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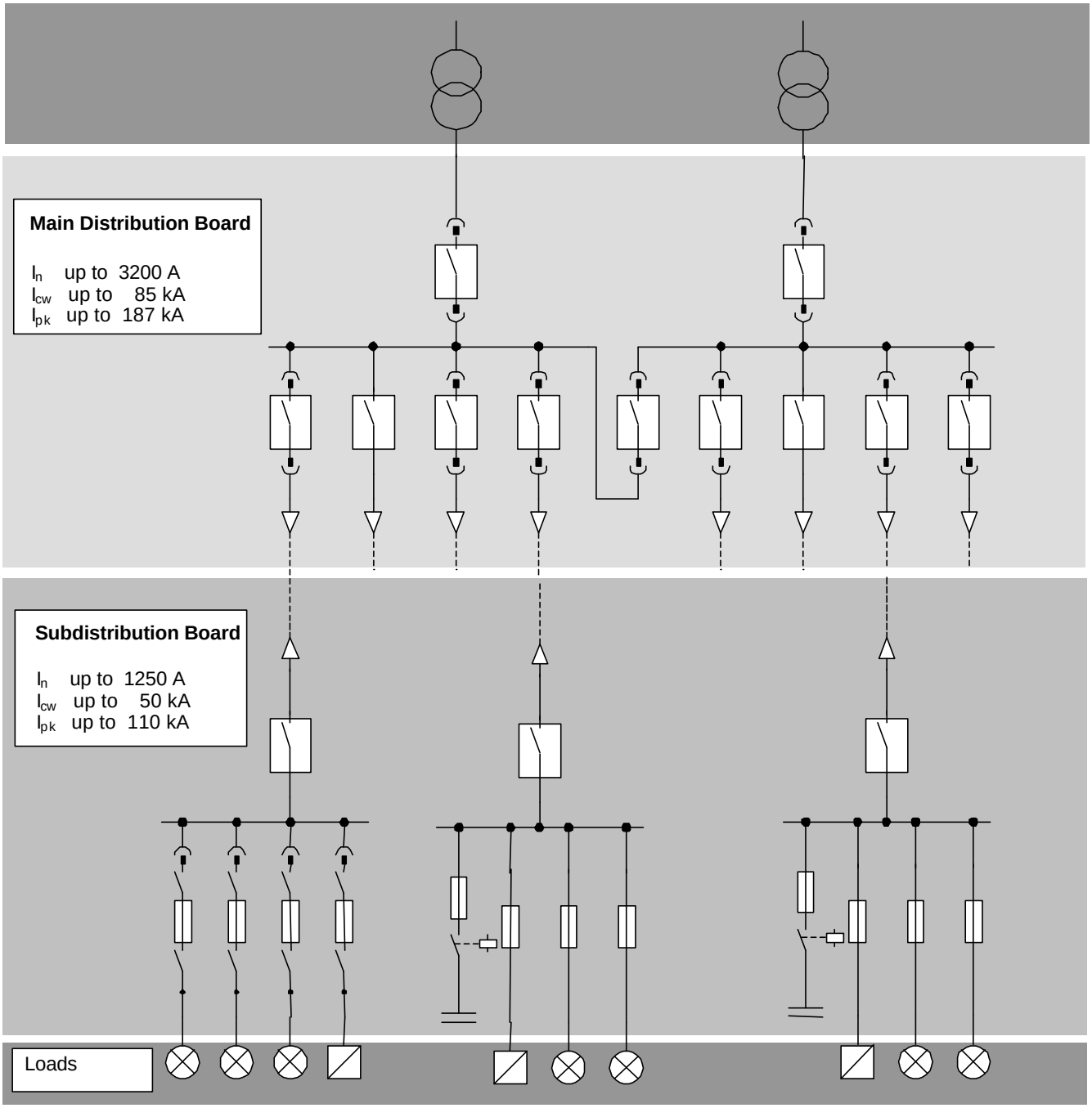
SIVACON for all Applications in Low-Voltage Network



Values refer to main busbar system

Type-tested Main Distribution Board SIVACON 8PT with Busbars rear

The SIVACON low-voltage switchboard is the standard solution for building and industrial technology. SIVACON is tailored to the needs of the world market, i.e. it takes into account the call for standard solutions from a single source on the one hand and on the other for local production and the resulting advantages in terms of financing and procurement close to the plant. As a power distribution board, SIVACON is available throughout the world and can be used for all applications up to 3200 A.

Modular Technology

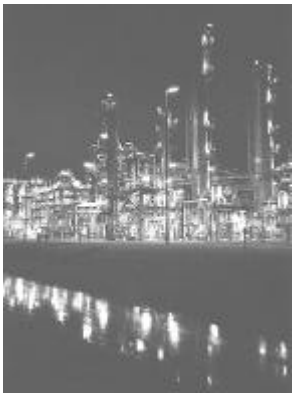
Every SIVACON is made exclusively from standardized and type-coded modules. All modules embrace a high quality conforming to Siemens design specifications. The multiple possibilities to combine the components fulfill every requirement. The exclusive use of high-quality Siemens switchgear ensures a long service endurance and reliable operation.

- Safety and proven quality for every system by type-testing
- Siemens switchgear for reliable operation
- Worldwide presence with local production

SIVACON offers advantages that set new standards:

- Type-tested standard modules (TTA)
- Variable busbar position at rear of the cubicle
- Busbar system 3 and 4 pole up to 3200 A
- Short-circuit strength I_{pk} up to 187 kA
- Multifarious combination possibilities
- Single front and back-to back installation
- Cable entry from above or below

Typical applications



Chemicals and mineral oil industry:
Main distribution boards

Power industry: power station
and auxiliaries systems

Public/private contractors:
building systems

Definitions

The definitions explained below are used in this catalog in conformity with VDE 0660, Part 500 and IEC 60439-1.

Low-voltage switchgear assembly
A combination of one or several low-voltage switching devices with affiliated equipment for controlling, measuring, signaling and the protective and control facilities etc., assembled completely under the manufacturer's responsibility, with all internal electrical and mechanical connections and construction components.

Type-tested low-voltage switchgear assembly (TTA)
Low-voltage switchgear assembly that conforms, without any substantial deviations, with the original type or system of the switchgear assembly that has been type-tested in accordance with the standard.

Function unit
Part of a low-voltage switchgear assembly with all electrical and mechanical components that contribute towards fulfillment of the same function.

Removable part

Part which, as a whole, may be removed from the switchgear assembly and replaced, even if the circuit to which it is connected is live.

Withdrawable unit
A withdrawable part which can be placed in a position in which an isolating gap is open, while it remains mechanically connected to the switchgear assembly.
Note: this isolating gap may be located on its own in the main circuits or in the main and auxiliary circuits.

Fixed part
Module consisting of equipment that is assembled and wired on one common load-bearing construction for fixed mounting.

Connected position
Position of a removable part or withdrawable unit in which it is fully connected for the intended function.

Test position
Position of a withdrawable unit in which the relevant main circuits on the incoming feeder end are open, but the requirements for an isolating gap do not need to be met, and in which the auxiliary circuits are connected in such a way that the functions of the withdrawable unit can be checked, but it remains mechanically connected to the switchgear assembly.
Note:
Opening may also be established by actuation of a suitable facility without any mechanical movement of the withdrawable unit.

Disconnected position
Position of the withdrawable unit in which isolating gaps in the main and auxiliary circuits are open while it remains mechanically connected to the switchgear assembly.
Remark:
The isolating gap may also be established by actuation of a suitable facility without mechanical movement of the withdrawable unit.

Removed position
Position of a withdrawable part or unit when it is located outside of the switchgear assembly and is separated from it mechanically and electrically.

Frame
A part of a switchgear assembly intended to support various components of a switchgear assembly or of a housing.

Housing
Part which protects the equipment against specific external influences and which provides protection from any direction against direct contact with a degree of protection of at least IP 2X.

Cubicle
Unit of a switchgear assembly between two successive vertical limiting levels.

Sub-section
Unit of a switchgear assembly between two successive horizontal limiting levels within one cubicle.

Compartment
Cubicle or sub-section which is enclosed except for the openings that are necessary for connection, control or ventilation.

Transport unit
Part of a switchgear assembly or a complete switchgear assembly suitable for shipping without being dismantled.

Rated diversity factor
The rated diversity factor of a switchgear assembly or of a part thereof (e.g. a cubicle or a sub-section) embracing several main circuits is the ratio of the largest sum of all currents to be expected at any given time in the relevant main circuits to the sum of the rated currents of all main circuits of the switchgear assembly or of the considered portion of the switchgear assembly. If the manufacturer specifies a rated diversity factor, this value must be applied during the course of heat development testing.

Number of main circuits	Rated diversity factor
2 and 3	0.9
4 and 5	0.8
6 up to and including 9	0.7
10 and more	0.6

Definitions

The most common definitions and abbreviations used for low-voltage switchgear assemblies, and their explanations, are listed below:

Definition	Explanation	Terms previously used
Rated short-time withstand current (I_{cw})	RMS value of the AC component of the short-time current that can be conducted for 1 second without damage. If time values are less than 1 second, the current and time period must be specified; e.g. 50 kA, 0.3 s Note: For time values up to 3 s $\Rightarrow$ $I^2 \times t$ = constant Calculation example for 3 s value (I_{cw} 50 kA): 3s value = $\sqrt{\frac{I^2 x t(1s)}{t(3s)}} = \sqrt{\frac{(50kA)^2 x 1s}{3s}} \Rightarrow$ 28.9 KA	Initial short-circuit AC current (I_k") or rated short-time current (I_{thr})
Rated peak withstand current (I_{pk})	Value of peak current under short circuit conditions ($I_{pk} = I_{cw} \bullet n$)	Rated impulse current (I_s) or short-circuit impulse current (i_p)
Rated current (I_n)	The rated current of a circuit on an assembly, stated by the manufacturer, taking into consideration the ratings of the components within the assembly, their position and application. This current must be carried without the temperature rise of its several parts exceeding the limits of IEC 60439-1 clause 7.3 when verified according clause 8.2.1	Nominal current (I_{th}, I_N) or nominal operating current (I_{the})
Rated ultimate short-circuit breaking capacity (I_{cu}) (for circuit-breakers)	Test sequence III O – t – CO (Breaking-Pause-On/Breaking) No temperature rise test required after test sequence	Nominal short-circuit breaking capacity (I_{cn}) Test sequence P1
Rated service short-circuit breaking capacity (I_{cs}) (for circuit-breakers)	Test sequence II O – t – CO – t - CO After the test sequence the specimen must undergo a temperature rise test without exceeding the temperature rise limits specified in IEC 60947-2	Nominal short-circuit breaking capacity (I_{cn}) Test sequence P2
Coordination type 1 (performance under short circuit conditions for motor starters)	Under short circuit conditions the starter shall cause no danger to persons or installation and may not be suitable for further service without repair and replacement of parts	"Class a" type of protection (IEC 292-1 superseded by IEC 947-4)
Coordination type 2 (performance under short circuit conditions for motor starters)	Under short circuit conditions the contactor or starter shall cause no danger to persons or installation and shall be suitable for further use. The risk of contact welding is recognized, in which case the manufacturer shall indicate the measures to be taken as regards the maintenance of the equipment (easy separation of contactor contact pieces without damaging the contact base)	"Class c" type of protection (IEC 292-1 superseded by IEC 947-4)
Rated operational voltage (U_e)	This is the voltage value, which, together with the rated current, determines the application of a circuit	Nominal operational voltage (U_e)
Rated insulation voltage (U_i)	This is the voltage value to which dielectric test voltages and creepage distances are referred.	Nominal insulation voltage (U_i)
Rated impulse withstand voltage (U_{imp})	This is the peak value of an impulse voltage which a circuit can withstand without failure and to which the values of clearances refer.	---
Rated impulse withstand voltage (U_{imp})	This is the peak value of an impulse voltage which a circuit can withstand without failure and to which the values of clearances refer.	---
Clearance	Distance between two conductive parts along a thread that is stretched the shortest way between these parts	Clearance in air
Isolation distance	Contact parting travel of a switching device which meets the values of clearance given for disconnectors	Isolation gap
Rated diversity factor ***Number of main circuits*** / ***Diversity factor*** *2 and 3* / *0.9* *4 and 5* / *0.8* *6 up to and including 9* / *0.7* *10 and more* / *0.6*	Is the ratio of the maximum sum, at any one time, of the assumed currents of all the main circuits involved (of an assembly or part thereof), to the sum of the rated currents of all the main circuits.	Nominal load factor or simultaneity factor

Preferred values of the factor n			The value of peak short circuit current (peak value of the first loop of the short circuit current including D.C. component) for determining the electrodynamic stresses shall be obtained by multiplying the r.m.s. value of the short circuit current by the factor n Allocation of the peak value and rms value of the short-circuit current: e.g.: I_{cw} = 100 kA, factor n = 2.2 I_{pk} = 100 kA x 2.2 = 220 kA The IEC standard values represent the majority of applications.	Preferred values of the factor n
RMS value of short-circuit current (kA)	***cos j***	***n***		
I £ 5	*0.7*	*1.5*		
5 < I £ 10	*0.7*	*1.7*		
10 < I £ 20	*0.3*	*2*		
20 < I £ 50	*0.25*	*2.1*		
50 < I	*0.2*	*2.2*		

Technical Data

Standards and specifications	Type-tested switchgear and control gear assembly (TTA) Testing of response to internal faults (arcing faults) (440 V, 50 kA, 300 ms)	IEC 60439-1(1999), DIN EN 60439-1 (VDE 0660 Part 500) IEC 61641, VDE 0660 Part 500, Supplement 2			
Creepag distances and clearance	Rated impulse withstand voltage (U_{imp}) Overvoltage category Pollution degree			8 kV III 3	
Rated insulation voltage (U_i)				1000	V
Rated operational voltage (U_e)			up to	690	V
Rated currents (I_n) busbars (3 pole and 4 pole)	Main horizontal busbars	Rated current Rated peak withstand current (I_{pk}) Rated short-time withstand current (I_{cw})	up to up to up to	3200 187 85	A kA kA, 1 s
	Vertical busbars for circuit-breaker design	Rated current Rated peak withstand current (I_{pk}) Rated short-time withstand current (I_{cw})	up to up to up to	3200 187 85	A kA kA, 1 s
	Vertical busbars for fixed-mounted design	Rated current Rated peak withstand current (I_{pk}) Rated short-time withstand current (I_{cw})	up to up to up to	1150 110 50	A kA kA*, 1 s
	Vertical busbars for In-line plug-in design 3NJ6	Rated current Rated peak withstand current (I_{pk}) Rated short-time withstand current (I_{cw})	up to up to up to	2100 110 50	A kA kA*, 1 s
Switchgear rated currents		Circuit-breakers Outgoing feeders	up to up to	3200 630	A A
Surface treatment	Frame parts, base Enclosure Doors, side panels, base covers	galvanised galvanised powder-coated			
Degree of protection	acc. to IEC 60529, EN 60529	IP 30 to IP 54			
Dimensions		Height: Width: Depth:		2000, 2200 mm (with base) 400, 600, 800, 850, 1000, 1200 mm 600 mm	

* Rated conditional short-circuit current I_{CC} up to 100 kA

Ambient Conditions/Degree of Protection

Environmental conditions for switchboards

The external climate and the external ambient conditions (natural foreign bodies, chemically active pollutants, small animals) may exert differing degrees of influence on the switchgear. Influences depend on what kind of air-conditioning system is installed in the switchgear room. The need for additional measures implemented on the switchgear therefore depends on the resulting interior climates, which are subdivided into three environmental classes:

Environmental class IR 1 (interior 1):

Interior of buildings with good thermal insulation or a high thermal capacity, heated or cooled; normally only the temperature is monitored, e.g. normal living rooms, offices, shops, transmission and switching exchanges, storage rooms for sensitive products.

Environmental class IR 2 (interior 2):

Interior of buildings with low thermal insulation or low thermal capacity, heated or cooled, without temperature monitoring. Heating or cooling may fail for several days on end, e.g. unmanned relay, amplifier and transformer stations, stables, automotive workshops, large manufacturing rooms, hangars.

Environmental class IR 3 (interior 3):

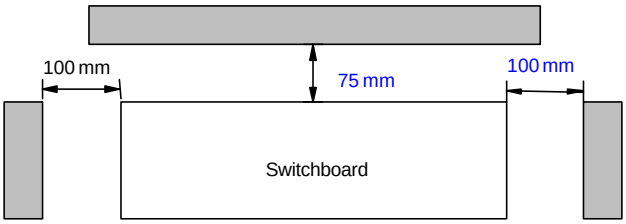
Interior of buildings without special thermal insulation and low thermal capacity, neither heated nor cooled, in humid heat regions too, e.g. work rooms, telephony rows, building entrances, barns, storerooms, unheated storerooms, sheds, garages and network stations.

Environmental conditions in the switchgear room				**Measures on the switchgear**				
Room climate in accordance with IEC 60721-3-3 acting directly on the switchgear	Ambient temperature Relative humidity	Condensation	Natural foreign matter, chemical pollutants, small animals	Heating	Degree of protection to operation area	Degree of protection to cable basement	Contact Treatment	
							Screwed Points	Moving contacts
Environmental class IR1	+5 to +40 °C 5 % to 85 % 24 h average max. 35 °C	None	None	--	IP30/40	--	--	--
Environmental class IR2	-25 to +55 °C 10 % to 98 % 24 h average max. 50 °C	Occasionally, approx. 1 x per month for 2 hours	None Flying sand, dust Small animals	-- -- --	IP30/40 IP54 IP40	-- -- IP40	-- -- --	-- -- --
Environmental class IR3	-25 to +55 °C 10 % to 98 % 24 h average max. 50 °C	Frequently, approx. 1 x per day for 2 hours	none Blown sand, dust Dripping water to IEC 60529 Blown sand, dust and dripping or splashing water to IEC 60529 Small animals	• • • • •	IP30/40 IP54 IP31/IP41 IP54 IP40	-- -- -- -- IP40	-- -- -- -- --	-- -- -- -- --
Regions with chemical emission		Continuously permissible concentration		Measures for higher concentrations				
		Sulphur dioxide (SO_2)	= 2 ppm	Pollutant-reducing measures are necessary in the event of higher concentrations, e.g. – Air intake for the operating room from a location with a low burden – Put the operating room under a slight excess pressure to atmospheric pressure to prevent inward diffusion of pollutants – Oversize switchgear or components such as busbars and distribution bars (Reduction of temperature rise)				
		Hydrogen sulphide (H_2S)	= 1 ppm					
		Hydrogen chloride (HCl)	= 3 ppm					
		Ammonia (NH_3)	= 15					
		Nitrogen oxides (NO_2)	= 2					
		Chloride covering C1 (salt mist)	= 2 mg/dm²					

Installation

Cubicle depth 600 mm: placed against wall or free standing

The following minimum clearances between the switchgear and obstacles must be observed:



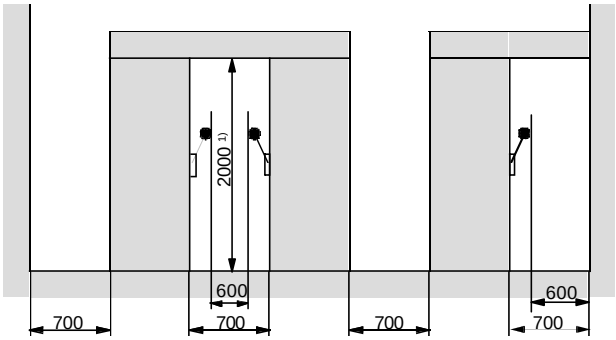
Dimensions refer to the frame dimensions.
A clearance of at least 300 mm from obstacles must be observed above the cubicles.

Installation altitudes in excess of 2000 m above MSL (mean sea level).

Reduction factors for cubicle installation altitudes in excess of 2000 m above MSL	
Altitude of installation site	Load reduction factor
up to 2200 m	0,88
2400 m	0,87
2500 m	0,86
2700 m	0,85
2900 m	0,84
up to 3000 m	0,83
3300 m	0,82
3500 m	0,81
up to 4000 m	0,78
4500 m	0,76
up to 5000 m	0,74

Operating and Maintenance Aisles

(acc. to DIN VDE 0100 part 729)



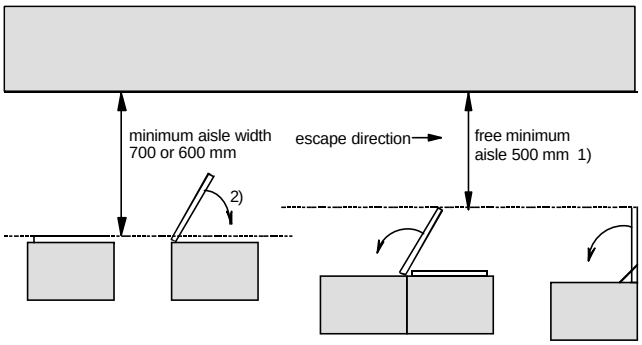
1) Minimum passage height under coverings or envelopments

Important:
When a lift truck is used to insert circuit-breakers, the minimum aisle widths must be coordinated to the lift truck.
Manufacturer: e.g. Kaiser + Kraft

Lift truck dimensions: Height 2000 mm
Width 680 mm
Depth 920 mm

Minimum aisle width: approx. 1500 mm

Reduced aisle widths in the area of open doors



1) In the case of switchgear fronts opposite one another, restriction by open doors (i.e. by doors that do not close in the escape direction) is reckoned with on only one side

2) Pay attention to door widths, i.e. a door must open by at least 90°

Door opening angle:
with single-cubicle arrangement = 180°
with multi-cubicle arrangement = 140°

Door width	Aisle width reduction with multi-cubicle arrangement
400 mm	260 mm
600 mm	390 mm
800 mm	520 mm
850 mm	550 mm

In the case of SIVACON, reduction in aisle width is not necessary if the doors can always be fitted so as to ensure that they close in the escape direction.

Maximum door width for each design	
Circuit-breaker design	800 mm
Fixed mounted design	850 mm
Reactive power compensation	800 mm
In-line plug-in design 3NJ6	600 mm

Transport

A transport unit can consist optionally of one ore more cubicles. The single or joint cubicles are bolted on transportation supports. Sufficient stability has to be ensured while transporting the switchboard.
The stability can be ensured e.g. by transportation supports with following dimensions:

Recommendation:

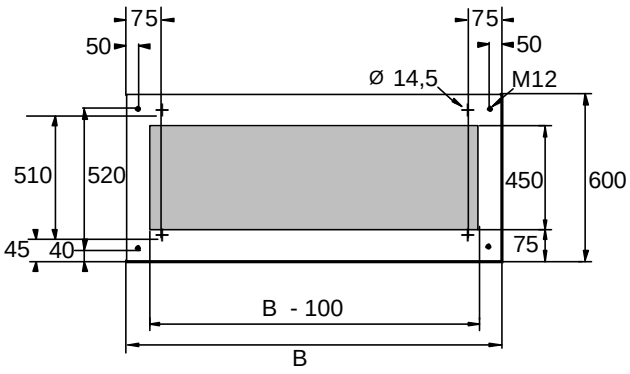
Transport floor length: transport unit length + 200 mm (min. 1400 mm)

Transport floor height: 190 mm

Transport floor depth: 1050 mm

Floor cutouts

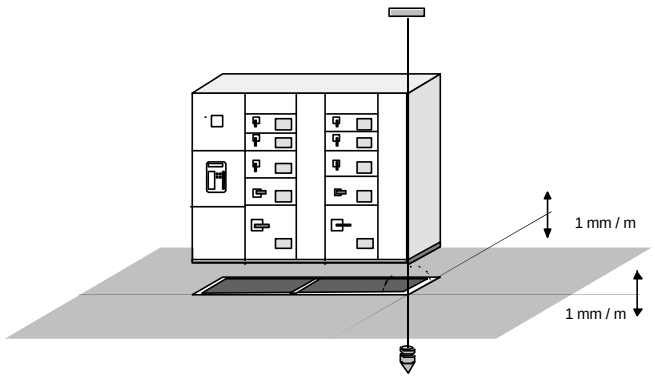
Cubicle depth 600 mm



Space for cables and busbar bushings
In the fixing plane

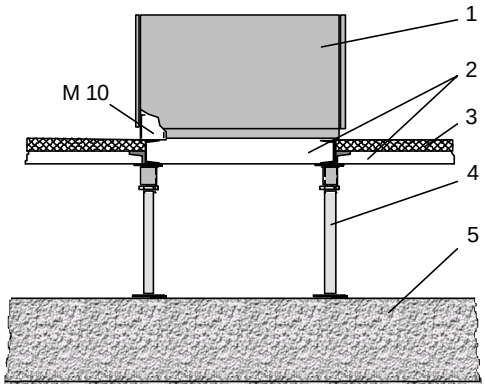
Foundation frame

Tolerances for fixing plane:



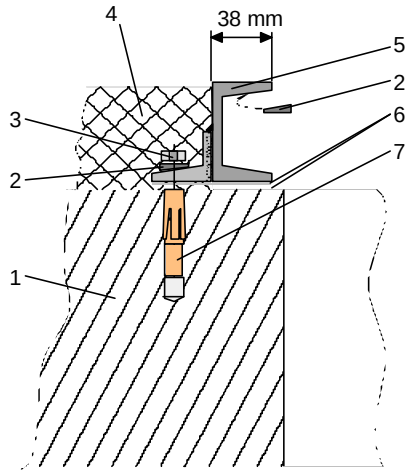
Attention: when using partitions for the cubicle-to-cubicle separation, the sheet thickness of the partitions of each 1mm have to be considered.

Installation on intermediate floor:



1 switchboard
2 box girder
3 fitted floor plate
4 support, adjustable
5 concrete floor

Foundation frame fixed on concrete:



1 concrete floor
2 washer DIN 434
3 bold
4 screed
5 foundation frame, e. g. U-profile DIN 1026
6 shims for levelling
7 heavy duty dowel

Rated Currents and Initial Short-Circuit AC Currents of Three-Phase Distribution Transformers with 50 to 3150 kVA

Rated voltage U_{rT}	400/230V, 50 Hz			525 V, 50 Hz			690/400 V, 50 Hz		
Rated value of the short-circuit voltage u_{kr}		4 %[1]	6 %[2]		4 %[1]	6 %[2]		4 %[1]	6 %[2]
Rated power	Rated current I_r	Initial short-circuit AC current I_k[3]		Rated current I_r	Initial short-circuit AC current I_k[3]		Rated current I_r	Initial short-circuit AC current I_k[3]	
kVA	A	A	A	A	A	A	A	A	A
50	72	1933	1306	55	1473	995	42	1116	754
100	144	3871	2612	110	2950	1990	84	2235	1508
160	230	6209	4192	176	4731	3194	133	3585	2420
200	288	7749	5239	220	5904	3992	167	4474	3025
250	360	9716	6552	275	7402	4992	209	5609	3783
315	455	12247	8259	346	9331	6292	262	7071	4768
400	578	15506	10492	440	11814	7994	335	8953	6058
500	722	19438	12020	550	14810	9158	418	11223	6939
630	910	24503	16193	693	18669	12338	525	14147	9349
800	1154	-	20992	880	-	15994	670	-	12120
1000	1444	-	26224	1100	-	19980	836	-	15140
1250	1805	-	32791	1375	-	24984	1046	-	18932
1600	2310	-	39818	1760	-	30338	1330	-	22989
2000	2887	-	52511	2200	-	40008	1674	-	30317
2500	3608	-	65547	2749	-	49941	2090	-	37844
3150	4550	-	82656	3470	-	62976	2640	-	47722

[1] u_{kr} = 4 %, standardized to DIN 42503 for S_{rT} = 50 ... 630 kVA
[2] u_{kr} = 6 %, standardized to DIN 42511 for S_{rT} = 100 ... 1600 kVA
[3] I_k Uninfluenced initial transformer short-circuit AC current when connecting to a network with an unlimited short-circuit power considering the voltage and rating factor of the transformer impedance according to DIN EN 60909 / DIN VDE 0102 (July 2002)

Short-Circuit Current Carrying Capacity of the Distribution Bars and Functional Units

The following statements apply to the short-circuit current carrying capacity of the distribution bars and functional units:

A reduction in the short-circuit strength of the feeders in comparison with the main busbars is permissible in conformity with VDE 0660 T500/4.94 (IEC 60439-1: 1992 + corrigendum 1993), section 7.5.5.1.2:

7.5.5 Circuits within switchgear assemblies

7.5.5.1 Main circuits

7.5.5.1.2 *Within one cubicle, the conductors (including the distribution bars) between the main busbars and the incoming feeder end of functional units including the components of these units may be designed for the reduced short-circuit load that occurs on the output end of the short-circuit protection facility of this unit, provided these connections are arranged in such a way that no short-circuit between phase conductors and/or between phase conductors and the PE conductor is to be expected under usual operating conditions. Such connections should preferably be established by means of solid conductors. Flexible conductors may be used if they are insulated and if they are adequately reliably secured.*

Note:
The definition above results from the fact that, in most cases, the distribution bars, contact systems from withdrawable units and the other supply lines to function units that branch off the main busbar are designed for considerably lower currents than the main busbar. With the small cross-sections that are adequate for the low feeder currents from the point of view of heat development, there is no point in aiming for the same dynamic and thermal short-circuit strength as for the main busbar.

Example:
If a prospective short-circuit current of 100 kA is to be expected and it is intended to use a 3VF5 circuit-breaker, it must naturally possess a switching capacity of 100 kA, but only allows a current with a peak value of approximately 50 kA to pass through, which corresponds to an rms value of only around 35 kA. Then, only this reduced current puts a load on all conductors of the circuit for the very short breaking time of the circuit-breaker.

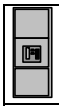
Rated Short-Circuit Breaking Capacity of the Circuit Breakers ACB, MCCB

Important note for the projecting!

The projecting tool SIMARIS SIVACON provides access to Air Circuit-Breakers and Molded Case Circuit-Breakers with standard making and breaking capacity.
The Order-No. has to be changed if there are higher requirements for the breaking capacity.

Power Dissipation Values

The power dissipation values stated below consist of approximate data for one cubicle with the main circuit of functional units to determine the dissipated power to be extracted from the switchroom. If applicable, power dissipation values of additional auxiliary devices must be taken into account.

 **Circuit-breaker design with 3WL (withdrawable unit)** **1 circuit-breaker/cubicle**		**approx. P_v [W] at % of rated current**	
		100	**80**
3WL1106 630 A	BG. I	270	180
3WL1108 800 A	BG. I	440	280
3WL1110 1000 A	BG. I	690	440
3WL1112 1250 A	BG. I	740	470
3WL1116 1600 A	BG. I	830	530
3WL1220 2000 A	BG. II	1080	690
3WL1225 2500 A	BG. II	1700	1090
3WL1232 3200 A	BG. II	2650	1690
 **Circuit-breaker design with 3VL (fixed-mounted)** **1 circuit-breaker/cubicle**		**approx. P_v [W] at % of rated current**	
		100	**80**
3VL5763 630 A		360	230
3VL6780 800 A		570	360
3VL7712 1250 A		510	320
3VL8716 1600 A		740	480
Fixed-mounted design:		**approx. P_v = 600 W**	
In-line plug-in design 3NJ6:		**approx. P_v = 1500 W**	

Cubicle Designations and Abbreviations

Cubicle type (German)	**Cubicle type (English)**	**Abbreviation**
Einspeise- und Abgangsfeld für 1 Leistungsschalter (Festeinbau oder Einschubtechnik)	**F**eeder **C**ircuit-**B**reaker for **1** circuit-breaker (fixed-mounted or withdrawable)	FCB1
Längskupplung Für Leistungsschalter (Festeinbau oder Einschubtechnik)	**B**us **C**oupling **L**ongitudinal for circuit-breakers (fixed-mounted or withdrawable)	BC L
Querkupplung für Leistungsschalter (Festeinbau oder Einschubtechnik)	**B**us **C**ouplers, Transverse for circuit-breakers (fixed-mounted or withdrawable)	BC T
Kabelabgangsfeld Festeinbau - Lasttrennleisten 3NJ4 bis 630 A	**O**utgoing **F**eeder **F**ixed-Mounted - in-line **d**isconnectors 3NJ4 up to 630 A	OFFD
Stecktechnik - Lasttrennleisten 3NJ6	**P**lug-In - in-line **d**isconnectors 3NJ6	OFPD
Kompensationsfeld Festeinbau	**P**ower **F**actor **C**orrection Cubicles Fixed-Mounted	PFC
Kabelabgangsfeld Festeinbau	**O**utgoing **F**eeder **F**ixed-Mounted	OFF
Felder für freie Projektierung	**C**ubicles for **C**ustomised **S**olutions	CCS