DF-2

THE MODULAR DESIGN

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1.1. DESIGN PHILOSOPHY AND APPLICATIONS OF THE DF-2

Deba is a fast-growing Belgian company that invests considerable time and energy in Research & Development to serve customers even better.
User-friendliness, safety and care for the environment were the main drive for developing Deba's switch equipment. Over time Deba has developed the "DF-2", a modular concept which combines all medium-voltage functions. This way Deba can provide "made-to-measure" solutions for all your medium-voltage needs.
The DF-2 cubicles and associated switch equipment offer a range of applications and can be used worldwide in many industries. DF-2 cubicles can be used with distribution and dispersion switchgears, transformer stations and medium-voltage engines, wind generators, co-generation, etc. ...

The DF-2-concept provides a solution for all your needs and wishes: it can replace obsolete installations and extend existing installations, and it is also perfectly suitable for completely new constructions.

1.2. MODULAR TYPE DF-2

The DF-2 system is a modular concept according to the "building block" principle, which means that the cubicles are produced in series. In this way the modular DF-2 concept meets the highest technical standards in a rational, economically sound manner.

The combination of cubicles is unlimited. The basic cubicles will be described in detail (refer to Chapter 3: "The basic modules of the type DF-2", p. 7). Very complex diagrams of distribution and transformer switchgear can be compiled through this extensive spectrum.

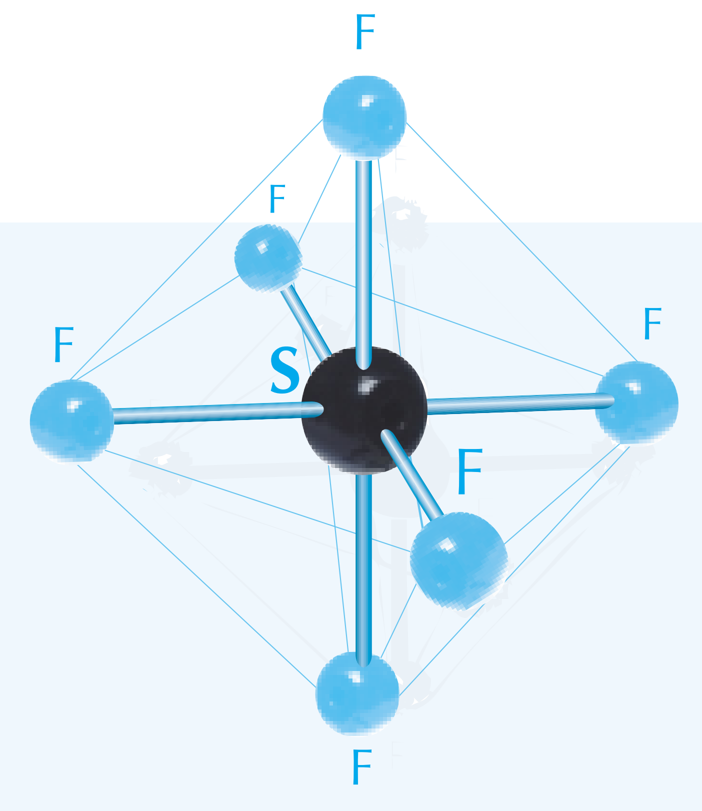
The cubicle dimensions are very limited as the switching occurs in a SF_6 insulation medium.

The semi-compact cubicles are particularly beneficial if the available space should pose a problem or if it is a heavy economic consideration.

Cubicles also contain all the functional interlocks so that it will be possible to apply them without a problem, according to all current standards, into a working space next to an important user . This will reduce capacity loss to the very minimum.

The cubicles have been fitted with a system for pressure discharge so that the user is protected against the consequences of a internal arc.
(see Chapter 1 for more details: 1.5 "Internal arc fixity and safety", p. 5)

1.3. SF_6 INSULATION



SF_6 stands for sulphuric hexafluoride and is a clear and odourless, inert, non-toxic and non-flammable gas. The gas is extremely stable which is especially due to the six covalent connections of the molecule. SF_6 has a molecular weight of 146.05, this is 5 times heavier than air, which means that it is one of the heaviest gasses. This gas can be obtained in cylinders anywhere in the world and is utilised extensively in the different sectors such as the petro-chemical field, the nuclear sector, and electron microscopy. SF_6 is present even between double glass.
For over 30 years SF_6 gas has proved to be advantageous as an insulation and interruption medium in high and medium voltage installations. One of the physical characteristics of SF_6 is that the gas neutralises electrons. This insulating property makes SF_6 particularly important to medium and high voltage switchgears, switches and transformers. As in MV and HV installations it is extremely important that the cables and switch equipment are well-insulated to avoid any electrical arc or short-circuits.
There is yet another advantage, the space that can be saved when SF_6 gas is chosen over air to ensure insulation. The RV 44 load break switch of Deba is filled with SF_6 gas. Switches are “sealed for life” and require minimal maintenance.
In the framework of recycling of electrical components, current standards require compulsory recuperation at the end of the life of components containing gas. The recuperation of SF_6 products is regulated and will be realised by specialised companies following a strict schedule.
Deba will be available at all times to help you in this specific domain.

1.4. STANDARDS

The DF-2 system has been certified according to IEC (International Electrotechnical Commission) standards:

The whole concept is in conformity with ISO procedures, certificate and ISO 9001. The testing of cubicles is carried out in accordance with IEC regulation and self-enforced quality requirements.

- **All cubicles are build according IEC 60298**
- **Option: Arc-killer SV-25 (more information on request)**

SPECIAL OPTION 1250 A

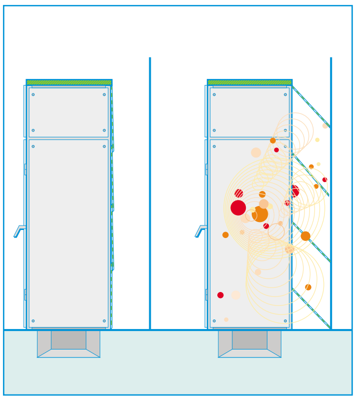
All cubicles can be supplied in a 1250 A design (according to IEC60265-1 – class E1), with a 1250 A busbar set.

1.5. INTERNAL ARC FIXITY AND PROTECTION

A short-circuit or another defect could cause an internal arc. Should there be an internal arc in a classic MV cubicle, it could inflict heavy damage on the installation possibly injuring the operator and electrocuting him. The DF-2 is designed to resist this, both regarding the operator and the installation. Through a very well thought-out pressure discharge system, the internal arc stays within the compartment where it originated and does not propagate towards the operator or to other compartments.

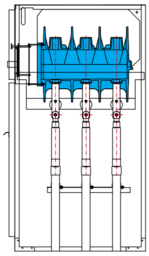
The anti-arc kit of DF 2 cubicles is designed as follows: By default all provided cubicles are fitted on the rear side with overpressure valves pointing downwards. The four valves are equally divided over the total height of the cubicles: The upper valve is for the busbar and the three other valves protect both the cable compartment and the equipment compartment. You can see these valves on the picture.
The roof of the cubicle is fitted lengthwise over a depth of 100 mm. With each delivery two enforced side plates will also be supplied which will completely close the cabin left and right up against the wall. This way an expansion space is created over the total height and width of the cabin.
For applications in accessible concrete outer cabins the anti-arc kit allows gasses to be diverted to the basement area. There is a conduct opening in the floor panel along the side of the wall for this purpose.

When conducting the various tests the cubicles were always set up "trihedral shockproof" in accordance with the conditions.



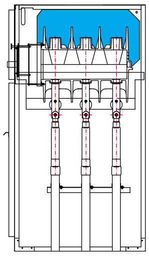
The figure illustrates what happens with the occurrence of an internal arc.

DF-2 cubicles were tested for this purpose at Kema for 16kA/1s at a nominal voltage of 17.5kV according to IEC 60298, Appendix AA, 6 criteria with a current of 20 kA.
The load break switch was tested according to IEC 60265-01 / class E3, third issue 1998/ 01.
Therefore all cubicles of Deba are internal arc resistant.



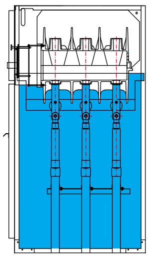
2.1. SWITCH GEAR COMPARTMENT

In this compartment, the SF_6 filled RV 44 load break switch of the "sealed for life" type forms the physical separation between the busbar set and the cable compartment. The switch has two functions: It is either the connection or the interruption of the electrical current between the high voltage cables and the busbar.



2.2. 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 produced in 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. Through hexagonal bolts the busbars are installed to the upper contact surfaces of the RV 44 switch-disconnector.

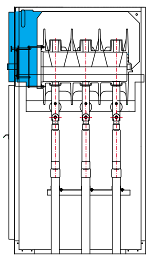


2.3. CABLE COMPARTMENT

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.

At a DF-A cubicle the cables are connected to the contact points below the RV 44 switch-disconnector. The cables of the DF-P cubicles are connected on the lower fuse base side. This type of cubicle also has an additional auxiliary earthing switch to divert any residual currents. DF-D and DF-EDN-D types have the earthing switches located in the cable compartment below.

The removable door, the synthetic floor pans in which the necessary conduct rubber has been provided for the cables and the cable supports all simplify the cable connection.



2.4. 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, minimum voltage relays, are also located in this compartment. Any engine control with the necessary electrical switch equipment, control and clamp strip are also installed in this compartment.

The compartment can be accessed very simply by disassembling the front panel.

3.1. STANDARD OVERVIEW OF THE CUBICLES

DF-A

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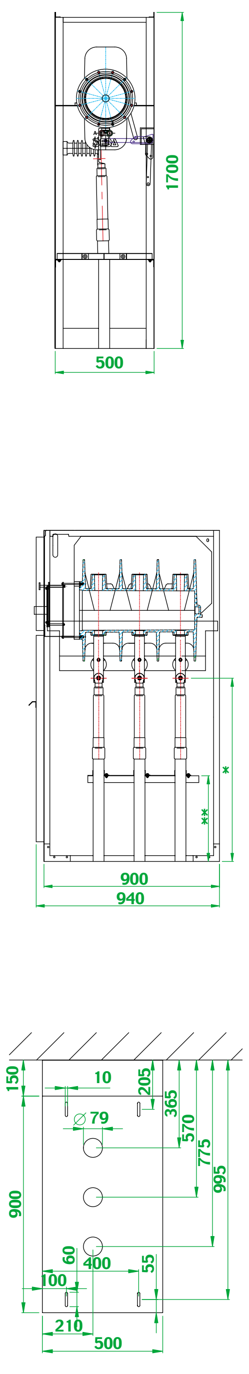

DF-P

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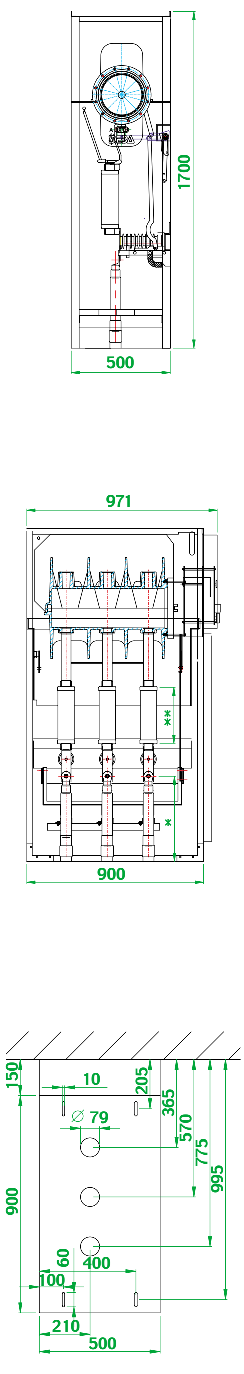

DF-AV

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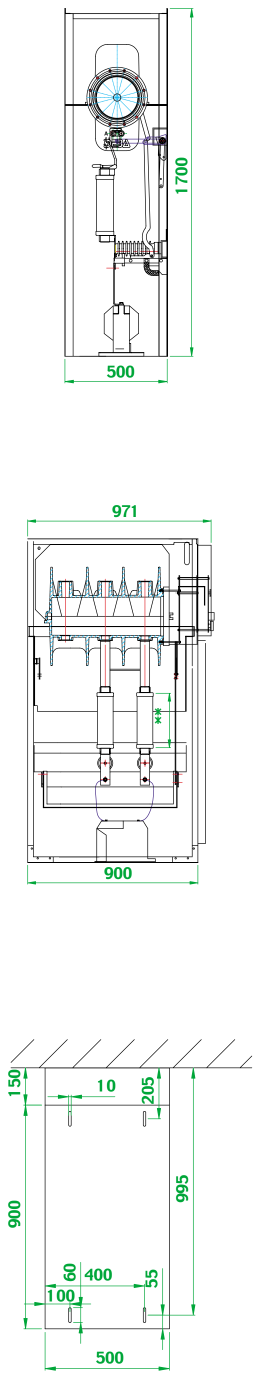

DF-D

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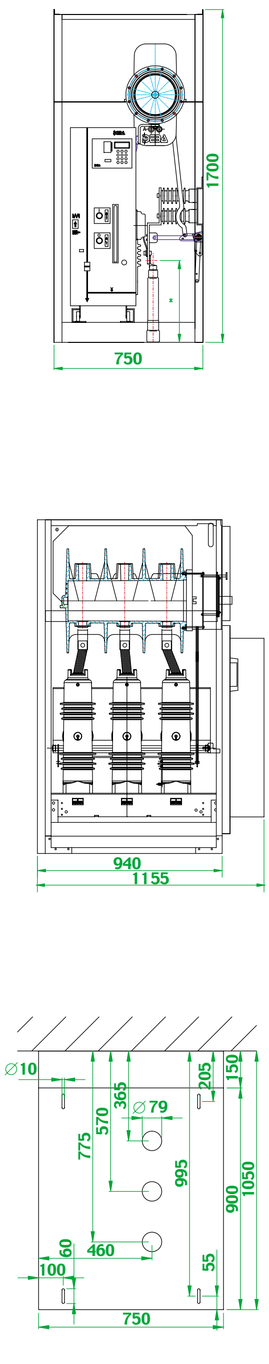

DF-D-500

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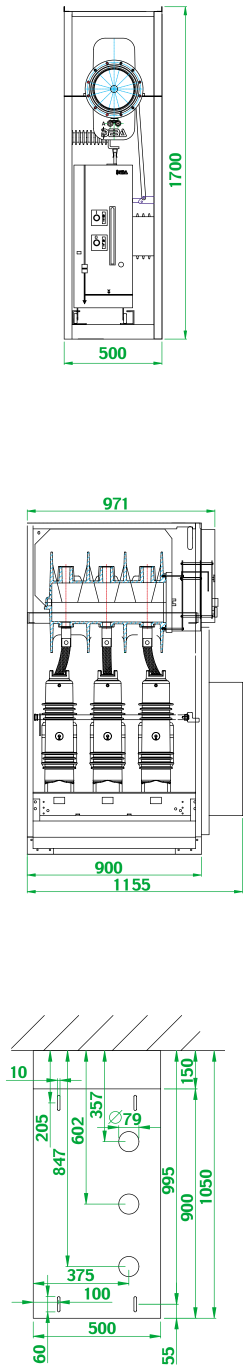


3.1. STANDARD OVERVIEW OF THE CUBICLES

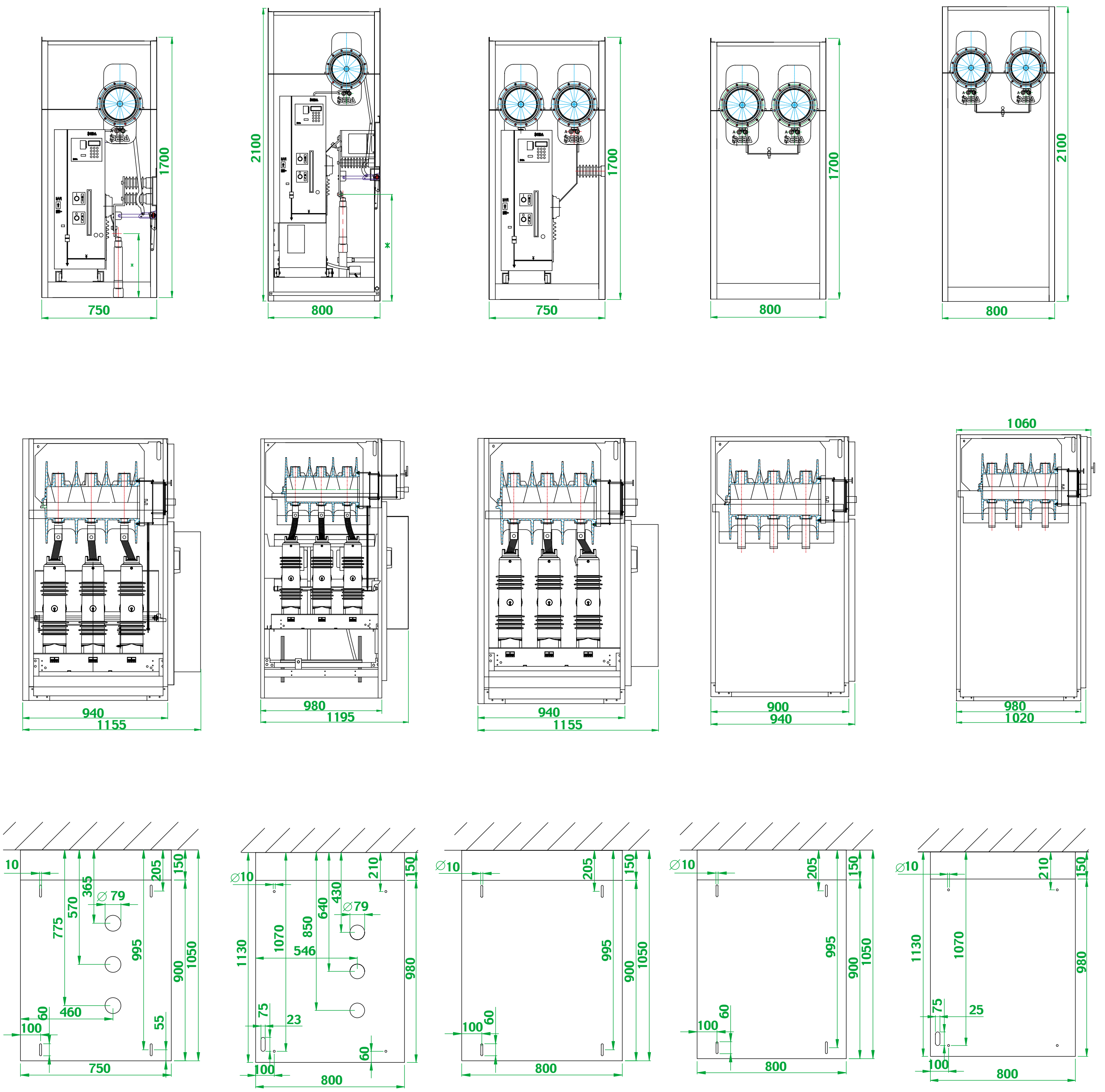
DF-D-W *- pg. 18 -*

DF-EDN-D *- pg. 19 -*

DF-AAD *- pg. 20-*

DF-LK *- pg. 21 -*

DF-EDN-LK *- pg. 22-*



3.1. STANDARD OVERVIEW OF THE CUBICLES

DF-C

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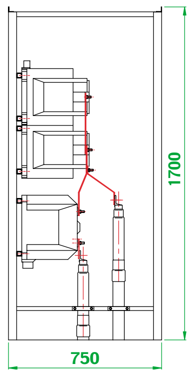

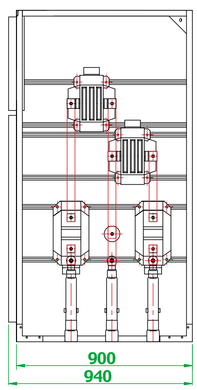

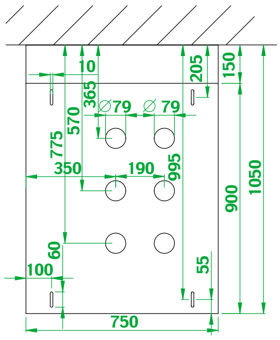

DF-C-500

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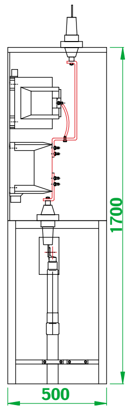

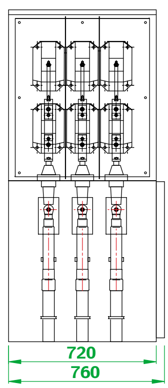

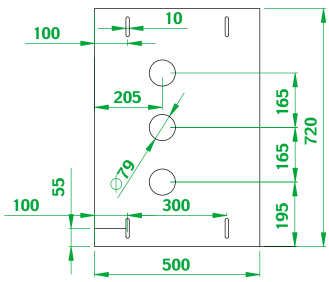

DF-T

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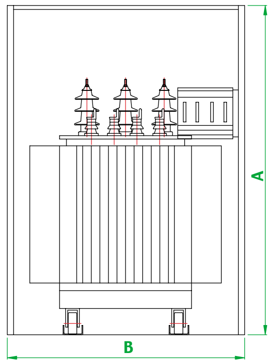

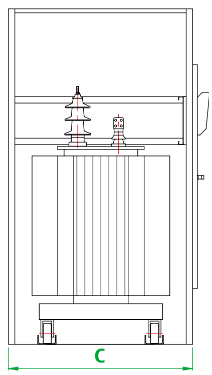

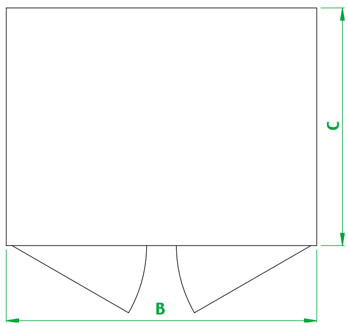

DF-K

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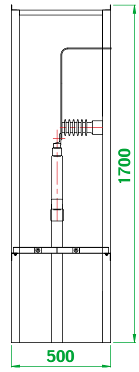
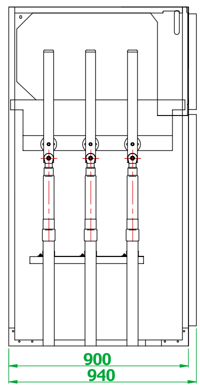
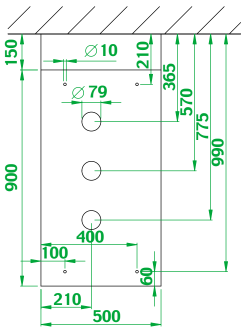
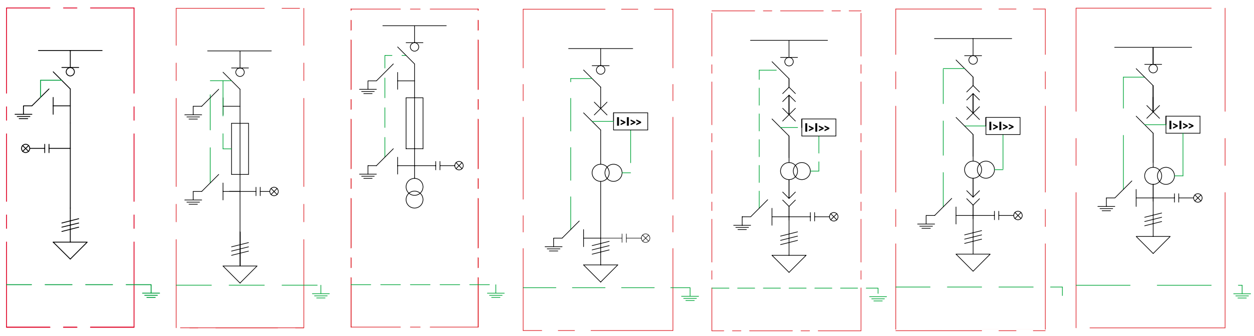




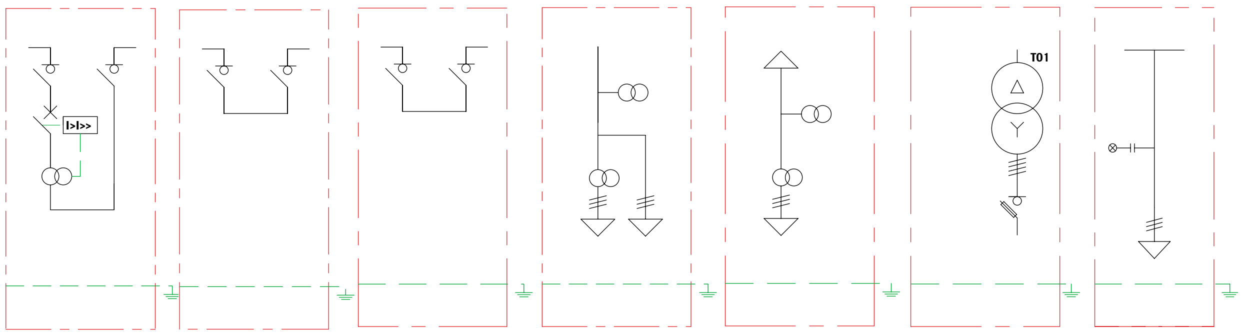


3.2. ELECTRICAL SPECIFICATIONS

DF-A DF-P DF-AV DF-D DF-D-500 DF-D-W DF-EDN-D



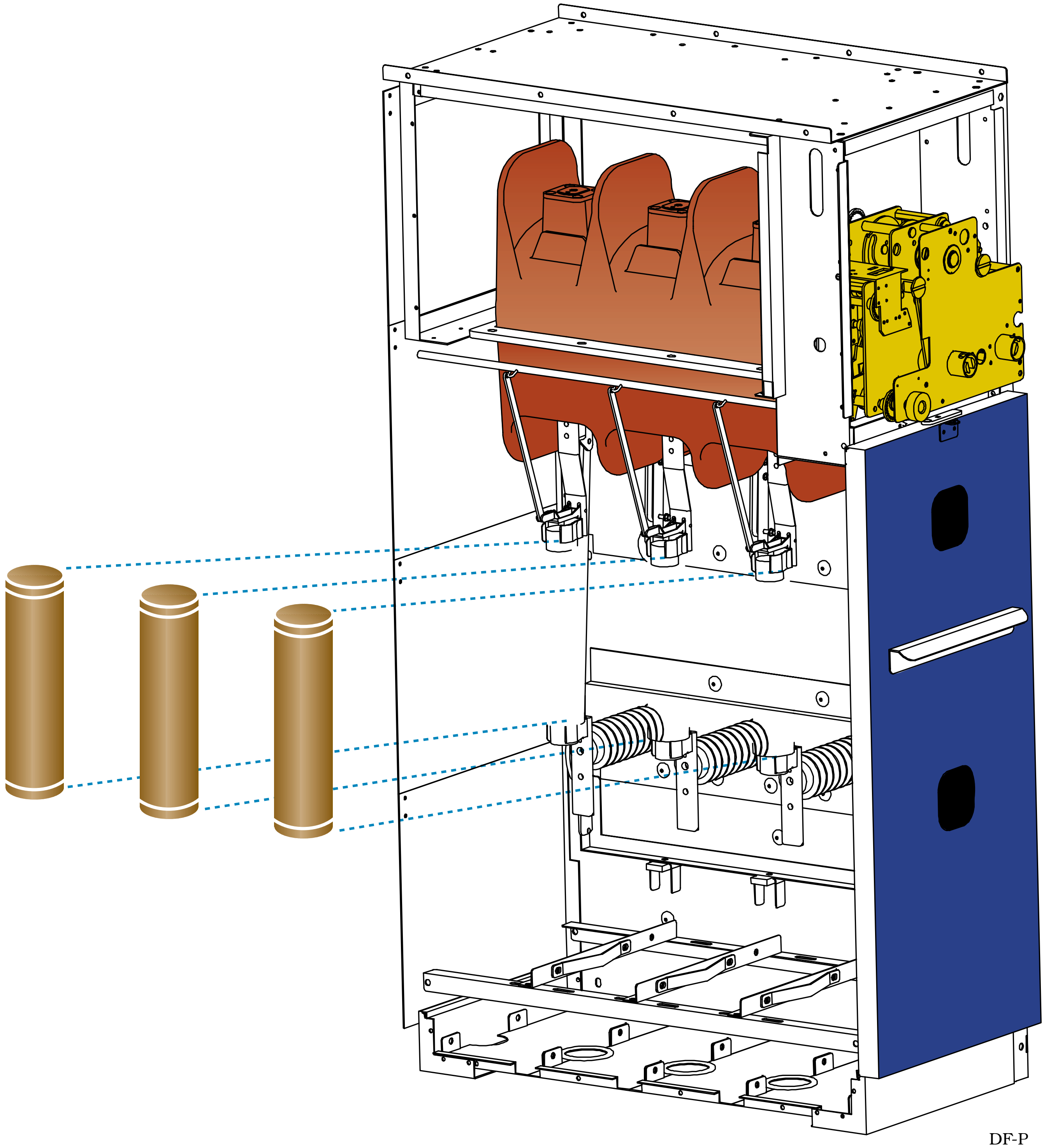
DF-AAD DF-LK DF-EDN-LK DF-C DF-C-500 DF-T DF-K



The cubicles meet the following technical specifications:

Rated voltage	kV	12	17.5	24
Impulse withstand voltage 1.2 / 50 µsec:				
- to earth and between phases	kV	75	95	125
- Over the insulated distance	kV	85	110	145
Power frequency withstand voltage:				
- to earth and between phases	kV	28	38	50
- Over the insulated distance	kV	32	45	60
Rated frequency	Hz	50/60	50/60	50/60
Rated current	A	800/1250(*)	800/1250(*)	800/1250(*)
Rated short-time current 1 sec.	kA	25	25	20
Rated peak value of the current	kA	63	63	50
Breaking capacity RV 44 (IEC 60265.1)				
- Rated current	A	800	800	630
- Closed loop	A	800	800	630
- Load cable charging	A	18	18	18
- Making current	kA	63	63	50
- Earth fault	A	100	100	100
- Earth fault cable charging	A	30	30	30
Internal arc 1 sec. (6 criteria)	kA	16	16	16
Degree of protection		IP4X		
Mechanical durability c/o		1000		
Standards	IEC 60298 Appendix AA, IEC 60129, IEC 60420, IEC 60694, C 64-701 (only in Belgium), IEC 60265.1			
Certificates	KEMA			

(*)According to IEC 60265.1 Class E1



DF-P

3.3. EXTENSIVE SPECIFICATIONS

The cubicles onsist off galvanised steel plate of 2mm. By choosing this plate size the cubicles are able to withstand internal arcs without any problems, both in the cable compartment as well as in the busbar compartment. A lot of attention was paid to the functional design so if there should be an internal fault, no bursts of flames can reach between plating surfaces, the door or between cubicles. A possible internal arc will also be guaranteed to be limited to the compartment in which it is created.

The roof of the cubicle can be easily dismantled easily providing access to the busbar during installation and/or maintenance activities.

The busbar in copper is manufactured in function of the currents, witch results into a minimum heating at the contact points. The user-friendly construction of the drive mechanisms allows optional features to be installed easily at a later stage. The optional features can even be installed without taking the cubicle out of service.

Deba's many years of experience resulted in a cable compartment as comfortable and functional as possible. Thanks to the removable door, the operator has maximum access to the connection points. This is of great importance when (dis)assembling cables and fuses and during maintenance works. Moreover, this will save time and lead to less industrial accidents.

All connection points and fuse holders have been manufactured from rounded-off material to make connecting them as easy and as safe as possible.

The earthing copper has been neatly stored behind folded panels and in no way affects the connection activities.

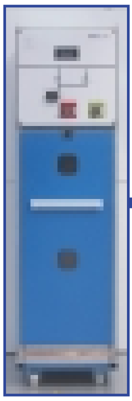
The high voltage cables can be supported by cable supports and the connection point in all types of cubicles is located high enough to install the terminals in the cubicle.

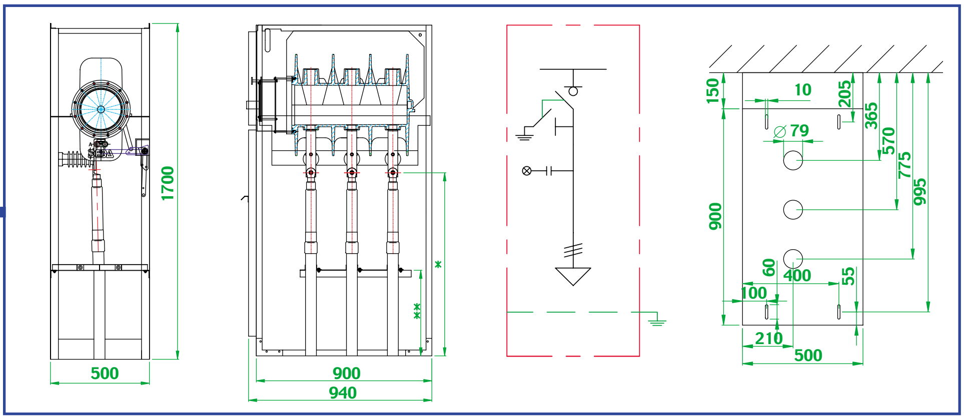
Manual operation of the cubicles requires a minimal switch force.

The clear and well-cared-for synoptic diagram provides a clear and safe overview of the different positions of the constituant parts of the cubicle. The accessories (such as floor pans and busbars) have been collected in boxes and ensure easy assembling of the cubicles.

The cubicles and its constituant parts can be equipped with a wide range of optional features on request, so that one can offer expert solutions to your needs.

3.3.1. DF-A: incoming cubicle of cable field with load break switch RV44 and interlocked earthing switch





Application: Supply cable connection.

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- interlocked earthing switch with making capacity up to 63 kA
- cable supporting
- door interlock
- sockets for capacitive voltage detector with possibility for parallel testing
- low-voltage compartment

Options:

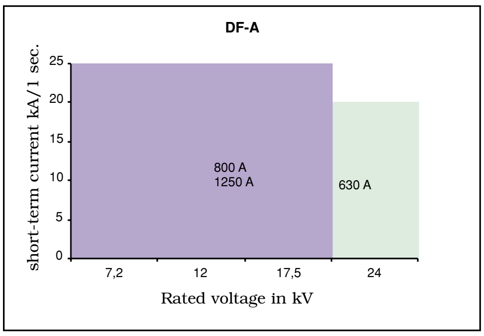
- block auxiliary contacts on load break switch
- block auxiliary contacts on earthing - switch
- key interlock on load break switch
- key interlock on earthing - switch
- key interlock on both
- no door interlock
- motor operation: 24-48-110 V AC/DC of 220 V AC
- short-circuit indicator (to be specified by the customer when the order is placed)
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on request)
- floor pans
- press-button control
- distance control

Please consult us for other options and dimensions.

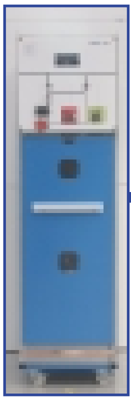
Details:

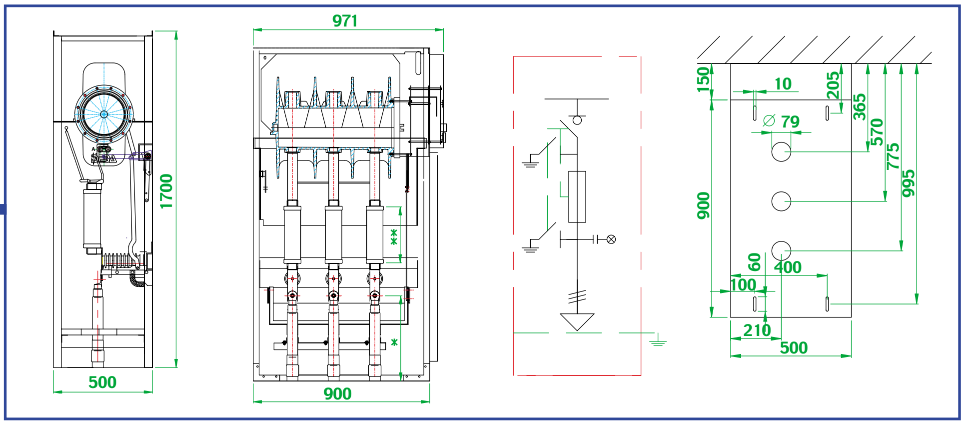
Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	1250-800	1250-800	630
Short-term current	kA	25	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	500	500	500
Depth	mm	1050	1050	1050
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



3.3.2. DF-P: Transformer protection cubicle with load break switch/fuse combination





Application: Transformer protection and MV-equipment protection.

Standard equipment:

- three-phase load break switch, class E3 according to IEC 60420, SF_6-insulation.
- double earthing switch with mutual interlock
- socle for HRC fuses:
  - o e = 292 mm. DIN 10 at 17.5 kV
  - o e = 442 mm. DIN 20 at 24 kV
  - o UTE
- triple-pole fuse trip
- switch-off mechanism through hitting bolt
- door interlock
- sockets for capacitive voltage detector
- low-voltage compartment

Options:

- block auxiliary contacts on load break switch
- block 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 *
- HRC fuses and/or spare fuses
- contact "fuse link has opened"
- automatic recloser
- set of 2 or 3 voltage transformers
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control
- distance control

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

Please consult us for other options and dimensions.

Details:

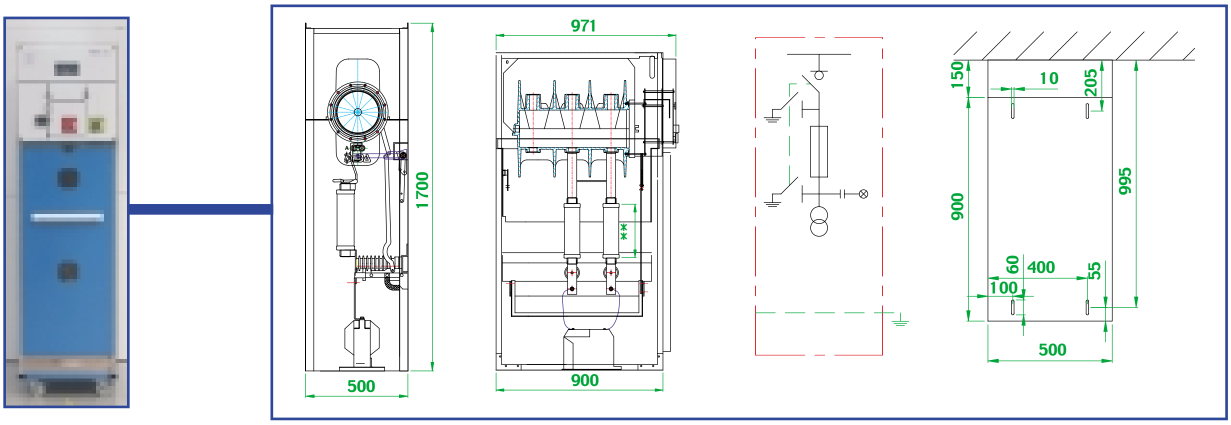
Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	800-1250	800-1250	630
Short-term current	kA	25	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
width	mm	500	500	500
depth	mm	1050	1050	1050
height	mm	1700	1700	1700
* Height between ground and end socket	mm	460	460	415
** fuse size	mm	292	292	442
Weight	kg	210	210	210

FUSE SELECTION TABLE

kVA/kV	5	6	10	11	12	15	20
100	25A	20A	16A	10A	10A	10A	6.3A
125	31.5A	25A	16A	16A	16A	10A	6.3A
160	40A	31.5A	20A	16A	16A	16A	10A
200	50A	40A	25A	20A	20A	16A	10A
250	63A	50A	31.5A	25A	25A	20A	16A
315	75A	63A	40A	31.5A	31.5A	25A	20A
400	100A	75A	50A	40A	40A	31.5A	25A
500	100A	100A	63A	50A	50A	40A	31.5A
630			75A	63A	63A	50A	40A
800			100A	75A	75A	63A	50A
1000			100A	100A	100A	75A	63A
1250						100A	63A
1600							100A

3.3.2. DF-AV: Protection cubicle for auxiliary voltage feeding or network survey



Application: Auxiliary voltage feeding or network survey.

Standard equipment:

- three-phase load break switch, of the type RV44, class E3, according to IEC 60420, interruption medium SF_6
- double interlocked earthing switch
- HRC fuse holders:
  - o e = 292 mm. DIN 10 at 17.5 kV
  - o e = 442 mm. DIN 20 at 24 kV
  - o UTE
- door interlock
- sockets for capacitive voltage detector
- low-voltage compartment
- assembly plate for auxiliary transformer(s)

Options:

- block auxiliary contacts on load break switch
- block auxiliary contacts on earthing - switch
- key interlock on load break switch
- key interlock on the earthing switch
- key interlock on both devices
- motor operation *
- HRC fuses or spare fuses
- auxiliary contact “fuse link burned”
- set of 1, 2 or 3 voltage transformers
- voltage indicator(s)
- pedestral of 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- press-button control
- distance control
- VT: x kV/x V x VA CL.XX

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

Please consult us for other options and dimensions.

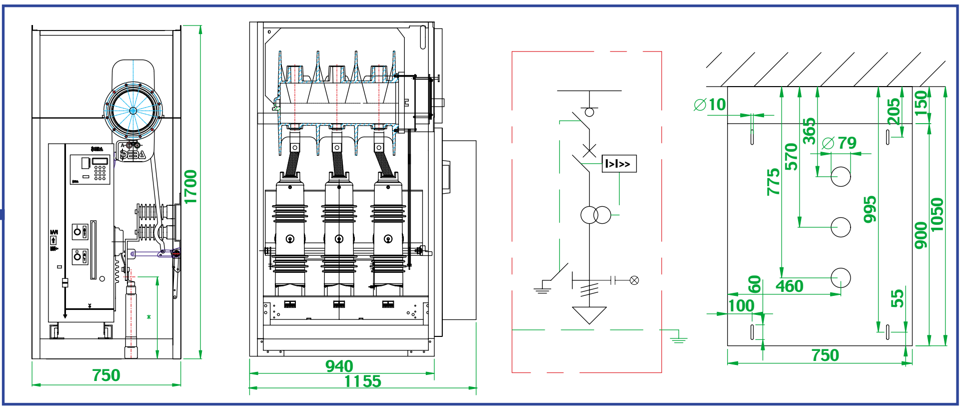
Details:

Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	6,3 A	6,3 A	6,3 A
Short time current	kA	25	25	20
Duration of the short time current	sec	1	1	1
Cubicle dimensions:				
width	mm	500	500	500
height	mm	1050	1050	1050
depth	mm	1700	1700	1700
Size of the fuses DIN (UTE)	mm	292	292	442 (550)
Weight of the cubicles (without VT’s)	kg	210(*)	210(*)	210(*)

(*)Overload due to VT’s and number of fuse holders may vary from 35 tot 150 kg.

3.3.4. DF-D: Protection cubicle with SF_6 of vacuum circuit breaker with integrated protection relay



Application: Protection of descending feeders with circuit breaker, transformer and MV-equipment protection.

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- vacuum circuit breaker with integrated protection relay, current transformers and open release
- interlocked earthing switch with rated making capacitiy up to 63 kA downstream of the capacity switch
- cable supporting
- door interlock
- sockets for capacitive voltage detector voltage indicators
- LV compartment

Cubicle options:

- block auxiliary contacts on the load break switch
- block 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 of 220 V AC
- short-circuit indicator (to be specified by the customer)
- earthing connections upwards from the circuit breaker
- circuit breaker SF_6 insulated
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on switch-disconnector
- distance control on switch-disconnector

Please consult us for other options and dimensions.

Options on the circuit breaker:

- motor operation *
- closing release
- shunt trip *
- under voltage release *
- block auxiliary contacts
- error contact
- supply for test protective relay (battery block)
- switch counter
- automatic recloser
- press-button control on circuit breaker
- distance control on circuit breaker
- key interlock

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

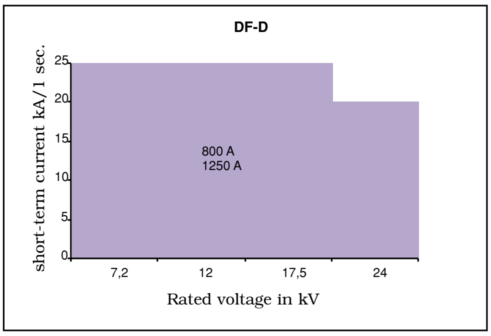
Details:

Specifications to be indicated for circuit breaker VA-2:

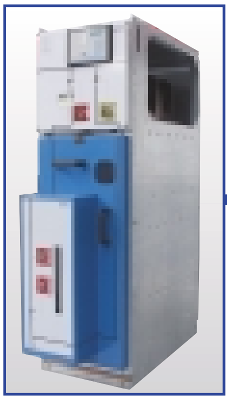
- short-circuit capacity
- rated current
- rated voltage
- capacity to be secured

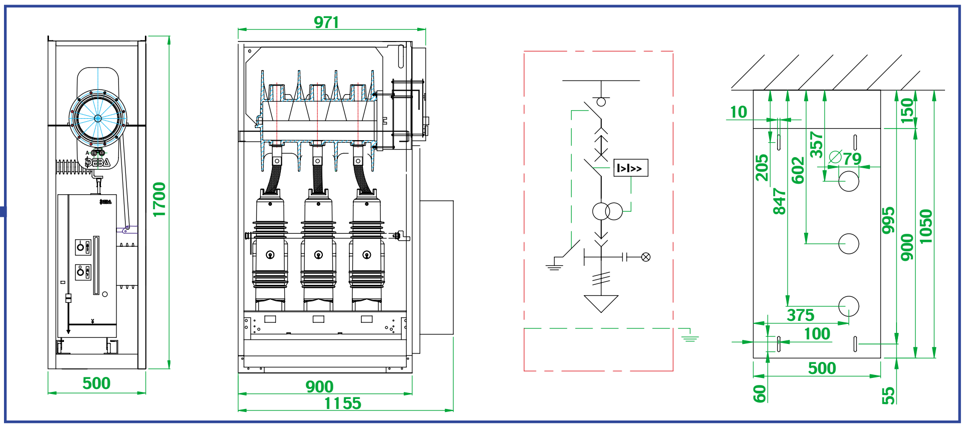
Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	800/1250	800/1250	800/1250
Short-term current	kA	25/31.5	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	750	750	750
Depth	mm	1050	1050	1050
Height	mm	1700	1700	1700
* Height between ground and end socket	mm	445	445	445
Weight	kg	460	460	460



3.3.5. DF-D-500: Protection cubicle with SF_6 of vacuum circuit breaker with integrated protection relay





Application: Securing of descending feeders with draw-out circuit breaker. The main advantage of a DF-D-500 cubicle is that it allows fast exchange of circuit breaker. This could for example be applicable to production processes with MV-equipment where shutdown has to be limited.

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- vacuum circuit breaker with integrated protection relay, current transformers and open release
- interlocked earthing switch with rated making capacitiy up to 63 kA downstream of the capacity switch
- cable supporting
- door interlock
- sockets for capacitive voltage detector
- low-voltage compartement
- draw-out circuit breaker

Cubicle options:

- block auxiliary contacts on the load break switch
- block 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 of 220 V AC
- short-circuit indicator (to be specified by the customer)
- earthing connections upwards from the circuit breaker
- circuit breaker SF_6 insulated
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on switch-disconnector
- distance control on switch-disconnector

Please consult us for other options and dimensions.

Options on the circuit breaker:

- motor operation *
- closing release
- shunt trip *
- under voltage release *
- block auxiliary contacts
- error contact
- supply for test protective relay (battery block)
- switch counter
- automatic recloser
- press-button control on circuit breaker
- distance control on circuit breaker
- key interlock

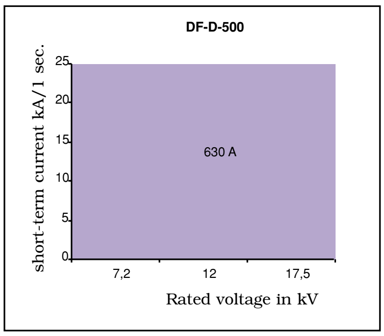
* obtainable voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

Details:
Specifications to be indicated for circuit breaker VA-2:

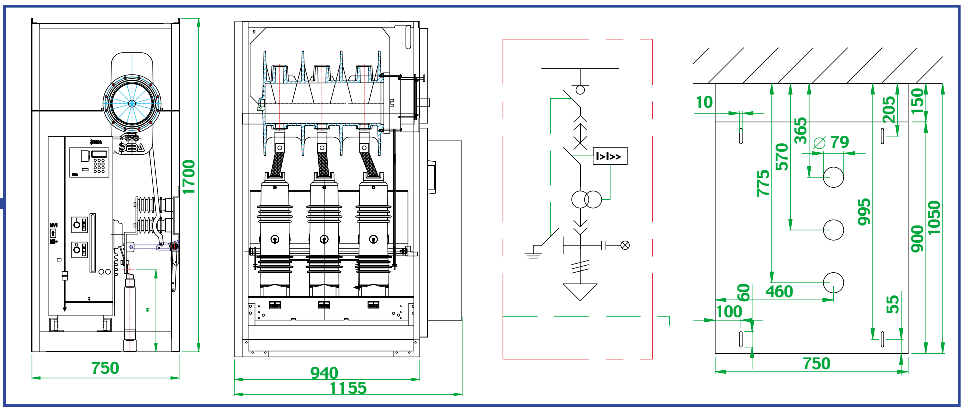
-short-circuit capacity
-rated current
-rated voltage
-capacity to be secured

Technische specificaties:

Rated voltage	kV	12	17.5
Rated current	A	630	630
Short-term current	kA	25	25
Time of the short duration of current	sec	1	1
Cubicle dimensions:			
Width	mm	500	500
Depth	mm	940	940
Height	mm	1700	1700
* Height between ground and end socket	mm	450	450
Weight	kg	400	400



3.3.6. DF-D-W: Protection cubicle with draw-out SF_6 or vacuum circuit breaker with integrated protection relay



Application: Securing of descending feeders with draw-out circuit breaker. The main advantage of a DF-D-W cubicle is that it allows fast exchange of circuit breaker. This could for example be applicable to production processes with MV-equipment where shutdown has to be limited.

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- vacuum circuit breaker with integrated protection relay, Current transformers and open release
- interlock earthing switch with rated making capacity up to 63 kA downstream of the capacity switch
- cable supporting
- door interlock
- sockets for capacitive voltage detector
- low-voltage compartment
- draw-out circuit breaker

Cubicle options:

- block auxiliary contacts on the load break switch
- block 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 or 220 V AC
- short-circuit indicator (to be specified by the customer)
- earthing connection upwards from the circuit breaker
- circuit breaker SF_6 insulated
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on switch-disconnector
- distance control on switch-disconnector

Please consult us for other options and dimensions.

Options on the circuit breaker:

- motor operation *
- closing release *
- shunt trip *
- delay /direct under voltage release *
- block auxiliary contacts
- error contact
- supply for test protective relay (battery block)
- switch counter
- automatic recloser
- press-button control on circuit breaker
- distance control on circuit breaker
- key interlock

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

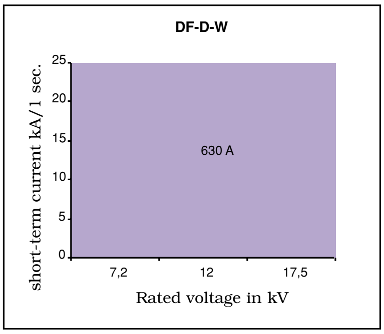
Details:

Specifications to be indicated for circuit breaker VA-2:

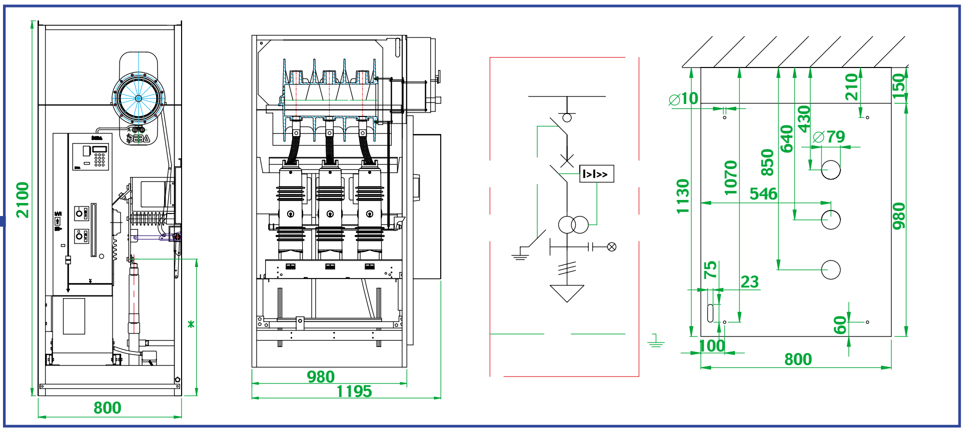
- short-circuit capacity
- rated current
- rated voltage
- capacity to be secured

Technical specifications:

Rated voltage	kV	12	17.5
Rated current	A	630	630
Short-term current	kA	25	25
Time of the short duration of current	sec	1	1
Cubicle dimensions:			
Width	mm	750	750
Depth	mm	1050	1050
Height	mm	1700	1700
* Height between ground and end socket	mm	445	445
Weight	kg	460	460



3.3.7. DF-EDN-D: Protection cubicle with vacuum circuit breaker



Application: Protection of descending feeders with circuit breaker.

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- vacuum circuit breaker
- interlock earthing switch with rated making capacity up to 63 kA downstream of the circuit breaker
- cable supporting
- door interlock
- holder for capacitive voltage indicators
- low-voltage compartment
- earthing connections upwards from the circuit breaker

Options of the cubicle:

- block auxiliary contacts on the load break switch
- block 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 or 220 V AC
- short-circuit indicator (to be specified by the customer)
- earthing connections outside of the cubicle
- voltage indicators
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on switch-disconnector
- distance control on switch-disconnector

Please consult us for other options and dimensions.

Options on the circuit breaker:

- motor operation *
- closing release *
- shunt trip *
- current transformer shunt trip
- delay / direct under voltage release *
- block auxiliary contacts
- error contact
- switch counter
- automatic recloser
- press-button control on circuit breaker
- distance control on circuit breaker
- key interlock

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

Details:

Specifications to be indicated for circuit breaker VA-2:

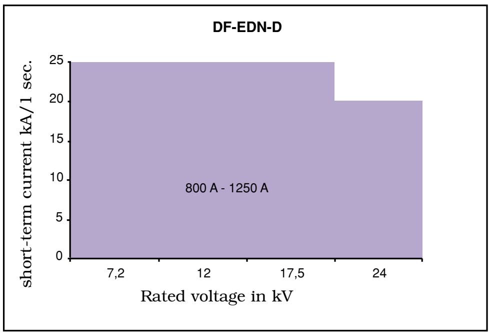
- short-circuit capacity
- rated current
- rated voltage
- capacity to be secured

Specifications to be indicated for the current transformer:

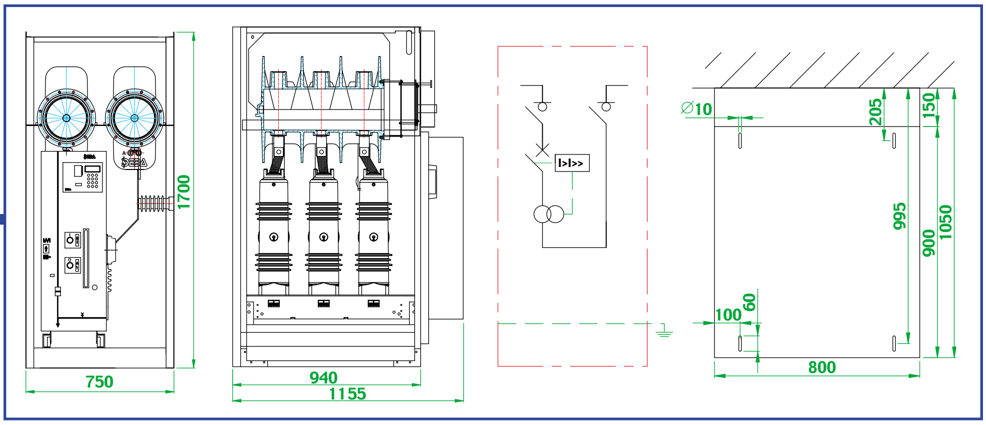
- Primary current
- Secundary current
- Capacity and Precision Class
- Insulation class
- Thermic withstand-current
- Special relays to provide when ordering

Technical specifications:

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	sec	1	1	1
Cubicle dimensions:				
Width	mm	800	800	800
Depth	mm	1130	1130	1130
height	mm	2100	2100	2100
* Height between ground and end socket	mm	765	765	765
Weight	kg	510	510	510



3.3.8. DF-AAD: Protection cubicle with double interruption



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

Standard equipment:

- three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- vacuum circuit breaker with/without integrated protection relay
- door interlock
- low-voltage compartment
- holder for capacitive voltage indicators load break switch 1 and/or 2

Cubicle options:

- block 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 of 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
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on load break switch 1 and/or 2
- distance control on load break switch 1 and/or 2
- current transformers

Please consult us for other options and dimensions.

Options of the circuit breaker:

- motor operation *
- closing release *
- shunt trip *
- current transformer shunt trip
- delayed/direct under voltage release * (battery block)
- block auxiliary contacts
- error contact
- supply for test protective relay
- switch counter
- automatic recloser
- press-button control on circuit breaker
- distance control on circuit breaker
- key interlock

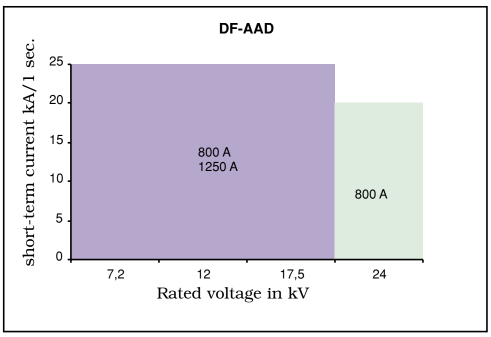
* obtainable voltages: 24 V AC/DC, 48 V AC/DC, 110 V AC/DC, 220 V AC

Details:
Specifications to be indicated for circuit breaker VA-2:

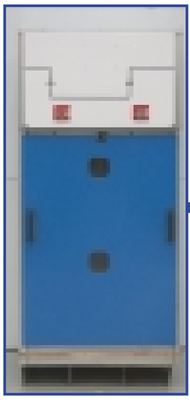
- short-circuit capacity
- rated current
- rated voltage
- capacity to be secured

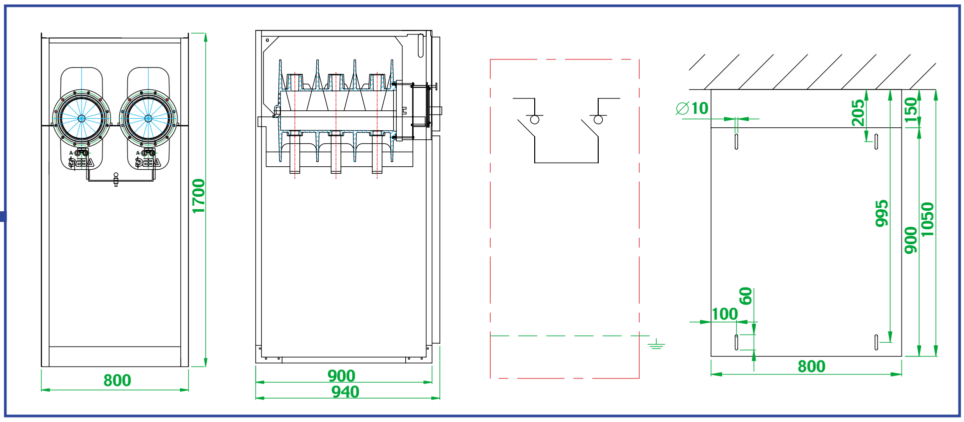
General information about a DF-AAD cubicle:

Rated voltage	kV	12	17.5	24
Rated current	A	800-1250	800-1250	800
Short-term current	kA	25	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	750	750	750
Depth	mm	1050	1050	1050
Height	mm	1700	1700	1700
Weight	kg	510	510	510



3.3.9. DF-LK: Busbar coupling cubicle





Application: Coupling between two parts of the MV-panel.

Standard equipment:

- 2 three-phase load break switches RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- door interlock
- low-voltage compartment
- holder for capacitive voltage indicators load break switch 1 and/or 2

Options:

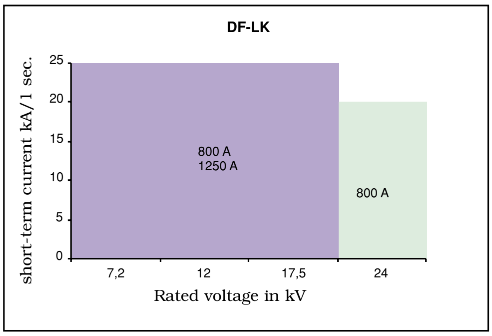
- block auxiliary contacts on load break switch 1 and/or 2
- key interlock on load break switch 1 and/or 2
- key interlock on earthing switch
- mechanical interlock between the load break switches
- no door interlock
- motor operation on load break switch 1 and/or 2: 24-48-110 V AC/DC or 220 V AC
- earthing switch
- earthing connections on load break switch 1 and/or 2
- earthing connections outside of cubicle
- capacitive voltage indicators switch-disconnector 1 and/or 2
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on load break switch 1 and/or 2
- distance control on load break switch 1 and/or 2
- current transformers

Please consult us for other options and dimensions.

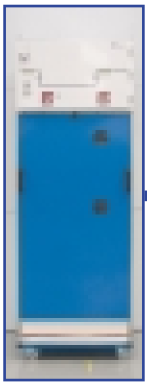
Details:

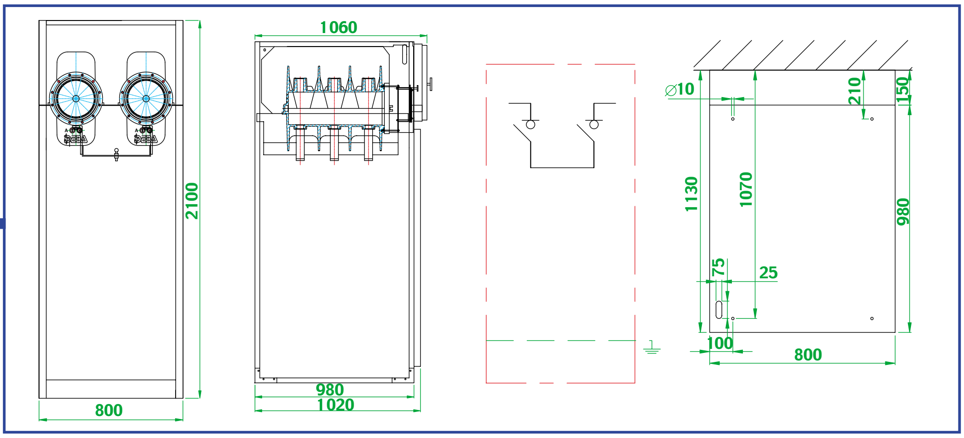
Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	800-1250	800-1250	800
Short-term current	kA	25	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	750	750	750
Depth	mm	1050	1050	1050
Height	mm	1700	1700	1700
Weight	kg	245	245	245



3.3.10. DF-EDN-LK: Busbar coupling cubicle





Application: Busbar interconnection between two parts of the MV-panel.

Standard equipment:

- 2 three-phase load break switch RV 44, class E3 according to IEC 60265.1, SF_6-insulation
- door interlock
- low-voltage compartment
- holder for capacitive voltage indicators load break switch 1 and/or 2

Cubicle options:

- block auxiliary contacts on load break switch 1 and/or 2
- block auxiliary contacts on earthing switch
- key interlock on load break switch 1 and/or 2
- key interlock on earthing switch
- no door interlock
- mechanical interlock between load break switches
- motor operation load break switch 1 and/or 2: 24-48-110 V AC/DC or 220 V AC
- earthing switch
- earthing connections upwards from the circuit breaker 1 and/or 2
- earthing ball clamps outside of cubicle
- capacitive voltage indicators load break switch 1 and/or 2
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- press-button control on load break switch 1 and/or 2
- distance control on load break switch 1 and/or 2
- circuit breaker

Please consult us for other options and dimensions.

Options on the circuit breaker:

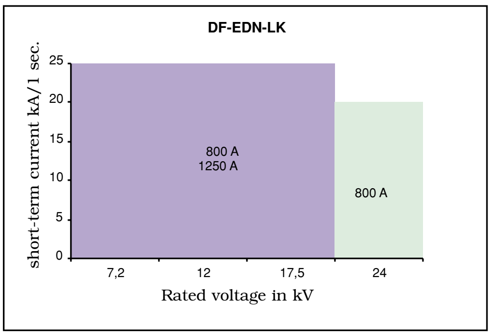
- motor operation *
- closing release *
- shunt-trip
- ampere metric switch-off coil
- under voltage release *
- block auxiliary contacts
- error contact
- supply for test protective relay (battery block)
- switch counter
- automatic recloser
- press-button control on capacity switch
- distance control on circuit breaker
- key interlock

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

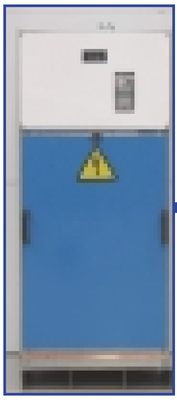
Details:

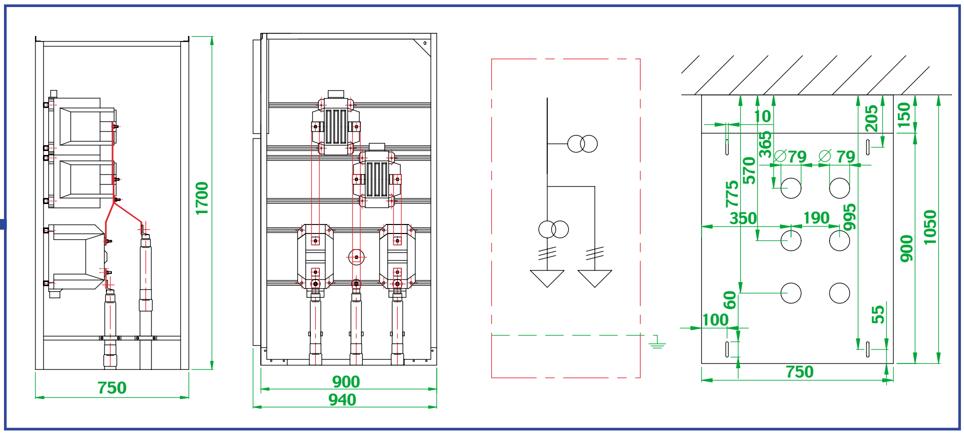
Technical specifications:

Rated voltage	kV	12	17.5	24
Rated current	A	800-1250	800-1250	800
Short-term current	kA	25	25	20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	800	800	800
Depth	mm	1130	1130	1130
Height	mm	2100	2100	2100
Weight	kg	320	320	320



3.3.11. DF-C: Metering cubicle





Application: The DF-C-cubicle has been designed for the positioning of the current and voltage transformers to measure the energy consumption.

Options:

- additional current transformers
- additional voltage transformers with or without MV and LV protection
- support for the positioning of measuring transformers
- measuring system with 3 CT's and 3 VT's
- measuring system with kWh metering and Kvarh metering (requirements to be specified by the customer)
- current measurement system
- voltage measurement system
- socle 200 mm, 300 mm or 400 mm height (Other dimensions on demand)
- floor pans
- low-voltage compartment safety box to secure voltage circuits

For other options and dimensions, please consult us.

Details:

The following current transformer cT specifications will be specified by the customer:

- Primary current
- Secundary current
- Capacity and precision class
- insulation class
- rated short time current

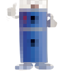
The following voltage transformer vT specifications will be specified by the customer:

- primary voltage secundary voltage
- Capacity and precision class
- insulation class

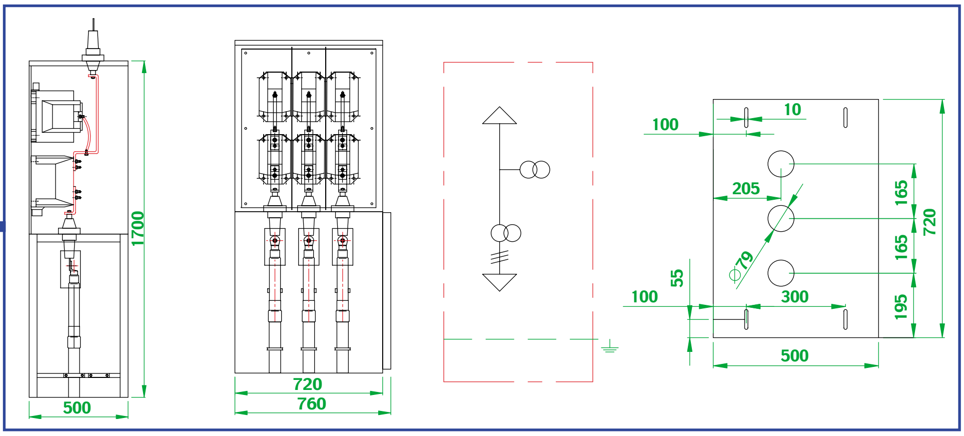
General information about a DF-C-cubicle:

Rated voltage	kV	12	17.5	24
Rated current	A	to 1250	to 1250	to 800
Short-term current	kA	to 25	to 25	to 20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	750	750	750
Depth	mm	1050	1050	1050
Height	mm	1700	1700	1700
Weight	kg	55*	55*	55*

* without equipment



3.3.12. DF-C-500: Metering cubicle



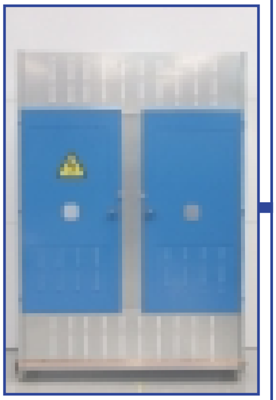
Application: The DF-C-500-cubicle has been designed for the positioning of the current and voltage transformers to measure the energy consumption.

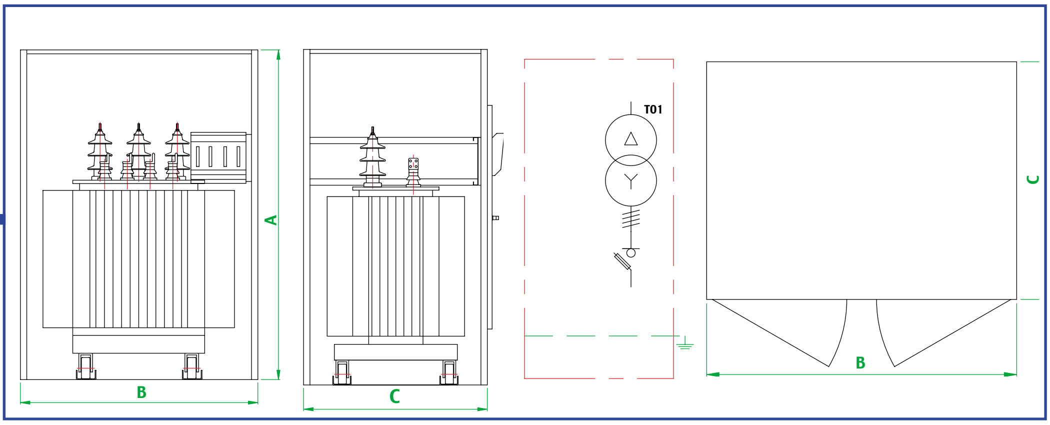
Standard equipment: 3 Ct's x > 5 A
3 Vt's x >110 V

General information about a DF-C-500-cubicle:

Rated voltage	kV	12	17.5	24
Rated current	A	to 1250	to 1250	to 800
Short-term current	kA	to 25	to 25	to 20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	500	500	500
Depth	mm	720	720	720
Height	mm	1700	1700	1700
Weight	kg	240	240	240

3.3.13. DF-T: transformer housing





Application:

The cubicle DF-T has been designed from the long-term practical experience of installing and connecting distribution transformers.

Standard equipment:

- windows
- ventilation openings

hinge door(s) in function of the cubicle width

In the table below you will find the standard dimensions of the DF-T-cubicle.

Cubicle dimensions in mm

	Oil-filled transformer			Cast resin transformer		
	Width	Height	Depth	Width	Height	Depth
	B	A	C	B	A	C
100 - 160 kVA	1200	1900	1050	1500	1900	1050
250 – 630 kVA	1400	2100	1150	1800	2100	1150
800 – 1000 kVA	1800	2100	1150	2000	2100	1200
1250 – 1600 kVA	2000	2100	1400	2200	2200	1300
2000 – 2500 kVA	2400	2400	1500	2400	2400	1400

Please note: These dimensions are approximate and could change in function on the project. Other dimensions can also be supplied on request.

Options:

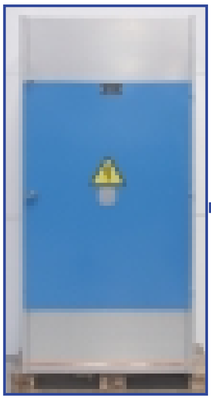
- key interlock with MV protection
- key interlock with LV protection
- shaft with rail set on top of the transformer housing
- LV compartment
- Oil receiving tray
- forced ventilation
- with closed back
- with closed roof
- extra ventilation
- opening for LV switch of LV equipment
- opening for the thermometer
- opening for digital measuring set
- holder for capacitive voltage indicators
- capacitive voltage indicators
- IP 2X / IP 4X / IP 315
- Interlockable doors
- interlock possibilities

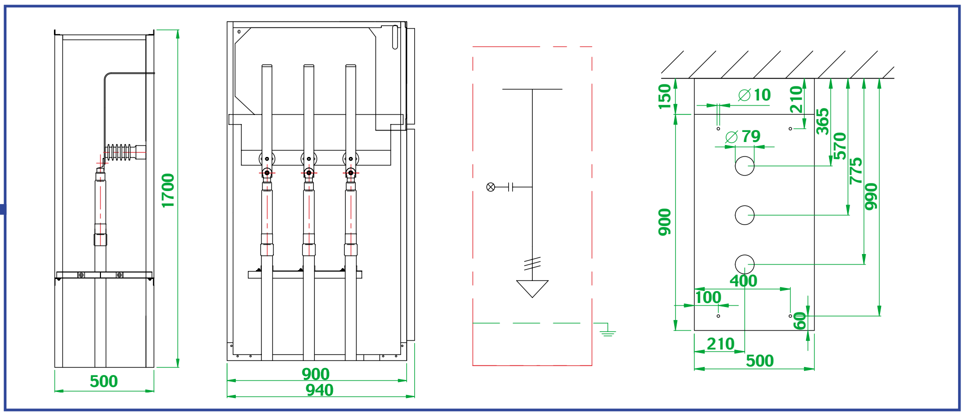
If a built-in LV switch will be required at the DF-T, the size needs to be specified.
For other options and dimensions you can always consult us.

Details:

When designing the DF-T special attention was paid to the ventilation problems The ventilation openings in the cubicle ensure that the transformer will constantly be ventilated.
The concept has been constructed in such a manner that the transformer can always be driven in and out smoothly.

3.3.14. DF-K: cable cubicle and/or rail shaft





Application: cubicles of type DF-K have been provided 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.

Options:

- holder for capacitive voltage indicators
- capacitive voltage indicators
- Short-circuit detectors (to be specified by the customer when ordering)
- earthing switch
- block 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
- socle 200 mm, 300 mm of 400 mm height (other dimensions on demand)
- floor pans
- door interlock

Please consult us for other options and dimensions.

Details:

Rated voltage	kV	12	17.5	24
Rated current	A	to 1200	to 1200	to 800
Short-term current	kA	to 25	to 25	to 20
Time of the short duration of current	sec	1	1	1
Cubicle dimensions:				
Width	mm	Made to meas.	Made to meas.	Made to meas.
Depth	mm	1050	1050	1050
Height	mm	Made to meas.	Made to meas.	Made to meas.
Height x	mm	1700	1700	1700
Weight	kg	55*	55*	55*

* without equipment

3.4. KEMA CERTIFICATE DF-A

1. Switch-disconnector

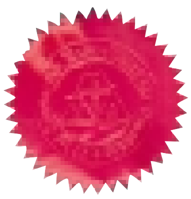
Test	Specification	Test results			
Insulation level	IEC 60265.1 IEC 60298 IEC 60694	Power frequency withstand voltage 1 min. - to earth and between phases: 38 kV - over the insulation distance: 45 kV Impulse withstand voltage 1.2/50 µsec 15 positive and 15 negative pulses per phase - to earth and between phases: 95 kV - over the insulation distance: 110 kV			
Rated making and break capacity	IEC 60129 IEC 60265.1	Component	Increase in temperature		
			Admitted	Measured	
		Pole terminals	65°C	47.5°C	
		Busbar set	65°C	59°C	
	IEC 60265.1	Nominal current 800 A Short-term current 25 kA / 1 sec.			
	IEC 60265.1 Class E3	Number switches	Type switches	Current (A)	Cos φ
	Function 1 (100% In)	100	C(O)	800	0.7
	Function 2 (5% In)	20	C(O)	42	0.7
	Function 2a	20	C(O)	800	0.7
	Function 4a (100%)	10	C(O)	18	Cap
	Function 4a (30%)	10	C(O)	5	Cap
	Function 5	5	C	63000	0.7
	Function 6a	10	C(O)	100	0.7
	Function 6b	10	C(O)	30	0.7
Mechanical endurance test IEC 60298	IEC 60265.1	1000 switches			

2. Earthing switch EM 20

Test	Specification	Test results			
Rated making and breaking capacity 25 kA/1 sec.	IEC 60129	Peak value of the current 50 kA/17.5 kV 63 kA/12 kV Short-term current 20 kA/1 sec. at 17.5 kV at 12 kV			
	IEC 60129	Number switches	Type switches	Current (A)	Cos φ
	17.5 kV 12 kV	5 2	C C	50000 63000	0.7 0.7
Mechanical endurance test	IEC 60129	1000 switches			

3. Cubicle

Test	Specification	Test results
Internal arc	IEC 60298 Appendix AA	16 kA / 1 sec. All 6 criterias have been met
No interruption test	EDF HN 64 S 41 § 7.106.1	14 kA / 1 sec.
Degree of protection	IEC 60298	IP4X
Actuating value voltage indicators	IEC 1243/5	DEBA VDS meets all standard requirements



3.4. KEMA CERTIFICATE DF-P

1. Fuse-switch-disconnetor

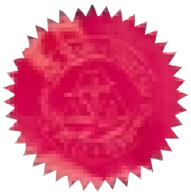
Test	Specification	Test results			
insulation level	IEC 60420 IEC 60298 IEC 60694	Power frequency withstand voltage 1 min. - to earth and between phases: 38 kV - over the insulation distance: 45 kV Impulse withstand voltage 1.2/50 µsec 15 positive and 15 negative pulses per phase - to earth and between phases: 95 kV - over the insulation distance: 110 kV			
Rated making and break capacity	IEC 60129 IEC 60120 IEC 60298	Component	Increase in temperature		
			Admitted	Measured	
		Fuse below	65°C	47.5°C	
		Fuse on top	65°C	59°C	
	IEC 60420	Nominal current 63 A			
	IEC 60420	Number switches	Type switches	Current (A)	Cos φ
	Function 1	1	(O)	25400	0.7
	Function 1	1	C(O)	25400	0.7
	Function 2	1	(O)	2540	0.7
	Function 2	1	C(O)	2540	0.7
	Function 3 Part 1	2	(O)	144	0.7
	Function 3 Part 2	2	(O)	174	0.7
	Function 4	3	(O)	640	0.7
Mechanical endurance test IEC 60298	IEC 60420	1000 switches			
Test on mechanical switch-fuse combination	IEC 60420 clause 6.106	1000 switches			

2. Earthing switch EM 20

Rated making and breaking capacity	IEC 60129	Peak value of the current 50 kA / 17.5 kV 63 kA / 12 kV Short-term current 20 kA / 1 sec. / 17.5 kV 25 kA / 1 sec. / 12 kV			
	IEC 60129	Number switches	Type switches	Current (A)	Cos φ
	17.5 kV 12 kV	5 2	C C	50000 63000	0.7 0.7
Mechanical endurance test	IEC 60129 1000 switches	1000 switches EM 20 over the fuses AE 20 below the fuses			

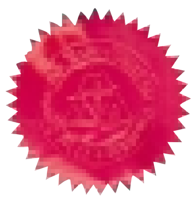
3. Cubicle

Internal arc	IEC 60298 Appendix AA	16 kA / 1 sec. All 6 criterias have been met
Test no interruption	EDF HN 64 S 41 § 7.106.1	14 kA / 1 sec.
Degree of protection	IEC 60298	IP4X
Actuating value voltage indicators	IEC 1243/5	DEBA VDS meets all standard requirements



3.4. KEMA CERTIFICATE DF-D

1. Switch-disconnector (in upper part of the cubicle)					
Test	Specification	Test results			
Insulation level	IEC 60265.1 IEC 60298 IEC 60694	Power frequency withstand voltage 1 min. - to earth and between phases: 38 kV - over the insulation distance: 45 kV Impulse withstand voltage 1.2/50 µsec 15 positive and 15 negative pulses per phase - to earth and between phases: 95 kV - over the insulation distance: 110 kV			
2. Circuit breaker (in lower part of the cubicle)					
insulation level	IEC 60298 Clause 6.1.7	Power frequency withstand voltage 1 min. - to earth and between phases: 38 kV			
	IEC 60298 Clause 6.1.6	Impulse withstand voltage 1.2/50 µsec 15 positive and 15 negative pulses per phase - to earth and between phases: 95 kV			
3. Earthing switch EM 20					
Rated making and break capacity	IEC 60129	Peak value of the current: 50 kA / 17.5 kV 63 kA / 12 kV Short-term current: 20 kA / 1 sec. at 17.5 kV 25 kA / 1 sec. at 12 kV			
	IEC 60129	Number switches	Type switches	Current (A)	Cos φ
	17.5 kV	5	C	50000	0.7
	12 kV	2	C	63000	0.7
Mechanical endurance test	IEC 60129	1000 switches			
4. Cubicle					
Internal arc	IEC 60298 Appendix AA	16 kA / 1 sec. All 6 criterias have been met			
No interruption test	EDF HN 64 S 41 § 7.106.1	14 kA / 1 sec.			
Degree of protection	IEC 60298	IP4X			
Actuating value voltage indicators	IEC 1243/5	DEBA VDS meets all standard requirements			

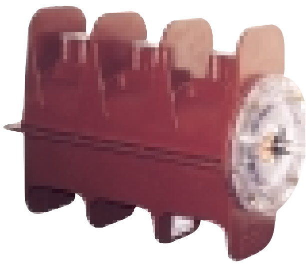


CHAPTER 4 : COMPONENTS FOR DF-2 CUBICLES

4.1. SWITCHES

4.1.1. RV 44: LOAD BREAK SWITCH

The load break switch RV 44 consists of an epoxy casing in which fixed and movable parts have been assembled. This switch has been filled with SF_6 gas pressured at 1.5 bar (abs) at 20°C. The particular characteristics of the SF_6 ensure an insulating and arc flame extinguishing function.
All synthetic parts in the switch are free of halogen, UV and ozone proof, enforced with glass fibre and according to class UL 94 Vo.
During the design the upmost care has been taken with the different parameters such as: very short arc times through an ideal switch speed at the switch-mechanics combination. The patented switch principle combines a maximum gas turn-around with a very precise finish of the electrical points for excellent dielectric characteristics and minimal contact erosion.



The RV 44 has been assembled in a manner which can be typified as “ sealed for life ”. The production process takes place in Deba’s establishment at Deinze and is subjected to the strictest control requirements. Each separate switch is measured systematically for gas density through a fully automatic He-lek detector. This construction seals the life expectancy of the set for 30 years (more details about the production process: refer to Chapter 6, pg. 39).
RV 44 switch is a two-position (open or closed) switch and its mechanical drive does not allow any inappropriate use. A fixed mechanical connection always reflects the correct indication on the synoptic diagram of the cubicle of the position of the switch. The RV 44 has also been tested for its function as visible interruption.

4.1.2. EM 20: EARTHING SWITCH

The decision was made to place the EM 20 earthing switch in the cable compartment after very careful safety considerations. This is the only safe manner in which the operator can visually check the position of the switch through the windows in the door of each cubicle.
The switching takes place in the air. The two controls, the load break switch and the earthing switch, have been accommodated in one control mechanism. As the requirements of the IEC standard have been met, these two controls are also mutually interlocked mechanically whereby any incorrect switch operation is excluded.
Included with this mechanical device are all details and advantages as described in chapter : 4.2 “mechanical drives” contain.
It is important to mention that the EM mechanism is also completely independent of the operator. An interesting feature is that the earthing point can be very easily assembled and disassembled and is virtually maintenance free. High safety is due to the operator always being able to see the state of the earthing contacts through the windows.

4.1.3. FUSE-SWITCH-DISCONNECTOR

The combination of switch and fuse consists of a RV 44 switch-disconnector, an EM 98 earthing switch, fuse holders and a second earthing knife assembled under the fuse holder. The earthing switches are connected to each other so they open and close simultaneously. The same interlocking as on the load break switch is also provided on the load break switch with HRC assembled fusing. A set of bars located on the top of the fusing ensures the three phase opening of the load break switch by means of the priming pin of the fusing when one of the safety fuses activates.

DF-P

4.1.4. VA-2: VACUUM CIRCUIT BREAKER

4.1.4.1. DESCRIPTION

These vacuum circuit breakers with side actuation have been designed with a view to the best performance and reliability. The breakers can be easily integrated in the air-insulated medium voltage cubicles.

Deba has developed two specific variants:

- VA-2 : vacuum circuit breaker with side actuation
- VA-2RP : vacuum circuit breaker with side actuation and integrated protection

4.1.4.2. AVAILABLE SPECTRUM

Type	Rated voltage (kV)	Rated current (A)	Breaking capacity (kA)
VA-2 12-25/8L	12	800	25
VA-2 12-25/12L	12	1250	25
VA-2 17.5-25/8L	17.5	800	25
VA-2 17.5-25/12L	17.5	1250	25
VA-2 24-20/8L	24	800	20
VA-2 24-20/12L	24	1250	20
VA-2RP 12-25/8L	12	800	25
VA-2RP 12-25/12L	12	1250	25
VA-2RP 17.5-25/8L	17.5	800	25
VA-2RP 17.5-25/12L	17.5	1250	25
VA-2RP 24-20/8L	24	800	20
VA-2RP 24-20/12L	24	1250	20

4.1.4.3. DETAILS AND ADVANTAGES

- Vacuum tube casing in epoxy-cast resin with natural protected ventilation, designed to even use in the most strict climatologic circumstances (IEC 60932 method A)
- “ last generation ” vacuum tubes
- Spring drive mechanism
- The breaker has been designed, manufactured and checked according to quality standard ISO 9001
- Type-tested according to IEC
- Maintenance-free
- Completely tested and assembled in the factory
- Replaces an MV circuit breaker without a problem, that is fitted with direct relays
- Current transformers can be positioned left or right of the set
- Integrated protection can be positioned left or right of the set
- One single model of current transformer for the whole range
- Digital protection with several characteristics

Possible drive mechanisms per type of cubicle:

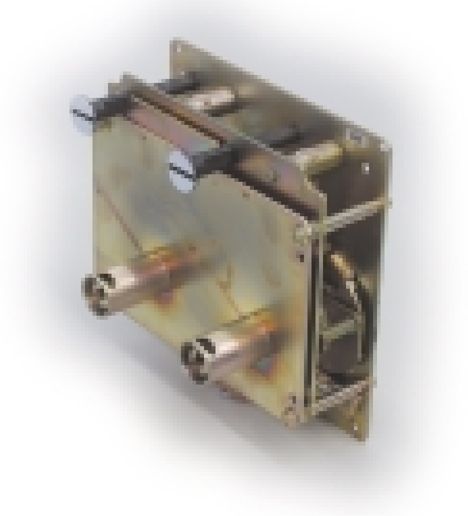
Cub./Mechanism	DA	DA-M	DA-K	DA-K-M	DA-EDN-D	DP	DP-M	DP-A	DP-A-M
DF-A	X	X						X	X
DF-P						X	X	X	X
DF-D	X	X						X	X
DF-EDN-D					X				
DF-DW	X	X						X	X
DF-K			X	X					
DF-LK	X		X	X					
DF-EDN-LK			X						
DF-AAD	X	X						X	X

The control speed of the mechanisms is independent of the operator.
Several types exist. The possible options per mechanism have been classified in the equipment table.

Description	**DA**	**DA-M**	**DA-K**	**DA-K-M**	**DA-EDN-D**	**DP**	**DP-M**	**DP-A**	**DP-A-M**
Motor operation *		X		X			X		X
Key interlock on both axles	X	X			X	X	X	X	X
Key interlock on switch axle	X	X			X	X	X	X	X
Key interlock on earthing - switch axle	X	X	X	X	X	X	X	X	X
Switch-on coil*								X	X
Shunt trip *						X	X	X	X
Melt through fuse signalisation (1 NO + 1 NC)						X	X	X	X
Mechanical signalisation melt through fuse						X	X	X	X
Minimal delay voltage triping (0-5”) *						X	X	X	X
Minimal direct voltage triping *						X	X	X	X
Fixing with lever in out with rotary button								X	X
Auxiliary contact 1 NO + 1 NC on LBS axle	X	X	X	X	X	X	X	X	X
Auxiliary contact 2 NO + 2 NC on axle	X		X		X	X		X	
Auxiliary contact 3 NO + 3 NC on LBS axle	X		X	X	X	X		X	
Auxiliary contact 1 NO + 1 NC on earthing axle	X	X			X	X	X	X	X
Auxiliary contact 2 NO + 2 NC on earthing switch axle	X	X			X	X	X	X	X
Auxiliary contact 3 NO + 3 NC on earthing switch axle	X	X			X	X	X	X	X

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

4.2.2. DA-MEC: DOUBLE FUNCTION CONTROL

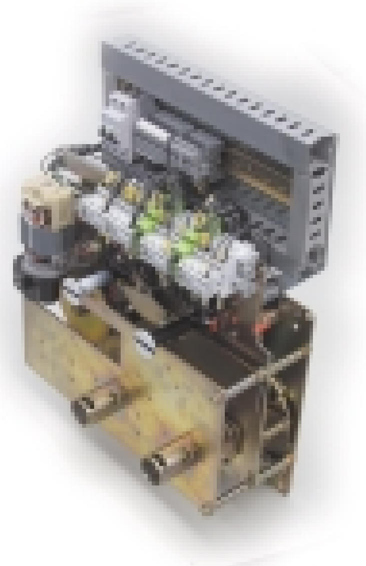


1. Function load break switch:
Closing and opening with indirect working with the use of a lever.

2. Function earthing switch:
Closing and opening with indirect working with the use of a lever.

The mechanism switches independently of the operator.
The energy needed for the controls is expanded by compressing a spring, which causes the opening and closing of the device after exceeding a deadlock.

4.2.3. DA-M-MEC: CONTROL WITH DOUBLE FUNCTION

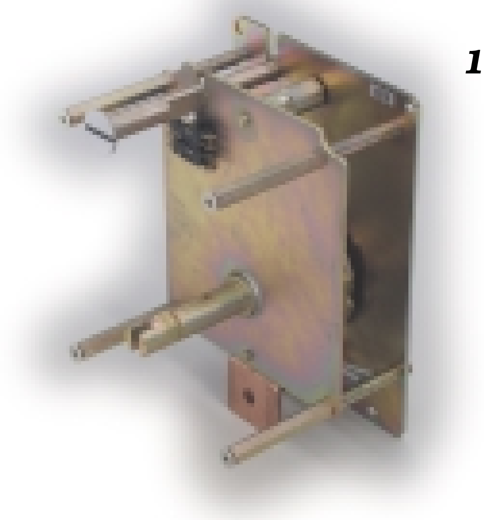


1. Function load break switch:
closing and opening with indirect action and through the aid of an engine

2. Function earthing switch:
closing and opening with indirect action with the use of a lever.

DA-M-MEC switches independently of the operator.
The energy needed for the controls is expanded by compressing a spring, which causes the opening and closing of the device after exceeding a deadlock.
The drive mechanism has been fitted as standard with an motor. The following voltages can be obtained:
24 V AC/DC, 48 V AC/DC, 110 V AC/DC and 220 V AC.
However, manual control will also be possible: This can be done by positioning the switch lever on the driver axle of the RV 44 and pressing lightly on the lever. In this way we disconnect the connection between axle and engine. The drive can now be switched.

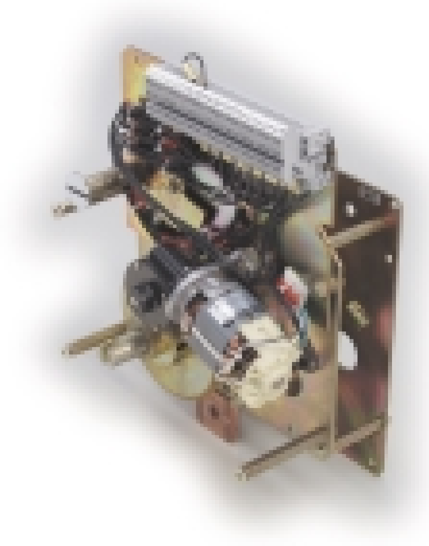
4.2.4. DA-K-MEC: CONTROL WITH SINGLE FUNCTION



1. Function load break switch:
Closing and opening through indirect action with the aid of a lever.

The mechanism switches independently of the operator.
The energy needed for the controls is expanded by compressing a spring, which causes the opening and closing of the device after exceeding a deadlock.

4.2.5. DA-K-M-MEC: CONTROL WITH SINGLE FUNCTION

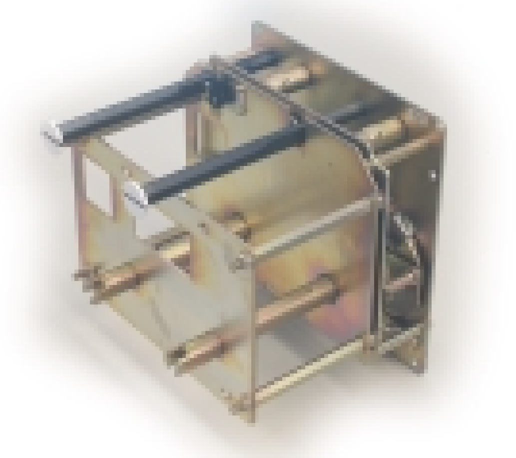


1. Function load break switch:
Closing and opening through indirect action through a motor.

The mechanism switches independently of the operator. The energy needed for the controls is expanded by compressing a spring, which causes the opening and closing of the device after exceeding a deadlock.

The drive mechanism has been fitted as standard with a motor. The following voltages can be obtained:
24 V AC/DC, 48 V AC/DC, 110 V AC/DC and 220 V AC.
However, manual control will also be possible: This can be done by positioning the switch lever on the driver axle of the RV 44 and pressing lightly on the lever. In this way we disconnect the connection between axle and engine. The drive can now be switched.

4.2.6. DA-EDN-D-MEC: CONTROL WITH DOUBLE FUNCTION

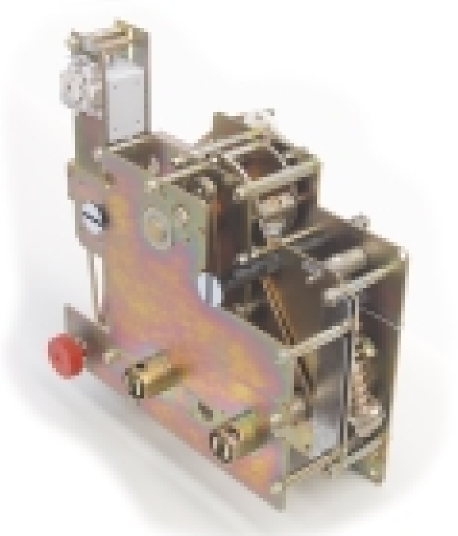


1. Function load break switch:
Closing and opening through indirect action with the aid of a lever.

2. Function earthing switch:
Closing and opening through indirect action with the aid of a lever.

The mechanism switches independently of the operator. The energy needed for the controls is expanded by compressing a spring, which causes the opening and closing of the device after exceeding a deadlock.

4.2.7. DP-MEC: CONTROL WITH DOUBLE FUNCTION

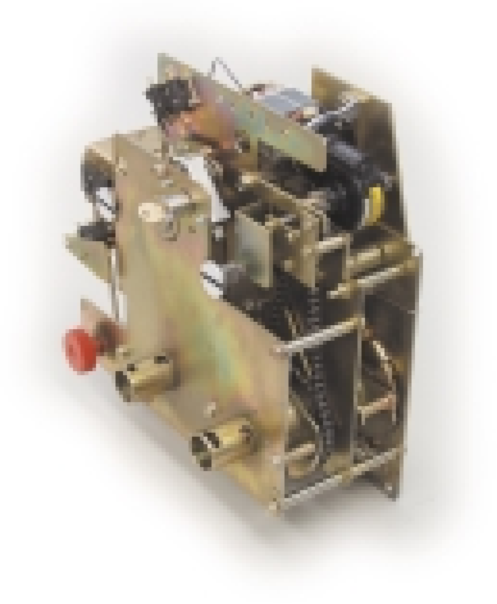


1. Function switch-disconnector: closing with the aid of a lever, open through indirect action by means of a rotary button, coil of automatic trip via HRC-circuit-breakers.

2. Function earthing switch:
Closing and opening through indirect action with the aid of a lever.

The energy needed for the controls is expanded by compressing two springs, simultaneously.

4.2.8. DP-M-MEC: CONTROL WITH DOUBLE FUNCTION



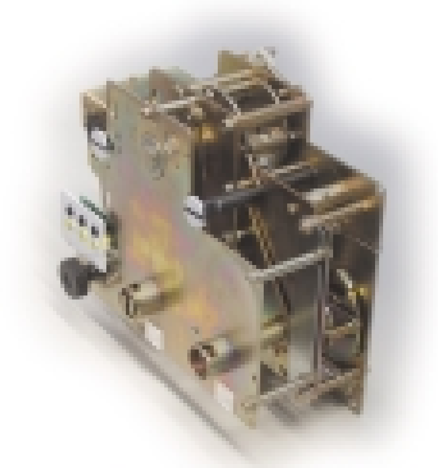
1. Function switch-disconnector: closing with the aid of an engine, to open through indirect action by means of a rotary button, coil of automatic trip via HRC-circuit-breakers.

2. Function earthing switch:
Closing and opening through indirect action with the aid of a lever.

The energy needed for the controls is expanding by compres-sing simultaneously two springs.

The drive mechanism has been fitted as standard with a motor. The following voltages can be obtained:
24 V AC/DC, 48 V AC/DC, 110 V AC/DC and 220 V AC.
However, manual control will also be possible by positioning the switch lever on the driver axle of the load break switch.

4.2.9. DP-A-MEC: CONTROL WITH DOUBLE FUNCTION

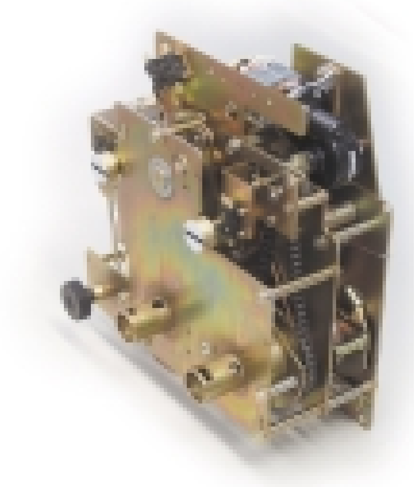


1. Function load break switch: Compressing the springs by means of the lever.
- Switching with a rotary button or a closing coil.
- Opening with a rotary button, an opening coil, or by fusing of a fuse.

2. Function earthing switch:
Closing and opening through indirect action with the aid of a lever.

The energy needed for the controls is expanded by compressing two springs simultaneously.

4.2.10. DP-A-M-MEC: CONTROL WITH DOUBLE FUNCTION



1. Function load break switch: Compressing the springs by means of the lever.
- Switching with a rotary button or a closing coil.
- Opening with a rotary button, an opening coil, or by fusing of a fuse.

2. Function earthing switch:
Closing and opening through with the aid of a lever.

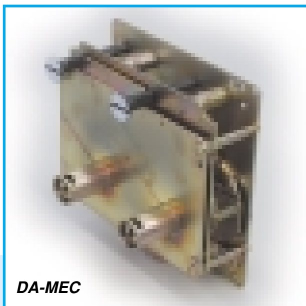
The energy needed for the controls is expanded by compressing two springs simultaneously.

The driver mechanism has been fitted as standard with a motor. The following voltages can be obtained:
24 V AC/DC, 48 V AC/DC, 110 V AC/DC and 220 V AC.
However, manual control will also be possible by positioning the switch lever on the driver axle of the load break switch.

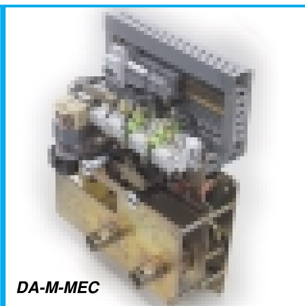
4.2. MECHANICAL DRIVES

4.2.1. INTRODUCTION

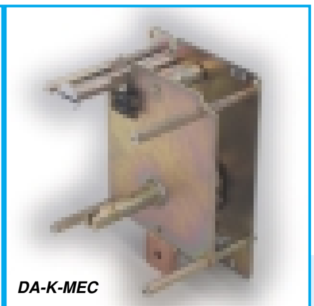
Many parts of the drive mechanism (DA-MEC, DP-MEC, with or without engine) have been manufactured out of special alloyed types of steel. These types of steel have been chosen because of their high tensile force, toughness and high resistance to bending, wringing and buckling. All sheetwork parts have been manufactured on modern laser and punch machines. All engine building parts have been manufactured at the most modern CNC process centres.
The two controls, the RV 44 switch-disconnector and the EM 20 earthing switch have been accommodated in one control mechanism. The mechanism switch independently of the operator and have absolutely no movability. In the “in” or “out” position a supplementary manual switch force bears no influence on the position of the RV 44 switch and the EM 20 earthing switch. The milled indicators show the correct position at all times of the RV 44 switch and the EM 20 earthing switch.
The force needed to control the mechanism is low and results in a high user-friendliness. The switch lever has been designed in such a manner that even cubicles positioned against a wall can be switched without a problem. The drives have been designed in such a manner that no moving parts are visible that could cause injury. It is possible to equip the mechanism with many options. These options can be very easily constructed on the standard mechanism. It is possible to disassemble the mechanism when the cubicle on which it has been assembled is in service. All metal components have been treated adequately. Special attention is paid to the springs that go through a complete stage in the area of chemical, mechanical and thermical treatment. Critical latchings even undergo a special dacromet treatment in addition. All this is to equal the high life expectancy of the RV 44 switch.



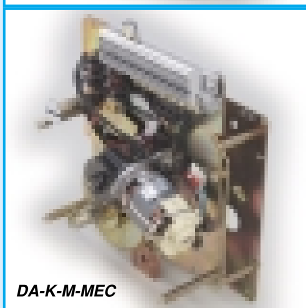
DA-MEC



DA-M-MEC

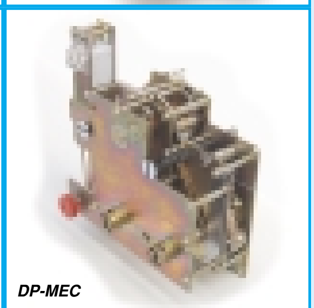


DA-K-MEC

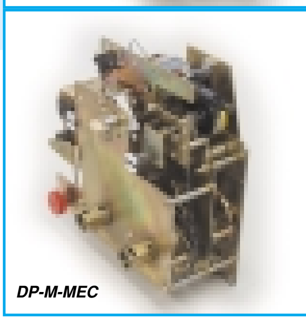


DA-K-M-MEC

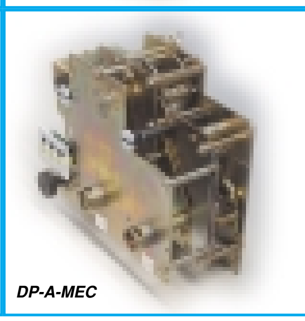
DA-EDN-D-MEC



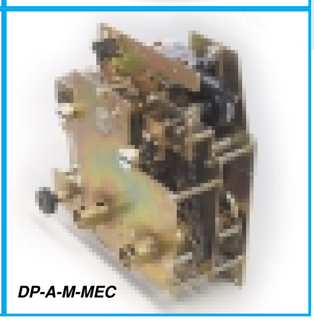
DP-MEC



DP-M-MEC



DP-A-MEC



DP-A-M-MEC

GENERALS

Because of the small dimensions of the different functional units the DF-2 system is eminently suited in cases where space is an important factor. From a practical point of view this means that the space in which the switchgear is positioned, has to meet IEC recommendations. By observing IEC recommendations the positioning of the different cubicles can occur in a normal manner. Moreover, the final result will be impeccable. When the switchgear is positioned on the provided base, the outer dimensions of the cubicles will continue to need to be taken into consideration, so that these can be positioned in a stable manner.
In order to resist to an internal arc, each cubicle needs to be anchored with the provided bolts.

The following items are of great importance during the installation and demand strict observance:

5.1. THE HEIGHT OF THE TECHNICAL ROOM

An unobstructed height of minimum **<u>2200 mm.</u>** is required. For dry transformers with a capacity of 1250 kVA or greater, unobstructed height of the room needs to be provided of at least **<u>2500 mm.</u>**

5.2. DIMENSIONS OF THE ACCESS DOORS

The minimal door height of the room consists of **<u>2200 mm.</u>**
It is important to know that all passageways to the space need to be provided with the same dimensions. If solely a DF-A, DF-P, DF-C of DF-D has been installed, a door height of **<u>2000 mm</u>** will be sufficient. In that case there are no transformers located in the room.

The width of all access doors can be chosen depending on the selected cubicles: dimensions of the widest cubicle + **<u>100 mm</u>** for standard passage way. For the correct dimensions of all cubicles we refer to the standard overview on p. 11 and to the table with the dimensions of the T-cubicle p. 25.
If there is to be a transformer in the room, its dimensions will have to be taken into account. The customer can always read about these dimensions the installation plans that Deba provides in case of order.

5.3. THE ACCESSIBILITY OF THE ROOMS

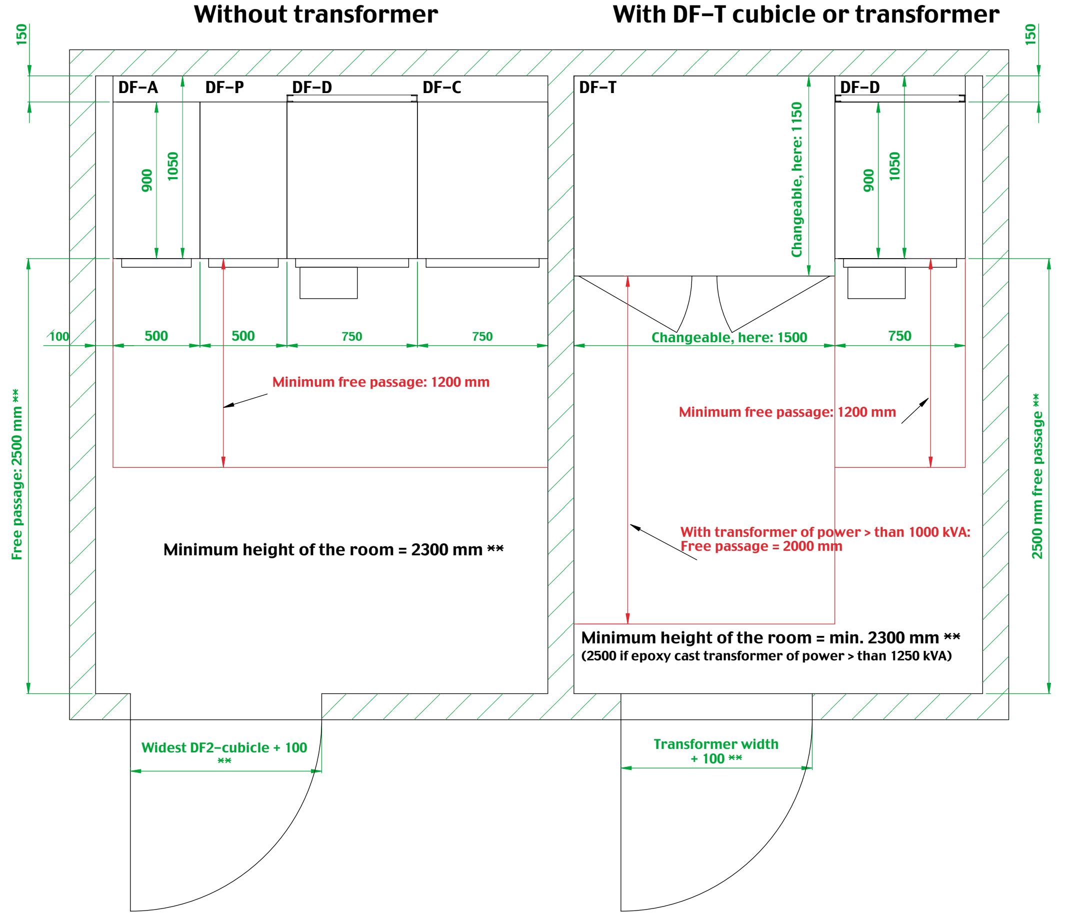
If the room cannot be accessed directly from the outside, all access doors have to meet above-mentioned dimensions.
If the room is accessed by a corridor, one has to take the turning movement into consideration that will have to be made to move the cubicle and/or the transformer into the room.

5.4. MINIMUM FREE PASSAGE FOR THE CUBICLES

The minimum free passage for the cubicles has to be at least **<u>1200 mm</u>**. However, a passage of 2500 mm is preferable because of the internal arc withstand.
The free passage for the transformer cubicles (DF-T) from 1000 kVA is **<u>2000 mm.</u>**
The cubicles need to be positioned at a distance of **<u>150 mm</u>** from the wall because of the internal arc withstand.
The transformer can be positioned against the wall.

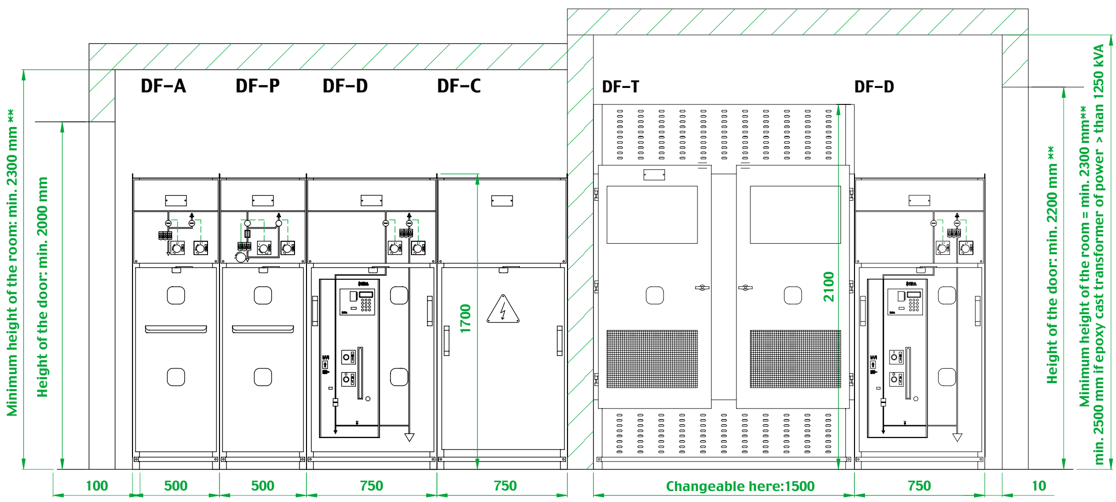
LAYOUT OF THE MV-ROOM

Without transformer | **With DF-T cubicle or transformer**



CUT VIEW OF THE MV-ROOM

Without transformer | **With DF-T cubicle or transformer**



** Other dimensions are possible in function of the specifications of the energy supplier.

5.5. THE CAPACITY OF THE TRANSFORMERS

The table below indicates the power losses in function of the cast resin transformer dry type. It is important to take this into consideration when calculating the necessary ventilation for the rooms.

Transformer capacity (kVA)	100	160	250	315	400	500	630	800	1000	1250	1600	2000
Power losses (W)	1605	2175	2850	3412	4012	4837	5745	6787	7875	10350	12450	16125

5.6. POSITIONING IN TECHNICAL ROOMS OF LEVEL-1

If the installation is not placed on the ground floor, there must be an access hatch to the level in question. The minimum dimensions of this hatch must always be 400 mm greater than the dimensions of the largest cubicle of the transformer. For the cubicle dimensions we refer to the standard overview p. 11 and the dimensions of the T cubicle p 25. The dimensions have also been clearly indicated on the drawings.

5.7. GENERAL REMARKS:

The DF-2 cubicles are designed for indoor use and are therefore placed in a room allocated for this purpose. This room should have a normal ambient temperature (a maximum of 45°C) and a normal humidity level. The cubicles are suitable for placing at elevated levels < 1000 m. For exposures to different temperatures and levels, please consult Deba. If several transformers will be installed, special attention needs to be paid to ventilation.

Important:

When positioning the cubicles one has to take into account:

- perfect levelling of the floor

- the measurements of the access doors

(If the room cannot be directly accessed from out side all access doors have to be able to accommodate the size)

Thanks to the modular concept of the system, installation of the cubicles as well as connection can be achieved very easily. We request you to follow the guidelines on the plans strictly and at all times. This will allow the installation to be carried out even more smoothly.

5.8. AFTER SALES SERVICE AND INSTALLATION

Deba offers a complete solution for service and installation of the DF-2 cubicles.
A specialised team is 24 hours a day and 7 days a week available: +32 9 371 75 51

6.1. THE PRODUCTION PROCESS OF THE DF-2 CUBICLES AT NEVELE

The DF-2 system is the result of a combination of modern design technologies and economic, ergonomic and environmently-friendly production processes. It all starts at the design department where your drawings will be customised via CAD applications. As soon as the drawings are approved production can start.

Deba's steel plate department works with the most modern machinery that can all be programmed by a CAD/CAM system. The automated laser, punch and pleating section can truly be called unique. Two ultra-fast punch-corner cutting scissor machines are each provided with an automatic loading and sorting system which sorts and saves the items. The numerous possibilities of the matrixes and plate feeders ensure that the cubicles can be uniformly produced as 100% user-friendly. After the laser and punch processing several panels are pleated on the fully automatic pleating bank, sorted and possibly continued on to a CNC-operated welding robot. This machine welds the fitting bolts and corners of the door panels and other parts. The doors are now subjected to a complete process where they are degreased, stained, phosphated, passivated and given an additional rinse with demineralised water. They are automatically sprayed with polyester powder in a powder spray cabin, after which they are baked in a oven at 200°C. The complete cubicle structure has been constructed of galvanised plates of high quality, is resistant to corrosion and has a long life expectancy.

In the assembly hall the specialised units are first pre-assembled. This split allows to dedicate the necessary care to obtaining a perfect balance and correct assembly of the constituent components. In the following stage the cubicles are assembled. This stage has been determined according to strict assembly procedures. After assembly, all cubicles undergo an extremely thorough control. The electrical tests include resistance measurements on the RV 44 load break switch and EM 20 earthing switch. The cubicle is subjected to a voltage test of 50 kV / 1 min. The most striking test is the one in which the closing speed of the load break switch and earthing switch is measured. One can even check the post-vibration of the electrical points during switching on a digital screen. The mechanical tests are used to check all fitting material, and the correct positions of parts and interlocks.

Right before being dispatched the cubicles will go to a final control point; this is where possible custom oriented optional features will be installed and checked separately. The cubicle is now ready for dispatch ... to a happy and satisfied customer!

Are you interested in taking a closer look at production ?
Do not hesitate to make an appointment for a visit.

6.2. THE PRODUCTION PROCESS OF THE SWITCHGEAR AT DEINZE

The DF-2 switch components are assembled in the production halls of Deba in Deinze. At first all incoming goods are checked for measurements, shape and position tolerance, surface roughness and surface treatment in the **measuring lab.** The electronic hardness measurements are conducted in practically all possible hardness scales. Moreover, all welded items are assessed before continuing the production process.

The **DP and DA mechanisms** of Deba distinguish themselves by their functional properties. They are assembled on working stations which have been established according to the findings of an in-depth labour analysis. The stations have been fitted with specially designed fittings in such a way that the operator has access from all directions to the mechanisms to be assembled. All the mechanisms can be equipped with all possible optional features. Before the mechanisms are given a final serial number, a thorough control procedure is carried out: mechanical actions are being controlled, optional features are being electrical tested and all interlocks are being checked. In case of more complex mechanisms some parts are being pre-assembled. Pre-assembly allows a better control in the production, especially when fine-mechanical parts and axle bearings need to be prepared.

The assembly of the **RV 44** switch-disconnectors is carried out by specially designed computer-operated assembly robots and evolves according to the applicable IEC standard 60265.1. The testing and filling procedure is carried out by fully automatic gas-fill installations connected to Helium leak detector. This High-tech combination is located in a dust-free “clean room” with a double air lock system. Each of these machines checks its own operations during each manoeuvre excluding any faulty action. This way Deba can guarantee equal quality for each switch. After assembly several switches are driven at once into the autoclaves for the appropriate leak test and fill procedure. The autoclaves and the switches are first vacuum pumped and a vacuum difference is created between the switches and the autoclaves. If there is no vacuum attrition, there is no vacuum leak. After these tests and approval the switches are filled with Helium under low pressure. Now it is checked if the mass spectrum meter can detect Helium atoms. This control takes place in the medium-fine vacuum area. After approval the switches are filled with He under high pressure. The mass spectrum meter tries again to detect Helium atoms. Afterwards the high vacuum area is tested. The built-in gas detectors linked to a mass spectrum meter again determine the leak limit value of the switches. After this final approval the Helium is evacuated out of the switches then filled with SF_6-gas under a pressure of 1.5 bar absolute. The switch is now ready for transport.

The earthing switch **EM 20** is an important part of the DF-2 concept and therefore also needs a precise assembly. The working station operates according to the FIFO-principle (First in, First out) with the result that the used materials will never be outdated. During the production process the moving contact pressure of the earthing switch are carefully calibrated as this is an important indicator for transient resistance. All connections are assembled on specified torques (Nm) by using adapted pneumatic tools. At last the phasing distance is being mutually checked for perfect matching with the RV 44 switch-disconnector.

Deba also possesses a **R&D centre** in Deinze. The objectives of this department are multiple and shape the company’s future. In addition to our continuous improvement and striving for a better quality, we also consider the use of modern technology and an extremely high degree of safety of the developed sets to be a paramount importance. Consumer satisfaction is an essential part of the engine behind this department.

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A road description is available on request or can also be found on our web site.

Interested in a company visit?
Do not hesitate to contact us for an appointment.
You are always welcome.

Notes :

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