17,5kV))

DR-6+/DT-6+ with 'Arc-Killer' series MV RMUs

Gas insulated switchgear (model DR-6+)

The DR-6+/DT-6+ is a special version of the standard DR-6 cubical. It has an in-built arc extinguishment system called the SV-50 'Arc-Killer', which can clear an arc fault in less than 25 ms, therefore protecting the cubicles, surrounding infrastructure and, most importantly, people against the negative consequences of an internal arc.

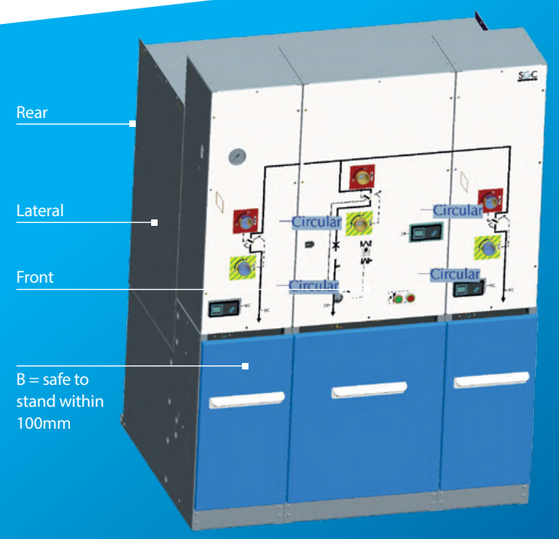
Arc-Killer option

Without Arc-Killer

With Arc-Killer

In the case of an internal arc, the expansion of hot gasses in a room can be reduced to an absolute minimum. This upgrades the internal arc classification (IAC) to category B, FLR 20kA 1 s. (F = frontal, L = lateral, R = rear).

As a result, the operator is protected against the negative consequences of an arc, whether they stand in front of the switchboard, next to it or behind it.



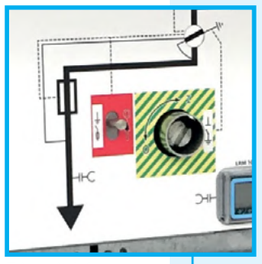
Arc-Killer provides a B-FLR classification

DR-6/DT-6 series of MV RMUs

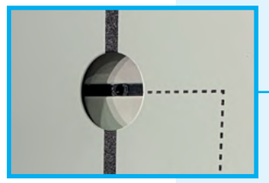
Typical panel layout

RV50 load break switch and earth switch which can both be padlocked in the open position

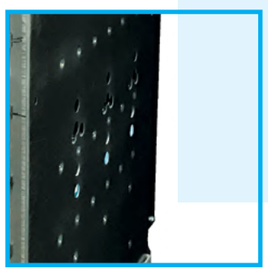
DR-6 with load break switches



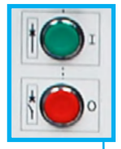
Trip switch fuse combination



Position indication



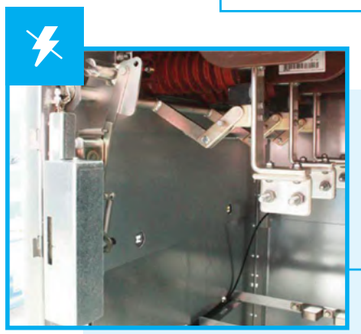
2mm thick steel walls ensuring internal arc fault containment



Local LBS motorisation buttons

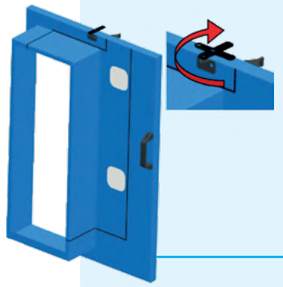
VCB tripping axel

Protection relay

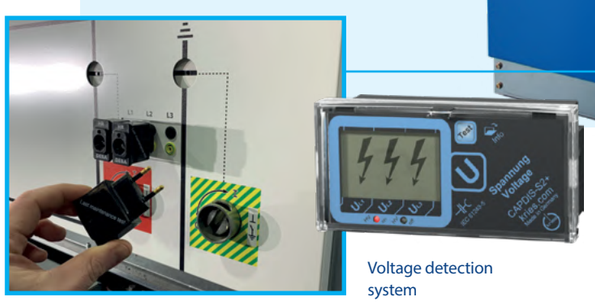


Internal Arc-Killer mechanism on the DT-6+

DT-6 with VCB



Access door to cable compartment. For safety, the door is mechanically interlocked whereby the earh switxh must be closed before the door can be removed and the load break switch can't be closed with the door removed. The door can be padlocked to stop removal.



Voltage detection system

DR-6/DT-6 series MV RMU - core components

Vacuum circuit breakers, load break switches and earth switches

RV-50 load break switch

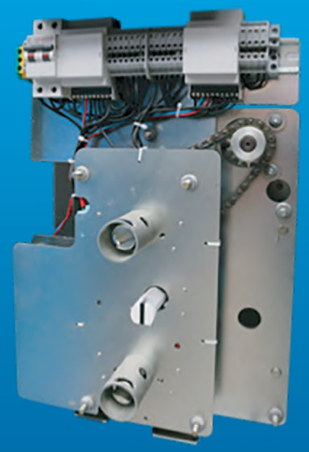
RV-50 LBS with integrated earthing switch

The RV-50 load break switch is a three-position (ON/OFF/EARTH) switch that has exceptional isolating and arc extinguishing capabilities. A short arcing time is achieved by optimising the speed of the mechanical drive in combination with a SF_6 gas rotation.

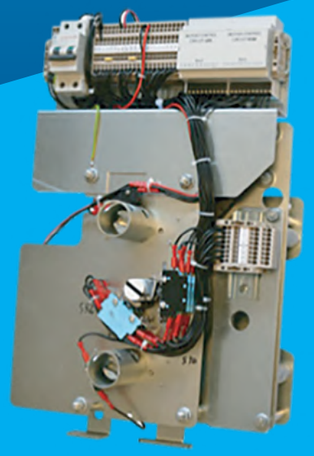
The RV50 provides:

- A natural interlock between the ON/OFF/EARTH positions
- Maintenance friendly operation
- Operation of switch in one mechanical drive with 2 different mechanically interlocked operating shafts
- Options for manual or motor operation. Motorisation allows for remote control, remote position indication and integration into a SCADA operated network.

The RV-50 does contain SF_6 gas and is 'sealed for life' in a fully wielded tank, having a design life of more than 200 years.



DA-53-MM
(fully motorised)



DP-50-MM
(fully motorised)

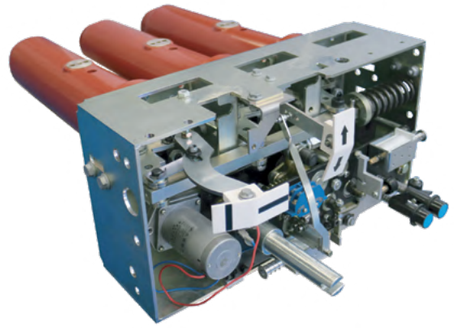
RV-50 LBS drive mechanisms

The RV-50 load break switch mechanical drive is made of a high tensile steel that accommodates both the operating axles (LBS and ES) and the interlocks. The spring type drive is operating independently of the operator and does not allow any function violation.

The indicator of the mechanical drive is directly connected with the LBS which assures at any time the real status of the LBS. The forces needed to control the mechanism are low ensuring operator comfort and safety.

The DA-53 series mechanism can be manual of fully motorised and is used with the combination LBS / ESW.

The DP-50 series mechanism can be manual of fully motorised and is used with the combination LBS / fuse switch and ESW.



VA-3 vacuum circuit breaker (VCB)

The VA-3 series of (VCBs) are an extremely compact and reliable, mechanically spring actuated general purpose device, suitable for most MV applications. The VA-3 is rated for 10,000 switching operations.

The VA-3 series can be manually switched (open / close cycle) by charging the operating springs by using a charging handle or automatically via an optional electric motor. Remote open / close operation requires the inclusion of a charging motor, a closing coil and a shunt coil.

Fuse holders

The fuse holders are water tight and are made for HRC fuses of the DIN and UTE type for voltages of 10, 17,5 and 24 kV.

Earthing on both sides of the fuses is clearly marked on the synoptic diagram. The access to the fuse holders is facilitated by a simple and logic interlock system allowing the opening of the door only after earthing of the cubicle.

MV panel with ISM VCB showing manual VCB opening lever

ISM magnetic VCB

The ISM magnetic actuator vacuum circuit breaker uses the latest vacuum interrupter technology and is ideal for frequent switching application as it can provide tens of thousands of switching operations.

At 12kV the ISM is capable of 50,000 operations and at 24kV it is capable of 30,000 operations.

The ISM VCB can only be closed electrically - mechanical closing is not possible*. The ISM VCB can be opened manually using the opening lever and electrically.

The circuit breaker operates through a control module

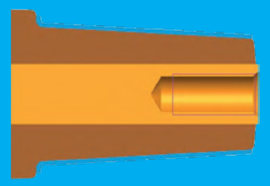
ISM VCB with control module and manual generator

* In absence of auxiliary voltage, a manually operated generator can be used.

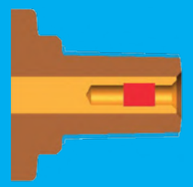
Cable connections

The cables in the switch and circuit breaker compartment are connected by means of bushings type interface C (630 A) with M16 screwed contacts. A maximum section of 240mm² per cable can be connected.

The cable connection on the switch fuse combination is performed by means plugs type interface A (250 A), a maximum section of 95 mm² per cable can be connected. All bushings are made according to EN 50181 standards. The cable compartment size allows one connector per bushing with a maximum of 240mm² per cable.



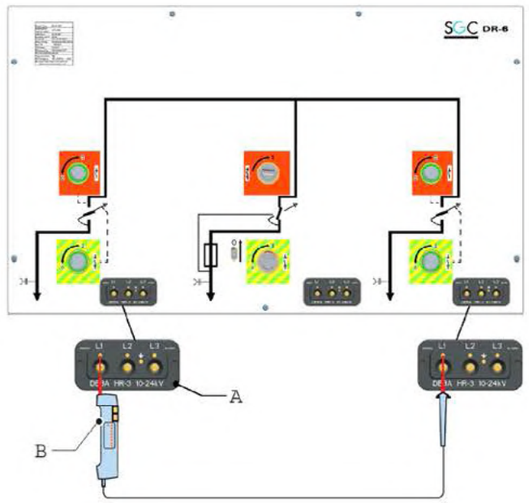
Cable transit type interface C



Cable transit type interface A

Phase sequence test points

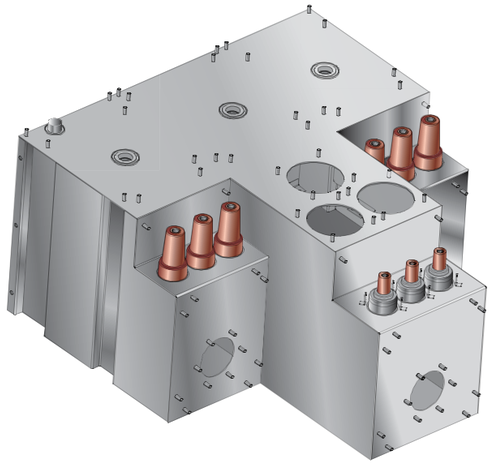
Through the removable voltage indicators, the phase sequence can be measured easily at the front panel.



The enclosure connections

The welded tank is sealed for life and tested under vacuum in the strictest conditions.

The enclosure accommodates the live components and is equipped with a rupture disk deviating the overpressure in the unlikely event of an internal fault.



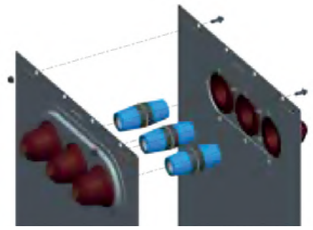
Synoptic diagram

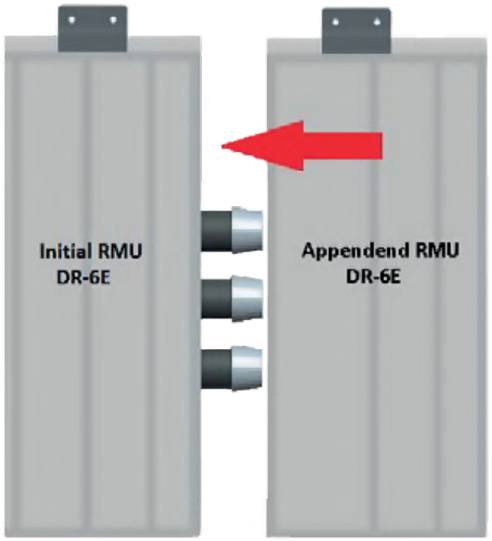
A very clear synoptic diagram is placed in front of each of the functions. This diagram also supports the voltage detection system (type HR or LRM), showing the presence of the voltage on the cables and allowing the use of phase concordance units. Short circuit indicators can find their place in the LV compartment and the associated ring type CTs in the cable compartment. Complementary accessories can be accommodated in a well designed LV box to be placed on the top of the concerned function(s).

Extensibility connections

Extensibility of the ring main unit is ensured by side placed or inner cone bushings.

An insulated extension device connects the two sets to be extended. Extension requires no special tooling nor special on site condition.





Cable transit type interface C

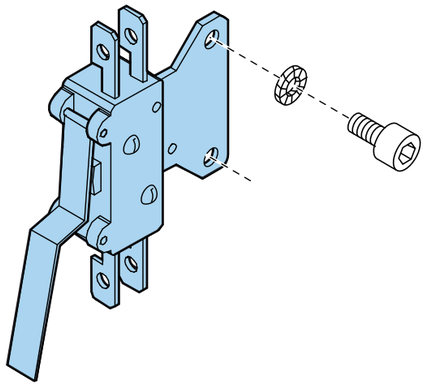
DR-6/DT-6 options and accessories range

A number of factory fit accessories are available. Electrically operated accessory voltages ranges available are: VDC: 24, 48, 110 or VAC: 110, 220 (accessories are not multi voltage)

Auxiliary contacts options for remote indication

- 1, 2, 3, 4x N(O/C) on RV-50 load break switch
- 1, or 2x N(O/C) on earth switch
- 1x N(O/C) ready to close indicator on ISM VCB
- 1x N(O/C) on ISM VCB control module in fault
- 1, 2, 3 x N(O/C) block aux. on ISM VCB
- 1 x N(O/C) block aux. on Ronis key interlock
- Blown fuse indicator
- 1 or 2 x N(O/C) block aux. on blown HRC fuse
- 1 x N(O/C) ready to close indicator on VCB VA-3

N (O/C) = Normally open (N/O) and normally closed (N/C)



Auxiliary switch

Lamp indications and resets

- Open/closed indication lamp (LBS and / or ESW)
- Open/closed indication lamp (VCB)
- Closing spring on VCB is charged/armed lamp
- VCB protection relay trip status active lamp
- VCB protection relay trip status active remote reset
- Trip circuit healthy indication lamp
- Heating turned ON indication lamp

Voltage indicator options and lamp indicators

- HR3 plug in cable side live line capacitive light indicator
- CAPDIS S1+ integrated capacitive voltage detecting system
- CAPDIS S2+ integrated capacitive voltage detecting system + relay O/P

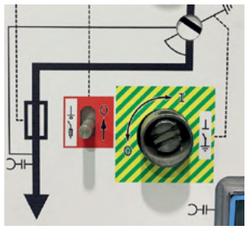
HR3 indicator

CAPDIS S1+

CAPDIS S2+

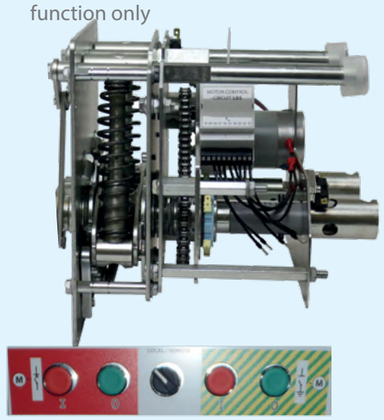
Manual operation trip open button for the DR-6-T panel

- The DR-6-T has a switchgear panel door mounted trip leaver to trip open the LBS. For all other panels, manual opening is achieved using the loose mechanical handle



Motorisation (RV-50 LBS and ESW)

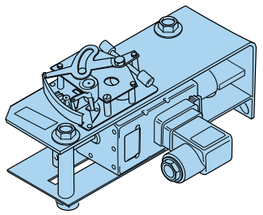
- Motor operation including local/remote switch and push buttons
  - 2 pole local / remote selector switch
  - 2 pole key operated local / remote selector switch
  - 2 pole padlockable local / remote selector switch
  - 3 pole local / off / remote selector switch
- 'Motorisation' allows for remote closing on all panels
- Closing time is 15 seconds (including spring charging time)
- Opening time is 15 seconds (including spring charging time) for DR-6-K
- LBS and ESW can still be operated manually
- VA-3 can be motorised for the spring charging function only



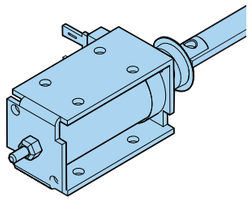
LBS and ESW motorisation mechanism

Remote operation coils / under voltage trip coils (UVT)

- Remote opening trip coil for DR-6-T (RV50 LBS).* For DR-6-T, auxiliary contact on LBS is required
- Remote opening trip coil for VA-3 VCB
- ISM remote open / close achieved via electronic controller
- Low energy opening trip coil VA-3**
- Closing coil for the VA-3 VCB
- Mechanical type (delayed or instant operation) UVT coil for the VA-3 VCB or RV-50 in the transformer protection panel DR-6-T
- Under voltage relay for the ISM
- Electronic type UVT coil for the VA-3***



UVT coil



Shunt coil

*DF-T remote coil opening time is less than 100ms
**24VDC rating available only
***220VAC rating available only

Operations counter

- An operation cycle counter can be fitted to the VCB (not the LBS)

Current transformers (CTs) and voltage transformers (VTs) for VCB panels

Two types of CTs can be used with the DR/DT-6 VCB panels:

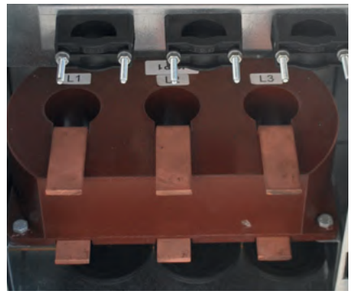
Block type

1) Toroidal type

*MTO = manufactured to order, typically 50/1, 100/1, 150/1, 400/1, 600/1, 800/1

Dual secondary cores available as an option for CTs and VTs

Typical CT/VT characteristics table

Technical specification		Block type		Toroidal type	
					
Core quantity		1 core CT		1 core CT	
Application		Revenue metering		Protection	
Ratio	Accuracy class	MTO	0.2(S) and 0.5(S)	50/1A	10P
				150/1A	5P
				200/1A	5P
				400/1A	5P
				600/1A	5P
Buden (VA)		10-15		2.5	
Ratio	Accuracy limit factor	MTO	N/A	50/1A	4
				150/1A	4
				200/1A	4
				400/1A	4
				600/1A	4
Voltage transformer data – block type design					
Application		Revenue metering		Protection	
Accuracy class		0.5		3P	
Buden (VA)		25			

IKI-20 short circuit / earth fault indicator

- The IKI-20 is used for the detection, indication and remote monitoring of short-circuits in high voltage networks.
- Additionally, it indicates earth-faults* in networks with solidly, low resistive or shortly low resistive earthed termination.

*Please contact NHP regarding limitations for earth fault detection.

ISM control module manual generator

- Hand held power supply for the ISM closing in the case of aux. power loss

Larger panel to accommodate surge arresters

- Surge arresters to be part of the elbow cable connector are not supplied by NHP/SGC, but need a special, larger version of the panel to accommodate the larger cable connection

Anti-condensation heater

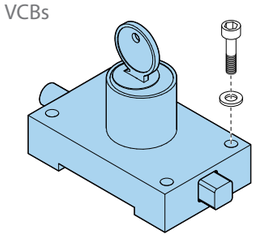
- Heater + thermostat, 30W/250VAC, thermostat 0-60°C

Electrical interlock

- Electrical interlock between ISM VCB and RV-50 LBS
- Electrical interlock between ESW and RV-50 LBS

Key interlocking

- Both the RV-50 LBS and the earth switch can have a Ronis type key interlocking system fitted (open or closed position options available)
- Ronis type key interlocks systems can be fitted to the VA-3 VCBs



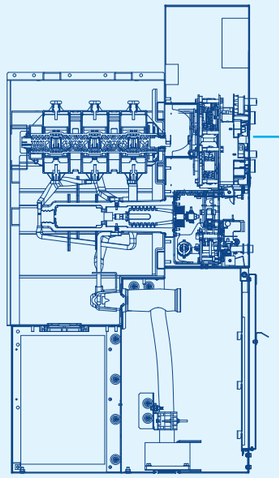
Ronis key interlock fitted to LBS/ESW panel

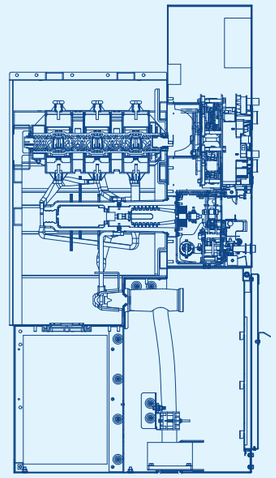
DR-6/DT-6 series MV RMU panel mechanical structure

Compartments

A) Low voltage compartment

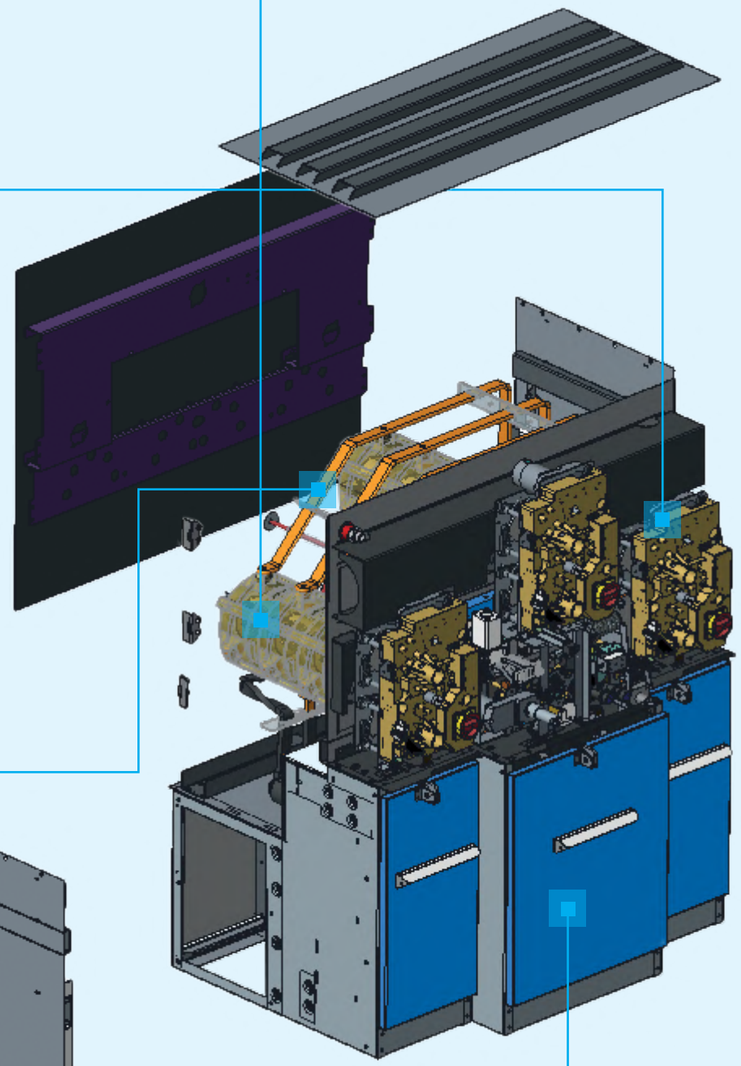
The drive mechanism that controls the RV-50 load break switch and the earthing switch EM-20 is fitted with the synoptic diagram and is located behind the front panel. Several accessories, such as the auxiliary contacts, switch-on or switch-off coils and minimum voltage relays are also located in this compartment. Any engine control with the necessary electrical switchgear, a control and clamp strip are also installed in this compartment. The compartment can be accessed very easily by disassembling the front panel.

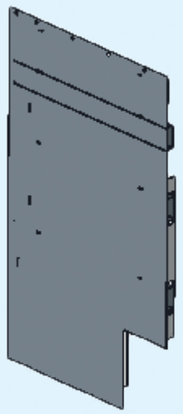


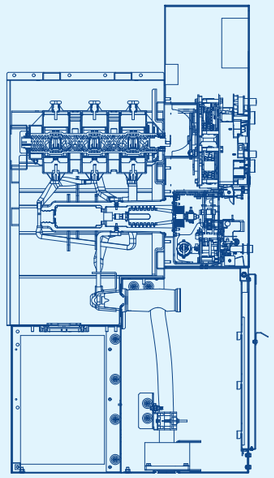


B) Busbar compartment

The busbar compartment is located in the upper part of the cubicle and behind the low voltage compartment. The modular busbar set is manufactured from specially provided electrolyte F25 copper of 60 x 10 mm with n = 5 mm (800 A). Several cubicles are connected through the bar set compartments. Hexagonal bolts connect the busbars to the upper contact surfaces of the RV-50 load break switch.

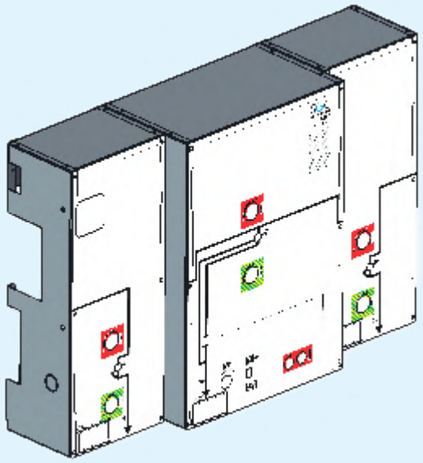


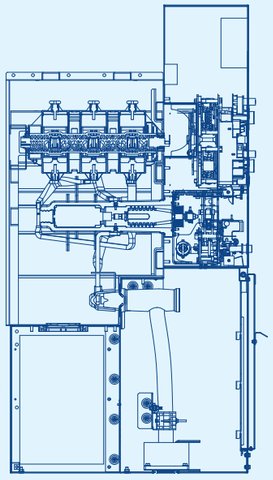




C) Switchgear compartment

The RV-50 load break switch is a three-position (ON/OFF/EARTH) switch that has exceptional isolating and arc extinguishing capabilities. A short arcing time is achieved by optimising the speed of the mechanical drive in combination with a SF_6 gas rotation.





D) Cable compartment

The cable compartment is located behind the interlocked, removable door of the DR-6 cubicle. This part of the field receives the cable(s) and contains the necessary equipment to connect the cable(s).

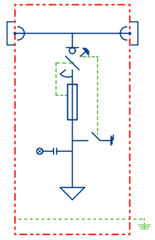
The earthing switch is installed below the load break switch.

The removable door, the sectional floor panels, which house the necessary conductive rubber for the cables and the cable supports, all simplify the cable connection.

DR-6/DT-6 series MV switchgear - available modules

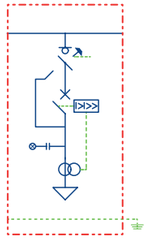
Specifications, dimensions and applications

NSIOP = network switch incoming / outgoing panel
FPSPP = fuse protection switch protection panel



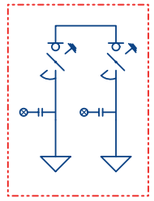
DR-6E T panel

An extensible combined fuse switch feeder protection panel



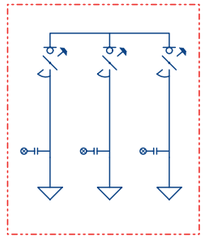
DR-6E D panel

An extensible vacuum circuit breaker protection panel



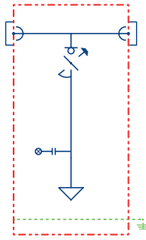
DR-6C 2K panel

A compact double NSIOP



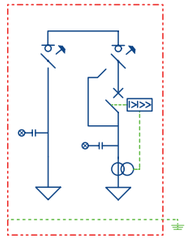
DR-6C 3K panel

A compact triple NSIOP



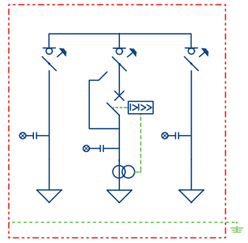
DR-6E K panel

An extensible single NSIOP



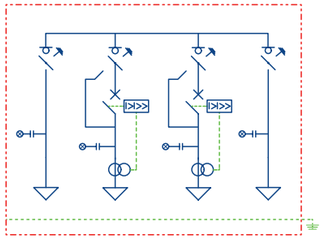
DR-6C KD panel

A compact single vacuum circuit breaker line protection panel and single NSIOP



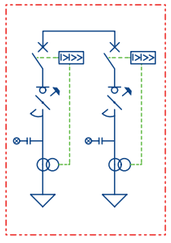
DR-6C 2KD panel

A compact single vacuum circuit breaker line protection panel and double NSIOP



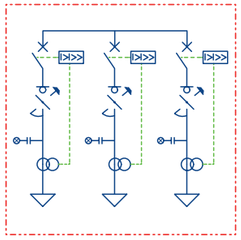
DR-6C 2K2D panel

A compact double vacuum circuit breaker line protection panel and double NSIOP



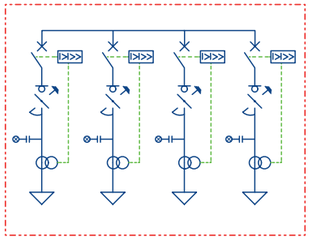
DT-6C 2D panel

A compact double vacuum circuit breaker line protection panel



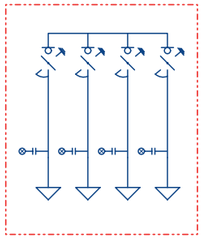
DT-6C 3D panel

A compact triple vacuum circuit breaker line protection panel



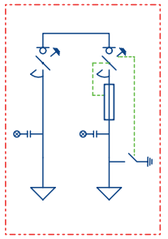
DT-6C 4D panel

A compact four vacuum circuit breaker line protection panel



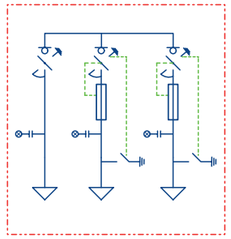
DR-6C 4K panel

A compact four NSIOP



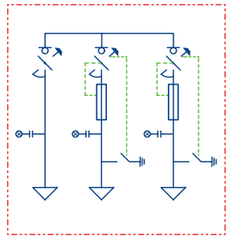
DR-6C KT panel

A compact combined single FPSPP and single NSIOP



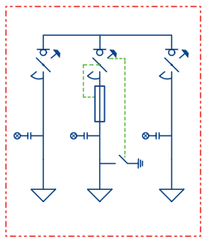
DR-6C K2T panel

A compact combined double FPSPP and single NSIOP



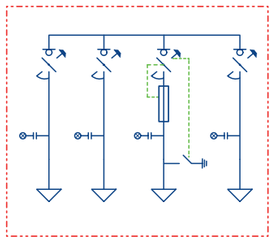
DR-6C K3T panel

A compact combined triple FPSPP and single NSIOP



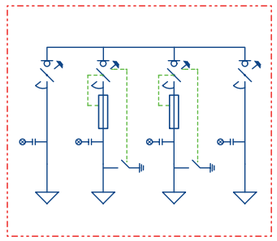
DR-6C 2KT panel

A compact combined single FPSPP and double NSIOP



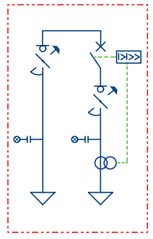
DR-6C 3KT panel

A compact combined single FPSPP and triple NSIOP



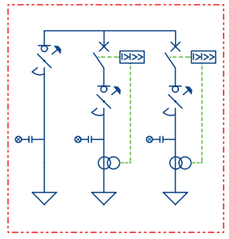
DR-6C 2K2T panel

A compact combined double FPSPP and double NSIOP



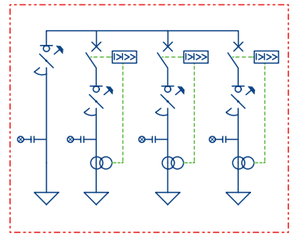
DT-6C KD panel

A compact vacuum circuit breaker line protection panel and single NSIOP



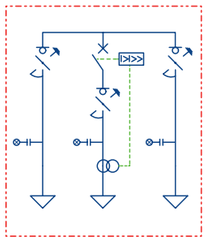
DT-6C K2D panel

A compact double vacuum circuit breaker line protection panel and single NSIOP



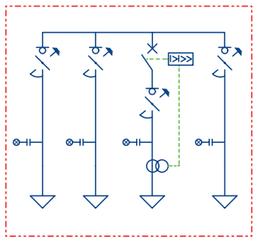
DT-6C K3D panel

A compact triple vacuum circuit breaker line protection panel



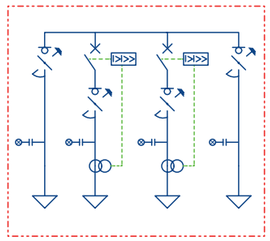
DT-6C 2KD panel

A compact vacuum circuit breaker line protection panel and double NSIOP



DT-6C 3KD panel

A compact vacuum circuit breaker line protection panel and triple NSIOP

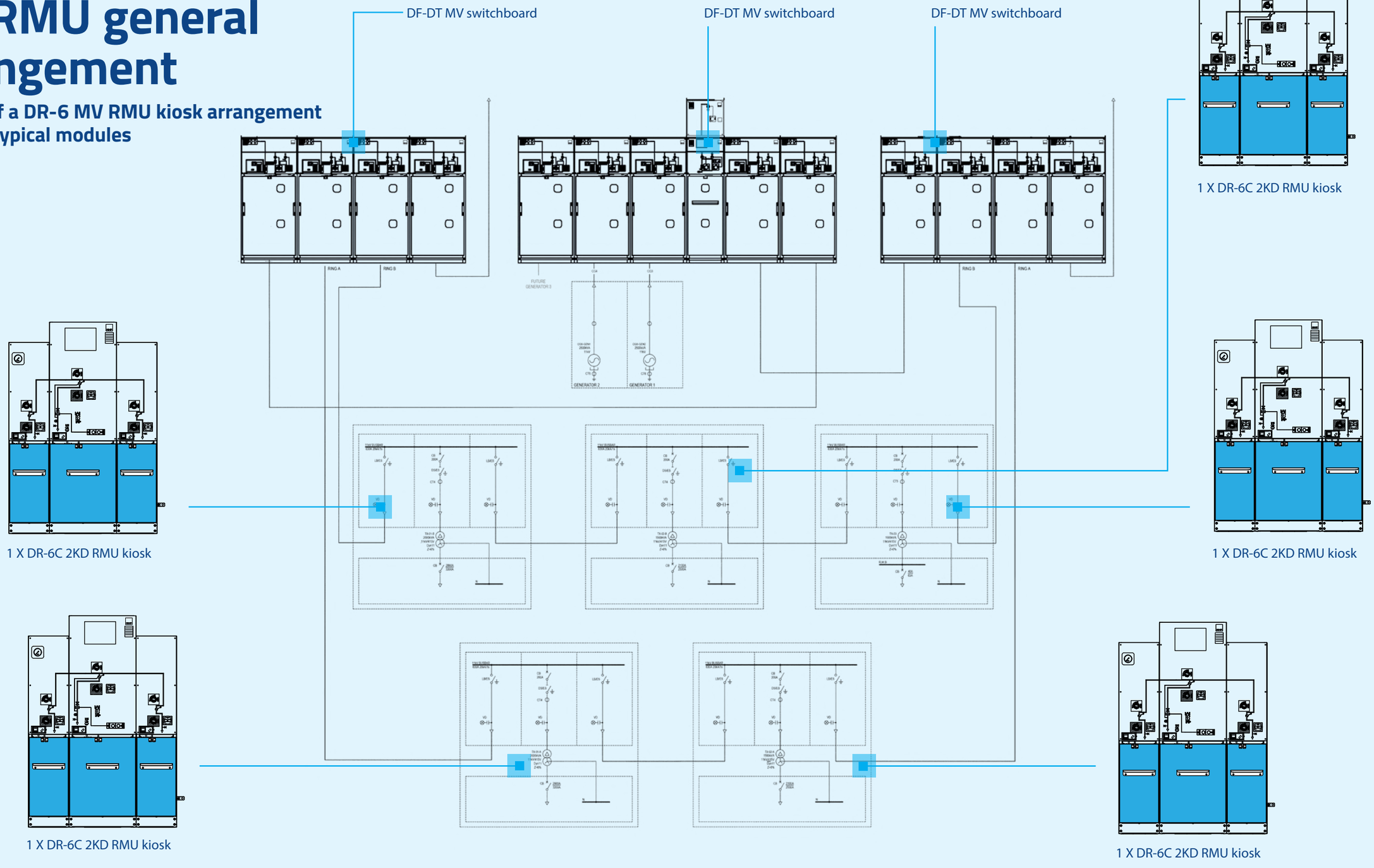


DT-6C 2K2D panel

A compact double vacuum circuit breaker line protection panel and double NSIOP

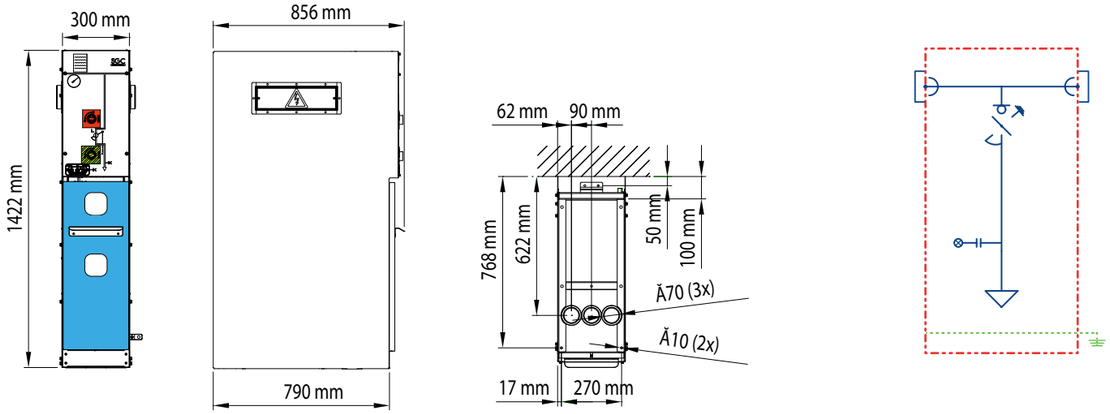
DR-6/DT-6 series MV RMU general arrangement

Example of a DR-6 MV RMU kiosk arrangement featuring typical modules



DR-6E-K panel

An extensible single network switch incoming / outgoing panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A protection panel that would typically be feeding outgoing cables connected to a transformer or load

Specification and dimensions

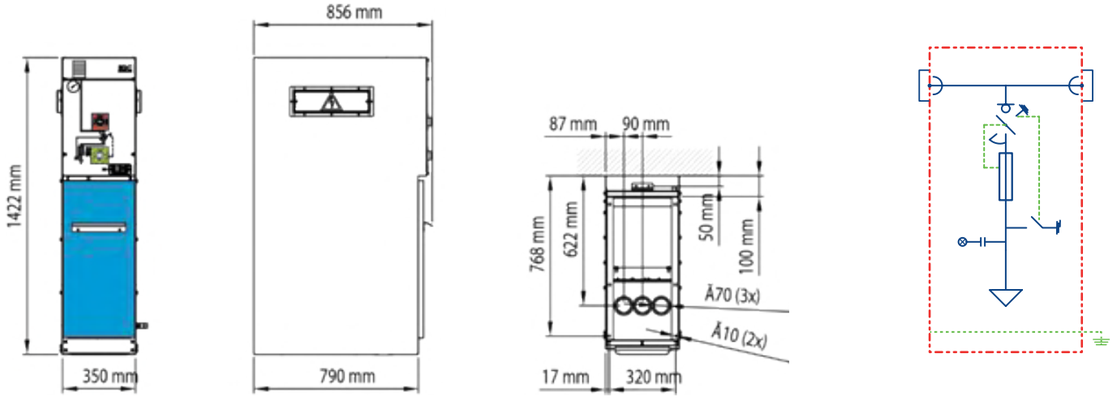
Rated voltage	kV	12	17,5	24/25
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	300	300	300
Depth including side plate	mm	1006	1006	1006
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	315	315	315

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

DR-6E-T panel

An extensible combined fuse switch feeder protection panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- Outgoing line protection panel typically feeding a transformer, load, or an outgoing cable

Specification and dimensions

Rated voltage	kV	12	17,5	24/25
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	300	300	300
Depth including side plate	mm	1006	1006	1006
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	210	210	210

Options

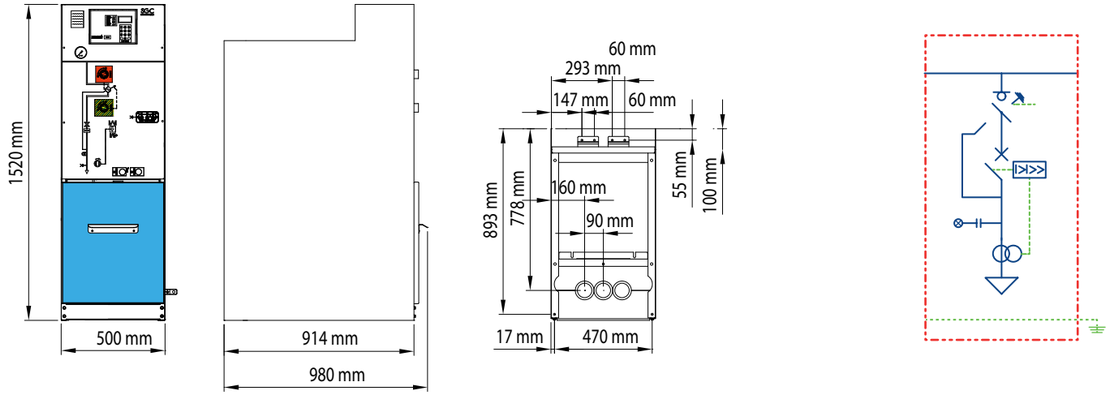
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for vacuum circuit breaker:

- Operating sequence CO or O-0,3s-CO-15s-CO
- Motor operation 24-48-110 VDC/110-220 VAC
- Auxiliary contacts (optionally spring charged)
- Operation counter
- Closing coil
- Tripping coil (x2)
- Mechanical close and/or trip button

DR-6E-D panel

An extensible vacuum circuit breaker protection panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- Outgoing line protection panel typically feeding a transformer, load or an outgoing cable

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	500	500	500
Depth including side plate	mm	1130	1130	1130
Height	mm	1520	1520	1520
Height between bottom and bushing	mm	745	745	745
Weight	mm	315	315	315

Options

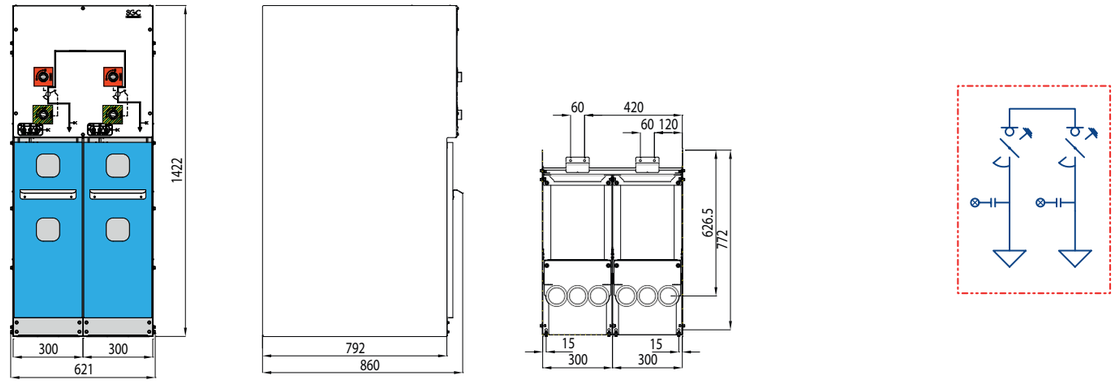
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for vacuum circuit breaker:

- Operating sequence CO or O-0,3s-CO-15s-CO
- Motor operation 24-48-110 VDC/110-220 VAC
- Auxiliary contacts (optionally spring charged)
- Operation counter
- Closing coil
- Tripping coil (x2)
- Mechanical close and/or trip button

DR-6C-2K panel

A compact double network switch incoming / outgoing panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network, often between kiosks

Specification and dimensions

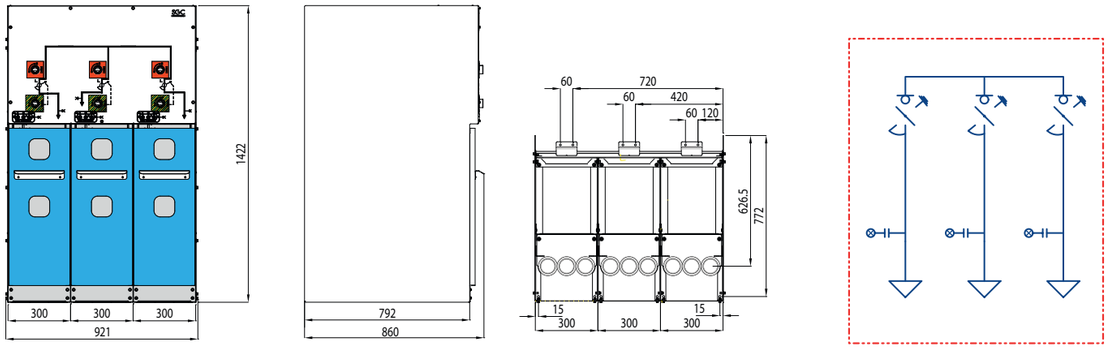
Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	621	621	621
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	210	210	210

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

DR-6C-3K panel

A compact triple network switch incoming / outgoing panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network, often between kiosks

Specification and dimensions

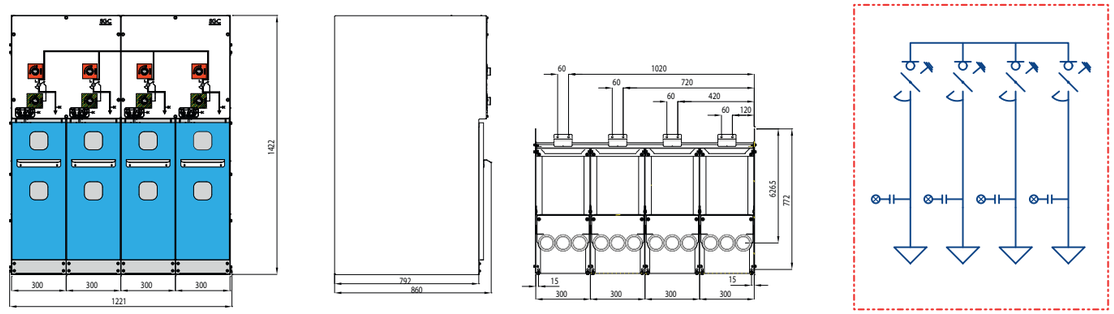
Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	921	921	921
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	315	315	315

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

DR-6C-4K panel

A compact four network switch incoming / outgoing panel



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network, often between kiosks

Specification and dimensions

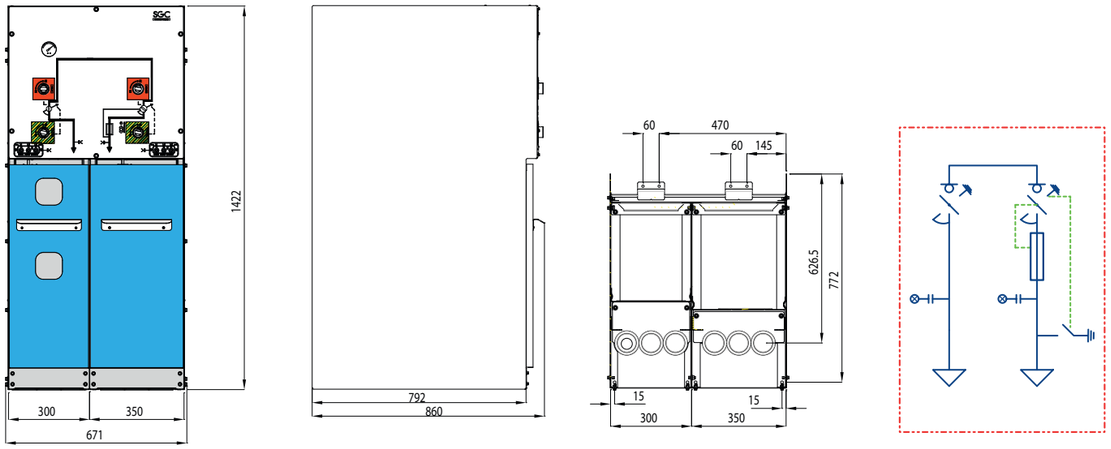
Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	921	921	921
Depth including side plate	mm	860	860	860
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	315	315	315

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

DR-6C-KT panel

A compact combined single fuse protection switch protection panel, single network switch incoming outgoing panel



Standard equipment for the isolator ‘K’ function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240 mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Standard equipment for the fuse switch ‘T’ function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240 mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Options for ‘K’ and ‘T’ function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type ‘Kries Capdis S1+’, ‘Kries Capdis S2+’, ‘Horstmann type Wega 1.2C’, ‘Horstmann type Wega 2.2C’
- Integrated windows

Options for ‘T’ function only

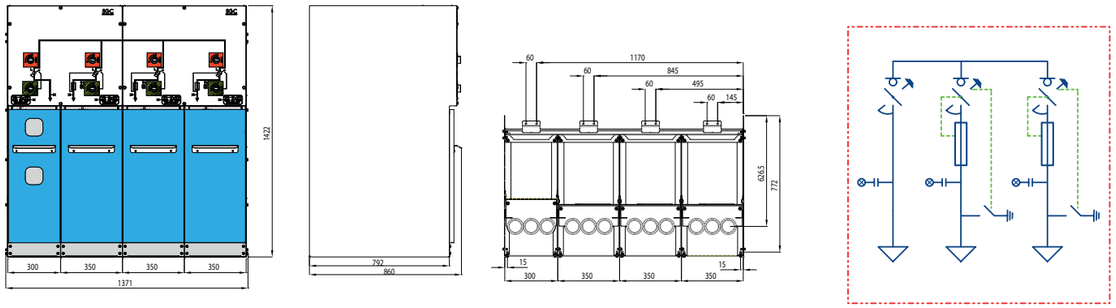
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuses
- Fault indiactor ‘fuse tripped’
- Fault contact ‘fuse tripped’
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	671	671	671
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	292/442/520 (DIN)/(UTE)
Weight	mm	295	295	295

DR-6C-K2T panel

A compact combined double fuse protection switch protection panel, single network switch incoming / outgoing panel



Standard equipment for the isolator 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240 mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides two protection panels that would typically be feeding outgoing cables connected to a transformer or load

Standard equipment for the fuse switch 'T' function

- Three phase three positions load break switch/fuse combination of the type RV-50, according to IEC62271-105
- 24kV-63A-Icc25kA with making capacity of 63kA
- Double interlocked earthing switch, with a making capacity up to 50kA
- Fuse holder for HRC fuses:
  - e = 292 mm DIN 10 / 17.5kV
  - e = 442 mm DIN 10 / 24kV
  - e = 520mm UTE 24kV
- Three pole fuse trip in case of one fuse tripping
- Bushing interface type A, according to DIN EN 50181
- Switch off mechanism through hitting bolt
- Cable clamps for monopolar cable with section up to 95mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'T' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for 'T' function only

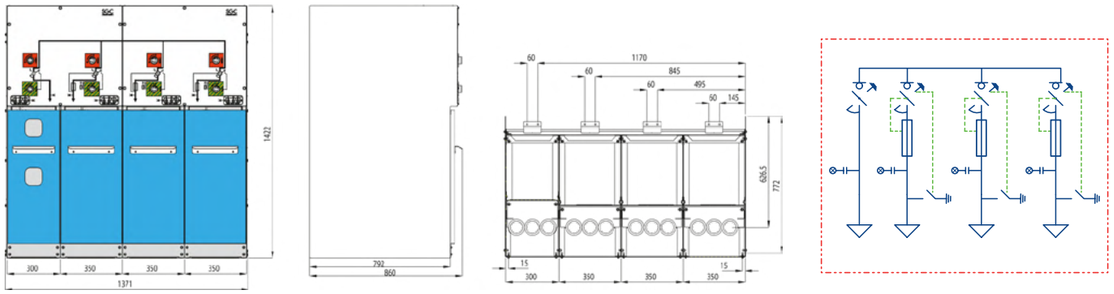
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuse
- Fault indiactor 'fuse tripped'
- Fault contact 'fuse tripped'
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1021	1021	1021
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	294 /442/520 (DIN)/(UTE)
Weight	mm	485	485	485

DR-6C-K3T panel

A compact combined triple fuse protection switch protection panel, single network switch incoming / outgoing panel



Standard equipment for the isolator 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides three protection panels that would typically be feeding outgoing cables connected to a transformer or load

Standard equipment for the fuse switch 'T' function

- Three phase three positions load break switch/fuse combination of the type RV-50, according to IEC62271-105
- 24kV-63A-Icc25kA with making capacity of 63kA
- Double interlocked earthing switch, with a making capacity up to 50kA
- Fuse holder for HRC fuses:
  - e = 292 mm DIN 10 / 17.5kV
  - e = 442 mm DIN 10 / 24kV
  - e = 520mm UTE 24kV
- Three pole fuse trip in case of one fuse tripping
- Bushing interface type A, according to DIN EN 50181
- Switch off mechanism through hitting bolt
- Cable clamps for monopolar cable with section up to 95mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'T' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- MV cable access door

Options for 'T' function only

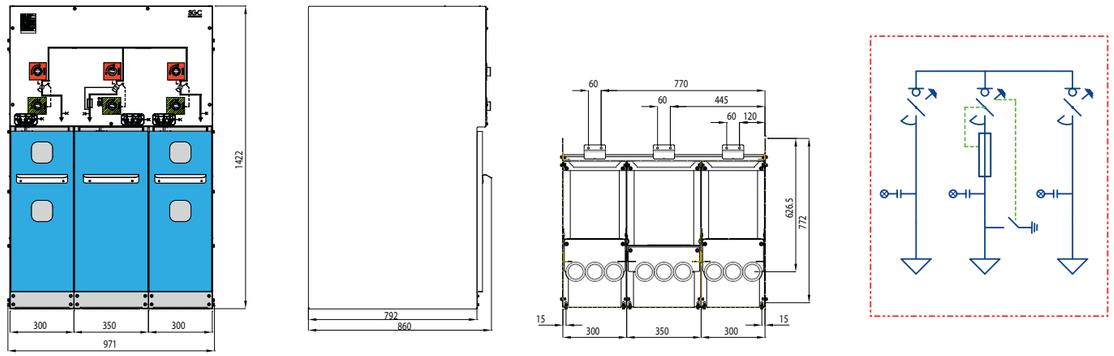
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuse
- Fault indiactor 'fuse tripped'
- Fault contact 'fuse tripped'
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1371	1371	1371
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	294 /442/520 (DIN)/(UTE)
Weight	mm	630	630	630

DR-6C-2KT panel

A compact combined single fuse protection switch protection panel, double network switch incoming / outgoing panels



Standard equipment for the isolator 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Standard equipment for the fuse switch 'T' function

- 'Three phase' three positions load break switch/fuse combination of the type RV-50, according to IEC62271-105
- 24kV-63A-Icc25kA with making capacity of 63kA
- Double interlocked earthing switch, with a making capacity up to 50kA
- Fuse holder for HRC fuses:
  - e = 292 mm DIN 10 / 17.5kV
  - e = 442 mm DIN 10 / 24kV
  - e = 520mm UTE 24kV
- Three pole fuse trip in case of one fuse tripping
- Bushing interface type A, according to DIN EN 50181
- Switch off mechanism through hitting bolt
- Cable clamps for monopolar cable with section up to 95mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'T' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base with heights of 200, 300, 400 mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for 'T' function only

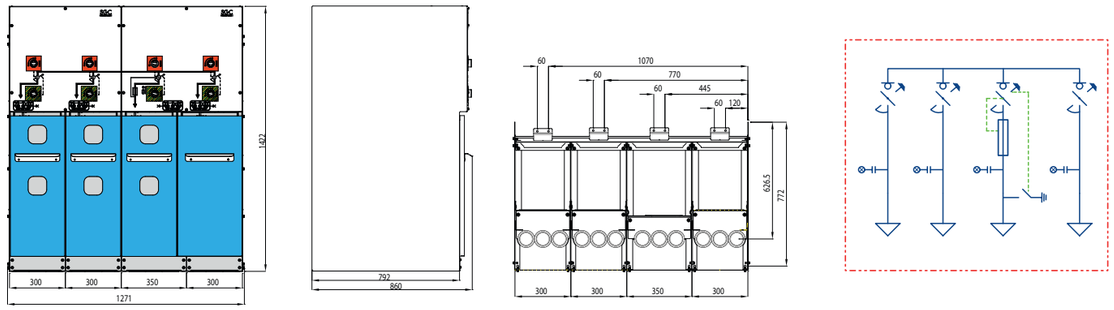
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuse
- Fault indiactor 'fuse tripped'
- Fault contact 'fuse tripped'
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	971	971	971
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	294 /442/520 (DIN)/(UTE)
Weight	mm	400	400	400

DR-6C-3KT panel

A compact combined single fuse protection switch protection panel, triple network switch incoming / outgoing panels



Standard equipment for the isolator 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Standard equipment for the fuse switch 'T' function

- Three phase three positions load break switch/fuse combination of the type RV-50, according to IEC62271-105
- 24kV-63A-Icc25kA with making capacity of 63kA
- Double interlocked earthing switch, with a making capacity up to 50kA
- Fuse holder for HRC fuses:
  - e = 292 mm DIN 10 / 17.5kV
  - e = 442 mm DIN 10 / 24kV
  - e = 520mm UTE 24kV
- Three pole fuse trip in case of one fuse tripping
- Bushing interface type A, according to DIN EN 50181
- Switch off mechanism through hitting bolt
- Cable clamps for monopolar cable with section up to 95mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'T' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base with heights of 200, 300, 400 mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for 'T' function only

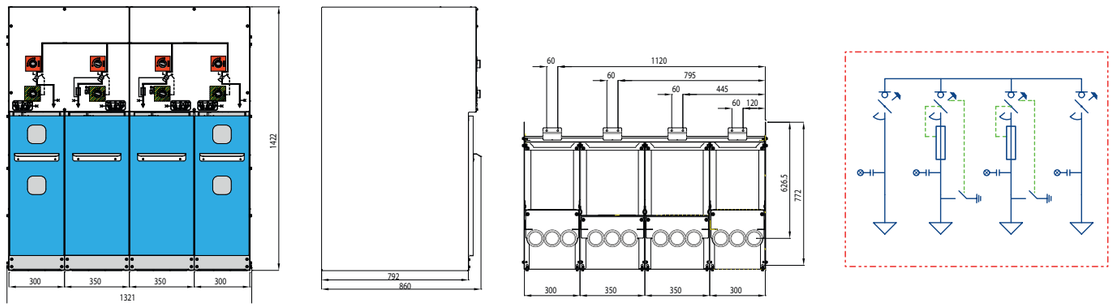
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuse
- Fault indicator 'fuse tripped'
- Fault contact 'fuse tripped'
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	971	971	971
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	294 /442/520 (DIN)/(UTE)
Weight	mm	400	400	400

DR-6C-2K2T panel

A compact combined double fuse protection switch protection panel, double network switch incoming / outgoing panels



Standard equipment for the isolator 'K' function

- Three phase three positions load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Standard equipment for the fuse switch 'T' function

- Three phase three positions load break switch/fuse combination of the type RV-50, according to IEC 62271-105
- 24kV-63A-Icc25kA with making capacity of 63kA
- Double interlocked earthing switch, with a making capacity up to 50kA
- Fuse holder for HRC fuses:
  - e = 292 mm DIN 10 / 17.5 kV
  - e = 442 mm DIN 10 / 24 kV
  - e = 520mm UTE 24 kV
- Three pole fuse trip in case of one fuse tripping
- Bushing interface type A, according to DIN EN 50181
- Switch off mechanism through hitting bolt
- Cable clamps for monopolar cable with section up to 95mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'T' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- No door interlock
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button control
- Remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for 'T' function only

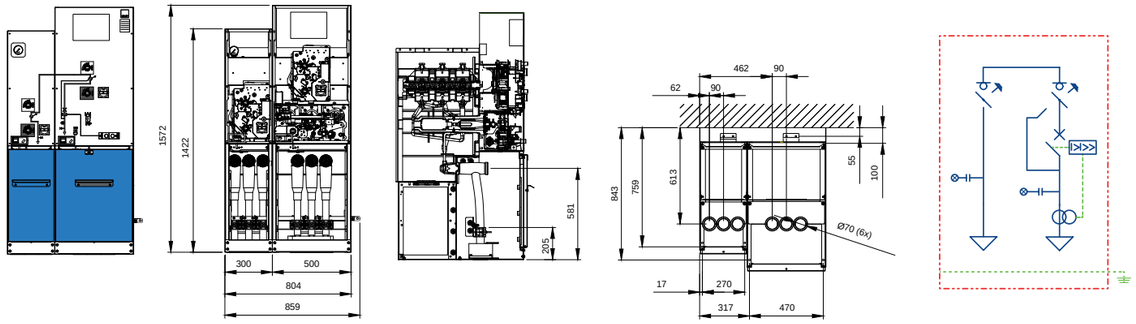
- Tripping coil (24-48-110 V DC or 110-230 V AC)
- Time delayed/direct under voltage release (24-48-110 V DC or 110-230 V AC)
- Closing coil (24-48-110 V DC or 110-230 V AC)
- HRC fuses or spare fuse
- Fault indiactor 'fuse tripped'
- Fault contact 'fuse tripped'
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1271	1271	1271
Depth including side plate	mm	1010	1010	1010
Height	mm	1422	1422	1422
Height between bottom and bushing (K/T)	mm	745/325	745/325	745/325
Fuse size	mm	292 (DIN)	292/442 (DIN)	294 /442/520 (DIN)/(UTE)
Weight	mm	640	640	640

DR-6C-KD panel

A compact single mechanically actuated vacuum circuit breaker line protection panel, single network switch incoming / outgoing panels



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	859	859	859
Depth including side plate	mm	1130	1130	1130
Height	mm	1572	1572	1572
Height between bottom and bushing	mm	581	581	581
Weight	mm	310	310	310

Options

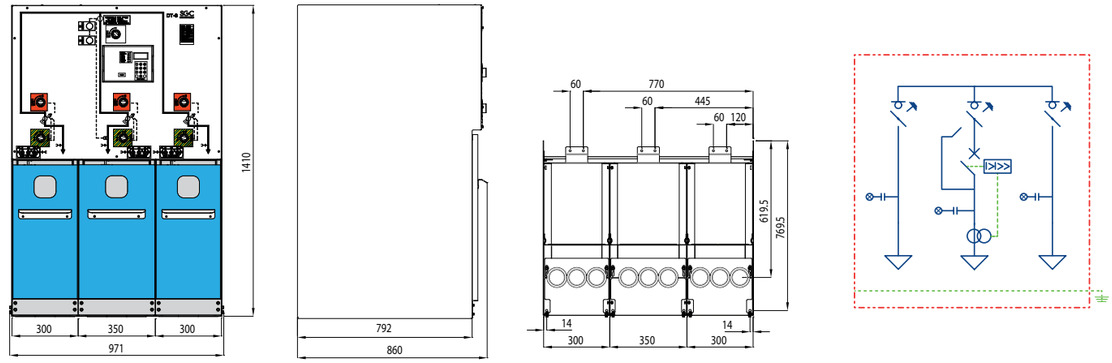
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch:
- 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch:
- 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for vacuum circuit breaker:

- Operating sequence CO or O-0,3s-CO-15s-CO
- Motor operation 24-48-110 VDC/110-220 VAC
- Auxiliary contacts (optionally spring charged)
- Operation counter
- Closing coil
- Tripping coil (x2)
- Mechanical close and/or trip button

DR-6C-2KD panel

A compact single mechanically actuated vacuum circuit breaker line protection panel, double network switch incoming / outgoing panels



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240 mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	621	621	621
Depth including side plate	mm	1130	1130	1130
Height	mm	1422	1422	1422
Height between bottom and bushing	mm	745	745	745
Weight	mm	210	210	210

Options

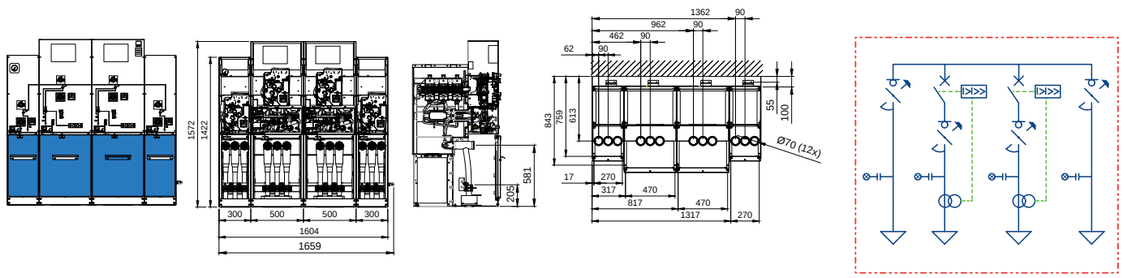
- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for vacuum circuit breaker:

- Operating sequence CO or O-0,3s-CO-15s-CO
- Motor operation 24-48-110 VDC/110-220 VAC
- Auxiliary contacts (optionally spring charged)
- Operation counter
- Closing coil
- Tripping coil (x2)
- Mechanical close and/or trip button

DR-6C-2K2D panel

A compact double mechanically actuated vacuum circuit breaker line protection panel, double network switch incoming / outgoing panels



Standard equipment

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm²
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - often between kiosks - and provides a protection panel that would typically be feeding outgoing cables connected to a transformer or load

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1600	1600	1600
Depth including side plate	mm	1130	1130	1130
Height	mm	1572	1572	1572
Height between bottom and bushing	mm	581	581	581
Weight	mm	580	580	580

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on load break switch and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400mm (other dimensions on request)
- Push button or remote control
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for vacuum circuit breaker:

- Operating sequence CO or O-0,3s-CO-15s-CO
- Motor operation 24-48-110 VDC/110-220 VAC
- Auxiliary contacts (optionally spring charged)
- Operation counter
- Closing coil
- Tripping coil (x2)
- Mechanical close and/or trip button

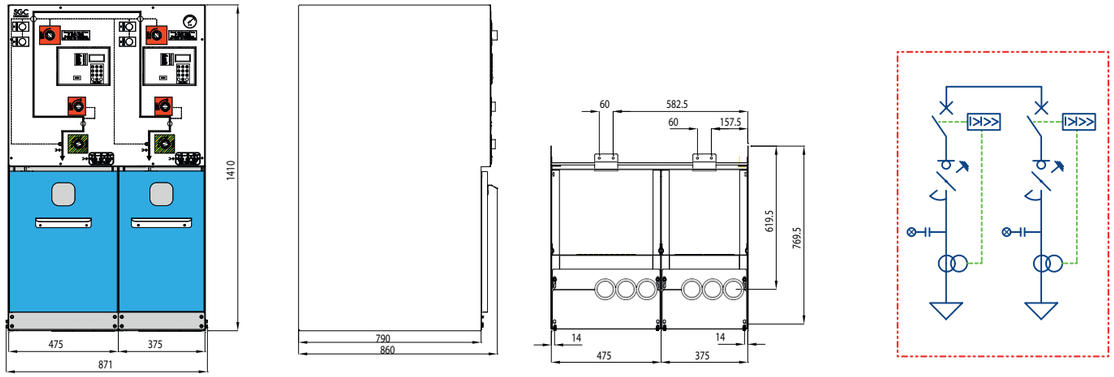
Case study

DT-6+ installation at a South Queensland based university

A university based in South Queensland installed a compact kiosk from NHP containing the DR-6+ and the RV-50 Arc-Killer. Due to the Arc-Killer technology, the DT-6 RMU provided an extra high level of arc flash safety, achieving an internal arc classificatrion (IAC) of BFLR-20 for 1 second.

DT-6C-2D panel

A compact magnetically actuated double vacuum circuit breaker line protection panel



Standard equipment

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection relay of the type GE or SEL
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- Two outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	871	871	871
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing	mm	537	537	537
Weight	mm	450	450	450

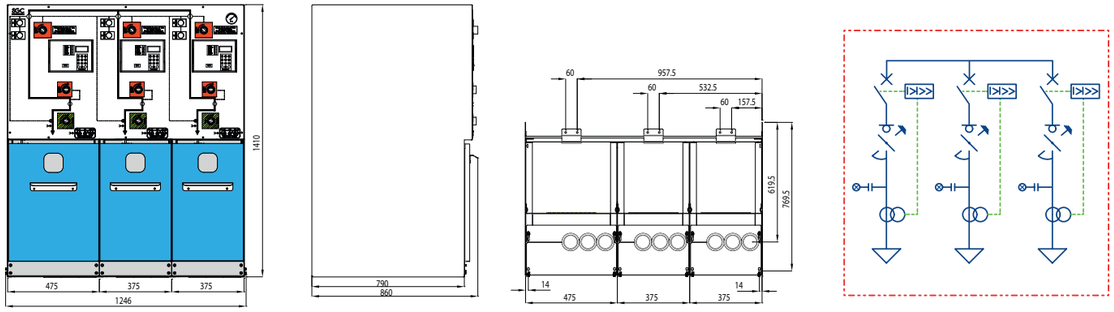
Installation showing DT-6 with a KD panel

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Set of auxiliary contacts on the circuit breaker
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- No door interlock
- Motor operation of the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button operation on the load break switch
- Remote control on the load break switch
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Automatic reclosing
- Integrated windows

DT-6C-3D panel

A compact magnetically actuated triple vacuum circuit breaker line protection panel



Standard equipment

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection relay of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- Three outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Specification and dimensions

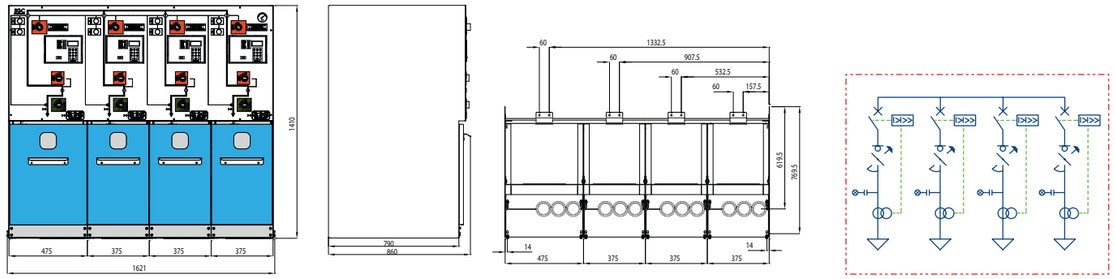
Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1246	1246	1246
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing	mm	537	537	537
Weight	mm	675	675	675

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Set of auxiliary contacts on the circuit breaker
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- No door interlock
- Motor operation of the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400 mm (other dimensions on request)
- Push button operation on the load break switch
- Remote control on the load break switch
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Automatic reclosing
- Integrated windows

DT-6C-4D panel

A compact magnetically actuated vacuum circuit breaker line protection panel, single network switch incoming / outgoing panel



Standard equipment

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing interface type C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- Four outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Specification and dimensions

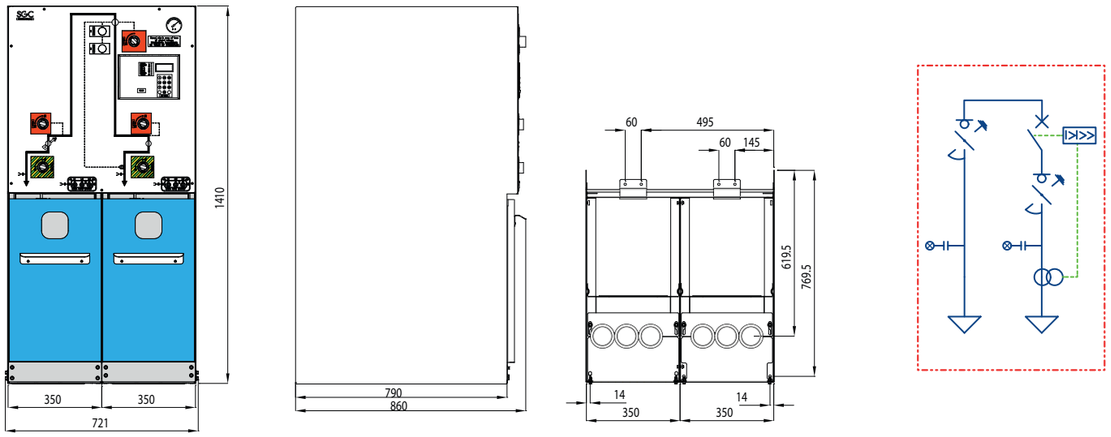
Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1621	1621	1621
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing	mm	537	537	537
Weight	mm	900	900	900

Options

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Set of auxiliary contacts on the circuit breaker
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break switch and earthing switch
- No door interlock
- Motor operation of the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button operation on the load break switch
- Remote control on the load break switch
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Arc-Killer SV-50
- Lateral extension
- Manometer
- Manometer with auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C, Horstmann type Wega 2.2C
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Automatic reclosing
- Integrated windows

DT-6C-KD panel

A compact vacuum circuit breaker line protection panel, single network switch incoming / outgoing panel



Standard equipment for the K function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides a protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the D function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP-600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panel

Options for K and D function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base of a height of 200, 300, 400 mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C' Horstmann type Wega 2.2C
- Integrated windows

Options for D function only

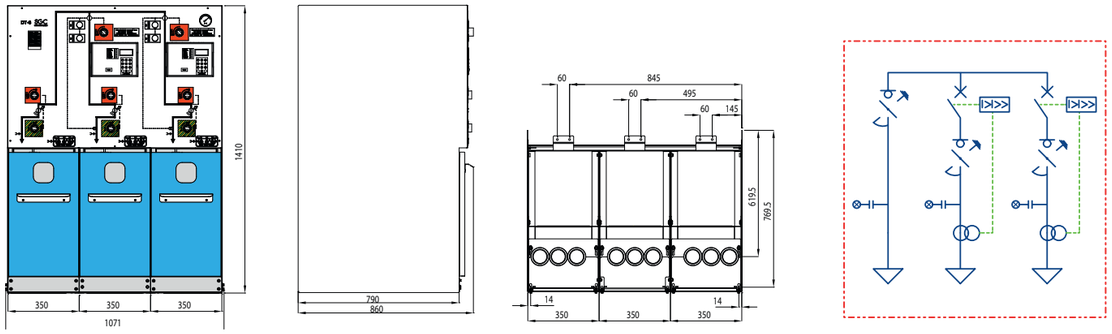
- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	721	721	721
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	745/537
Weight	mm	300	300	300

DT-6C-K2D panel

A compact magnetically actuated double vacuum circuit breaker line protection panel, single network switch incoming / outgoing panel



Standard equipment for the 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA,
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides a two outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the 'D' function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA â€“ cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'D' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type 'Kries Capdis S1+', 'Kries Capdis S2+', 'Horstmann type Wega 1.2C', 'Horstmann type Wega 2.2C'
- Integrated windows

Options for 'D' function only

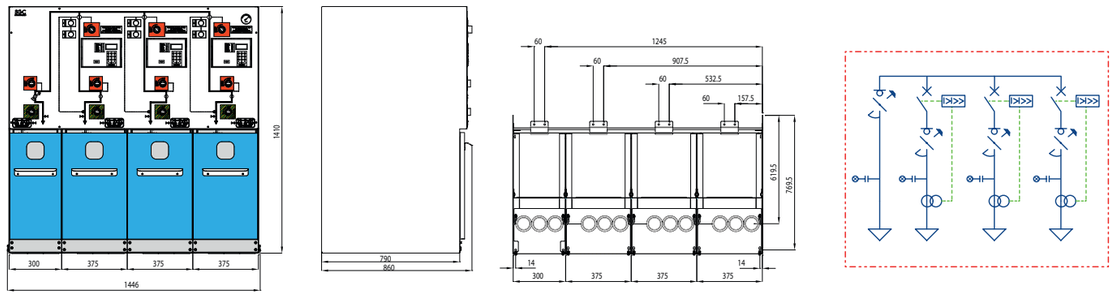
- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1071	1071	1071
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	745/537
Weight	mm	550	550	550

DT-6C-K3D panel

A compact magnetically actuated triple vacuum circuit breaker line protection panel, single network switch incoming / outgoing panel



Standard equipment for the 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network and provides a three outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the 'D' function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'D' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C, Horstmann type Wega 2.2C
- Integrated windows

Options for 'D' function only

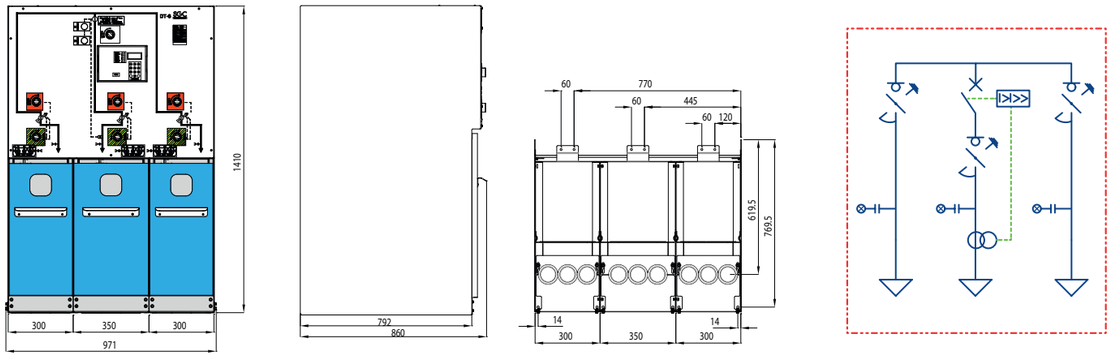
- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1446	1446	1446
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	475/537
Weight	mm	775	775	775

DT-6C-2KD panel

A compact magnetically actuated vacuum circuit breaker line protection panel, double network switch incoming / outgoing panel



Standard equipment for the 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - typically between kiosks - and provides an outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the 'D' function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'D' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle heights of 200, 300, 400mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C, Horstmann type Wega 2.2C
- Integrated windows

Options for 'D' function only

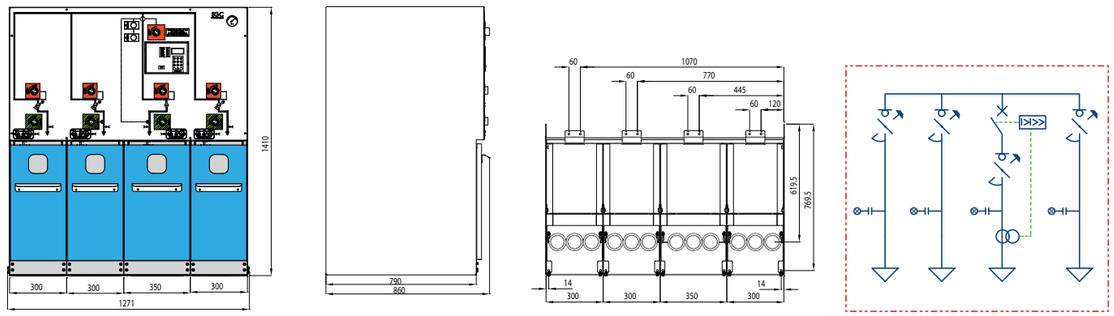
- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	971	971	971
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	475/537
Weight	mm	400	400	400

DT-6C-3KD panel

A compact magnetically actuated vacuum circuit breaker line protection panel, triple network switch incoming / outgoing panel



Standard equipment for the 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - typically between kiosks - and provides an outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the D function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'D' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400 mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C, Horstmann type Wega 2.2C
- Integrated windows

Options for 'D' function only

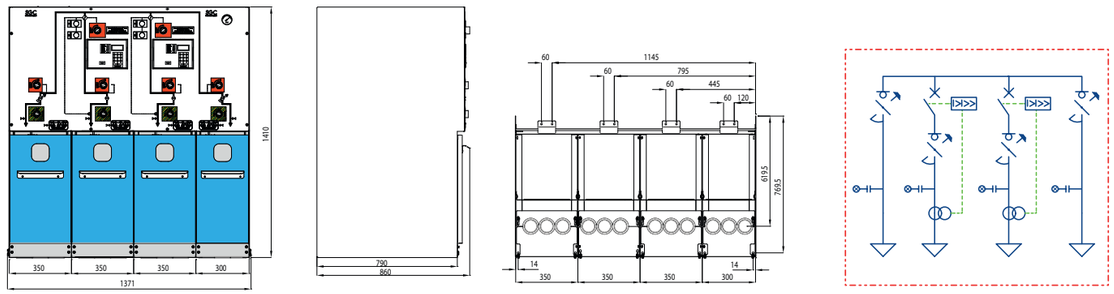
- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 V AC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1271	1271	1271
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	475/537
Weight	mm	505	505	505

DT-6C-2K2D panel

A compact magnetically actuated double vacuum circuit breaker line protection panel, double network switch incoming / outgoing panel



Standard equipment for the 'K' function

- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Interlocked earthing switch with a making capacity up to max. 50kA
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Gland plates
- Operating handle

Application

- A switch that allows connectivity within the ring network - typically between kiosks - and provides a two outgoing line protection panel, typically feeding a transformer, load or an outgoing cable

Standard equipment for the 'D' function

- Three pole vacuum circuit breaker of the type ISM, class E2, M2 according to IEC 62271-100, equipped with a magnetic actuator and integrated digital protection of the type RP600
- Three phase multiple rating current transformer (50-150-200-400-600/1 // 2.5VA – cl. 10P4-5P4-5P4-5P4-5P4), integrated in the cable compartment
- Three phase three position load break switch of the type RV-50, class E3 according to IEC 62271-103
- Earthing switch with a making capacity of 50kA, downstream of the circuit breaker interlocked with the load break switch
- Bushing type interface C, according to DIN EN 50181
- Cable clamps for monopolar cable with section up to 240mm^2
- Door interlock
- Integrated voltage indicators of the type Mevoco HR-3
- LV compartment
- MV cable access door
- Floor panels

Options for 'K' and 'D' function

- Set of auxiliary contacts on the load break switch
- Set of auxiliary contacts on the earthing switch
- Key interlock on the load break switch
- Key interlock on the earthing switch
- Key interlock on both load break and earthing switch
- No door interlock
- Motor operation on the load break switch: 24-48-110 V DC or 110-230 V AC
- Motor operation on the earthing switch: 24-48-110 V DC or 110-230 V AC
- Short circuit indicator (to be specified by the customer)
- Cubicle base heights of 200, 300, 400mm (other dimensions on request)
- Push button control on the load break switch
- Remote control on the load break switch
- Arc-Killer SV-50
- Lateral extension
- Manometer with or without auxiliary contact
- Integrated voltage indicator of the type Kries Capdis S1+, Kries Capdis S2+, Horstmann type Wega 1.2C, Horstmann type Wega 2.2C
- Integrated windows

Options for 'D' function only

- Set of auxiliary contacts on the circuit breaker
- Push button control on the circuit breaker
- Remote control on the circuit breaker
- Automatic opening and closing by means of a control module: 24-60V DC or 110-230 V AC
- Time delayed / direct under voltage function by means of an auxiliary relay: 24-48-110 V DC or 110-230 VAC
- Protection relay specified by customer
- Test feeding for integrated protection relay (battery bloc)
- Automatic reclosing
- Integrated windows

Specification and dimensions

Rated voltage	kV	12	17,5	24
Rated current	A	630	630	630
Rated short term current	KA	20	20	12.5
Time of the rated short time current	S	1	1	1
Width	mm	1371	1371	1371
Depth including side plate	mm	1010	1010	1010
Height	mm	1410	1410	1410
Height between bottom and bushing (K/D)	mm	745/537	745/537	475/537
Weight	mm	660	660	660

TES-R

TRAFO ELETTRO

Cast resin dry type medium voltage transformers

TES-R is a customisable medium voltage transformer

- Made from flame resistant cast resin material
- Applicable service voltage is 11, 22 and 36kV
- Ideal for solution for arc fault mitigation

Cast resin MV transformers

E3 | C2 Performance | F1

Compact design | Seismic zones | Long life

TES-R

NHP TES-R cast resin transformers by Trafo Elettro from 50kVA to 6MVA with voltages up to 36kV.

Due to the flame-resistant and self-extinguishing materials used, they are perfect for indoor and special applications like rail, hospitals, data centres, high rise buildings and highly ecological environments.

Furthermore, the inherent design provides an additional benefit of reduced maintenance requirements.

Key characteristics:

Long service life

- The casting process allows a low level of partial discharge

Custom manufactured

- Voltages, impedances, efficiency, HV plug-in bushings and more

Compact design

- Optimised dimensions and terminals arrangement for critical situation of space

Built for local standards

- Type tested to AS60076, complies with MEPS AS2374.1.2 ensuring minimum energy losses

High environmental resistance

- Specific treatment for magnetic core and frames to withstand the most extreme environmental conditions

Heavy duty

- Special design structure for seismic zones or for using applications with high level vibrations

Eco-friendly

- Research and development of the highest performing materials, combined with an advanced design for high energy efficiency. Safe to use and easy to dispose of.

Applications:

- Indoor installations
- Reduced fire risk (F1 class). Crucial for inside public buildings like hospitals, hotels and airports
- Highly polluted places and atmospheres (E3 class), common in mines, paper mills, off-shore and on-shore sites, oil and gas systems, desalination plants and cement factories.
- Extremely low temperatures (C2 class)
- Distribution power grids, railways networks or substations

Applicable standards:

- AS 60076 Power Transformers
  – Parts 1, 2, 3, 5, 10 and 11
- AS 2374.1.2 Power Tx - Minimum Energy Performance Standard (MEPS)

Technical specification

TES-R cast resin transformers 11kV

Cast resin Tx nominal power @ 11kV primary and 415VAC secondary at 50Hz		kVA	100	200	250	315	500	750	1000	1250	1500	2000	2500	3000	3150	3500
Transformer design			Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer
Cooling system			AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN
Ambient temperature		°C	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40
Loading condition			Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
Altitude		m a.s.l.	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Number of phases		Nr	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Frequency		Hz	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Primary voltage		V	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
Primary current		A	5.248792778	10.49758556	13.12198194	16.53369725	26.24396389	39.36594583	52.48792778	65.60990972	78.73189166	104.9758556	131.2198194	157.4637833	165.3369725	183.7077472
Tappings		%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%
No. load secondary voltage		V	415	415	415	415	415	415	415	415	415	415	415	415	415	415
Secondary current		A	139.1246278	278.2492557	347.8115696	438.2425777	695.6231392	1043.434709	1391.246278	1739.057848	2086.869418	2782.492557	3478.115696	4173.738835	4382.425777	4869.361974
Vector group			Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11
No. load losses		W	380	530	640	750	1100	1450	1850	2200	2500	3000	4200	4800	5100	5400
No. load current		%	1	0.7	0.7	0.6	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5
Load losses at 75°C		W	2100	3600	4100	4800	5500	8300	9000	11300	12900	20000	21300	22700	23500	24200
Load losses at 120°C		W	2400	4150	4700	5500	6200	9400	10200	12700	14500	22500	24000	25600	26500	27500
Short circuit impedance		%	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Efficiency (MEPS)	50% cosφ 1	%	98.070	98.460	98.550	98.670	98.840	98.960	99.030	99.080	99.120	99.160	99.190	99.260	99.260	99.260
Efficiency	50% cosφ 0.8	%	97.609	98.078	98.217	98.341	98.692	98.749	98.912	98.936	98.989	98.933	98.990	99.075	99.078	99.131
Efficiency	100% cosφ 1	%	97.295	97.714	97.909	98.054	98.561	98.574	98.809	98.822	98.879	98.741	98.885	98.997	99.007	99.069
Efficiency	100% cosφ 0.8	%	96.642	97.158	97.399	97.580	98.208	98.224	98.516	98.532	98.603	98.431	98.610	98.749	98.762	98.839
Voltage drop	100% cosφ 1	%	2.551	2.233	2.042	1.911	1.412	1.425	1.195	1.191	1.142	1.299	1.135	1.030	1.018	0.963
Voltage drop	100% cosφ 0.8	%	5.263	5.091	4.982	4.904	4.592	4.601	4.448	4.446	4.413	4.518	4.408	4.336	4.328	4.289
Thermal insulation class			F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F
Primary insulation levels		kV	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95	12 - 28 - 75/95
Secondary insulation levels		kV	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3
Windings material		HV / LV	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al
Amb./Climatic/Fire behaviour classes			E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1
Windings temperature rise		°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Sound pressure level	distance: 1 m	dBA	49	52	54	55	58	60	61	63	64	66	67	68	67	70
Sound power level	distance: 1 m	dBA	61	65	67	68	72	74	75	77	79	82	83	84	83	86
Base interaxis distance		mm	520 x 520	670 x 670	670 x 670	670 x 670	670 x 670	670 x 670	820 x 820	820 x 820	820 x 820	1070 x 1070	1070 x 1070	1070 x 1070	1070 x 1070	1070 x 1070
Painting	Spec. PS013															
Enclosure dimensions (Lb x Wb x Hb)		mm	1720 x 1050 x 1530	1720 x 1050 x 1530	1790 x 1100 x 1760	1790 x 1100 x 1760	1900 x 1120 x 1960	2000 x 1190 x 2090	2120 x 1260 x 2290	2120 x 1260 x 2290	2300 x 1390 x 2590	2300 x 1390 x 2590	2670 x 1400 x 2610	2670 x 1400 x 2610	2670 x 1400 x 2610	2670 x 1400 x 2610
Enclosure weight		kg	240	240	270	270	310	340	400	400	490	490	510	510	510	510
Partial discharge		pC	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
Transformer weight		kg	500	750	850	1000	1400	1850	2350	2700	3150	3850	4850	5350	5900	5900
Packing weight		kg	90	120	150	150	180	210	270	270	300	450	510	510	540	540
Transformer dimensions	L x W x H	mm	1000 x 610 x 1160	1120 x 610 x 1310	1090 x 760 x 1420	1190 x 760 x 1460	1300 x 760 x 1580	1370 x 760 x 1750	1540 x 910 x 1880	1540 x 910 x 1900	1600 x 910 x 2080	1710 x 1320 x 2310	1860 x 1320 x 2370	1890 x 1320 x 2410	1920 x 1320 x 2430	1920 x 1320 x 2480
Packing dimensions	L x W x H	mm	1250 x 860 x 1460	1370 x 860 x 1610	1340 x 1010 x 1720	1440 x 1010 x 1760	1550 x 1010 x 1880	1620 x 1010 x 2050	1790 x 1160 x 2180	1790 x 1160 x 2200	1850 x 1160 x 2380	1960 x 1570 x 2610	2110 x 1570 x 2670	2140 x 1570 x 2710	2170 x 1570 x 2730	2170 x 1570 x 2780

Notes:
This data is in a condensed format, therefore specific data has been omitted. Additional technical data is available upon request.
Tolerance according to AS60076
Manufacturing according to standards AS60076.11
Data and characteristics are a guide only and can be changed without notice.

Company with management system certified by DNV
ISO 9001
ISO14001

Technical specification

TES-R cast resin transformers 22kV

Cast resin Tx nominal power @ 22kV primary and 415Vac secondary at 50Hz		kVA	100	200	250	315	500	750	1000	1250	1500	2000	2500	3000	3150	3500
Transformer design			Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer	Cast resin transformer
Cooling system			AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN
Ambient temperature		°C	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40
Loading condition			Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
Altitude		m a.s.l.	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Number of phases		Nr	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Frequency		Hz	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Primary voltage		V	22000	22000	22000	22000	22000	22000	22000	22000	22000	22000	22000	22000	22000	22000
Primary current		A	2.624396389	5.248792778	6.560990972	8.266848625	13.12198194	19.68297292	26.24396389	32.80495486	39.36594583	52.48792778	65.60990972	78.73189166	82.66848625	91.85387361
Tappings		%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%
No. load secondary voltage		V	415	415	415	415	415	415	415	415	415	415	415	415	415	415
Secondary current		A	139.1246278	278.2492557	347.8115696	438.2425777	695.6231392	1043.434709	1391.246278	1739.057848	2086.869418	2782.492557	3478.115696	4173.738835	4382.425777	4869.361974
Vector group			Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11
No. load losses		W	400	640	760	970	1300	1700	2200	2650	2950	3000	4450	5300	5950	6200
No. load current		%	1.1	0.9	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4
Load losses at 75°C		W	2000	3800	4100	4500	5700	7800	9300	11300	12900	20000	20600	21500	23500	22800
Load losses at 120°C		W	2300	3850	4650	5150	6450	8800	10500	12700	14500	22500	23200	24200	26500	25900
Short circuit impedance		%	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Efficiency (MEPS)	50% cosφ 1	%	98.070	98.420	98.490	98.590	98.740	98.850	98.920	98.970	99.010	99.060	99.090	99.190	99.190	99.190
Efficiency	50% cosφ 0.8	%	97.621	98.036	98.114	98.240	98.565	98.717	98.808	98.848	98.916	98.933	98.985	99.063	99.012	99.103
Efficiency	100% cosφ 1	%	97.371	97.804	97.882	98.094	98.474	98.619	98.746	98.787	98.850	98.741	98.906	99.026	98.980	99.091
Efficiency	100% cosφ 0.8	%	96.735	97.270	97.366	97.629	98.099	98.280	98.437	98.488	98.567	98.431	98.636	98.786	98.729	98.867
Voltage drop	100% cosφ 1	%	2.454	2.086	2.023	1.802	1.462	1.346	1.224	1.191	1.142	1.299	1.104	0.983	1.018	0.917
Voltage drop	100% cosφ 0.8	%	5.212	5.007	4.970	4.838	4.624	4.549	4.468	4.446	4.413	4.518	4.387	4.304	4.328	4.258
Thermal insulation class			F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F	F / F
Primary insulation levels		kV	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125	24 - 50 - 125
Secondary insulation levels		kV	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3
Windings material		HV / LV	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al
Amb./Climatic/Fire behaviour classes			E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1	E3 - C2 - F1
Windings temperature rise		°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Sound pressure level	distance: 1 m	dBA	48	52	55	57	59	61	63	64	65	67	68	69	70	70
Sound power level	distance: 1 m	dBA	60	65	68	70	73	75	78	79	81	83	84	85	86	86
Base interaxis distance		mm	520 x 520	670 x 670	670 x 670	670 x 670	670 x 670	670 x 670	820 x 820	820 x 820	820 x 820	1070 x 1070	1070 x 1070	1070 x 1070	1070 x 1070	1070 x 1070
Painting	Spec. PS013															
Enclosure dimensions (Lb x Wb x Hb)		mm / kg	1720 x 1050 x 1530	1790 x 1100 x 1760	1790 x 1100 x 1760	1790 x 1100 x 1760	1900 x 1120 x 1960	2000 x 1190 x 2090	2120 x 1260 x 2290	2120 x 1260 x 2290	2300 x 1390 x 2590	2670 x 1400 x 2610	2670 x 1400 x 2610	2920 x 1600 x 2795	2920 x 1600 x 2795	2920 x 1600 x 2795
Enclosure weight			240	270	270	270	310	340	400	400	490	510	510	610	610	610
Partial discharge		pC	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 6	< 5
Transformer weight		kg	550	900	1000	1200	1550	2000	2550	3100	3600	4300	5250	6050	6500	6800
Packing weight		kg	120	150	150	180	180	210	270	300	330	480	540	570	570	600
Transformer dimensions	L x W x H	mm	1080 x 610 x 1200	1240 x 760 x 1370	1240 x 760 x 1480	1320 x 760 x 1520	1410 x 760 x 1640	1470 x 760 x 1810	1590 x 910 x 1940	1700 x 910 x 1980	1730 x 910 x 2140	1800 x 1320 x 2390	1920 x 1320 x 2430	2040 x 1320 x 2470	2070 x 1320 x 2490	2160 x 1320 x 2490
Packing dimensions	L x W x H	mm	1330 x 860 x 1500	1490 x 1010 x 1670	1490 x 1010 x 1780	1570 x 1010 x 1820	1660 x 1010 x 1940	1720 x 1010 x 2110	1840 x 1160 x 2240	1950 x 1160 x 2280	1980 x 1160 x 2440	2050 x 1570 x 2690	2170 x 1570 x 2730	2290 x 1570 x 2770	2320 x 1570 x 2790	2410 x 1570 x 2790

Notes:
This data is in a condensed format, therefore specific data has been omitted. Additional technical data is available upon request.
Tolerance according to AS60076
Manufacturing according to standards AS60076.11
Data and characteristics are a guide only and can be changed without notice.

Company with management system certified by DNV
ISO 9001
ISO14001

TES-R series MV cast resin transformers

Cast resin

The TES-R series of MV cast resin transformers are manufactured in Italy by Trafo Elettro and distributed within Australia and New Zealand by NHP.

Cast resin transformers offers a safer and easier solution for the customer, as there is a lower fire potential and reduced maintenance requirements.

Trafo Elettro cast resin transformers are certified in compliance with IEC 60076-11 for:

E3 and E2 (environmental class)

transformers suitable for heavy pollution area with humidity above 95%

C2 (climatic class)

transformers suitable for operation, transport and storage with ambient temperatures down to -25°C

F1 (fire behaviour class)

transformers suitable for areas with high risk of fire being self-extinguishing

TES-R functional unit part number description

The TES-R specification part numbers consist of six elements that indicate all the key parameters.

TES-R	11	0415	1000	Dyn11	IP00
TES-R = cast resin construction TES-RA = amorphous cast resin construction	Primary voltage 11kV, 22kV or 36kV	Secondary voltage (customer to specify)	Tx rating (kVA)	Vector group	IP rating

TES-R transformer examples

TES-R –11- 0415-1000-Dyn11-IP00

TES-R –22- 0415-6000-Dyn11-IP00

TES-RA –11- 0415-500-Dyn11-IP00

TES-RA amorphous cast resin transformer

Amorphous cast resin transformers are constructed to be extremely efficient, as they have much lower 'no load losses' compared to standard transformers. The transformer core is made using amorphous metal instead of silicon steel.

Advantages of amorphous cast resin transformers

Eco-friendly

Research and development reduces no-load losses by up to 70%, thus reducing overheads and the level of CO_2 emissions.

Heavy duty

The laminations do not undergo corrosion, which may decrease the performance of the unit.

Long life

Lower losses = less heat which reduces the ageing of the insulation and gives the transformer a longer lifetime.

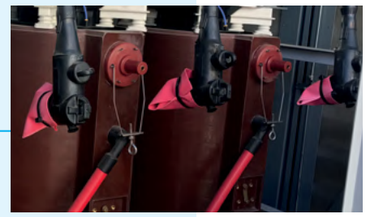
TES-R series MV cast resin transformers

Designed for arc fault mitigation by design

NHP's cast resin transformers offer 'arc mitigation by design', reducing the potential arc flash risk and improving safety. This is achieved by using:

- A high dielectric strength resin film 'monoblock'
- Limiting the inter-winding voltages to not more than 15VAC
- Using extensive insulation and shrouding on all terminations and connections
- Plug-in bushings with earth screened HV terminations

Insulated LV terminals



Plug-in bushings with earth screened HV terminations

Insulated connections (all 6 connections)

Designed for reduced partial discharge levels

A partial discharge occurs when a small electrical spark breaches the air voids within a power transformer's windings. The measured level of partial discharge is directly related to the quality of the insulation material used in the transformer construction. The lower the value of the measured partial discharge, the longer you can expect the transformer to remain in service.

NHP's cast resin transformers are constructed using quality materials, resulting in a partial discharge level of <5 pc. This is a 50% improvement over the IEC/AS 60076.11 requirement. The industry standard is <10pc, so NHP is setting a new standard!

Having a lower partial discharge level indicates the high quality of the cast resin material used and results in a 3-5 year increase in service life.

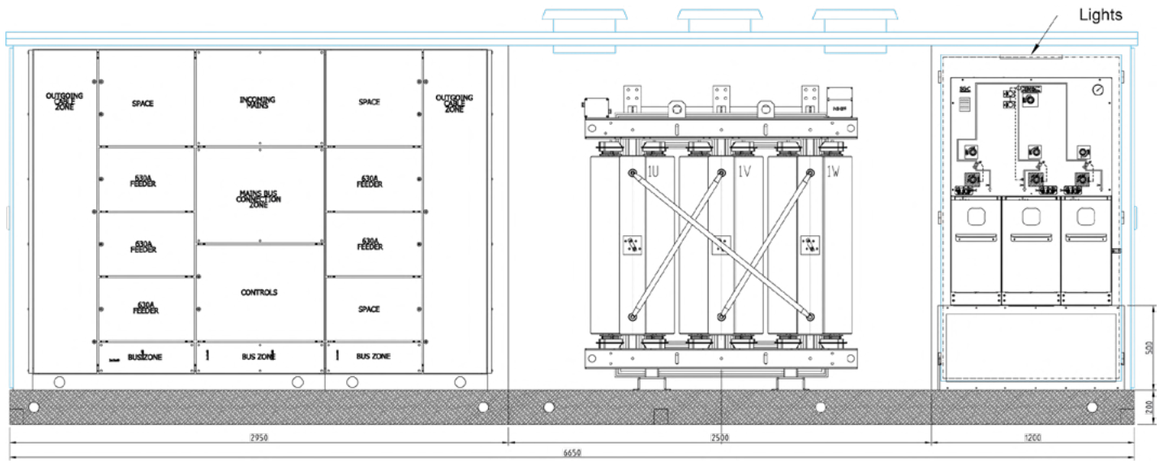
Transformer undergoing partial discharge testing

Designed for retrofit with customised, compact designs

NHP's cast resin transformers can be custom manufactured including voltages, impedances, efficiency, vector group, tapping ratios, option of HV plug in bushings, top or bottom LV connections, physical proportions and more.

This allows a custom designed transformer's dimensions to be tailored to the available space, allowing ease of replacement for replacement / retrofit applications.

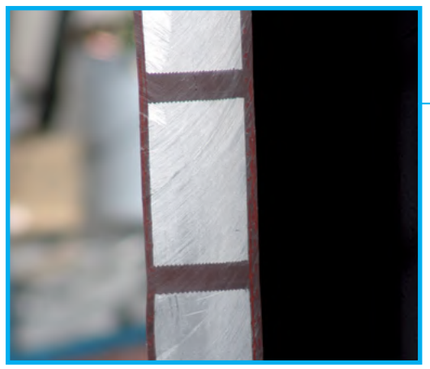
Below: NHP 1500kVA TES-R cast resin transformer specially customised and optimised with a reduced height to fit into an existing MV kiosk. A height reduction of 10% was achieved over the standard design, allowing for better clearances and easier cable terminations.



TES-R series MV cast resin transformers

Typical layout

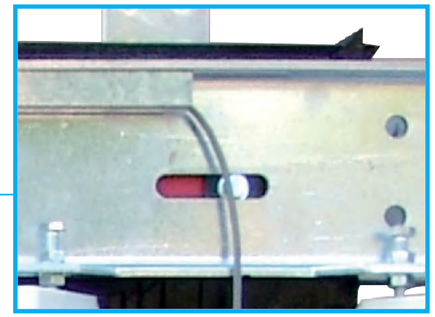
Cast resin transformers are typically provided with an IP23 enclosure for indoor applications



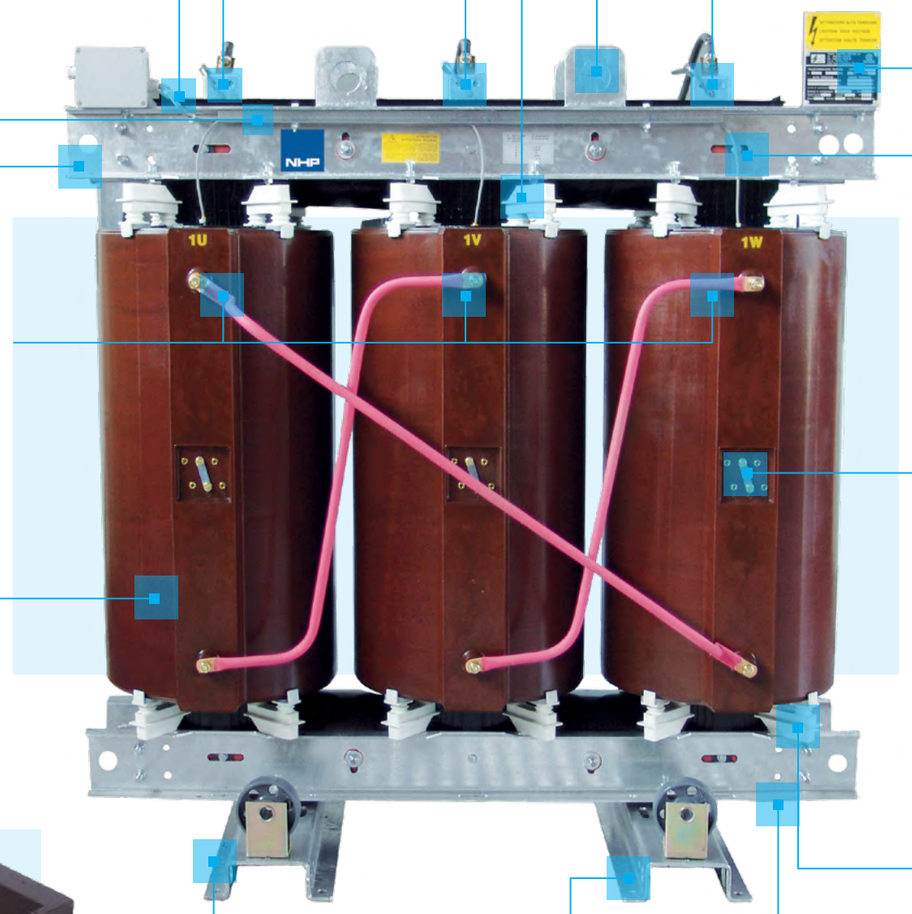
Vacuum casting process allows uniform distance between windings

Greater cooling surfaces

Rating plate can be placed as required



Design of clamps that allow a greater aeration and cooling windings



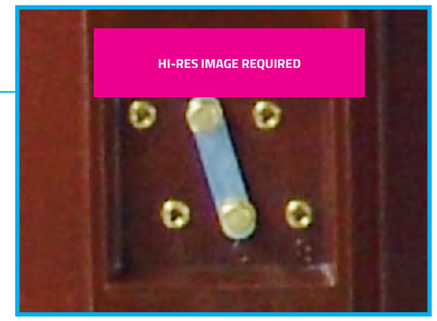
Low voltage terminals

4 lifting eyebolt

Provision for medium voltage surge arresters

Channel for probes

High voltage terminals



Off-load tap changer

Optional anti-vibration dampers

Windings supports fixed to the lower clamps

2 earthing terminals

Holes on the trolley for transformer fastening during transport

Optional surge arresters

TES-R series MV cast resin transformer - core components

Magnetic core, low and high voltage windings and sensors

Magnetic core

Manufactured with low-loss cold rolled grain oriented steel laminations, insulated with carlyte, mitred type or step-lap, the magnetic core of the transformer results in the reduction of the sound level and no-load losses. This also guarantees high sturdiness and stability during movements and in the event of short circuit stresses.

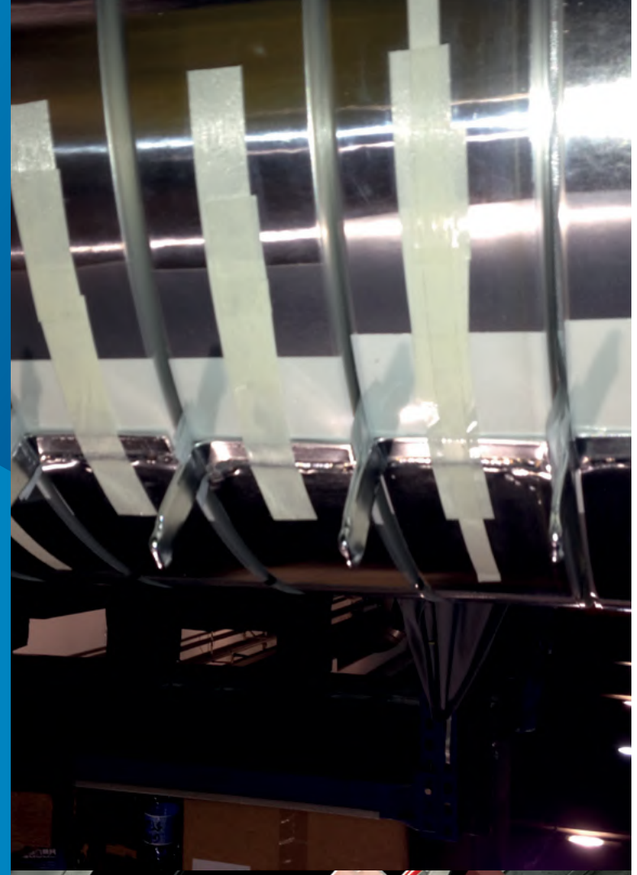
Low voltage windings

The low voltage windings consist of electrolytic aluminium foils, insulated by pre preg material, impregnated with 'H' class epoxy resin and heat treated in an oven to form a compact unit, which provides sufficient strength which can withstand short-circuit forces in the transformer. The low voltage terminals are produced with aluminium bars through automatic welding and fixed to the upper yoke clamping frame by suitable spacers.

It is also possible to manufacture copper windings (i.e. terminals arrangement for connection to busbars).

High voltage windings

The high voltage windings are manufactured with overlapped coils in aluminium strips, connected in series, with rounded corners and insulated with polyester material films. Once the single winding is completed, the entire coil is anchored by glass fibre net and after a suitable drying cycle, all windings are casted under vacuum with epoxy resin "F" class mixed with quartz and trihydrated alumina. Each production cycle is sampled with calorimetric analysis to test the vitreous transition. The adjustment points are obtained directly in the centre of the winding and the various positions are made through brass bridges.



Temperature monitor (T154 and NT935)

The T154 is a microcontroller based unit for the temperature control of MV cast resin transformers. The T154 maintains the standard 4 PT100 inputs (3 phase transformer and a fourth option for the core or the ambient temperature) and 4 dry contact relay outputs, ALARM and TRIP, FAULT signal operation and start ventilation system (FAN). Dry contact relay outputs, ALARM and TRIP, FAULT signal operation and start ventilation system (FAN).

The NT935 is the advanced temperature monitor that has the same look and feel as the T154 and offers the same functionality as the T154, with the additional feature of a MODBUS RTU communicable RS485 interface and a 4-20mA output.

Anti-vibration dampers

Optional anti-vibration dampers can be fitted to the transformer to mitigate the vibrations resulting from the normal operation of the transformer from being transmitted into the adjoining structures of the building.

Fan controller

The VRT200 is a basic fan controller with 2 outputs that is able to drive 3 fans each and is triggered by the output signal from the T154.

Protection and operation of ventilation systems for cast resin transformers are integrated in one device. The VRT200 is equipped with leds for visual anomalies indication and FAULT relay for signal anomalies. Fans can be driven remotely (dry contact input) or locally via the front push button.

Surge arresters

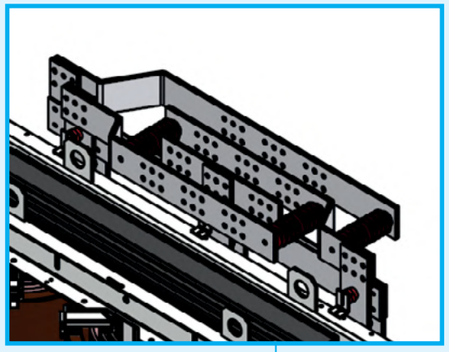
Medium voltage surge arrestors can be installed with the cast resin transformer to mitigate the effects of over voltages that could exceed the system's Basic Insulation Level.

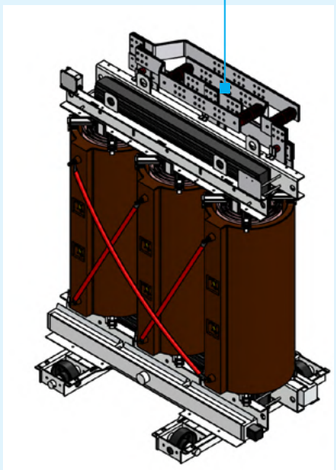
Plug-in bushings option

The HV connections can be provided via brass studs or plug-in type bushings mounted on and supported by the upper and lower parts of the HV winding cast resin structure. This provides a physically unimpeded method for connection of HV cabling. HV plug-in bushings that accept plug-in earth screed elbows are available as an option and should be utilised if an additional level of arc flash mitigation is required.

LV bus duct connections

The interface for the LV bus duct connections is provided via a set of pre-bent busbars that bolt perfectly to the transformer.





Standards

NHP transformers comply with the latest edition of the following standards:

AS 60076-1 Power Transformers	Part 1: General
AS 60076-2 Power Transformers	Part 2: Temperature rise
AS 60076-3 Power Transformers	Part 3: Insulation levels, dielectric tests and external clearances in air
AS 60076-5 Power Transformers	Part 5: Ability to withstand short circuit
AS 60076-10 Power Transformers	Part 10: Determination of sound levels
AS 60076.11 Power Transformers	Part 11: Dry type
AS 2374.1.2 Power Transformers	Minimum Energy Performance Standard (MEPS) requirements for distribution transformers*

* NHP transformers meet the requirements of Minimum Energy Performance Standard for Power Transformers as designated in AS 2374.1.2. Table 2. High efficiency versions meeting the requirements of Table 4 shall also be available on request

Quality assurance and testing

Transformers are manufactured at a facility certified to ISO 9001-2008 quality management standards and to ISO 14001 environmental management standards.

Routine testing

Routine tests are undertaken in accordance with AS 60076, part 1 clause 10.1.1 include:

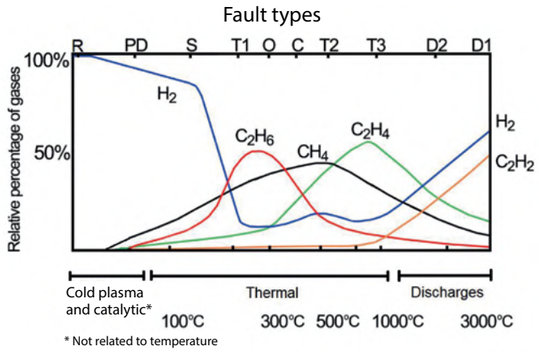
- Dimensional, accessories presence and operation check
- Separate-source AC withstand voltage test
- Induced AC withstand voltage test
- Partial discharge measurement
- Measurement of no load loss and no load current
- Measurement of short-circuit impedance and load losses
- Measurement of winding resistance
- Measurement of the transformation ratio and vector group

Factory Acceptance Testings (FATs)

Video witnessing of standard FATs is available for a set cost.

Special testing

NHP cast resin transformers can undergo special testing both 'in-house' and / or by a third party certified (CESI) laboratory. Below are examples of special tests that are sometimes requested for an additional cost



In-house factory testing

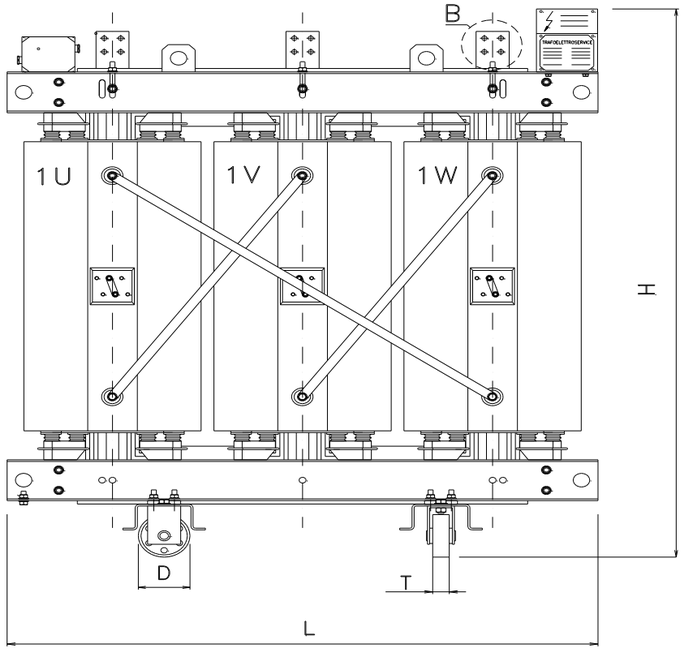
- Lightning impulse test as per IEC 60076-3 standards
- Temperature rise test as per IEC 60076-2 standards
- Measurement of sound level as per IEC 60076-10 standards
- Thermal image scans of all four sides and top of transformer after it has been energised for 24 hours with no load

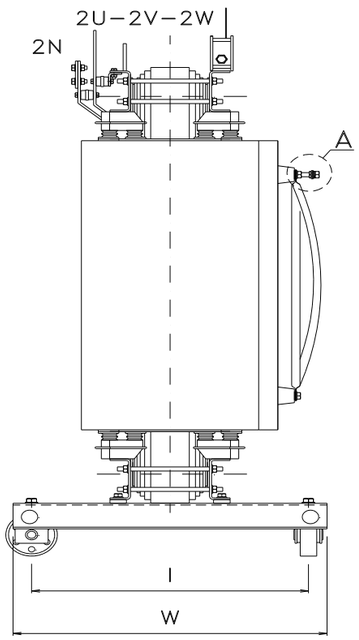
Third party certified laboratory (CESI) testing

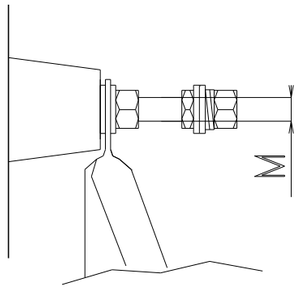
- IP tests
- IK tests
- Lightning impulse test as per IEC 60076-3 standards
- Temperature rise test as per IEC 60076-2 standards
- Measurement of sound level as per IEC 60076-10 standards
- Short circuit tests as per IEC 60076-5 standards

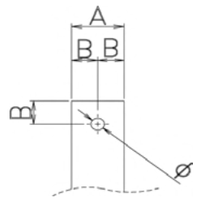
TES-R series MV cast resin transformer dimensional details 11kV

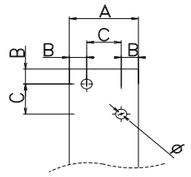
With and without enclosure

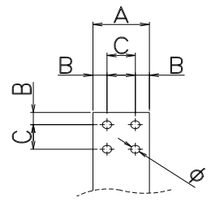


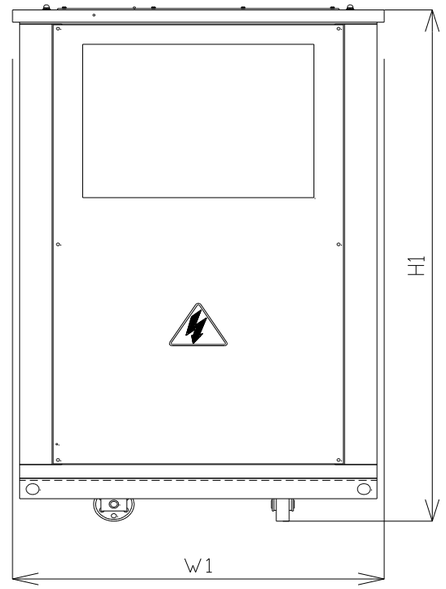


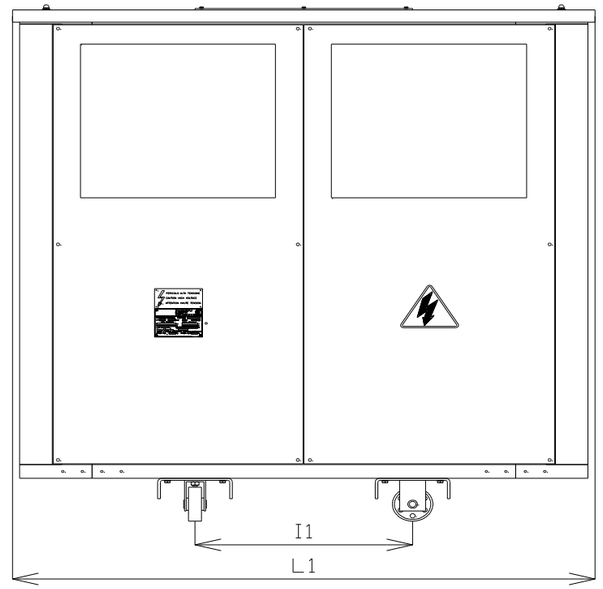








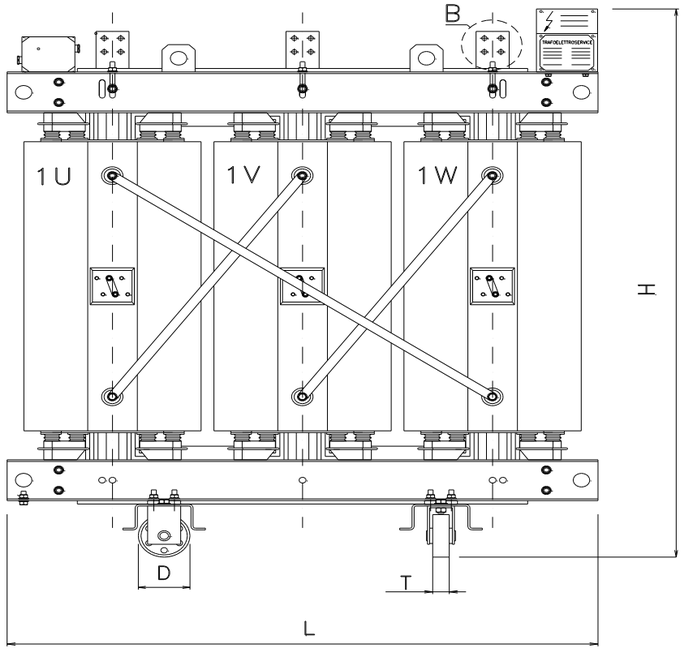


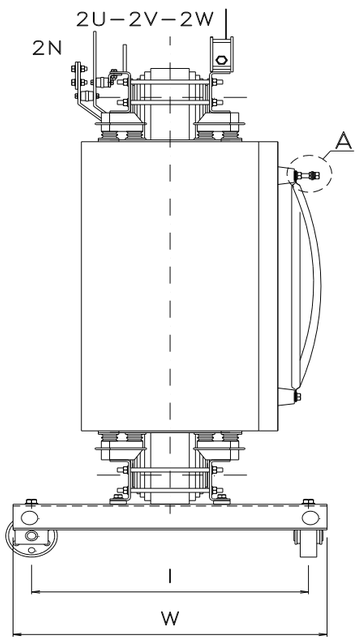


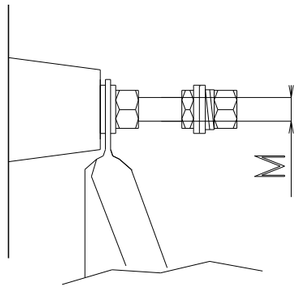
Power	kVA	100	200	250	315	500		750	1000	1250	1500	2000	2500	3000	3150	3500
TRANSFORMER IP00																
L	mm	1000	1120	1090	1190	1300		1370	1500	1540	1640	1760	1970	1890	1970	1920
W	mm	610	610	760	760	760		760	910	910	910	1220	1320	1320	1320	1320
H	mm	1160	1310	1420	1460	1580		1750	1780	1900	2060	2260	2240	2410	2270	2480
I	mm	520	520	670	670	670		820	820	820	820	1070	1070	1070	1070	1070
D	mm	100	100	125	125	125		125	125	150	150	200	200	200	200	200
T	mm	40	40	40	40	40		40	40	60	60	70	70	70	70	70
Total weight	kg	500	750	850	1000	1400		1850	2300	2700	3250	3850	4650	5350	5350	5900
ENCLOSURE IP 21 - 31																
L1	mm	1720	1720	1790	1790	1900		2000	2250	2250	2250	2800	2800	2670	2800	2670
W1	mm	1050	1050	1100	1100	1120		1190	1350	1350	1350	1650	1650	1400	1650	1400
H1	mm	1530	1530	1760	1760	1960		2090	2450	2500	2500	2600	2600	2610	2600	2610
I1	mm	520	520	670	670	670		670	820	820	820	1070	1070	1070	1070	1070
Total weight	kg	240	240	270	270	310		340	450	450	450	550	550	510	550	510
LV - HV TERMINALS																
A	mm	30		50		60		80		100	120					
B	mm	15		25		15		20		25	30					
C	mm	/	/	/	/	30		40		50	60					
Ø	mm	13						13		17						
M	mm	12						12			16					

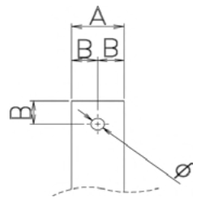
TES-R series MV cast resin transformer dimensional details 22kV

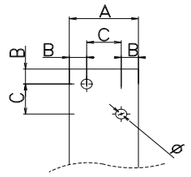
With and without enclosure

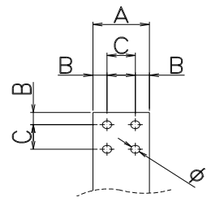


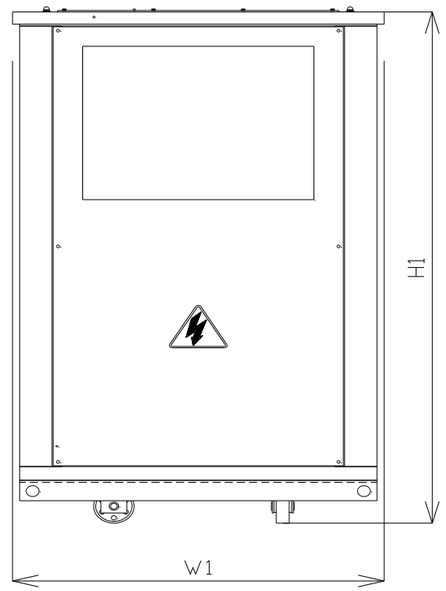


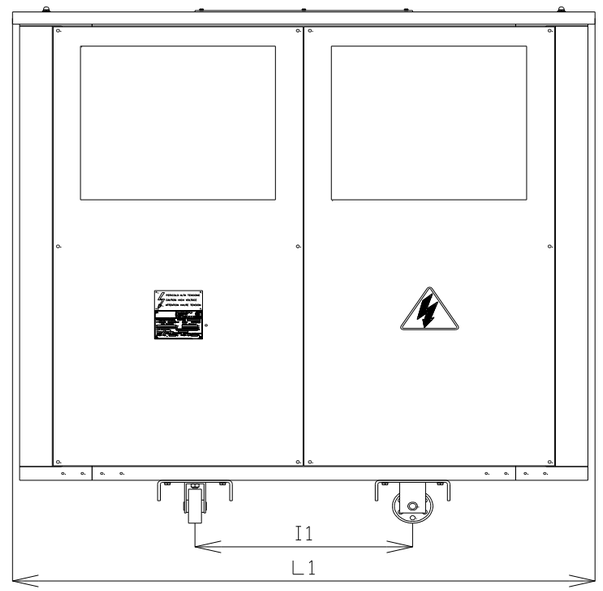












Power	kVA	100	200	250	315	500		750	1000	1250	1500	2000	2500	3000	3150	3500
TRANSFORMER IP00																
L	mm	1080	1240	1240	1320	1410		1470	1590	1700	1730	1800	1920	2040	2070	2160
W	mm	610	760	760	760	760		760	910	910	910	1320	1320	1320	1320	1320
H	mm	1200	1370	1480	1520	1640		1810	1940	1980	2140	2390	2430	2470	2490	2490
I	mm	520	520	670	670	670		820	820	820	820	1070	1070	1070	1070	1070
D	mm	100	100	125	125	125		125	125	2500	2500	200	200	200	200	200
T	mm	40	40	40	40	40		40	40	60	60	70	70	70	70	70
Total weight	kg	550	900	1000	1200	1550		2000	2550	3100	3600	4300	5250	6050	6500	6800
ENCLOSURE IP 21 - 31																
L1	mm	1720	1790	1790	1790	1900		2000	2120	2120	2300	2670	2670	2920	2920	2920
W1	mm	1050	1100	1100	1100	1120		1190	1260	1260	1390	1400	1400	1600	1600	1600
H1	mm	1530	1760	1760	1760	1960		2090	2290	2290	2590	2610	2610	2795	2795	2795
I1	mm	520	520	670	670	670		670	820	820	820	1070	1070	1070	1070	1070
Total weight	kg	240	270	270	270	310		340	400	400	490	510	510	610	610	610
LV - HV TERMINALS																
A	mm	30		50		60		80		100	120					
B	mm	15		25		15		20		25	30					
C	mm	/	/	/	/	30		40		50	60					
Ø	mm	13						13		17						
M	mm	12						12					16			

TES-OM

Oil immersed type medium voltage transformers

TES-OM is a customisable medium voltage transformer

- Made from rugged materials to withstand extreme conditions
- Applicable service voltage is 11, 22 and 36kV
- Ideal for outdoor or indoor applications

Oil immersed MV transformers

Economical | Compact design | Seismic zones | High environmental resisntace

TES-OM

NHP TES-OM oil immersed transformers range from 50kVA to 7MVA with voltages up to 36kV.

The traditional oil transformers are available with oil conservator or hermetically sealed type with integral fins.

The insulating oil is mineral type PCB free, preventively treated and dried, filled under vacuum

Key characteristics:

- Economical
  Designed for easy installation with accessories properly wired and positioned, simplifying installation and maintenance, therefore reducing costs
- Custom manufactured
  Voltages, impedances, efficiency, HV plug-in bushings and more
- Compact design
  Optimised dimensions and terminals arrangement for critical situation of space.
- Built for local standards
  Type tested to AS60076, complies with MEPS AS2374.1.2 ensuring minimum energy losses
- High environmental resistance
  Specific coating treatment and use of stainless steel bolts to withstand the most extreme environmental conditions
- Heavy duty
  Special design structure for seismic zones or for using applications with high level vibrations
- Eco-friendly
  A combination of the best materials combined with an advanced design provides high energy efficiency. Non-flammable or bio-oil can be used to reduce the environmental risk.

Applications:

- Indoor or outdoor installations
- High polluted places and atmospheres
- Common in mines, paper mills, off-shore and on-shore sites, oil and gas systems, desalination plants and cement factories
- Extremely low temperatures (C2 class)
- Suitable for use in seismically unstable and high vibration environments
- Distribution power grids, solar / wind farms, railways networks or substations

Applicable standards:

- AS 60076 Power Transformers
  – Parts 1, 2, 3, 5, 10
- AS 1767.1 Insulating liquids - Spec for unused mineral insulating oils for Tx
- AS 2374.1.2 Power Tx - Minimum Energy Performance Standard (MEPS)

Technical specification

TES-OM oil immersed transformers 11kV

Oil Immersed Tx Nominal power @ 11kV Primary and 415Vac secondary at 50Hz		kVA	100	200	250	315	500		750	1000	1250	1500	2000	2500	3000
Transformer design			Oil immersed	Oil immersed	Oil immersed	Oil immersed	Oil immersed		Oil immersed	Oil immersed	Oil immersed	Oil immersed	Oil immersed	Oil immersed	Oil immersed
Cooling system			ONAN	ONAN	ONAN	ONAN	ONAN		ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN
Ambient temperature		°C	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40		-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40
Loading condition			Distribution	Distribution	Distribution	Distribution	Distribution		Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
Altitude		m a.s.l.	1000	1000	1000	1000	1000		1000	1000	1000	1000	1000	1000	1000
Number of phases		Nr	3	3	3	3	3		3	3	3	3	3	3	3
Frequency		Hz	50	50	50	50	50		50	50	50	50	50	50	50
Primary voltage		V	11000	11000	11000	11000	11000		11000	11000	11000	11000	11000	11000	11000
Primary current		A	5.248792778	10.49758556	13.12198194	16.53369725	26.24396389		39.36594583	52.48792778	65.60990972	78.73189166	104.9758556	131.2198194	157.4637833
Tappings		%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%		±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%
No. load secondary voltage		V	415	415	415	415	415		415	415	415	415	415	415	415
Secondary current		A	139.1246278	278.2492557	347.8115696	438.2425777	695.6231392		1043.434709	1391.246278	1739.057848	2086.869418	2782.492557	3478.115696	4173.738835
Vector group			Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11		Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11
No. load losses		W	190	380	400	650	660		970	1000	1270	1550	2400	2000	2400
No. load current		%	1.5	1.3	1.2	1.1	0.9		0.8	0.7	0.7	0.6	0.6	0.5	0.4
Load losses at 75°C		W	1750	2150	3450	3500	1750		1750	1750	1750	1750	1750	1750	1750
Short circuit impedance		%	4	4	4	4	6		6	6	6	6	6	6	6
Short circuit current		kA	3.5	7	8.7	11	11.6		17.4	23.2	29	34.8	46.4	58	69.6
Efficiency (MEPS)	50% cosφ 1	%	98.76	99.09	99	99.040	99.129		99.208	99.265	99.306	99.348	99.391	99.396	99.42
Efficiency	50% cosφ 0.8	%	98.455	98.866	98.753	98.804	98.913		99.012	99.083	99.134	99.186	99.24	99.246	99.27
Efficiency	100% cosφ 1	%	98.097	98.751	98.483	98.700	98.656		98.805	98.834	98.918	99.007	99.142	99.033	99.072
Efficiency	100% cosφ 0.8	%	98.632	98.443	98.111	98.380	98.326		98.511	98.546	98.651	98.761	98.930	98.795	98.843
Voltage drop	100% cosφ 1	%	1.815	1.149	1.450	1.185	1.402		1.254	1.254	1.167	1.076	0.922	1.072	1.033
Voltage drop	100% cosφ 0.8	%	3.575	3.201	3.308	3.223	4.586		4.488	4.488	4.430	4.368	4.261	4.365	4.338
Inrush current		X * rated current	18	18	18	17	15		12.5	10	10	9.5	9	9	8
Time constant inrush current			0.02	0.02	0.02	0.02	0.04		0.06	0.08	0.08	0.09	0.10	0.10	0.11
Primary insulation levels		kV	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95		12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95	12 - 28 - 95
Secondary insulation levels		kV	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3		1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3
Windings material		HV / LV	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al		Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al
Thermal insulation class			A	A	A	A	A		A	A	A	A	A	A	A
Windings temperature rise		°C	65	65	65	65	65		65	65	65	65	65	65	65
Sound pressure level	Distance: 1 m	dBA	43	47	43	48	50		51	53	54	59	60	61	62
Sound power level	Distance: 1 m	dBA	51	54	51	57	59		61	63	65	69	72	73	74
Base interaxis distance		mm	520	520	520	670	670		670	820	820	820	1070	1070	1070
Partial discharge		pC	< 5	< 5		< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	
Oil weight		kg	170	270	310	330	420		490	540	660	800	970	1210	1300
Total weight		kg	750	1150	1300	1350	1800		2250	2700	3400	3850	5000	5900	6700
Packing weight		kg	140	150	160	170	190		230	260	290	320	390	450	510
Transformer dimensions	L x W x H	mm	1250 × 1330 × 1480	1420 × 1530 × 1500	1440 × 1560 × 1580	1460 × 1560 × 1670	1590 × 1640 × 1800		1640 × 1740 × 1930	1710 × 1770 × 1970	1740 × 1780 × 2160	1870 × 1810 × 2270	1930 × 1920 × 2290	2180 × 2060 × 2550	2250 × 2180 × 2580
Packing dimensions	L x W x H	mm	1480 × 1490 × 1775	1520 × 1630 × 1800	1540 × 1660 × 1880	1560 × 1660 × 1970	1690 × 1740 × 2150		1810 × 1870 × 2280	1840 × 1880 × 2360	1970 × 1910 × 2570	2030 × 2020 × 2600	2280 × 2160 × 2860	2350 × 2280 × 2880	2330 × 1845 × 2655

Notes:
This data is in a condensed format, therefore specific data has been omitted. Additional technical data is available upon request.
Tolerance according to AS60076
Manufacturing according to standards AS60076.11
Data and characteristic are a guide only and can be changed without notice.

Company with management system certified by DNV
ISO 9001
ISO14001

Technical specification

TES-OM oil immersed transformers 22kV

Oil Immersed Tx Nominal power @ 22kV Primary and 415Vac secondary at 50Hz		kVA	100	200	250	315	500		750	1000	1250	1500	2000	2500	3000
Transformer design			Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed		Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed	Oil Immersed
Cooling system			ONAN	ONAN	ONAN	ONAN	ONAN		ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN
Ambient temperature		℃	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40		-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40	-25 / +40
Loading condition			Distribution	Distribution	Distribution	Distribution	Distribution		Distribution	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
Altitude		m a.s.l.	1000	1000	1000	1000	1000		1000	1000	1000	1000	1000	1000	1000
Number of phases		Nr	3	3	3	3	3		3	3	3	3	3	3	3
Frequency		Hz	50	50	50	50	50		50	50	50	50	50	50	50
Primary voltage		V	22000	22000	22000	22000	22000		22000	22000	22000	22000	22000	22000	22000
Primary current		A	2.624396389	5.248792778	6.560990972	8.266848625	13.12198194		19.68297292	26.24396389	32.80495486	39.36594583	52.48792778	65.60990972	78.73189166
Tappings		%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%		±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%	±2x2,5%
No. load secondary voltage		V	415	415	415	415	415		415	415	415	415	415	415	415
Secondary current		A	139.1246278	278.2492557	347.8115696	438.2425777	695.6231392		1043.434709	1391.246278	1739.057848	2086.869418	2782.492557	3478.115696	4173.738835
Vector group			Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11		Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11	Dyn 11
No. load losses		W	190	380	400	650	660		970	1000	1270	1550	2400	2000	2400
No. load current		%	1.5	1.3	1.2	1.1	0.9		0.8	0.7	0.7	0.6	0.6	0.5	0.4
Load losses at 75°C		W	1750	2150	3450	3500	1750		1750	1750	1750	1750	1750	1750	1750
Short Circuit Impedance		%	4	4	4	4	6		6	6	6	6	6	6	6
Short Circuit Current		kA	3.5	7	8.7	11	11.6		17.4	23.2	29	34.8	46.4	58	69.6
Efficiency (MEPS)	50% cosφ 1	%	98.76	99.09	99	99.040	99.129		99.208	99.265	99.306	99.348	99.391	99.396	99.42
Efficiency	50% cosφ 0.8	%	98.455	98.866	98.753	98.804	98.913		99.012	99.083	99.134	99.186	99.24	99.246	99.27
Efficiency	100% cosφ 1	%	98.097	98.751	98.483	98.700	98.656		98.805	98.834	98.918	99.007	99.142	99.033	99.072
Efficiency	100% cosφ 0.8	%	98.632	98.443	98.111	98.380	98.326		98.511	98.546	98.651	98.761	98.930	98.795	98.843
Voltage drop	100% cosφ 1	%	1.815	1.149	1.450	1.185	1.402		1.254	1.254	1.167	1.076	0.922	1.072	1.033
Voltage drop	100% cosφ 0.8	%	3.575	3.201	3.308	3.223	4.586		4.488	4.488	4.430	4.368	4.261	4.365	4.338
Inrush current		X * rated current	18	18	18	17	15		12.5	10	10	9.5	9	9	8
Time constant inrush current			0.02	0.02	0.02	0.02	0.04		0.06	0.08	0.08	0.09	0.10	0.10	0.11
Primary insulation levels		kV	24-50-125	24-50-125	24-50-125	24-50-125	24-50-125		24-50-125	24-50-125	24-50-125	24-50-125	24-50-125	24-50-125	24-50-125
Secondary insulation levels		kV	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3		1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3	1,1 - 3
Windings material		HV / LV	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al		Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al	Al / Al
Thermal insulation class			A	A	A	A	A		A	A	A	A	A	A	A
Windings temperature rise		℃	65	65	65	65	65		65	65	65	65	65	65	65
Sound pressure level	Distance: 1 m	dBA	43	47	43	48	50		51	53	54	59	60	61	62
Sound power level	Distance: 1 m	dBA	51	54	51	57	59		61	63	65	69	72	73	74
Base interaxis distance		mm	520 x 520	670 x 670	670 x 670	670 x 670	670 x 670		670 x 670	820 x 820	820 x 820	820 x 820	1070 x 1070	1070 x 1070	1070 x 1070
Partial discharge		pC	< 5	< 5		< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5	
Oil weight		kg	170	270	310	330	420		490	540	660	800	970	1210	1300
Total weight		kg	750	1150	1300	1350	1800		2250	2700	3400	3850	5000	5900	6700
Packing weight		kg	140	150	160	170	190		230	260	290	320	390	450	510
Transformer dimensions	L x W x H	mm	1250 × 1330 × 1480	1420 × 1530 × 1500	1440 × 1560 × 1580	1460 × 1560 × 1670	1590 × 1640 × 1800		1640 × 1740 × 1930	1710 × 1770 × 1970	1740 × 1780 × 2160	1870 × 1810 × 2270	1930 × 1920 × 2290	2180 × 2060 × 2550	2250 × 2180 × 2580
Packing dimensions	L x W x H	mm	1480 × 1490 × 1775	1520 × 1630 × 1800	1540 × 1660 × 1880	1560 × 1660 × 1970	1690 × 1740 × 2150		1740 × 1840 × 2230	1810 × 1870 × 2280	1840 × 1880 × 2360	1970 × 1910 × 2570	2030 × 2020 × 2600	2280 × 2160 × 2860	2350 × 2280 × 2880

Notes:
This data is in a condensed format, therefore specific data has been omitted. Additional technical data is available upon request.
Tolerance according to AS60076
Manufacturing according to standards AS60076.11
Data and characteristic are a guide only and can be changed without notice.

Company with management system certified by DNV
ISO 9001
ISO14001

TES-OM series of medium voltage transformers

Oil immersed (OM)

The TES-OM series of MV oil immersed transformers are manufactured in Italy by Trafo Elettro and distributed within Australia and New Zealand by NHP.

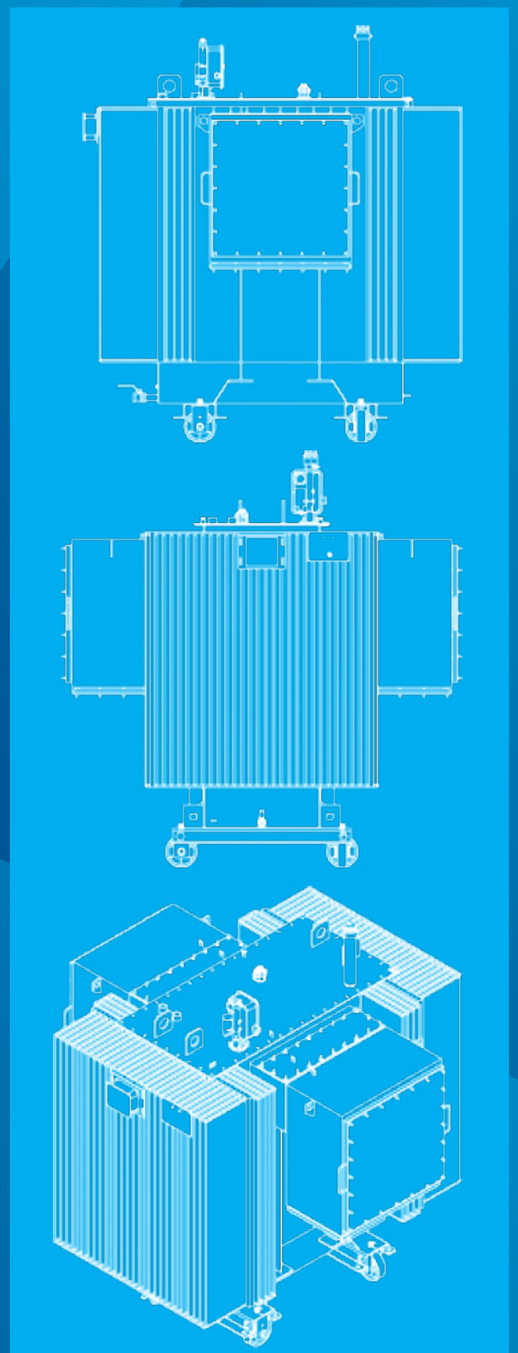
Oil immersed transformers offer a customised and reliable solution, as the typical design allows many configurations and installations.

Thanks to their design, oil immersed transformers are suitable for indoor or outdoor installations, highly polluted places, low temperature areas and seismic / high vibration conditions.

Designed for retrofit with customised, compact designs

NHP's oil immersed transformers can be custom manufactured including voltages, impedances, efficiency, vector group, tapping ratios, optional HV plug-in bushings, top or bottom LV connections, physical proportions and more.

This allows a custom designed transformer's dimensions to be tailored to the available space, allowing ease of replacement for replacement / retrofit applications.

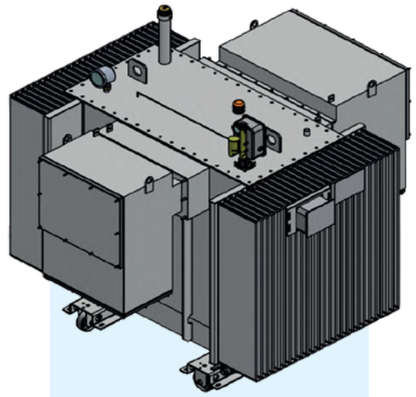


TES-OM functional unit part number description

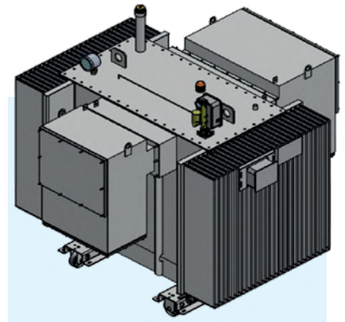
The TES-OM specification part numbers consist of six elements that indicate all the key parameters.

TES-OM	11	0415	1000	Dyn11	P	H	M
TES-OM = Oil immersed construction	Primary voltage 11kV, 22kV or 36kV	Secondary voltage (customer to specify)	Tx rating (kVA)	Vector group	Transformer style P = Padmount K = Kiosk style	Oil management H = Hermitically sealed C = Conservator type	Oil type M = Mineral S = Synthetic E = Ester based

TES-OM transformer examples



TES-OM –11- 0415-2000-Dyn11-P-H-M (padmount with cable boxes)



TES-OM –11- 0415-2000-Dyn11-K-H-M (kiosk style with HV plug-in bushings and LV flat busbar type bushing)

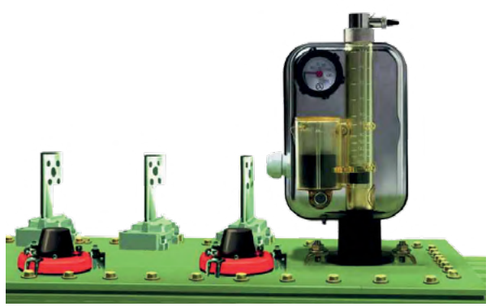
TES-OM –11- 0433-XX-Dyn11-P-H-M

TES-OM –11- 0433-1500-Dyn11-K-H-M

TES-OM series MV oil immersed transformers

Safety and performance by design

NHP's oil immersed transformers offer 'increased safety by design', by reducing the potential risks associated with temperature monitoring, insulation of live parts, maintenance and handling.



Temperature and pressure sensors

Health of the transformer can be checked by monitoring the oil and winding temperature and a pressure valve will open in the case of an over pressure situation.

High flash point oil – reduce fire risk

NHP can offer an ester based dielectric oil, which not only provides a very high flash point over traditional mineral oils, but is ideal for environmentally sensitive locations as the fluid is biodegradable.

Plug-in bushings with earth screened HV elbow connectors

The HV connections can be provided via brass studs or plug-in type bushings which connect the network cables to the primary and secondary windings through the cover while electrically isolating them. HV plug-in bushings that accept plug-in earth screed elbows are available as an option and should be utilised if an additional level of arc flash mitigation is required.

Earthing terminal

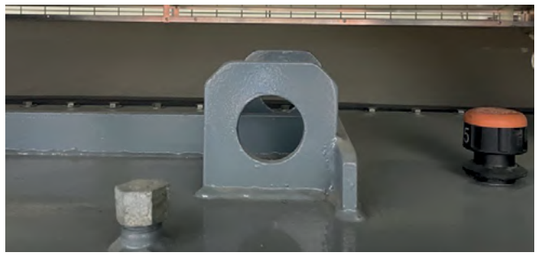
Two earthing points are integrated in each tank, with stainless stud, stainless flag with 12mm hole and stainless threaded M10 terminal being the available earthing point types.

Drain valve

The drain valve is used to drain or sample the transformer oil from the transformer tank. These valves are fitted to the transformer tank by welding the pipe of the valve to the tank. These valves are 100% tested to ensure no leakages.

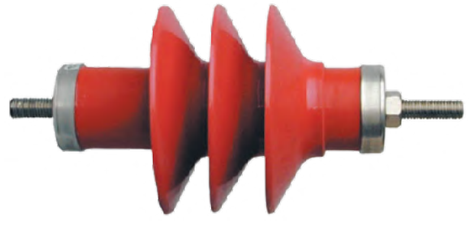
Tap changers

The off-load tap changer regulates the primary voltage by adapting it as closely as possible to the network voltage. Adjustments must be made with the power disconnected - move the knob in the required direction following what is shown on the rating plate.



Lifting points

Welded lifting points are used for untanking and handling. Two lifting points are supplied for units weighing up to 3.5 tons, while four are supplied for heavier units.



Surge arresters

Medium voltage surge arrestors can be installed with the transformer to mitigate the effects of over voltages that could exceed the systems Basic Insulation Level (BIL).

TES-OM series MV oil immersed transformers

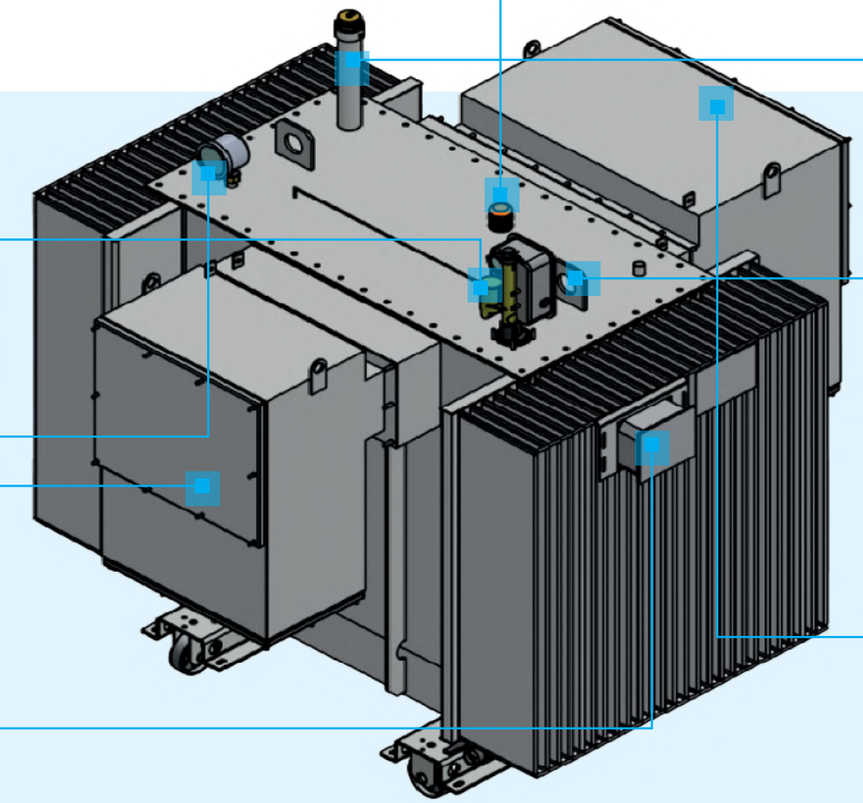
Typical layout*

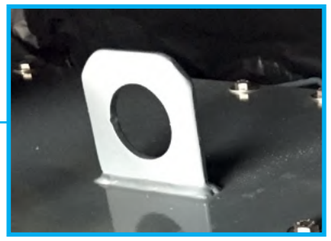
* Kiosk style transformer with HV plug-in bushings and LV flat busbar type bushing shown

Lockable tap changer

Safety valve

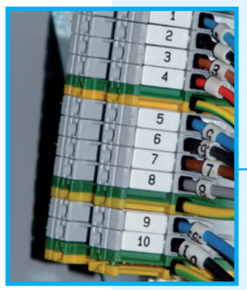
Temperature and pressure monitor





Lifting points

LV terminals



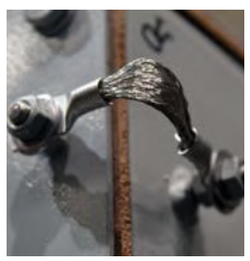
Auxiliary terminal box

HV plug-in bushing

Winding temperature monitor

Rating plate

Filter press and drain valves to avoid long connection distances



Earthing terminals

Customised cable boxes can be produced

TES-OM series MV oil immersed transformer - core components

Magnetic core, low and high voltage windings and sensors

Magnetic core

Manufactured with low-loss cold rolled grain oriented steel laminations, insulated with carlyte, mitred type or step-lap, the magnetic core of the transformer results in the reduction of the sound level and no-load loses. This also guarantees high sturdiness and stability during movements and in the event of short circuit stresses.

Low voltage windings

The low voltage windings are made using electrolytic aluminium or copper foils, insulated with an adequate thermal class material. This design ensures the winding is protected and is resistant to any high short-circuit forces. The outgoing terminals are made with aluminium or copper bars.

High voltage windings

The high voltage windings are manufactured with electrolytic copper enamelled wire or strip insulated with pure cellulose paper, normally wound directly above the LV winding.

This resulting winding is compact and strong in order to withstand short circuit electrodynamic forces.

The windings can be realised with many types of conductor and winding materials depending on the application.

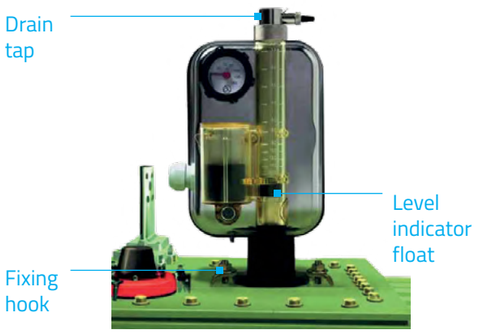
Temperature monitor (DS-150 and DGTP2)

DS-150

The DS-150 is a robustly designed thermometer which is used to measure the temperature of the transformers insulating oil. This is the standard device NHP supplies with TES-OM transformers.

DGTP2

The DGPT2 is the advanced integrated protection device that checks the oil temperature, pressure and the oil level of hermetically sealed transformers.



Pressure valve

50 VG

The 50 VG safety valve tested to EN 50216/A2 is a fully brass construction. It is designed to control and instantly discharge pressure which results from gases, which are a by-product of short circuits inside the transformer tank. The 50 VG is offered as the standard valve on the TES-OM transformers.

50 T

The 50T is an advanced pressure valve that serves the same function as the 50 VG, with the added feature of a 'valve open signal' N/O and N/C indication contact.

Winding temperature indicator

The MSRT 150-W measures the temperature of the transformer winding using an indirect heat sensitive resistive circuit through which a current flows. The thermometer can be fine tuned via the potentiometer on the indicator dial and can be fitted with up to four changeover micro-switches for control of cooling or for operating alarm and trip circuits.

Winding temperature is an important indicator of the load and should be monitored continuously to prevent unacceptable overload and possible thermal degradation.

Quality assurance and testing

Transformers are manufactured at a facility certified to ISO 9001-2008 quality management standards and to ISO 14001 environmental management standards.

Routine testing

Routine tests are undertaken in accordance with AS 60076, part 1 clause 10.1.1 include:

- Dimensional, accessories presence and operation check
- Separate-source AC withstand voltage test
- Induced AC withstand voltage test
- Partial discharge measurement
- Measurement of no load loss and no load current
- Measurement of short-circuit impedance and load losses
- Measurement of winding resistance
- Measurement of the transformation ratio and vector group.

Standards

NHP transformers comply with the latest edition of the following standards

AS 60076-1 Power Transformers	Part 1: General
AS 60076-2 Power Transformers	Part 2: Temperature rise
AS 60076-3 Power Transformers	Part 3: Insulation levels, dielectric tests and external clearances in air
AS 60076-5 Power Transformers	Part 5: Ability to withstand short circuit
AS 60076-10 Power Transformers	Part 10: Determination of sound levels
AS 1767.1 Insulating Liquids	Specification for unused mineral insulating oils for transformers
AS 2374.1.2 Power Transformers	Minimum energy performance standard (MEPS)*

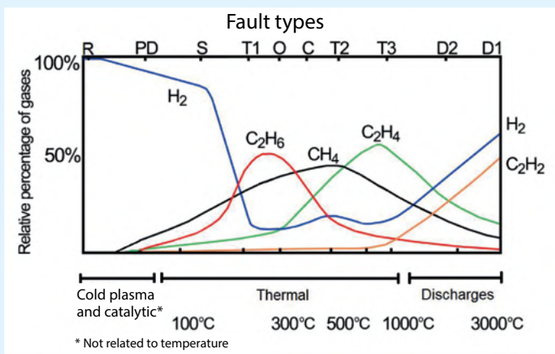
*NHP transformers meet the requirements of Minimum Energy Performance Standard for Power Transformers as designated in AS 2374.1.2. Table 2. High efficiency versions meeting the requirements of Table 4 shall also be available on request

Factory Acceptance Testings (FATs)

Access to a video on standard FATs is available for a set cost.

Special testing

NHP cast resin transformers can undergo special testing both 'in-house' and / or by a third party certified (CESI) laboratory. Below are examples of special tests that are sometimes requested for an additional cost



In-house factory testing

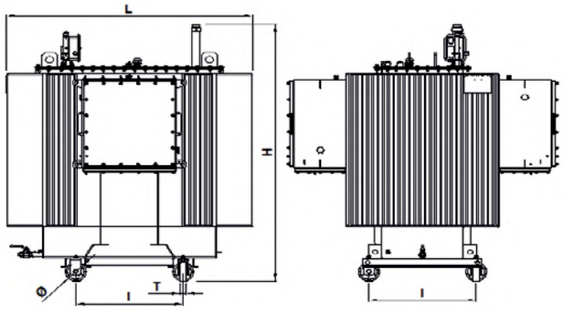
- Lightning impulse test as per IEC 60076-3 standards
- Temperature rise test as per IEC 60076-2 standards
- Measurement of sound level as per IEC 60076-10 standards
- Thermal image scans of all four sides and top of transformer after it has been energised for 24 hours with no load

Third party certified laboratory (CESI) testing

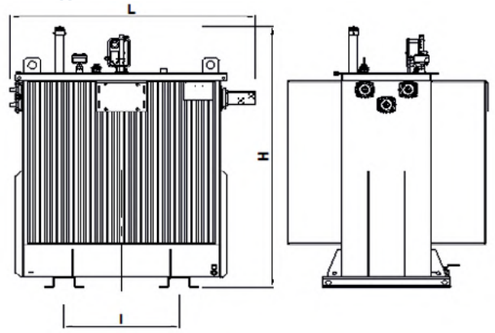
- IP tests
- IK tests
- Lightning impulse test as per IEC 60076-3 standards
- Temperature rise test as per IEC 60076-2 standards
- Measurement of sound level as per IEC 60076-10 standards
- Short Circuit Tests as per IEC 60076-5 standards

TES-OM series MV oil immersed transformer dimensional details

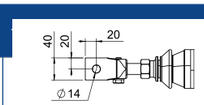
PAD mount type



Kiosk type



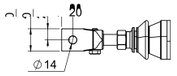
Rated power (kVA)	Secondary voltage (V)	Rate sec. current (A)	Cable size (mm²)
250	415	348	1 x 240 2 x 150
400	415	556	2 x 185
500	415	696	2 x 240
630	415	876	4 x 150 4 x 185
1000	415	1391	4 x 240



Porcelain bushing 1kV-630A - Brass flag 8mm thk.

240mm²-M12

2 x 150mm²-M12

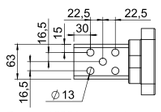


Porcelain bushing 1kV-630A - Brass flag 8mm thk.

2 x 185mm²-M12

Busbar 1600A - Tinned copper 12mm thk.

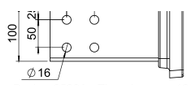
2 x 240mm²-M12



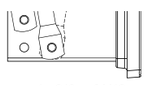
Busbar 1600A - Tinned copper 12mm thk.

4 x 150mm²-M12

4 x 185mm²-M12

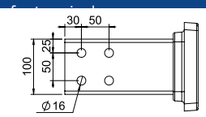


Busbar 2500A - Tinned copper 12mm thk.

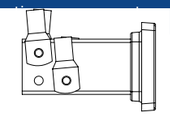


4 x 240mm²-M12

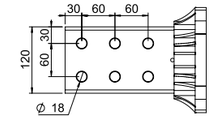
Rated power (kVA)	Secondary voltage (V)	Rate sec. current (A)	Cable size (mm²)
1250	415	1739	4 x 300
1500	415	2087	4 x 500
2000	415	2782	6 x 500
2500	415	3478	6 x 630



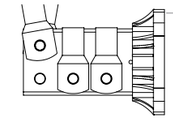
Busbar 2500A - Tinned copper 12mm thk.



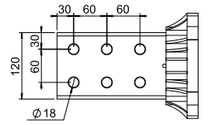
4 x 300mm²-M12



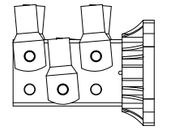
Busbar 3150A/B - Tinned copper 12mm thk.



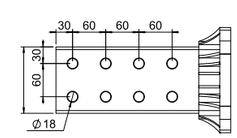
4 x 500mm²-M16



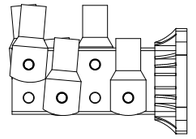
Busbar 3150A/B - Tinned copper 12mm thk.



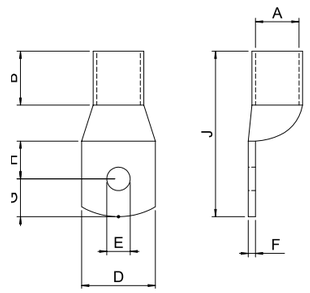
6 x 500mm²-M16



Busbar 5000A/B - Tinned copper 20mm thk.



6 x 630mm²-M16



Cabel (mm²) and bolt	E (mm)	A (mm)	D (mm)	F (mm)	B (mm)	G (mm)	H (mm)	J (mm)
150 - M12	13	16.7	32	5.8	32	18	18	75
185 - M12	13	18.5	36	5.8	32	18	18	79
240 - M12	13	21.2	41	7	38	21	21	92
300 - M12	13	23.8	46	7.8	42	23	23	101
500 - M16	17	30	56	9	50	27	27	119
630 - M16	17	34	64.4	11	58	32	32	139

Power	kV	100	200	250	315	500	750		1000	1250	1500	2000	2500	3000
PAD MOUNT TYPE														
L	mm	1250	1420	1440	1460	1590	1640		1710	1740	1870	1930	2180	2250
W	mm	1330	1530	1560	1560	1640	1740		1770	1780	1810	1920	2060	2180
H	mm	1480	1500	1580	1670	1800	1930		1970	2160	2270	2290	2550	2580
Oil weight	kg	170	270	310	330	420	490		540	660	800	970	1210	1300
Total weight	kg	750	1150	1300	1350	1800	2250		2700	3400	3850	5000	5900	6700
KIOSK TYPE														
L	mm	1110	1190	1200	1250	1320	1390		1440	1480	1530	1670	1810	1890
W	mm	730	930	960	970	1020	1080		1150	1170	1230	1320	1460	1550
H	mm	1480	1500	1580	1590	1710	1930		1970	1990	2050	2080	2550	2580
Oil weight	kg	170	270	310	330	420	490		540	660	800	970	1210	1300
Total weight	kg	750	1150	1300	1350	1800	2250		2700	3400	3850	5000	5900	6700
COMMON DIMENSIONS														
I	mm	520	520	520	670	670	670		820	820	820	1070	1070	1070
Φ	mm	100	100	100	125	125	125		125	150	150	200	200	200
T	mm	40	40	40	40	40	40		40	60	60	70	70	70

DFX
Medium voltage kiosk solutions

DFX is a customisable medium voltage kiosk

- Made from rugged materials to withstand extreme conditions
- Applicable service voltage is 11 and 22kV
- Ideal for outdoor applications

DFX MV kiosks

Customer design

Long life

Arc-Killer option

DFX-GP and DFX-S

NHP DFX kiosks are custom designed to suit a wide variety of applications and are available in a general purpose type and a special purpose type. DFX MV kiosks are suitable for network voltages of 11kV and 22kV meeting power requirements from 200kVA up to 2500kVA. Full switchroom solutions, enclosed switchgear and enclosed transformers can also be provided upon request.

Key characteristics:

- **Built to last**
  Designed and built using quality materials. Also featuring the DF-2+ MV switchgear which has a 50 year design life to meet the Australian Defence standard MIEE
- **Custom manufactured transformer characteristics**
  Voltages, impedances, efficiency, HV plug-in bushings and more
- **Compact design**
  Optimised dimensions and terminals arrangement for critical situation of space
- **Built for local standards**
  Type tested to AS60076, complies with MEPS AS2374.1.2 ensuring minimum energy losses
- **High environmental resistance**
  Specific coating treatment and use of stainless steel bolts to withstand the most extreme environmental conditions
- **Arc flash standards**
  NHP's DFX kiosk with the DR6+ or DF2+ is designed to comply with IAC-AB internal arc classification and includes the Arc-Killer technology as standard
- **Temperature monitoring**
  The health of core components can be tracked 24/7 via optional temperature monitoring sensors

Applications:

- Indoor or outdoor installations
- Highly polluted places and atmospheres common in mines, paper mills, off-shore and on-shore sites, oil and gas systems, desalination plants and cement factories
- Ring networks
- Defence, healthcare and heavy industry

Applicable standards:

- AS 2067
- AS 62271.202
- MIEE 2011 Amendment 3 (Defence)
- AS 4312
- AS 60529
- AS/NZS 61439
- AS 3000

DFX series of medium voltage kiosks

Designed For eXcellence (DFX)

The DFX series of prefabricated kiosk substations is engineered to suit customer specification and application requirements and can house a variety of HV and LV equipment. DFX kiosks are available in a variety of configurations, can be provided with oil immersed or cast resin transformers (11 and 22kV) and suit power requirements from 200kVA up to 2500kVA.
Full switchroom solutions can also be provided upon request.

The DFX difference

NHP's DFX kiosks are designed and built to last. Quality materials are used and they are assembled and fully tested in Australia.

NHP DFX kiosks have been widely installed all over Australia and New Zealand, powering critical industries such as:

- Defence
- Mining
- Utilities
- Intensive farming
- Rail
- Hospitals and health centres
- Water
- Airports
- Commercial buildings

DFX functional unit part number description

The DFX specification part numbers consist of seven elements that indicate all the key parameters.

DFX-GP	HVTxLV	11kV	1000	C	S	3WAD
Kiosk series DFX-GP is 'general purpose' DFX-SP is 'special purpose' Typically used for Defence 'MIEE' specifications	Kiosk configuration HV+Tx+LV HV+Tx Tx+LV	Rated network voltage 11kV 22kV	Rated power (kVA) 200, 315, 500, 750, 1000,1500,2000, 2500	Transformer type C = Cast resin O = Oil immersed	Output power S = Standard: 80-85% output A = Advanced: 85-90% output P = Premium: 100% output	RMU family 3WGD = 3 way gas insulated DR6 4WGD = 4 way gas insulated DR6 3WAD = 3 way air insulated DF2

DFX kiosk example

DFX-GP-HVTxLV-11kV-1500-C-A-3AWD (showing HV section with DF2 switchgear)

DFX-GP-HVTxLV-11kV-1500-C-A-3AWD (showing LV section)

DFX-GP-HVTxLV-11kV-1500-C-A-3AWD (showing Tx section)

Technical specification

DFX MV kiosk

DFX kiosk - technical data		UOM	GP kiosk with DR6+/DT6+		SP defence kiosk with DF2+	
General charactristics						
Ambient temperature	Normal operating conditions	°C	-5 to +40			
	Operation in hot climates	°C	+50 (deratings apply)			
Type of ventilation			Natural			
Design life		years	30		50	
Enclosure IP rating - LV and HV compartments			IP54			
Enclosure IP rating - Tx compartments			IP23 (Oil)/ IP33D (CR)			
Enclosure material			MM / SS /AL			
Electrical ratings						
Network voltage		kV	11	22	11	22
Rated primary voltage		kV	12/17.5	24	17.5	24
BIL		kV	75/95	125	95	125
Rated maximum power of kiosk substation		kVA	200 -2500		200 -1500	
Output capicity @Mx ambient temp, % of max. power	Premium	%	100			
	Advanced	%	85 - 90			
	Standard	%	80 - 85			
Internal arc classification (by design)			IAC - AB			
Internal arc withstand current (MV side) for 1s		kV	20			
Internal arc withstand current (LV side) for 1s - OPTION		kV	65			
MV switchgear						
Switchgear type			DR6+ (3 or 4 way)		DF2+ ADA (A)	
Rated current		A	630		800	
Short time current withstand for 1s		kA	20	16/20	25	20
Transformer						
Transformer type			Cast resin or oil immersed HS			
Air forced cooling of transformer - option			Yes (≥1000 kVA)		No	
Rated secondary voltage			415 / 433			
Rated secondary current			≤2800		≤2100	
Vector group			Dyn1 or Dyn 11			
S/C impedance , %			4% (≤ 500kVA) / 6% (> 500 kVA)			
Minimum energy performance (AS 2374.1.2)			MEPS (Standard / HEPS (option))			
LV system						
LV switchboard type			NHP Custom Built or NHP / Cubic (option)			
LV switchboard form factor			3BiH		3B	
LV switchboard IP rating			IP33			
Short time current withstand for 1s		kA	≤65			
Incomer ACB rated current		A	≤4000			
Max number / sizes of LV CBs			TBA			

General section

Kiosk series
DFX-GP - General Purpose
DFX-SP - Special Purpose

Kiosk configuration
HV+Tx+LV
HV + Tx
Tx + LV

Kiosk power output	
Standard	80-85% output
Advanced	85-90% output
Premium	100% output

Kiosk rated power, kVA
200kVA
315kVA
500kVA
750kVA
1000kVA
1500kVA
2000kVA
2500kVA

Rated network voltage,kV
11kV
22kV

Transformer section

Cast resin transformer option

Transformer type
Cast resin

Transformer protection device
T154 overtemperature relay
NT935 advanced temp monitor with RS485

Oil immersed transformer option

Transformer type
Oil immersed

Transformer protection device
Combined overtemp/ overpressure / low oil and gas protection device

Transformer oil
Mineral oil
FR3 vegetable oil
Midel EN vegetable oil

Common options for cast resin and oil transformer

Transformer taps
±2 x 2.5%
±3 x 2.5%
±4 x 2.5%

Transformer efficiency
MEPS transformer
High energy perfomance transformer

Transformer testing option
Lightning impulse test as per IEC 60076-3 standards
Temperature rise test as per IEC 60076-2 standards
Measurement of sound level as per IEC 60076-10 standards
Short circuit withstand
Video witnessing of standard FATs

Transformer design ambient temp.
40°C
50°C

Transformer efficiency
MEPS transformer
High energy perfomance transformer

HV section

Gas insulated RMU options

RMU family gas insulated
3-way gas insulated DR6 (with mech VCB)
3-way gas insulated DT6 (with magnetic VCB)
4-way gas insulated DR6 (with mech VCB)
4-way gas insulated DT6 (with magnetic VCB)

VCB with manual or remote capability gas insulated
VA-3 VCB with manual spring-charged mechanism and trip coil
VA-3 VCB with motorised mechanism, trip coil and closing coil for remote control
ISM VCB with magnetically actuated driving mechansim ready for remote control

LBS with manual or remote capability gas insulated
RV-50 LBS manual operating mechanism for DR6
RV-50 LBS motorised mechanism for DR6 (on ring switches only)

ESW with manual or remote capability gas insulated
Earth swith with manual operating mechanism for DR6
Earth switch with motorised mechanism for DR6 (on ring switches only)

Auxiliary contact gas insulated
ESW 2NO+2NC aux. contacts for DR6
LBS 2NO+2NC aux. contacts for DR6

RMU other options
Manual generator and interface
Short circuit indicator (on ring switches)
Local / remote selector switch

RMU model (gas insulated switchgear)
DT6+ 2KD 12kV 20kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 VCB, with Arc-Killer
DT6 2KD 12kV 20kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 VCB
DT6+ 2KD 24kV 16kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 VCB, with Arc-Killer
DT6 2KD 24kV 16kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 VCB
DT6+ E 2KD 12kV 20kA 3-way compact extensible GIS RMU with 2 ring switches and 1 VCB, with Arc-Killer
DT6 E 2KD 12kV 20kA 3-way compact extensible GIS RMU with 2 ring switches and 1 VCB
DT6+ E 2KD 24kV 16kA 3-way compact extensible GIS RMU with 2 ring switches and 1 VCB, with Arc-Killer
DT6 E 2KD 24kV 16kA 3-way compact extensible GIS RMU with 2 ring switches and 1 VCB
DR6+ 2KD 17.5kV 20kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 mechanical VCB, with Arc-Killer
DR6 2KD 17.5kV 20kA 3-way compact non-extensible GIS RMU with 2 ring switches and 1 mechanical VCB
DT6+ 2K2D 12kV 20kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 VCB, with Arc-Killer
DT6 2K2D 12kV 20kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 VCB
DT6+ 2K2D 24kV 16kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 VCB, with Arc-Killer
DT6 2K2D 24kV 16kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 VCB
DR6+ 2K2D 17.5kV 20kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 mechanical VCB, with Arc-Killer
DR6 2K2D 17.5kV 20kA 4-way compact non-extensible GIS RMU with 2 ring switches and 2 mechanical VCB

Air insulated RMU options

RMU family air insulated
3-way air insulated DF2 (with mech VCB)

VCB with manual or remote capability
VAS-2 VCB with manual spring-charged mechanism and trip coil
VAS-2 VCB with motorised mechanism, trip coil and closing coil for remote control

LBS with manual or remote capability
RV-44 LBS with manual operating mechanism for DF2
RV-44 LBS with motorised operating mechanism for DF2 (on ring switches only)

ESW with manual or remote capability
Earth switch with manual operating mechanism for DF2
Earth switch with motorised mechanism for DF2 (on ring switches only)

Auxiliary contact
ESW 2NO+2NC aux. contacts for DF2
LBS 2NO+2NC aux. contacts for DF2

RMU other options
Heater and thermostat
Short circuit indicator (on ring switches)
Local / remote selector switch

RMU model (air insulated switchgear)
DF2+ ADA 17.5kV 25kA 3-way switchboard AIS with 2 ring switches and 1 mechanical VCB, with Arc-Killer
DF2 ADA 17.5kV 25kA 3-way switchboard AIS with 2 ring switches and 1 mechanical VCB
DF2+ ADA 24kV 20kA 3-way switchboard AIS with 2 ring switches and 1 mechanical VCB, with Arc-Killer
DF2 ADA 24kV 20kA 3-way switchboard AIS with 2 ring switches and 1 mechanical VCB

Common options for gas insulated and air insulated swichgear

RMU protection relay
P15D self powered O/C E/F relay
P154 powered O/C E/F relay
P14NB powered non-directional feeder management relay 11IN/12OUT TCS RS485
P14NB powered non-directional feeder management relay 8N/8OUT RS485
P14DB powered directional feeder management relay 11IN/12OUT TCS RS485
P14DB powered directional feeder management relay powered 8N/8OUT RS485

Key interlock
Key interlock for LBS line open for SGC
Key interlock for LBS line close for SGC
Key interlock for ESW line open for SGC
Key interlock for ESW line close for SGC

RMU VDS
Capdis S1+ VDS
Capdis S2+ VDS (with aux. contact)

LV section

Incomer

Form of separation of LV SWBD
Form 3B
Form 3Bih

Incomer circuir breaker trip unit type
Thermal magnetic (MCCB)
Basic electronic (MCCB)
Non-automated (ACB)
Automated (ACB)

Incomer MCCB accessories
Shunt trip
Under voltage trip
Motor operation
Shaft extension handle
Captive lock
Terminal cover
Auxiliary switch
Alarm switch

Fault current of LV switchborad
25
36
50
65

Incomer circuit breaker type
Moulded circuit breaker
Air circuit breaker

Incomer ACB accessories
Shunt controller
Undervoltage coil
Trapped key interlock
Motor mechanisim including LRG
Mechanical interlock

Incomer other options
NEMO smart meter with fuses
CTs for meter
Surge arresters with fuses

LV switchboad/incomer circuit breaker rating
630A
1000A
1250A
1600A
2000A
2500A
3200A
4000A

LV section

Feeder

Feeder circuit breaker
Moulded circuit breaker
Air circuit breaker

Feeder MCCB accessories
Shunt trip
Under voltage trip
Motor operation
Shaft extension handle
Captive lock
Terminal cover
Auxiliary switch
Alarm switch

Feeder ACB accessories
Shunt controller
Undervoltage coil
Trapped key interlock
Motor mechanisim iIncluding LRG
Mechanical interlock

Feeder circuit breaker rating
100A
160A
250A
400A
630A
800A
1000A
1250A
1600A
2000A
2500A
3200A
4000A

Feeder other options
NEMO smart meter with fuses
CTs for meter
Surge arresters with fuses

Encloser section

LV section IP rating
IP54
IP55
IP56

HV section IP rating
IP54
IP55
IP56

Transformer section IP rating
IP23D
IP33D
IP34D
IP43
IP44

Enclosure material option
2mm Mild Steel, Zinc Annealed
2mm Galvabond
3mm Mild Steel, Zinc Annealed
3mm Galvabond
4mm Aluminium
2mm Stainless steel 304
3mm Stainless steel 304
2mm Stainless steel 316
3mm Stainless steel 316

Roof cowlings
No cowlings
2 cowlings
4 cowlings

Enclosure paint option
Storm Grey N42
Custom Colour

Enclosure features
Three segregated compartments for MV switchgear, transformer and LV switchgear
Galvanised (PFC) metal channel base frame
Full metal base, incorporating switchgear removable gland plates for cable entry/exit
Weatherproof ventilation grills and filters on the front doors
Removable double overlapping doors at the HV and LV ends, fitted with 3-point locking
110˚ to 160˚ door swing on door where door hinges are installed
Hinged doors or lift off side covers for access to transformer section
Earthing on all main components as per AS62271.202
Internal compartment lighting installed and connected in each compartment
DB for light and power

Addtional options

Battery charger and batteries
Battery charger 24VDC 18A with 105Ah battery
Battery charger 24VDC 22A with 150Ah battery
Customised battery charger is available

DESN/PCMS compartmnet or cabinet
Separate cabinet for PLC/BCMS/SCADA equipment located in LV section, including wiring of SCADA signals to the terminal strip
Separate compartment for PLC/BCMS/SCADA equipment, including wiring of SCADA signals to the terminal strip

Battery charger location
Battery charger installed in a separate compartment
Battery charger installed in LV compartment

Remote control (mimic) panel
Remote control and indication panel (for HV RMU control)

NHP panelboard
NHP customised panelboard

DFX series of MV kiosks

Safety and performance by design

NHP's DFX kiosks offer 'increased safety and performance by design', reducing the potential risks associated with arc flash mitigation, temperature management, insulation of live parts and ease of maintenance.

Temperature monitoring

The health of the core components can be tracked 24/7 via temperature monitoring:

- **Transformer health –** monitor windings and fluid (for oil type) temperatures
- **MV switchgear –** monitor connection points and busbar using the FTX digital temperature system
- **LV switchboard –** monitor the internal temperature of the Air Circuit Breaker using integrated 3C technology

Insulation, shrouding and plug-in transformer bushings

Using extensive insulation and shrouding on all terminations and connections reduces potential exposure to live components.

Furthermore, HV plug-in bushings that accept plug-in earth screed elbows are available as an option and should be utilised if an additional level of arc flash mitigation is required.

50 year design life for Australian Defence projects

DFX-S (special purpus) kiosks feature DF-2 switchgear which has undergone testing and goes beyond the standards. This additional testing allows NHP to claim a 50 year design life under normal service conditions as required by the MIEE Australian Defence specification.

SWITCHGEAR 50 YEAR DESIGN LIFE

Australian Government
Department of Defence

Kiosks designed to meet the arc fault standards

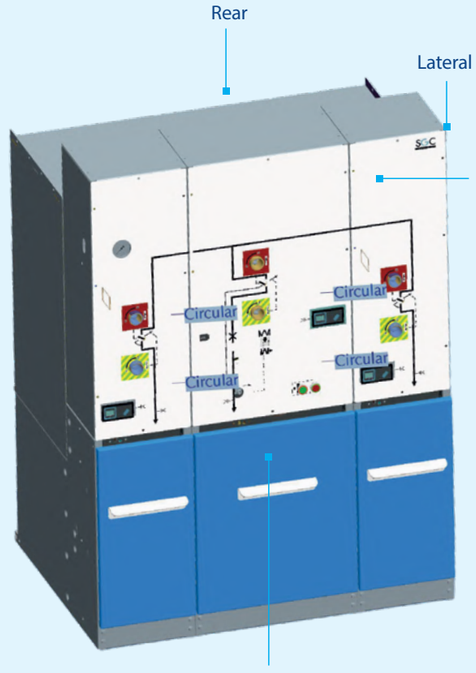
NHP's DFX kiosk with the DR-6+ or DF-2+ is designed to comply with IAC-AB internal arc classification and includes the Arc-Killer technology as standard. Furthermore, there is no need to design and install chimney systems to expel dangerous arc fault gases externally to the kiosk. This improves the safety for electrical operators wo may be working inside or outside the kiosk.

The internal arc class (IAC) describes the types of accessibility, test arrangement, test procedure and accetance criteria applied to the switchgear.

The types of accessibility A and B ('A' is for authorised personnel only and 'B' is for general public, respectively). The accessibility of type A and B is further explained by defining different sides of the enclosure as front (F), lateral (L) and rear (R) side.

NHP's DFX kiosks provide an IAC – AB-FLR 20kA,1s as per IEC62271-200 which ensures protection for the operator as well as general public from all four sides of the cubicle.

This is a superior rating to most other switchgear products on the market.



B = safe to stand within 100mm

DF-2+ with Arc-Killer provides a B-FLR classification

AS/NZS 61439 compliant LV switchboard

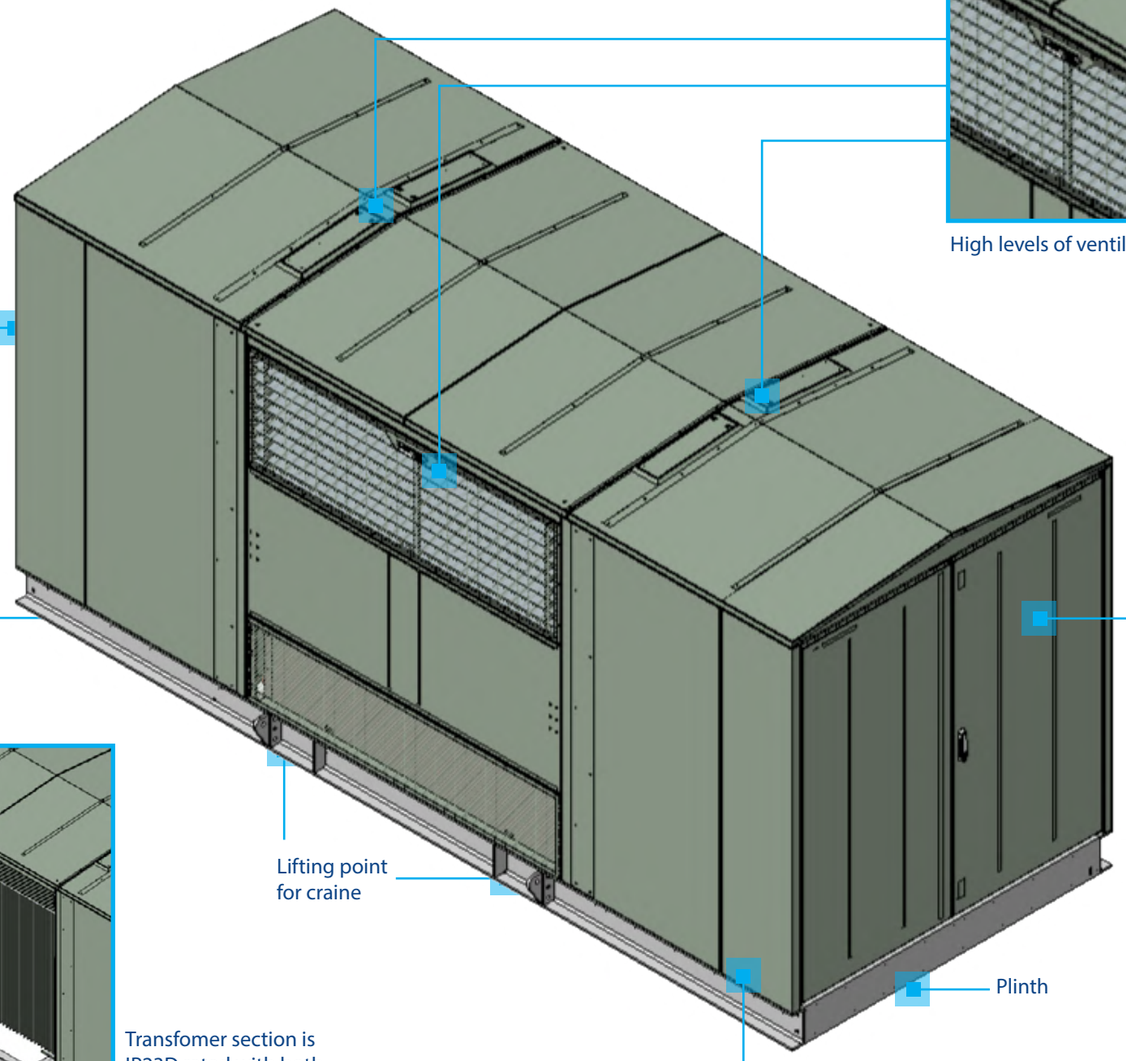
NHP's DXF kiosks have an LV switchboard built with the CUBIC Modular system. CUBIC is an IEC / AS/NZS 61439 test verified system, ensuring the highest levels of safety and performance.

Generous space for easy servicing

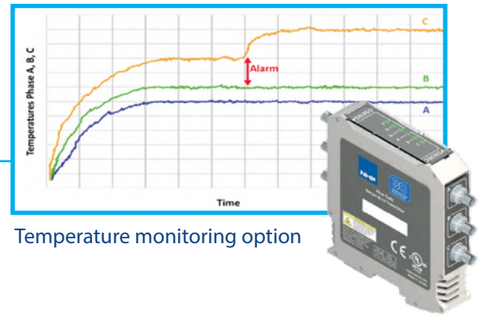
NHP's DFX kiosks have been designed with the end user in mind. The transformer section is generously sized to allow for easy access, facilitating the correct environment for servicing and maintenance.

DFX series of MV kiosks

Typical layout*



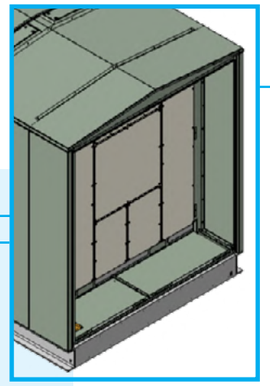
High levels of ventilation



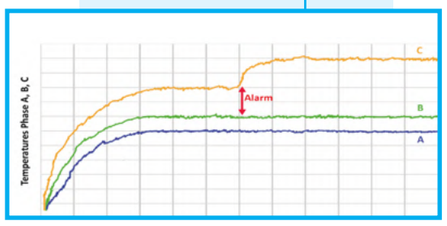
Temperature monitoring option

STANDARDS Australia

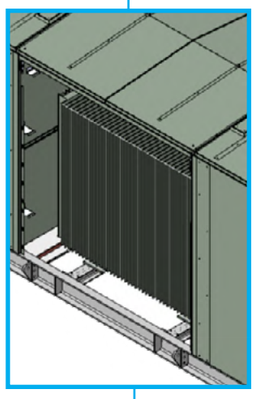
AS/NZS 61439 verified switchboard



LV section is IP3X rated



Integrated temperature monitoring option

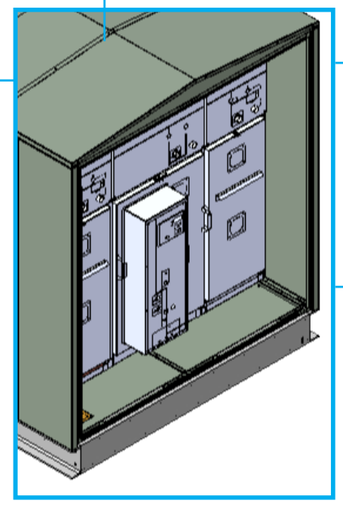


Transfomer section is IP23D rated with both oil immsered or cast resin types

Lifting point for craine

Plinth

Mild steel, stainless steel or aluminium enclosure material



HV section is IP54 rated

50 year design life

IAC-AB with Arc-Killer

Winding temperature monitor

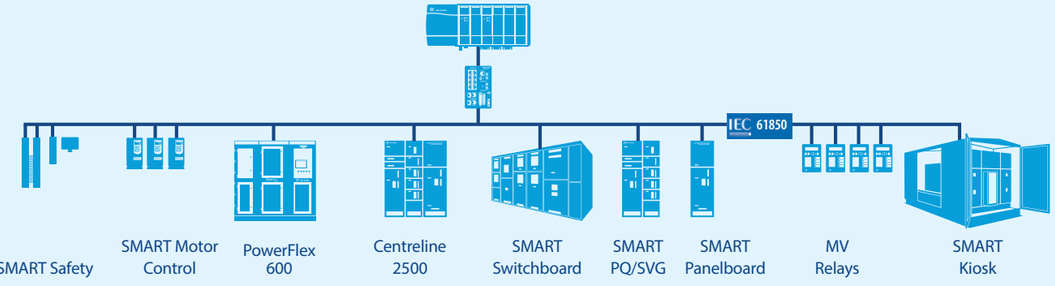
HV plug-in bushing for safety

Temperature and pressure monitor

*Kiosk style transformer with HV plug-in bushings and LV flat busbar type bushing shown

NHP SMART Solutions – Enabling the Connected Enterprise

Upgrade the DFX kiosk with NHP's SMART digital devices and integrate it into the Connected Enterprise.



DFX series MV kiosks - core components

MV RMUs, MV transformers and low voltage switchboards

MV RMUs – for DFX-G (general purpose type)

DR-6/DT-6 and DR-6+/DT-6+ GIS

The DR/DT-6 RMU provides a network switching function by load break/earth switch and protection functions by a fuse switch or a dedicated vacuum circuit breaker in applications with rated voltage up to 24kV with a maximum current of 630A.

DR-6+ is a special DR-6 model that features Arc-Killer technology.

Compact and extensible

3-position load break switch

Arc-Killer option

Modular design

2-position load break switch

Arc-Killer option

MV RMUs – for DXF-S ('Special purpose' type)

DF-2/DF-2+ AIS

DF-2's modular design allows you to create simple and custom-made combinations of MV cubicles with a rated voltage of up to 24kV. DF-2+ is a special DF-2 model that features Arc-Killer technology.

The DFX-S kiosk always uses the DF-2 switchgear as it features a 50 year design life. For Australian Defence projects that follow the guidelines outlined in the MIEE document, switchgear with a 50 year design life is required.

MV Transformers – for DFX-G and DFX-S cast resin and oil immersed

NHP TES-R cast resin transformers range from 50kVA to 6MVA with voltages up to 36kV.

Due to the flame-resistant and self-extinguishing materials used, they are perfect for indoor and special applications like rail, hospitals, data centres, high rise buildings and highly ecological environments.

E3

C2 Performance

F1

Long life

Compact design

Seismic zones

NHP TES-OM oil immersed transformers range from 50kVA to 7MVA with voltages up to 36kV.

The traditional oil transformers are available with oil conservator or hermetically sealed type with integral fins.

The insulating oil is mineral type PCB free, preventively treated and dried and filled under vacuum.

Economical

Compact design

Seismic zones

High environmental resisntace

Custom and AS/NZS61439 verified LV switchboard – for DFX-G and DFX-S

NHP can supply a custom LV switchboard or use the CUBIC Modular switchboard system, which is independently tested for verification to IEC61439 and is applicable to AS/NZS61439 'Original Manufacturer' verification requirements.

The CUBIC Modular system has also passed arc fault containment testing for AS/NZS 61439 Annex ZD and the more demanding IEC/TR 61641.

DFX series MV enclosed solutions

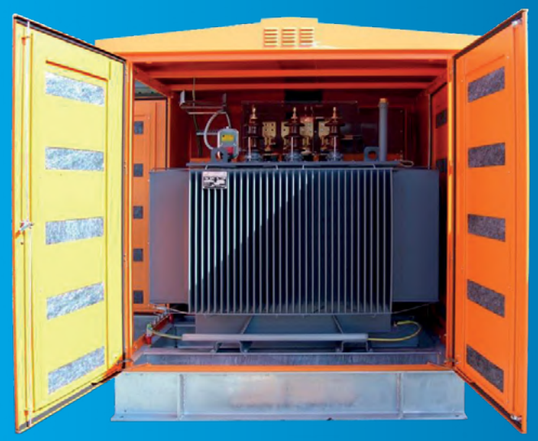
Enclosed switchgear and enclosed transformers

MV enclosed switchgear

The DF-2 switchgear can be provided already installed into an outdoor rated enclosure, providing a more economical solution when compared to a full switchroom or sub station building. NHP has provided a large number of customised enclosed switchgear solutions into many industries, typically in harsh environments. As these designs tend to always be customer specific, please contact NHP for more information.

MV enclosed transformers

The NHP cast resin and oil immersed transformers can be supplied already installed into an outdoor rated enclosure, providing a very economical yet robust solution. As these designs tend to always be customer specific, please contact NHP for more information.



Quality manufacturing

Quality assurance

NHP MV kiosks use transformers and MV switchgear components that are manufactured at facilities certified to ISO 9001-2008 quality management standards and to ISO 14001 environmental management standards.

Routine testing

Routine tests are undertaken in accordance with relevant AS/NZS standard:

MV switchgear

- Contact resistance (ductor) test on main bus according to AS62271.200
- Power frequency withstand voltage test (hi pot) according to AS62271.200
- Mechanical operations test of all switching devices and full checking of interlocks according to AS62271.2027.3
- Electrical operations test via local control and from DESN/BCMS terminals. Check monitoring signals on DESN/BCMS terminals after switching CB and switches according to AS62271.2027.3

HV interconnections

- Power frequency withstand voltage test (hi pot) according to AS62271.2027.1

LV switchboard

- Tested separately per NHP standard FAT before installed in kiosk according to AS 61439

Kiosk

- Interpanel wiring between MV panels, kiosk sections, MV SWGR to Tx temp. relay according to AS62271.2027.4
- Voltage withstand test on aux. Circuits according to AS62271.2027.2

Transformer

- MV VCB trip via Tx overtemperature or DGPT2 relay according to AS62271.2027.3

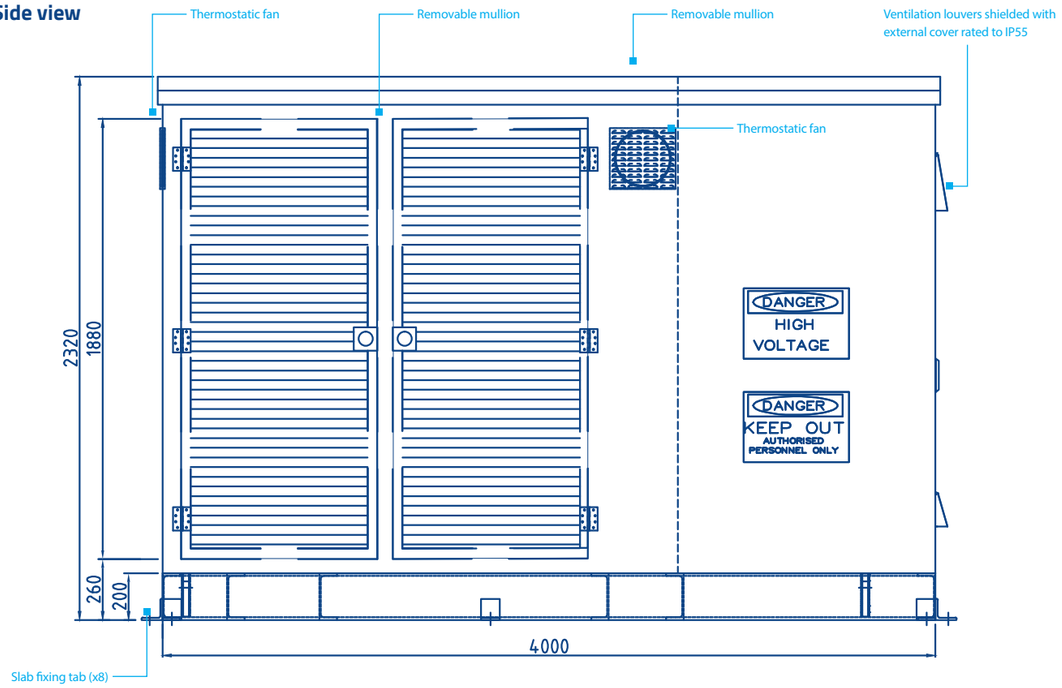
Standards

NHP DFX kiosks comply with the latest edition of the following standards:

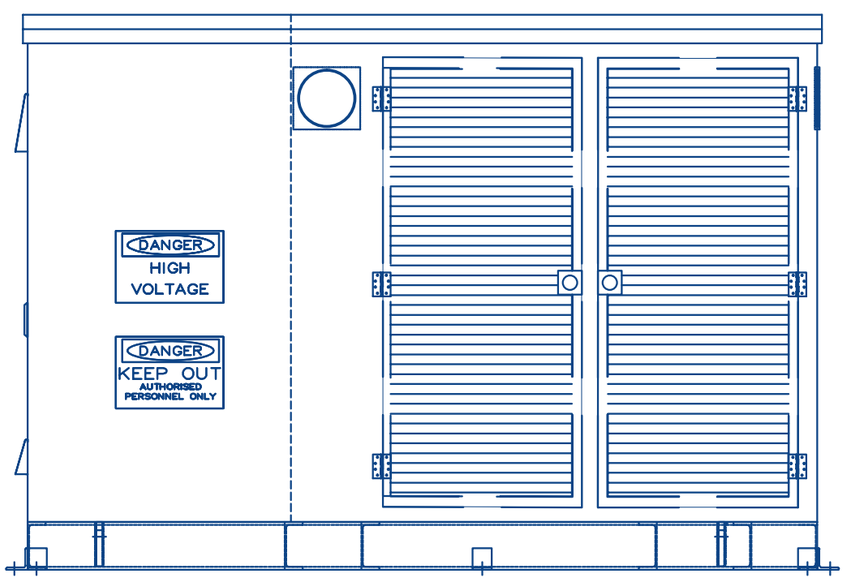
AS 3000	Wiring rules
AS 2067	Substations and HV installations
AS 62271.1	HV switchgear - Common Spec
AS 62271.200	HV Switchgear 1-52kV
AS 62271.202	HV prefabricated subs
AS 60071	Power transformers
AS 61439	LV switchboards
MIEE 2011, Amend. 3 – 1 June 2018	Defence electrical engineering standard
AS 4312	Atmospheric corrosivity zones in Australia
AS 60529	Degrees of protection provided by enclosures

750 - 1000kVA DR6+ cast resin immersed GP kiosk

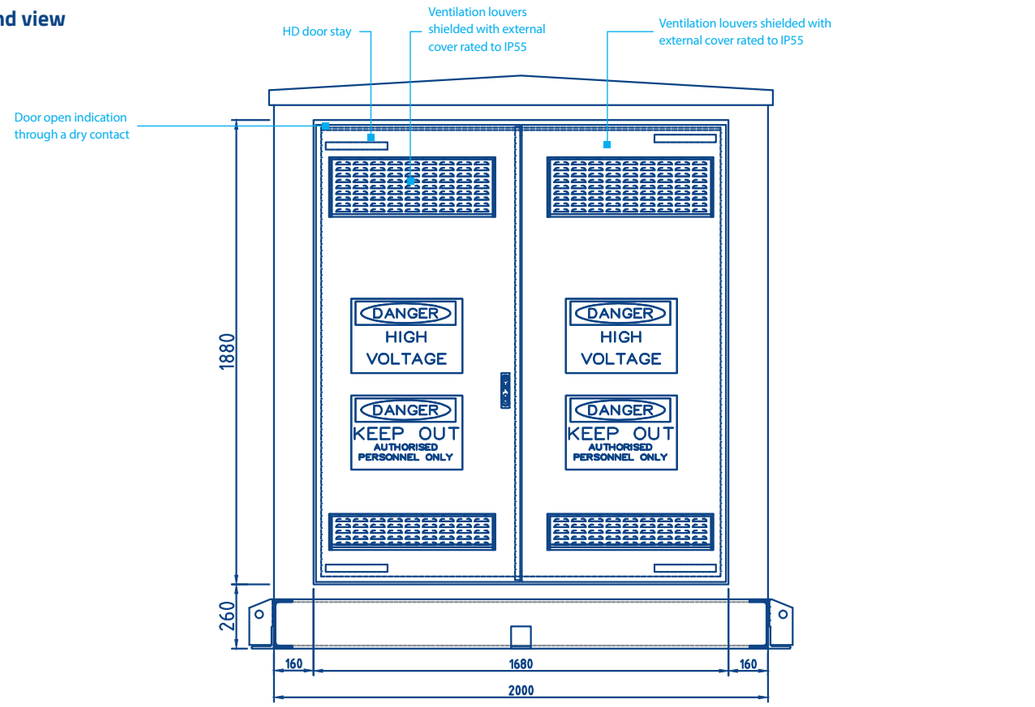
Side view



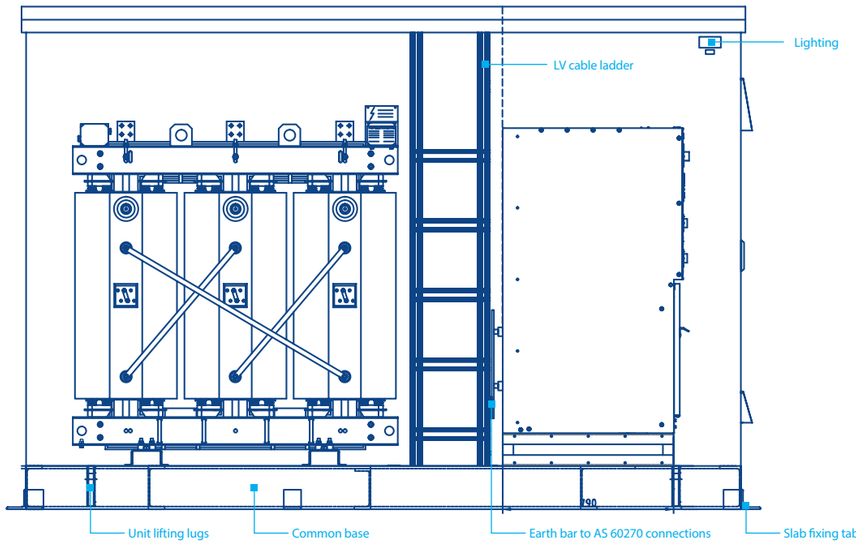
Side view



End view



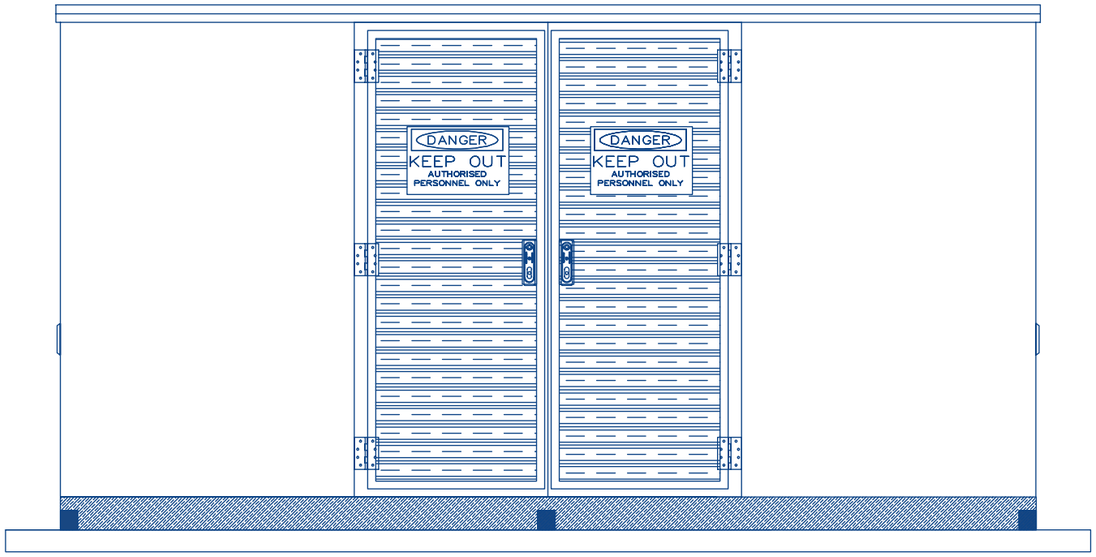
Section view



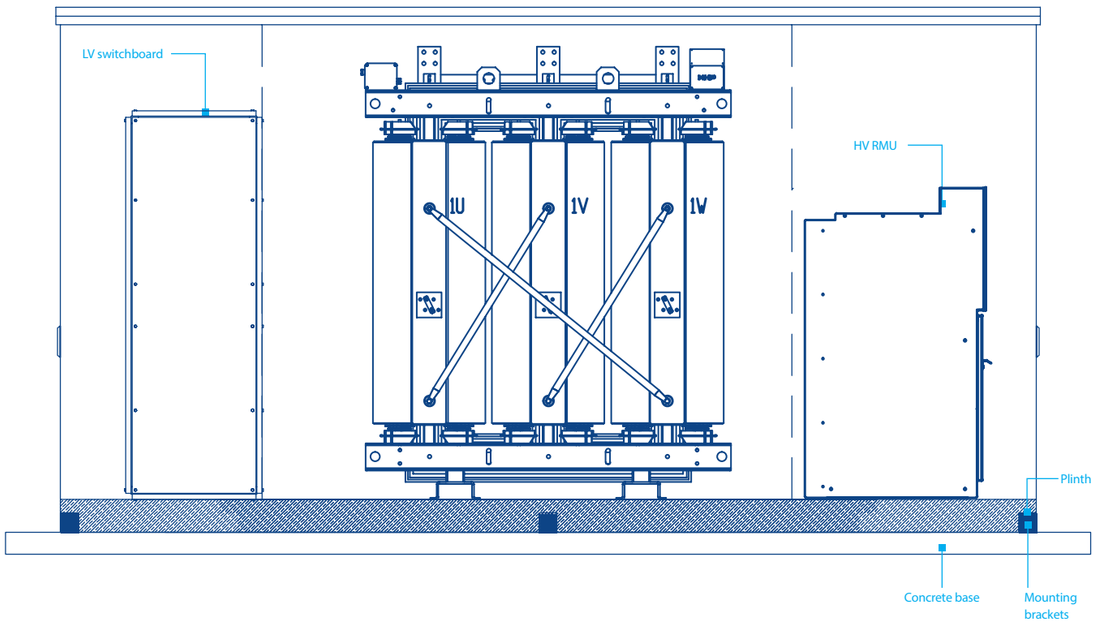
General description		
Material	Enclosure	2.0mm zinc anneal sheet steel
	Plinth	200 X 75mm PFC channel, hot dipped galvanised
Degree of protection	HV and LV end section	IP55
	Transformer section	IP34
Switchgear	DR6+ with SV-50 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	24kV
	Rated current	630A
	Short-time current	20kA
	IAC classification	BFLR 20kA 1S
Transformer	Cast resin 750kVA 22kV / 0.415kv Dyn1 50Hz	

1500kVA DR6+ cast resin GP kiosk

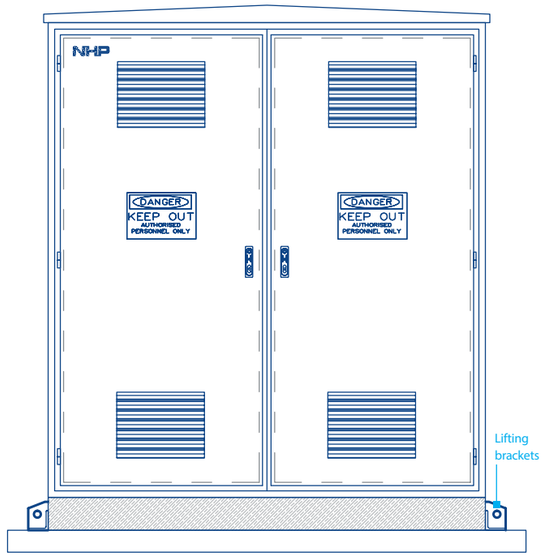
Side view



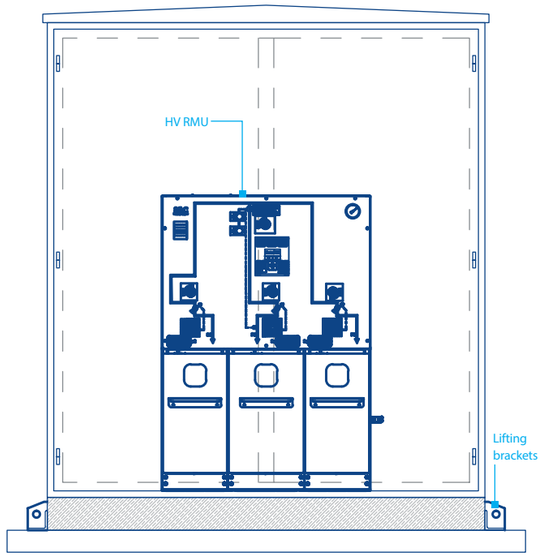
Section view



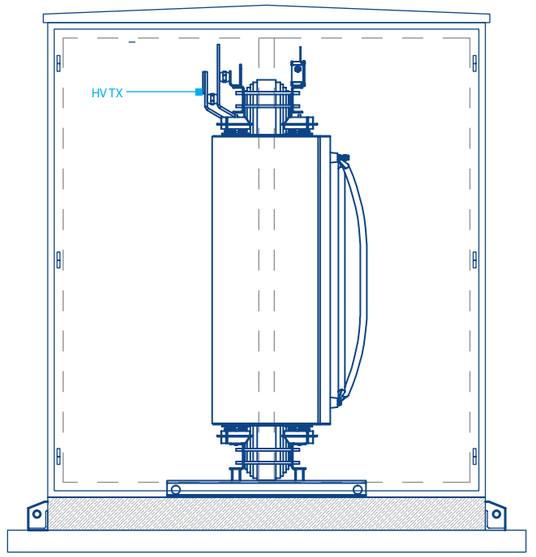
End view



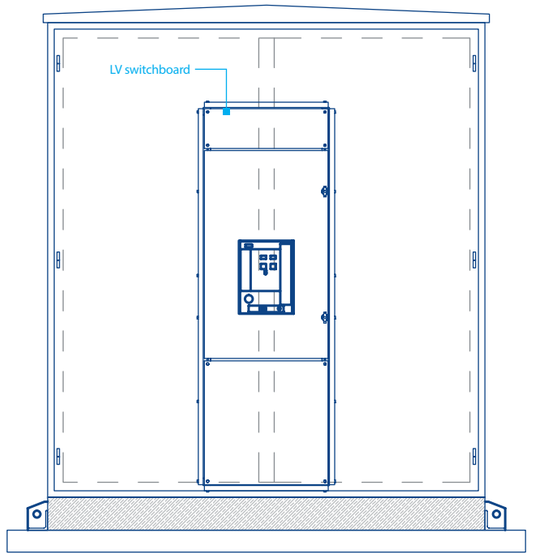
End view



End view (HV TX)



End view (LV SWBD)

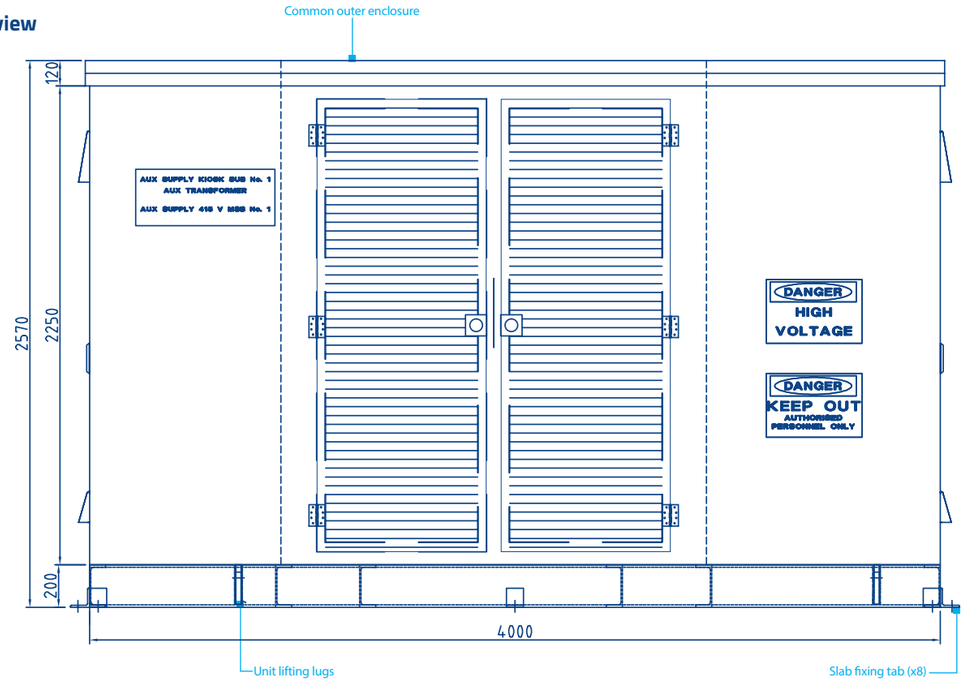


General description		
Material	Enclosure	3.0mm Galvabond
	Plinth	250x90mm PFC channel, hot dipped galvanised
Degree of protection	HV and LV end section	IP54
	Transformer section	IP33D
LV section	NHP Terasaki 2500A 3P	
Switchgear	DR6+ with SV-50 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	17.5kV
	Rated current	630A
	Short-time current	20kA
	IAC classification	BFLR 20kA 1S
Transformer	Cast resin 1500kVA 11kV / 0.415kV Dyn1 50Hz	

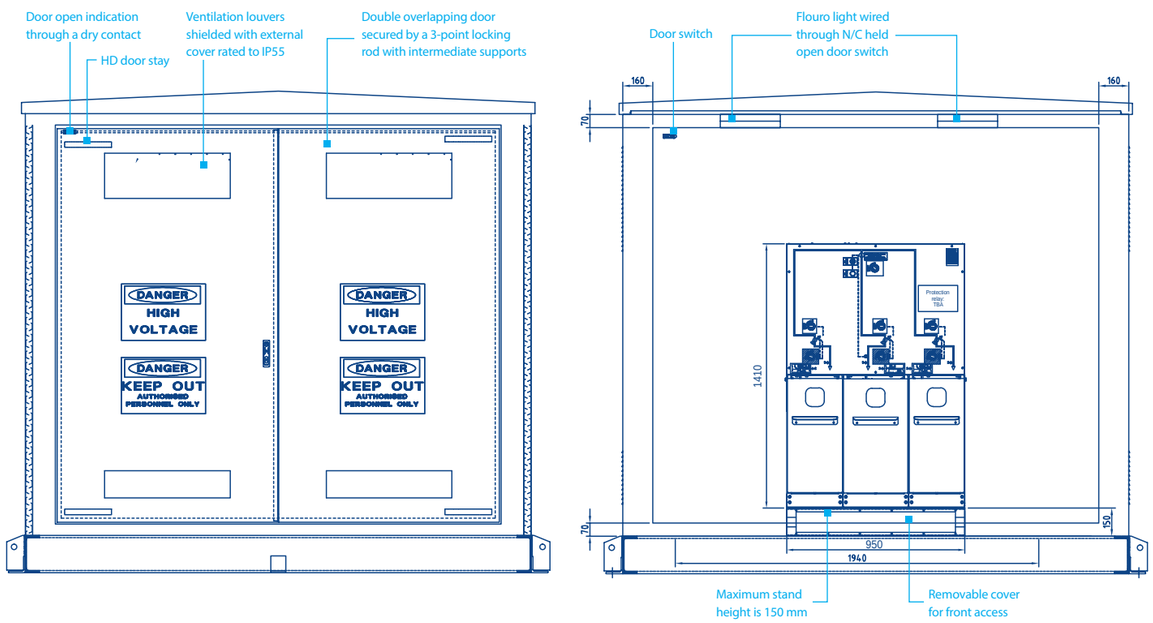
DFX series MV kiosks - typical drawing details

2000kVA DR6+ oil immersed GP kiosk

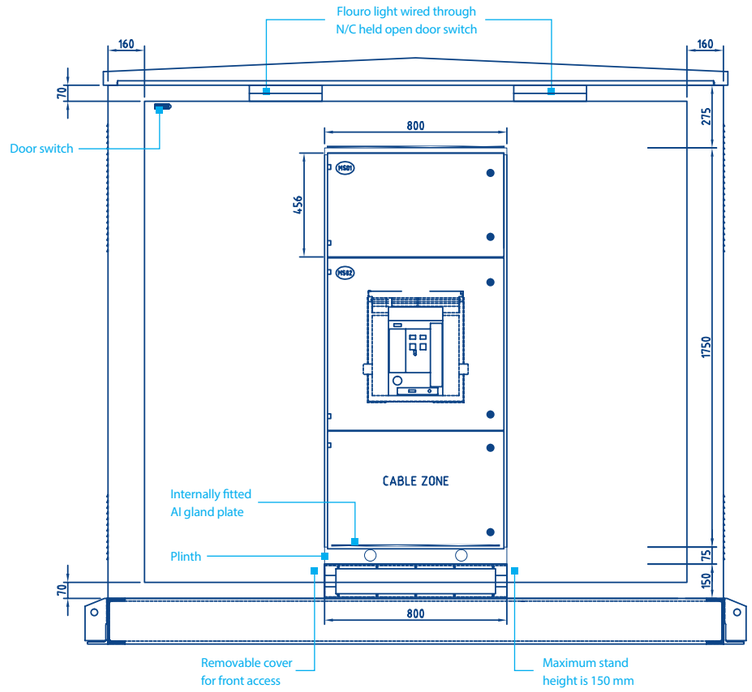
Side view



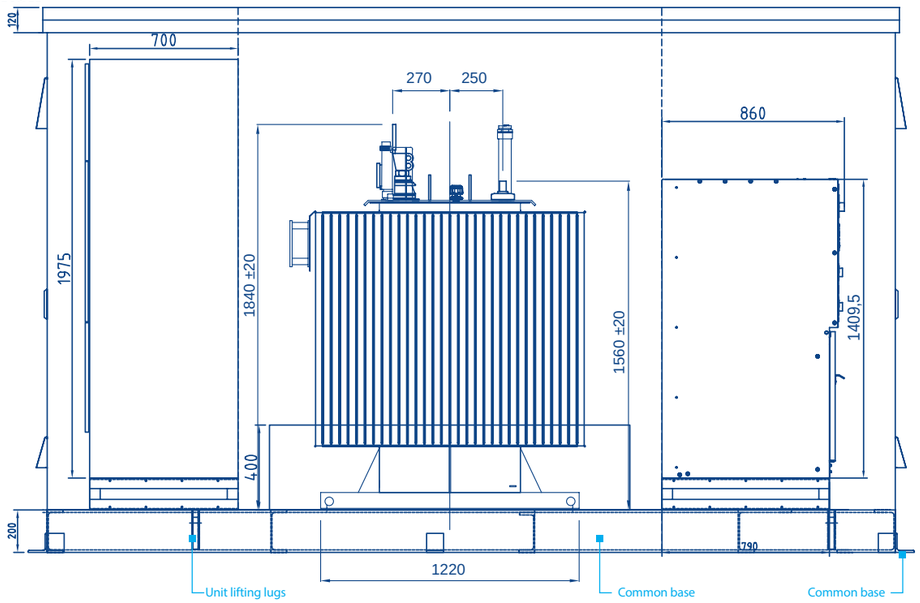
End views



End view



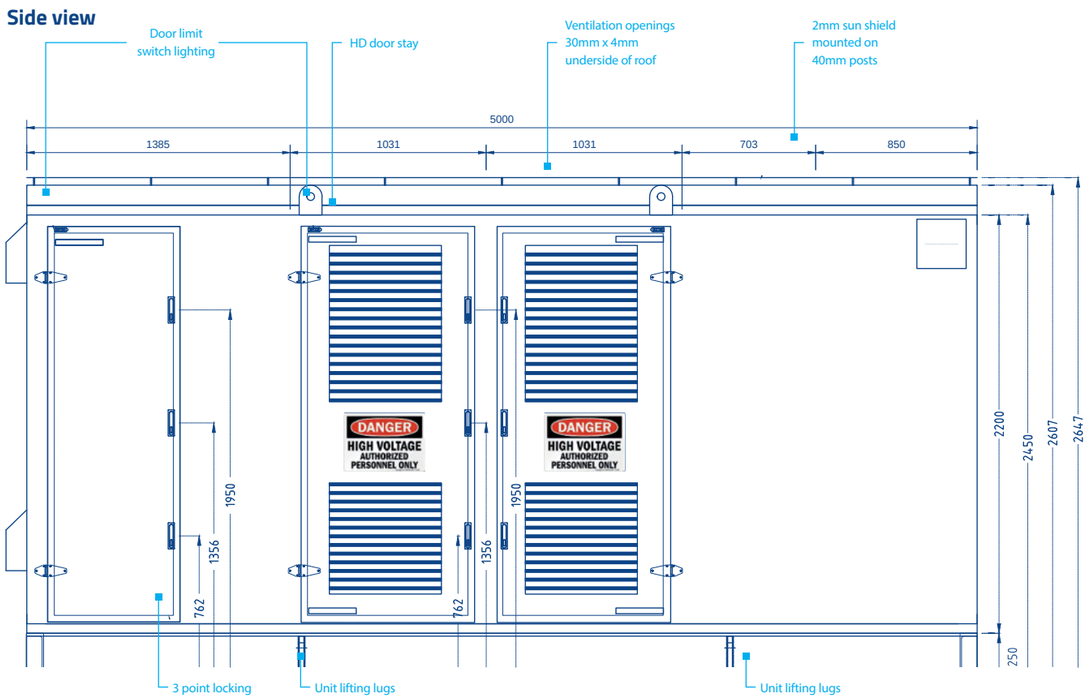
Section view



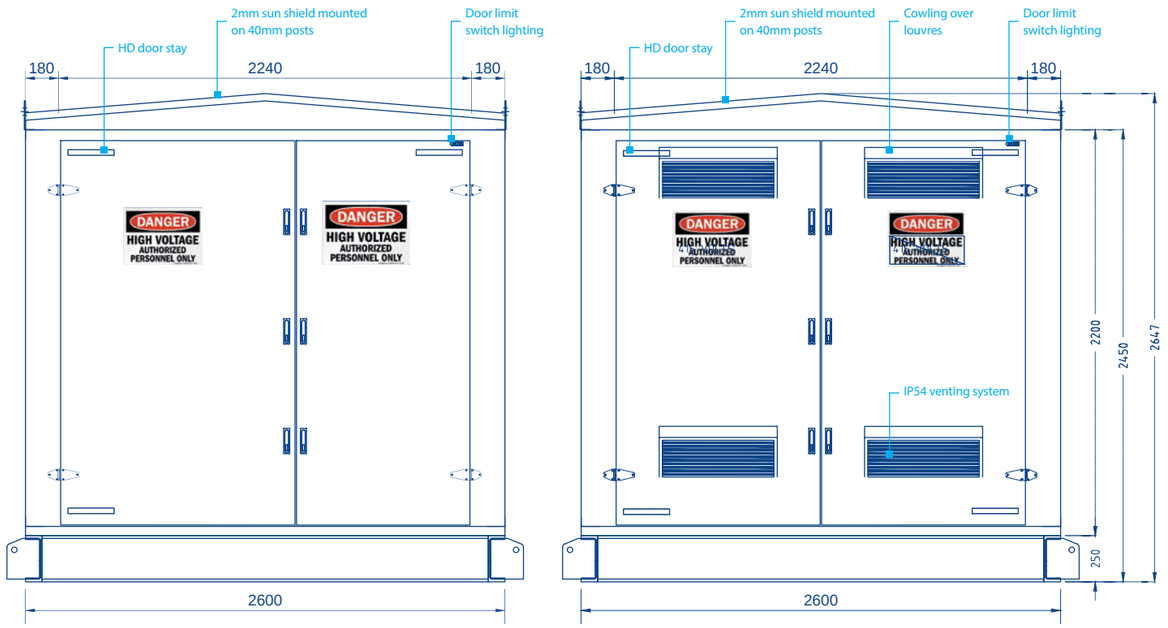
General description		
Material	Enclosure	2.0mm zinc anneal sheet steel
	Plinth	200 x 75mm PFC channel, hot dipped galvanised
Degree of protection	HV and LV end section	IP55
	Transformer section	IP23D
LV section	NHP Terasaki 2500A 3P	
Switchgear	DR6+ with SV-50 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	22kV
	Rated current	630A
	Short-time current	20kA
	IAC classification	BFLR 20kA 1S
Transformer	Oil immersed 2000kVA 22kV / 0.415kV Dyn1 50Hz	

1500kVA DF2+ oil immersed SP kiosk

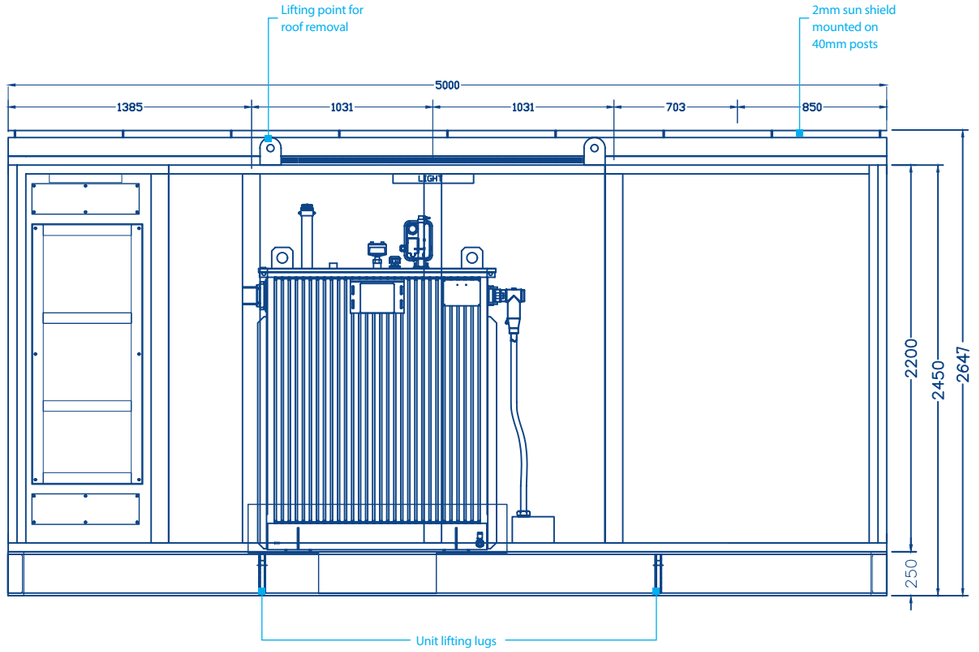
Side view



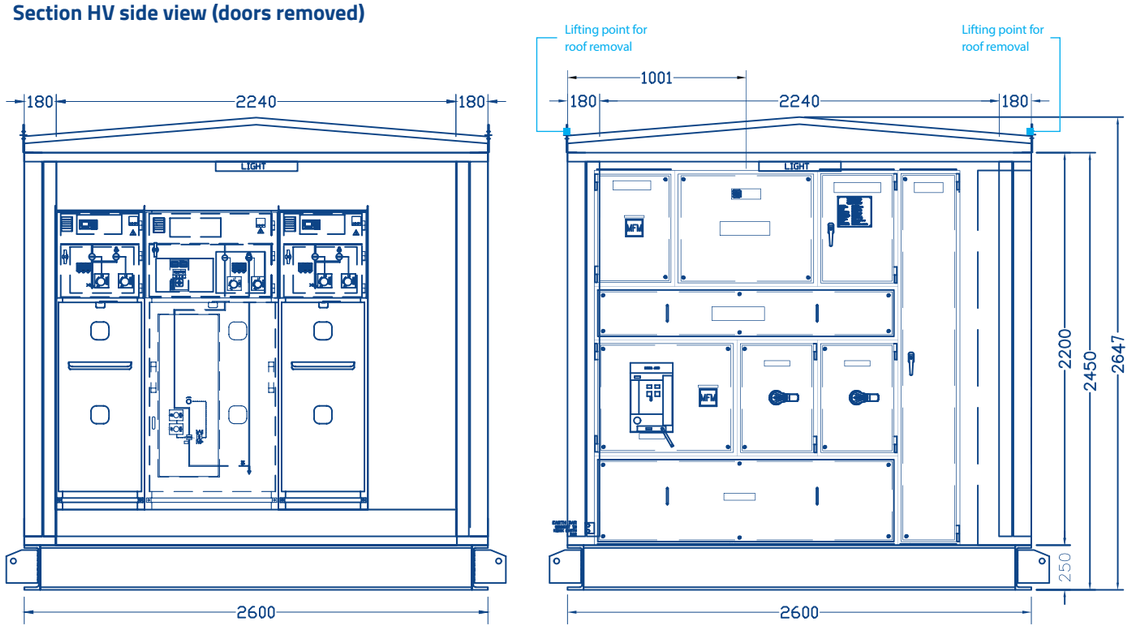
End view



Section view inside



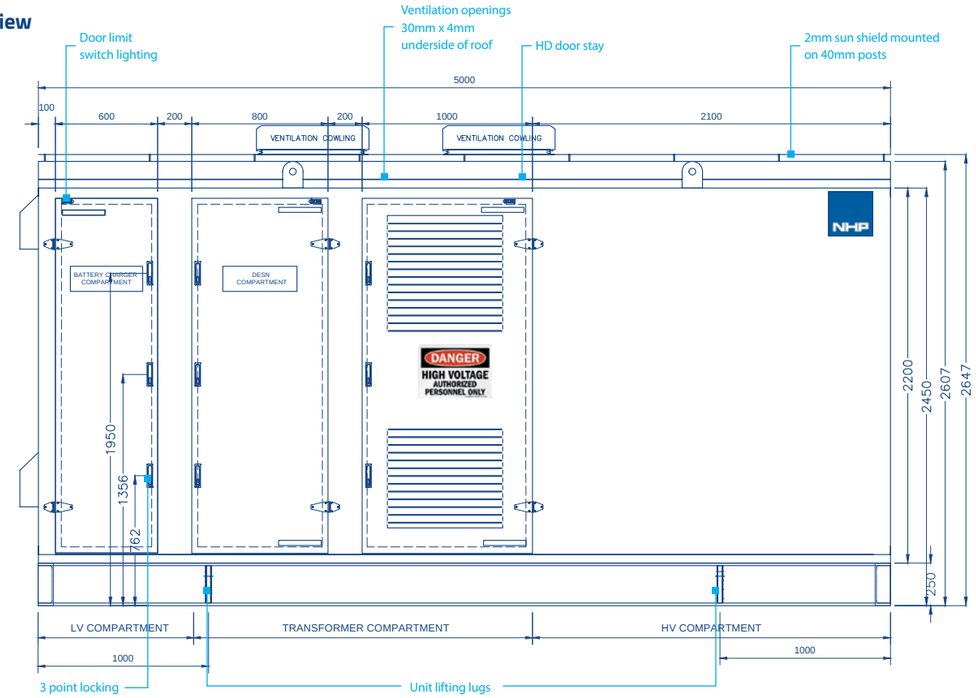
Section HV side view (doors removed)



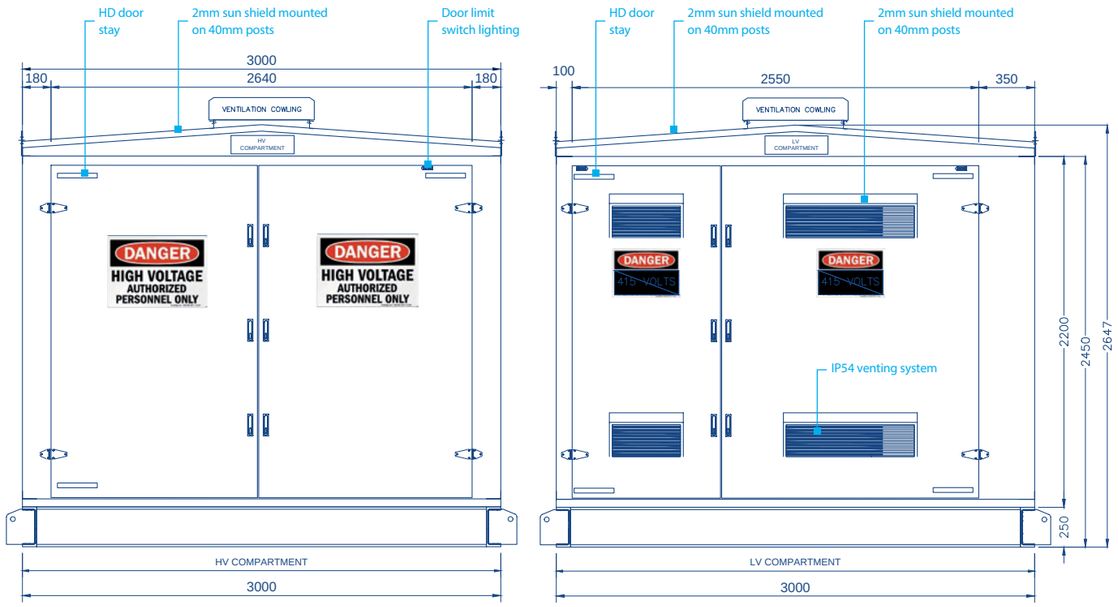
General description		
Material	Enclosure	3.0mm zinc anneal sheet steel
	Plinth	250 x 90mm channel iron, hot dipped galvanised
Degree of protection	HV and LV end section	IP56
	Transformer section	IP23D
Switchgear	DF2+ with SV-25 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	17.5kV
	Rated current	800A
	Short-time current	25kA
	IAC classification	BFLR 20kA 1S
Transformer	Oil immersed 1500kVA 11kV / 0.415kV Dyn1 50Hz	

1500kVA DF2+ cast resin SP kiosk

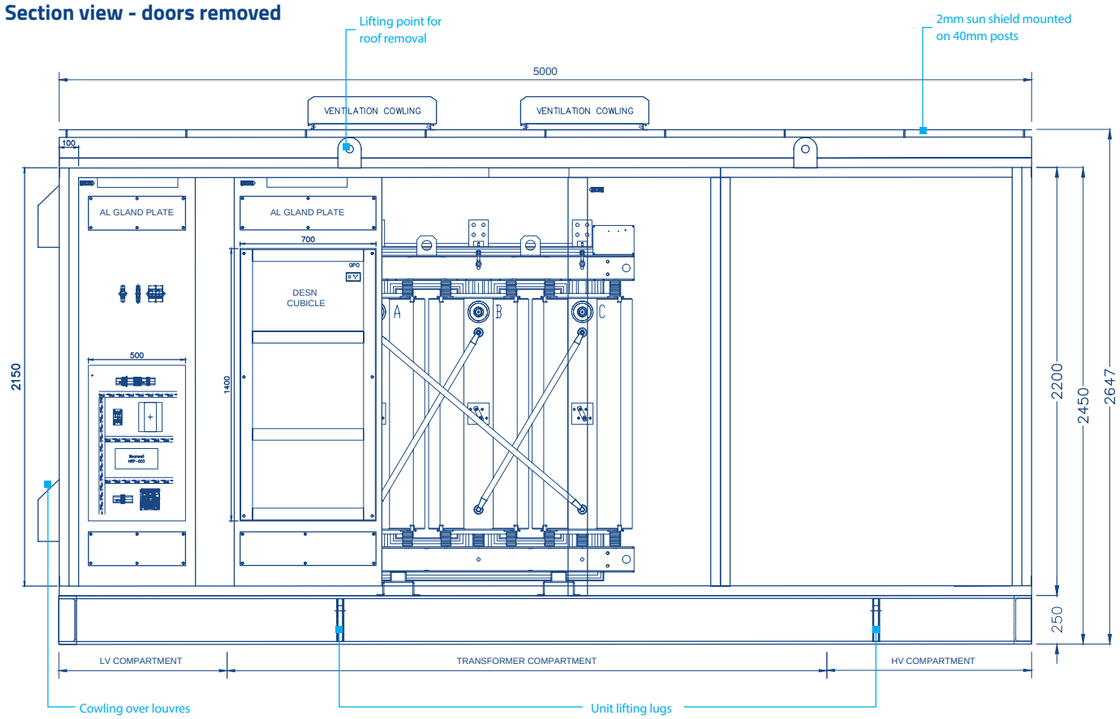
Side view



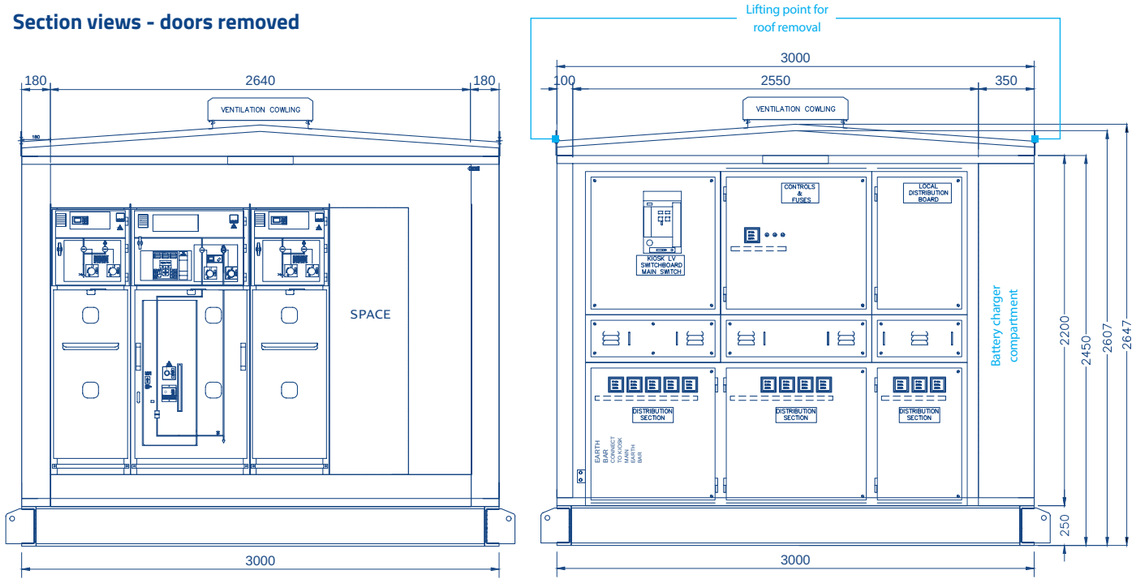
End views



Section view - doors removed



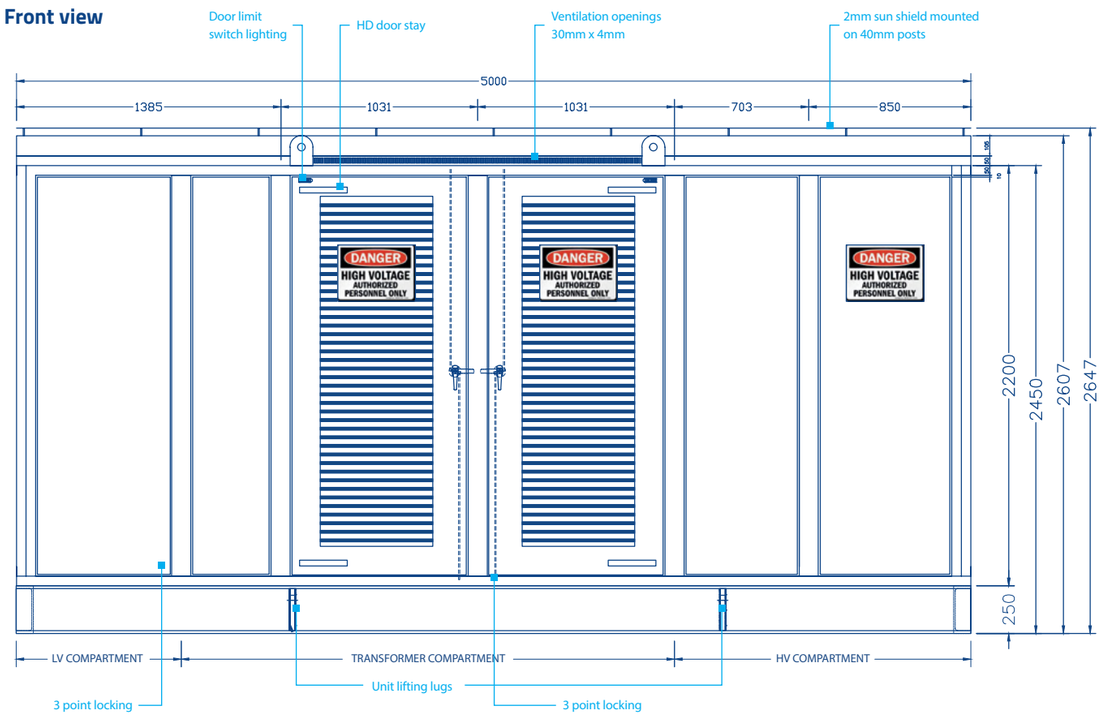
Section views - doors removed



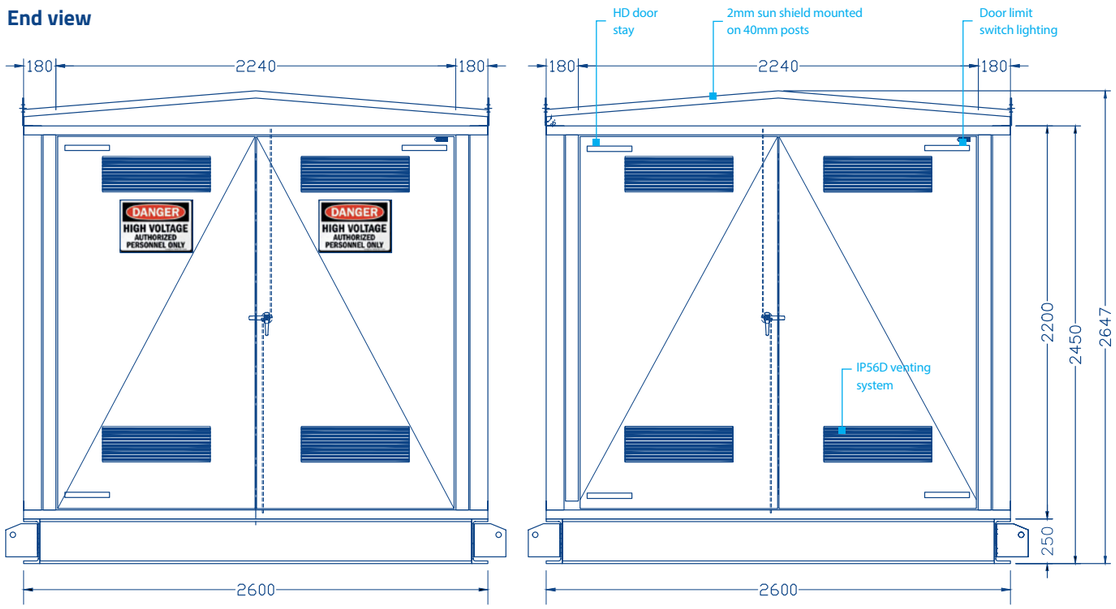
General description		
Material	Enclosure	3.0mm galvabond
	Plinth	250 x 90mm PFC channel, hot dipped galvanised
Degree of protection	HV and LV end section	IP54
	Transformer section	IP33D
Switchgear	DF2+ with SV-25 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	17.5kV
	Rated current	800A
	Short-time current	25kA
	IAC classification	BFLR 20kA 1S
Transformer	Cast resin 1500kVA 11kV / 0.415kV Dyn11 50Hz	

2500kVA DF2+ cast resin GP kiosk

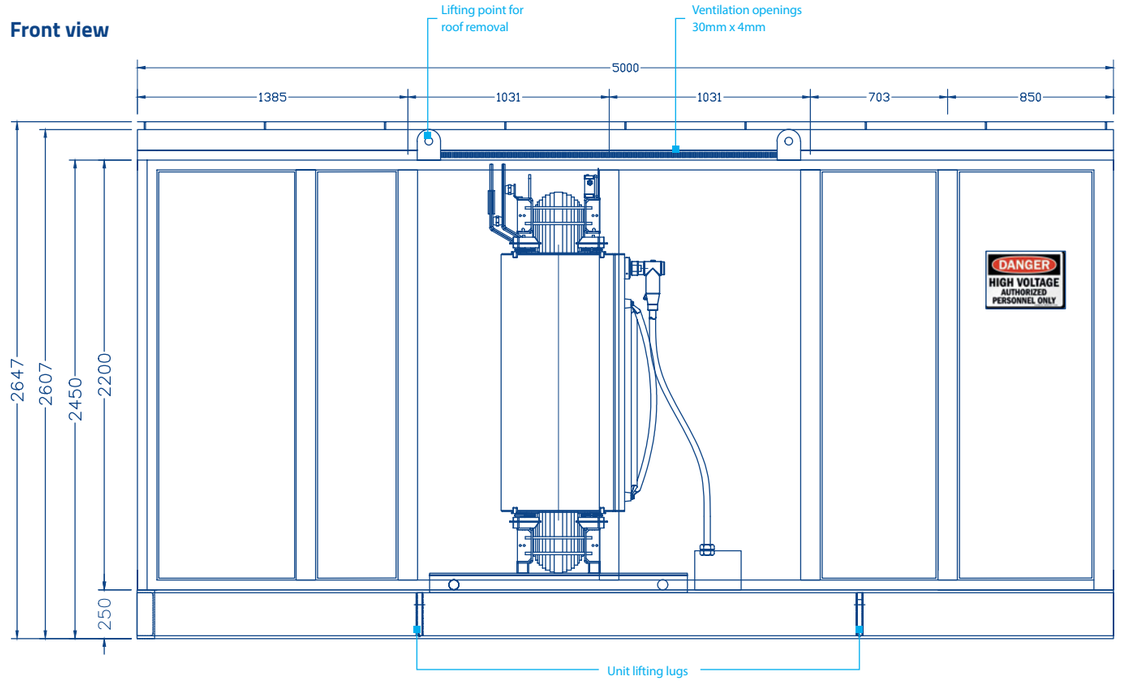
Front view



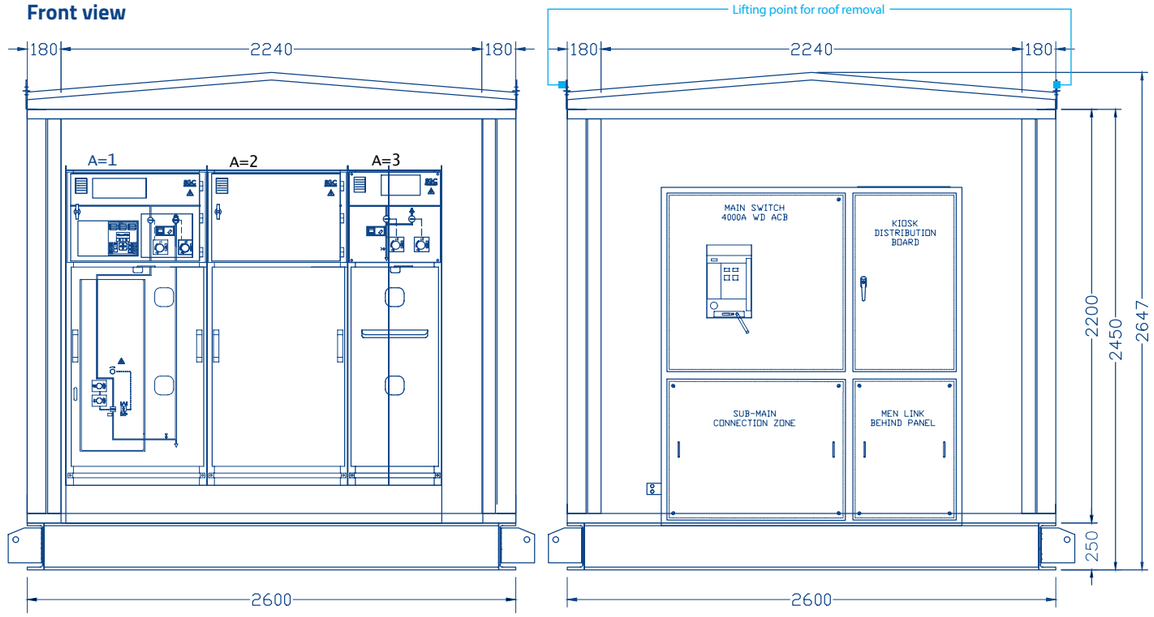
End view



Front view



Front view



General description		
Material	Enclosure	2.0mm zinc anneal sheet steel
	Plinth	250 x 90mm channel iron, hot dipped galvanised
Degree of protection	HV and LV end section	IP56
	Transformer section	IP33D
Switchgear	DF2+ with SV-25 Arc-Killer (mechanical arc quenching system)	
	Rated voltage	22kV
	Rated current	800A
	Short-time current	25kA
	IAC classification	BFLR 20kA 1S
Transformer	Cast resin 2500kVA 11kV / 0.415kV Dyn1 50Hz	

Project delivering and engineering capabilities

Seamless project delivery

Our dedicated project team ensures seamless project delivery while providing engineering support and flexible customised solutions. We have successfully delivered projects over 10 years in the defence, mining, healthcare, critical infrastructure and food and beverage sectors.

Services include

- Engineering and local customisation
- Analysis and performance simulation
- Electrical and 3D design development
- Local manufacturing and factory acceptance testing
- Low and medium voltage servicing and support
- Training and product familiarisation services

Why NHP?

Safety, reliability, availability, compliance and customisation

Safety - safety of people was the main priority when developing our range of MV switchgear, transformers and kiosks.

Key features - 'Arc Killer', our arc quenching system, visible earth switch and in line isolation, CR transformer with arc mitigation by design, no need to externally vent arc fault gasses in kiosk.

Reliability - NHP MV products are built to last and ensure great reliability.

Key features - switchgear with a 50-year design life, modern vacuum switching and load break technology, the most advanced method in HV winding fabrication, environmental and climate class tested and reduced partial discharge.

Availability - maximising uptime with MV product range.

Key features - modular design - repair or extend panels quickly, minimum moving parts and maintenance, significantly reduce downtime after an arc fault, assemble or repair on site, designed for retrofit with customised, compact designs.

Compliance - CNHP's MV switchgear, cast resin transformers and kiosks meet and exceed global standards.

Key features - switchgear tested to the global standards and a B-FLR classification, kiosks designed to meet the arc fault standards, transformers tested for use in harsh environments.

Customisation - customised solutions from a trusted partner.

Key features - local solutions for local customers, outdoor enclosed switchgear solutions - outdoor and indoor enclosed transformer solutions, NHP can tailor your MV kiosk.

Critical infrastructure project references

Medium Voltage Solutions

NHP MV case study

Healthcare

Monash Children's Hospital and Monash Medical Centre (Victoria)

The Monash facilities are tier 1 hospitals with a trauma Centre.

NHP supplied:

- Cast resin transfomers
- 24kV DF-2 switchgear
- CUBIC AS/NZS1439 verified low voltage switchboard and Concept panelboards
- No power loss 'closed transition' transfer switches

Brisbane based hospitals (Queensland)

Royal Brisbane and Women's Hospital are major hospitals with an emergency department.

NHP supplied:

- Protection panels with MiCOM and Agile relays
- Factory designed panels
- Engineering support and site acceptance testing

Regional based hospital (Central Queensland)

Rockhampton base hospital is a major hospital with an emergency department.

NHP supplied:

- Oil immersed transfomers
- Neutral earth transformers and neutral earth resisters
- 11kV DF-2 switchgear with Agile protection relays

Additional NHP healthcare project references

- Tweed Valley Hospital (currently under construction, using MV and LV products)
- Victorian Comprehensive Cancer Centre (LV products only)
- St. John of God (LV 'closed transition' transfer switch and LV products only)
- Northern Hospital (LV 'closed transition' transfer switch and LV products only)
- Footscray Hospital (LV 'closed transition' transfer switch and LV products only)
- Latrobe Valley Hospital (LV 'closed transition' transfer switch and LV products only)
- Wonthaggi Hospital (LV products only)

NHP MV installations

Government

NHP has been the MV equipment supplier of choice for many Australian state and federal government critical infrastructure projects due to the general requirement to provide a 50 year switchgear design life as outlined in the MIEE standard. Due to the sensitive nature of these projects, only limited information can be presented.

SWITCHGEAR 50 YEAR DESIGN LIFE

VICTORIA State Government

Australian Government
Department of Defence

24kV DF2 switchgear in kiosk, with Agile P14D feeder protection relays

Outdoor enclosed cast resin transformers

NHP MV installations

Heavy industry

Tasmanian based quarry

This quarry based in Hobart mines materials used in the creation of construction products.

NHP supplied:

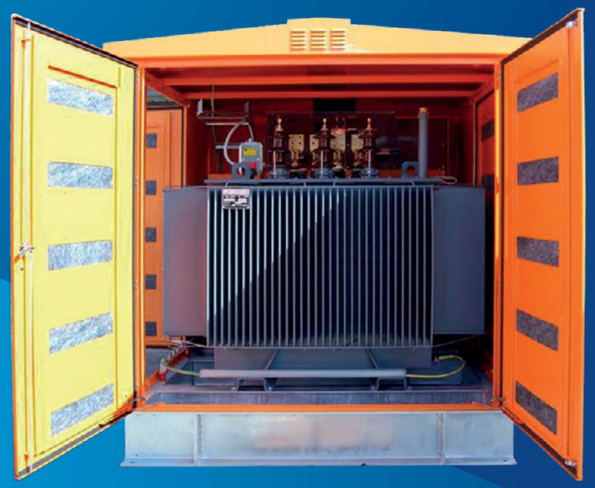
- 1MVA kiosk substation
- 17.5kV DF-2+ switchgear with Arc-Killer
- 11kV oil immersed transformer and LV switchboard

LNG facility (Northern Territory)

This LNG plant is a major player in production of clean, efficient and reliable natural gas for the Asia-Oceanic region.

NHP supplied:

- 22kV kiosk substations (4 off)
- 22kV oil immersed transformer and LV switchboard



New Zealand based steel mill (Auckland)

Currently, the mill produces 650,000 tonnes of steel a year, which is either used domestically or exported.

NHP supplied:

- Kiosk substations
- 17.5kV DF-2+ switchgear with Arc-Killer

Queensland based gas plant

This gas plant is one of the largest Australian coalbed methane companies, developing methane reserves within the Bowen and Surat Basins of Queensland.

NHP supplied:

- Water pumping station kiosk substations
- 17.5kV DF-2+ switchgear with Arc-Killer
- 1 and 2MVA oil immersed transformer and LV switchboard

NHP MV installations

24/7 operation

Queensland based hotel and casino

This Queensland based complex contains an impressive convention, exhibition and event gala space for up to 2,300 people, restaurants, bars, a 24-hour casino and two luxury 5-star hotels.

NHP supplied:

- Upgrade of MV distribution system
- 17.5kV DF-2+ switchgear with Arc-Killer

Customer requirements:

Low ceiling in the room introduced a problem as a traditional arc venting system into the room was unsafe.

The solution was to use the NHP DF-2+ switchgear wit the Arc-Killer which allows arc fault containment within the panel

NHP MV case studies

Large MV switchrooms

Australian government project

NHP supplied a complete MV switchroom which not only housed all of the MV/LV equipment typically found in an MV kiosk, but provided the facility for HV operators to safely and easily enter and exit the housing and access the equipment.

NHP supplied:

- Upgrade of MV distribution system
- 17.5kV DF-2+ switchgear with Arc-Killer

NHP Services and Solutions

Your partner for success

All businesses strive to run a profitable, safe and sustainable operation, even when they face complex challenges. The NHP Services and Solutions team is the sole authorised partner of a number of manufacturers including Rockwell Automation and Terasaki, with the ability to help you achieve your goals with our comprehensive range of services, including:

- technical support
- field services
- maintenance contracts
- repair services and training.

These services are designed to minimise downtime, stabilise maintenance costs and modernise plant assets. They are delivered by NHP's qualified technicians who have the expertise, experience and equipment to meet your needs.

You will also benefit from our extensive local stockholding and sound processes, with a holistic approach across automation, industrial switchgear, training and commissioning business requirements. With the NHP Services and Solutions team, you can enjoy complete peace of mind and a competitive edge.

Our Commitment

The NHP Services and Solutions team has an extensive infrastructure including repair centres, test rooms, field service technicians, application engineers and a team of project coordinators.

With 55 years of experience in the electrical and engineering industry, our specialist teams work collaboratively to design and deliver solutions to maximise the success of your project. We pride ourselves on customer service excellence and are committed to look after our customers for the life of their project and beyond.

Our team of service technicians hold tertiary and/or trade qualifications and regularly participate in supply line partner training programs to ensure our services are completed in line with manufacturer specifications.

Equipped with comprehensive product knowledge, our technicians are committed to delivering best practice in electrical services, while providing an exceptional customer experience.

Our capabilities

The NHP Services and Solutions team offers a range of services to help you maximise the performance and longevity of your electrical and engineering products, including:

Preventative maintenance
Extend the product lifespan and prevent unplanned downtime through a maintenance program that suits your site requirements and budget.

Commissioning and start-up
We can assess your application demands and configure your products according to your project requirements, conduct pre-commissioning and witness tests before dispatch on site.

Modernisation: retrofits and upgrades
We can install retrofit solutions for a variety of products and brands, with the possibility to customise them to meet your specific needs. We can work within your existing switchboard environment and provide a cost-effective solution that complies with Australian standards and practices.

Site assessments and reliability evaluations
We can evaluate your install base and provide a report on the factors that affect the reliability and life cycle of your equipment. We can also advise you on the best solutions to fix the problem areas that are lowering your efficiency and increasing your costs.

Training
We can provide formal classroom training sessions or customised training at your site. Our field service training covers equipment operation and maintenance related to your site install base. With NHP Services and Solutions, you can get the best out of your electrical and engineering products.

Why choose NHP?

NHP understands that a good product is only as good as the people who support it. That's why we are committed to excellence in customer service and support. We offer internationally recognised power distribution and protection products, combined with local knowledge and expertise, to deliver best practice services from concept design to installation and after-sales service, including project management.

When you partner with NHP you get:

- **Extensively trained and qualified service technicians**
- **NHP project management**
- **National service network**
- **Extensive local stockholding**

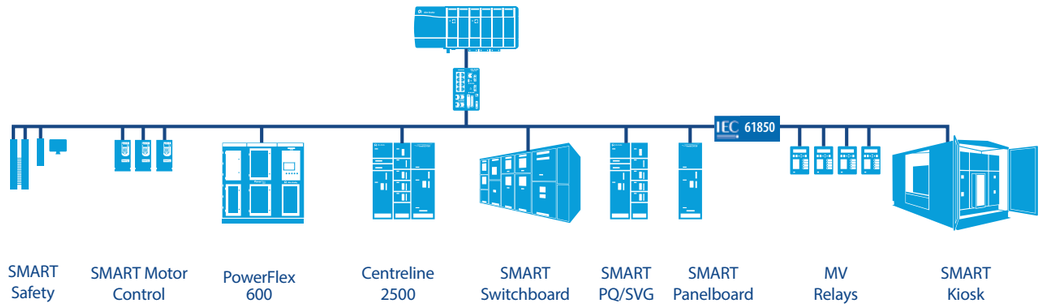
The NHP Hub

The NHP Hub is a purpose built, specialist demonstration and training facility located at NHP's head office in Melbourne. The fully interactive displays have been constructed to replicate typical site installations, facilitating hands on demonstrations and customer training.

The NHP Hub showcases NHP's fully connected SMART Distribution, SMART Motor Control, SMART Safety and Rockwell Automation portfolios, all integrated and communicating via an Ethernet/IP network. Rockwell Automation's FT View network is used to visualise data from all SMART industrial devices on a single integrated platform.

Initiative technologies on display at The NHP Hub include

- MV SMART kiosks / switchgear / transformers
- SMART CUBIC switchboard system
- SMART Concept panelboard system
- Terasaki air circuit breakers
- 3C over temperature protection technology
- Arc flash mitigation technologies/Arc LogiX System
- SMART power quality solutions
- Open and closed transition transfer switches
- Energy management and reporting solutions
- Safety and sensor products
- MV and LV drives
- Intelligent motor control centres which include motor protection, soft starters and drives



To experience a variety of practical demonstrations and learning activities in a safe and controlled environment, please call **1300 NHP NHP** or contact your **local NHP Account Representative** to arrange a tour of the NHP Hub.

Notes

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Electrical Engineering Products

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