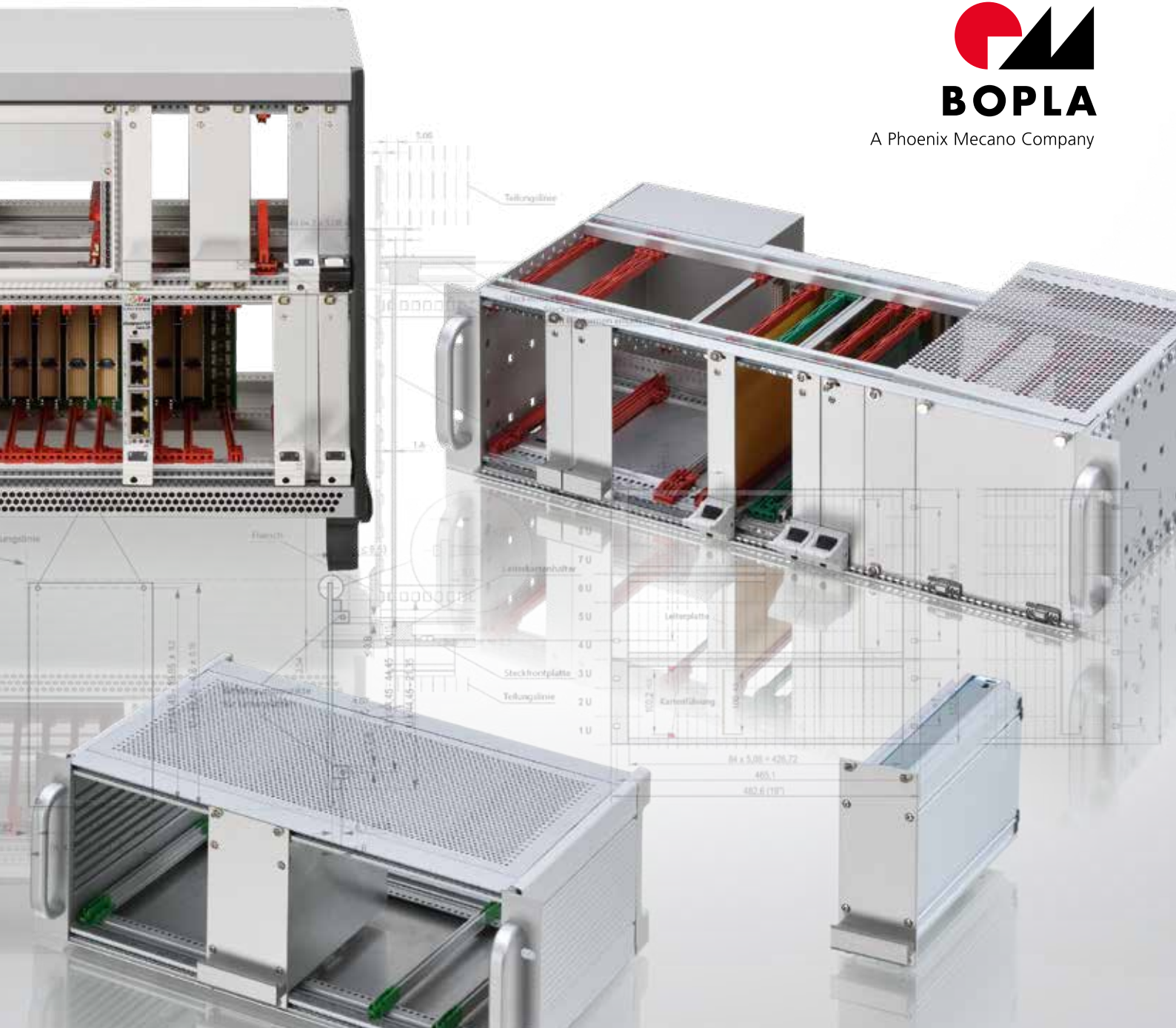




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19" SYSTEMS

Standard overview

BOPLA
enclosures ■ content matters

The world of 19 inch applications

The 19" assembly system consists of dimensionally-matched mechanical and electromechanical components which allow the mechanical design and wiring in a modular construction of electrical devices and equipment. The dimensional harmonisation of the components is completed by means of specific pitch lines, in particular with regard to hole positions and rows of holes.

For this reason, the 19" assembly system can be described as the "mechanical construction kit" for electronic devices and equipment.

The 19-inch assembly system is designed in such a way that complete devices and equipment can be built up in a modular form. This means that in their electrical functions, various plug-in units are assembled mechanically in accordance with standardised measurements or with coordinated dimension levels.

This guarantees that plug-in units can be positioned next to each other as required and that in turn subracks with different module insertions can be used on top of each other in one frame, cabinet or enclosure.

Internorm Stil



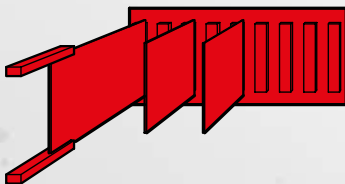
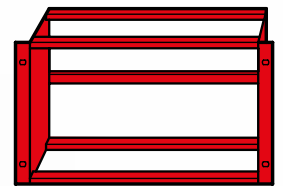
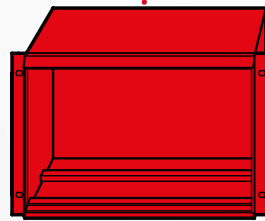
Interzoll Plus



Interzoll



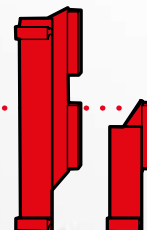
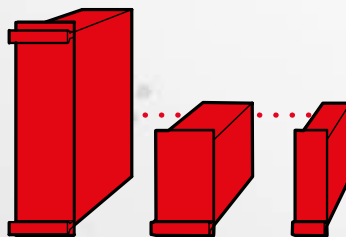
Intertego



Electronic



Plug-in unit



Plug-in front panel & accessories

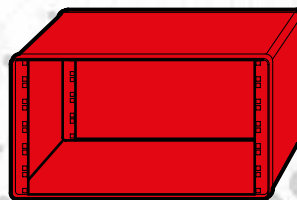
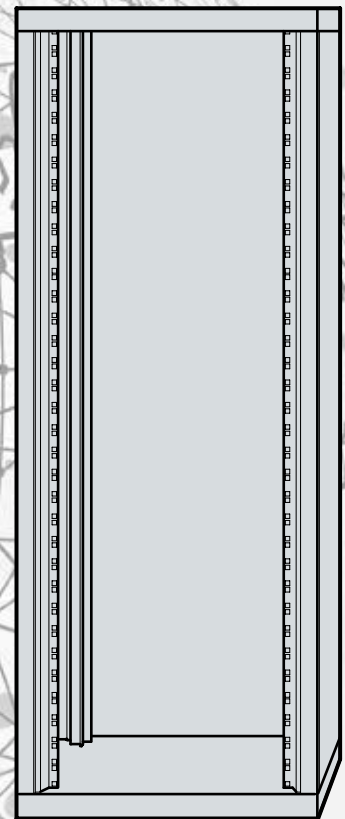




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Interzoll Modul



Internorm

19" definitions

Terms and names

All dimensions in the very comprehensive 19" system are stated in millimetres. However, some basic dimensions have been taken over from measurements which were originally in the imperial system (inches), for example the 19" measurement. The 19" assembly system would be more correctly better described as the "482.6 mm assembly system".

In spite of the designation "19-inch assembly system", the 19-inch measurement (= 482.6 mm) does not have a key function. The 19-inch measurement is only used once as a width dimension for the front panel of plug-ins and subracks and is derived from US standard C38.9 which is used worldwide.

As the first standardised measurement of the assembly system, it also provided the name for it.

19" subracks are open metal enclosures which can be used to hold PCBs (e.g. Euro cards) and/or plug-in units.

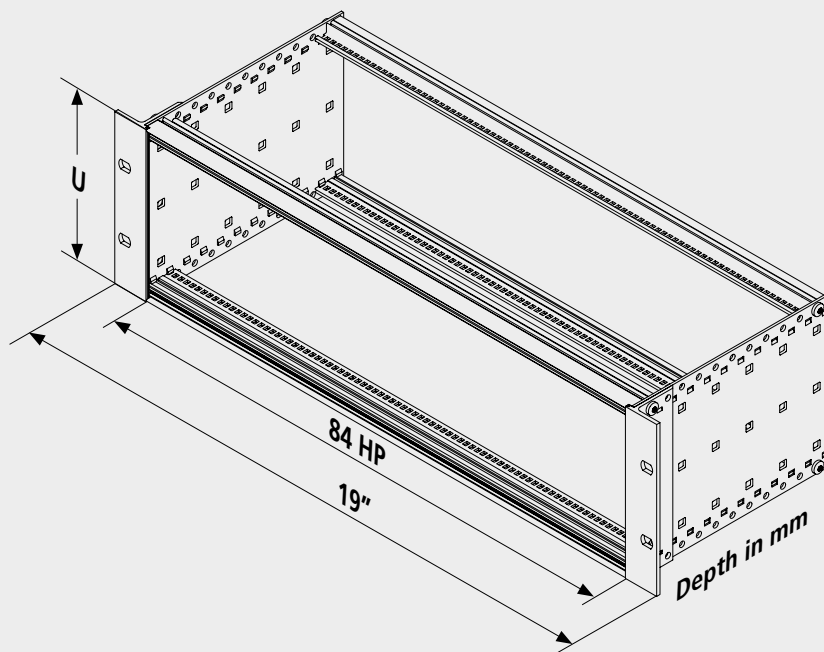
The required dimensionings are formalised in appropriate standards:

IEC 60297-3-101, -102, -103, -104 and -105
IEEE 1101.1, 1101.10 and 1101.11

System dimensions

Basic dimensions – inch – millimetres

1 HP	= 5.08 mm	= Horizontal pitch
1 U	= 44.45 mm	= Unit (height)
1"	= 25.4 mm	= 1 inch
0.1"	= 2.54 mm	= 1/2 HP
0.2"	= 5.08 mm	= 1 HP
1.75"	= 44.45 mm	= 1 U
19"	= 482.6 mm	19 x 25.4 mm
19" carrier	= 426.72 mm	= 84 HP available installation width (84.0 x 5.08 mm)



Tolerances & 19" standards

Tolerances for processing work and equipment (DIN ISO 2768-m)

We specialise in the processing of enclosures and the integration of electronic components. To do this, we carry out all the necessary work stages on the most up-to-date machines and plant. Our standard tolerances for processing and equipment comply with DIN ISO 2768-m.

Nominal size range

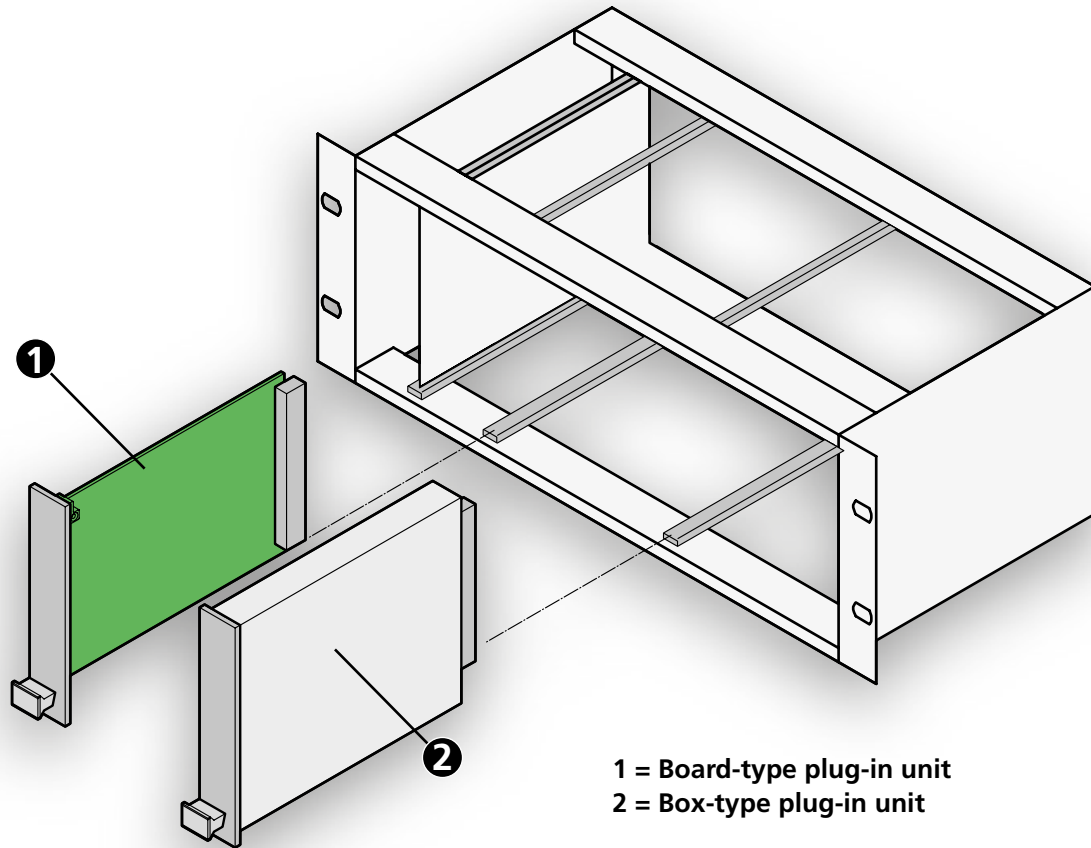
from 0.5 to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1000
±0.1	±0.1	±0.2	±0.3	±0.5	±0.8

Overview of standards for 19" products:

Our 19" enclosures comply with a large number of international standards which cover not only mechanical but also electromagnetic compatibility and vibration resistance.

Internal and external dimensions comply with: IEC 60297-3-101 /DIN EN 60297-3-101) / IEEE 1101.1 (subracks and plug-in units)	Refers to product group Intertego (in part sections), Internorm Stil, Interzoll Plus, Internorm (for fitting 19" plug-in units), Interzoll Modul, Interzoll, part front and plug-in front panels, extractor handles (HGS), frame-type plug-in units
IEC 60297-3-102 (DIN EN 60297-3-102) / IEEE 1101.10/11 (injector/extractor handles)	Internorm Stil, Interzoll Modul, extractor handles (HGS)
IEC 60297-3-103 (DIN EN 60297-3-103) (coding and alignment pin)	Internorm Stil, Interzoll Modul, extractor handles (HGS)
Earth conductor connections comply with: DIN EN 50178 / VDE 0160 DIN EN 60950 Teil 1 / VDE 0805 Part 1 DIN EN 61010-1 / VDE 0411 Part 1	Refers to product group Internorm Stil Internorm Stil Internorm Stil
EMC test acc. to: VG 95373 Part 15 IEC 61587-3	Refers to product group Intertego, Internorm Stil Interzoll Modul
Shock and vibration test acc. to: IEC 61587-2 BN 411002 BN 411003 EN 50155 DIN EN 45545-1	Refers to product group Interzoll Modul Interzoll Modul, Interzoll Interzoll Modul Interzoll Modul Interzoll Modul, Internorm Stil
Fire protection behavior acc. to: DIN EN 45545-2	Refers to product group Interzoll Modul, Internorm Stil
For direct screw-type connectors acc. to: IEC 60603-2 (DIN EN 60603-2, formerly: DIN 41612)	Refers to product group Internorm Stil, Interzoll Plus, Interzoll Modul, Interzoll, Intertego, CombiCard 1000-7000
For plug-in units acc. to: IEC 60297-3-101 (DIN EN 60297-3-101)	Refers to product group Internorm Stil, Interzoll Plus, Interzoll Modul, extractor handles (HGS), plug-in front panels, frame-type plug-in units, Interzoll, Intertego, Combi-Card 1000-7000
For plug-in units with insertion and extraction function acc. to: IEC 60297-3-102 (DIN EN 60297-3-102) / IEEE 1101.10/11	Refers to product group Internorm Stil, Interzoll Modul, extractor handles (HGS)
IP classification: DIN EN 60529; VDE 0470-1	Refers to product group Internorm Stil (IP 20), Internorm (IP 54), Interzoll Modul (IP 20), Interzoll (IP 20), Interzoll Plus (IP 20), Intertego (IP 40 / 20 – with ventilation)

19" system dimensions



19" system dimensions and definitions

The width over the mounting flanges is 482.6 mm (19"), which is the origin of the term 19" system.

Width:

The overall width behind the mounting flanges (incl. screws) shall be max. 449 mm. The subrack aperture width is subdivided into a modular pitch of 1 HP = 5.08 mm (2/10").

Height:

The subrack total height is defined by a multiple of a unit of 1 U = 44.45 mm (1 3/4").

Depth:

The subrack total depth is not explicitly specified by the standard. The individual dimensions depend on the board depth, rear connector tails or rear input/output plug-in units.

A slot is a multiple of horizontal pitches and may be different in specific applications.

A board-type plug-in unit consists of a printed board fitted with a front panel and a connector. The subrack aperture dimensions on the front are mirrored to the rear in case of rear mounted plug-in units.

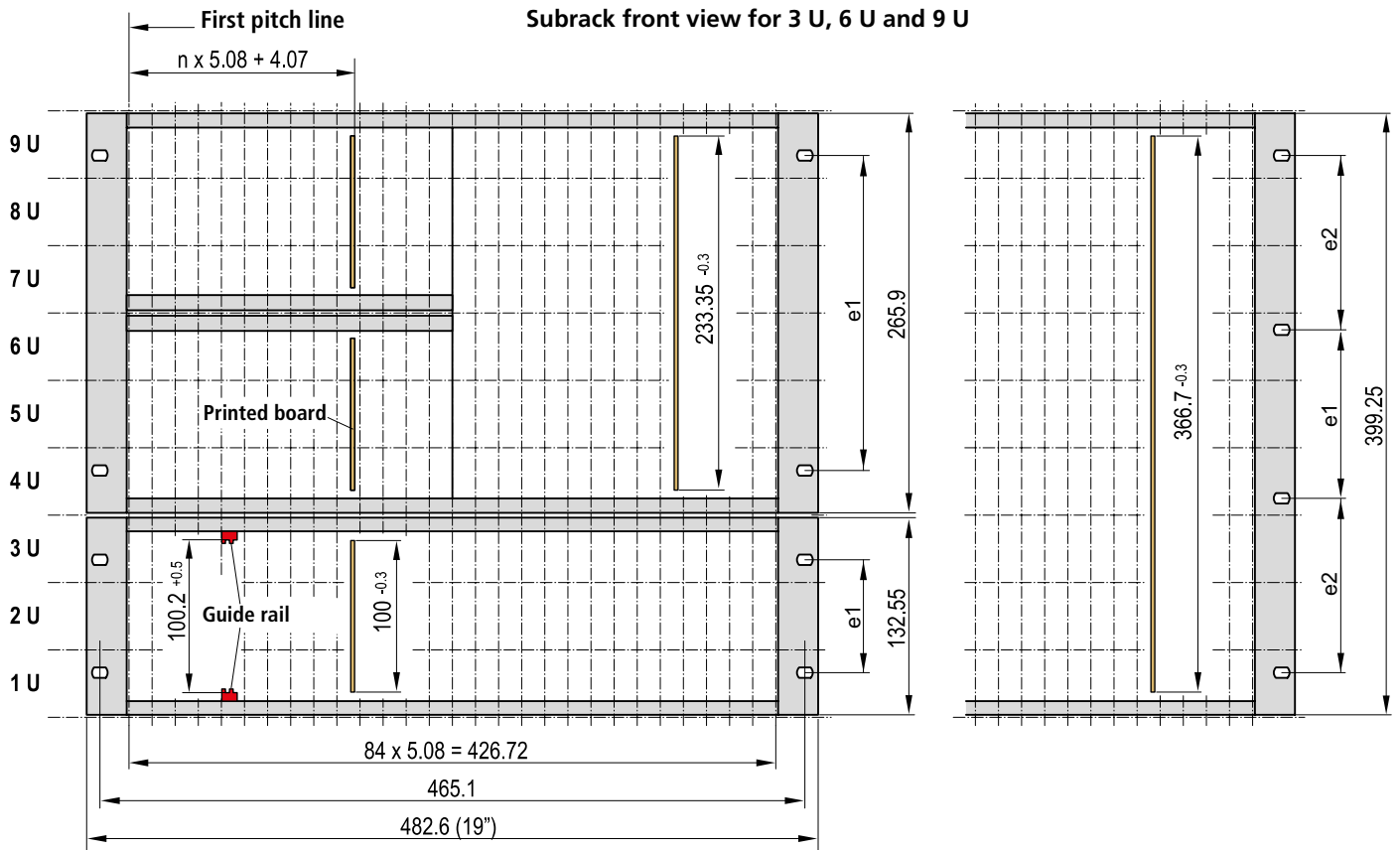
A box-type plug-in unit is typically houses bulky components or multiple boards.



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Basic dimensions | Subrack



Height:

1 U = 44.45 mm

Nominal: $(44.45 - 0.8) \pm 0.4$

3 U = $(3 \times 44.45 - 0.8) \pm 0.4 = 132.55 \pm 0.4$

Width:

482.6 mm ± 0.4

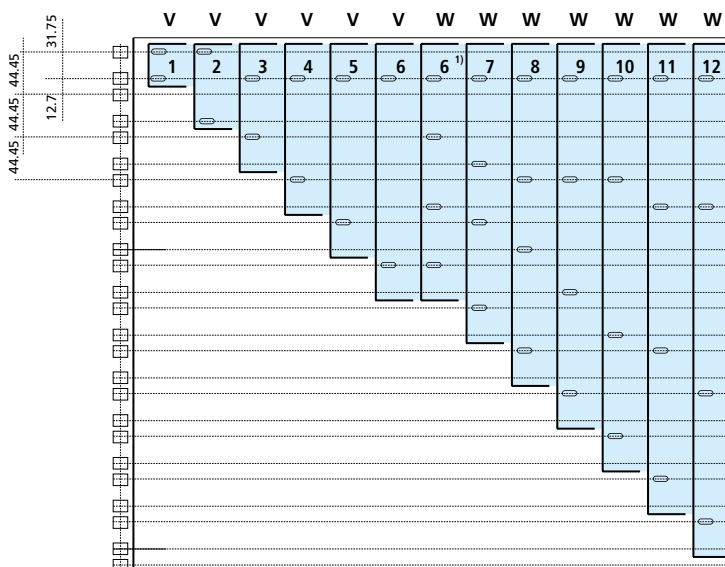
Mounting grid for front panels: 5.08 mm

Subrack aperture: $> 84 \times 5.08$ mm

Note:

The height dimension $100.2 + 0.5$ mm is derived from the printed board height dimension and a min. tolerance of 0.2 mm.

The max. tolerance of $0.2 + 0.5 = 0.7$ mm includes the clearance tolerance of the subrack horizontal members.



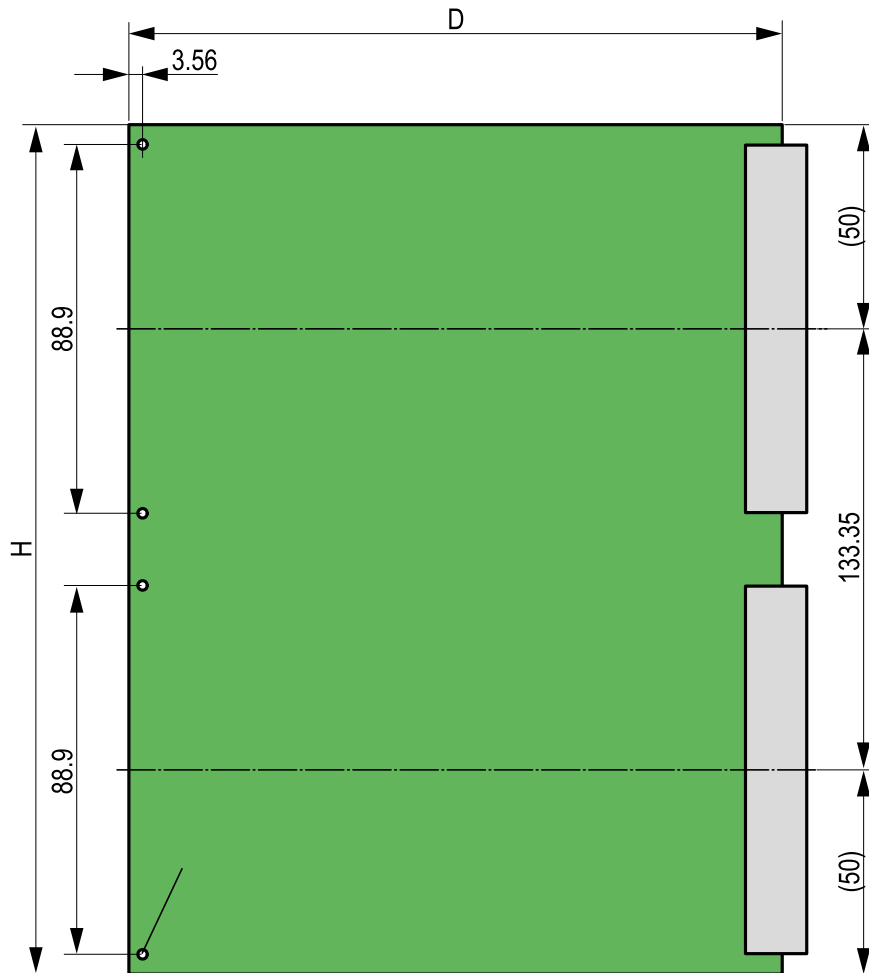
Size	Type	Height	e1	e2
1	V	43.65	31.75	-
2	V	88.10	76.20	-
3	V	132.55	57.15	-
4	V	177.00	101.60	-
5	V	221.45	146.05	-
6	V	265.90	190.50	-
6 ¹⁾	W	265.90	76.20	57.15
7	W	310.35	57.15	88.90
8	W	354.80	76.20	101.60
9	W	399.25	120.65	101.60
10	W	443.70	165.10	101.60
11	W	488.15	146.05	133.35
12	W	532.60	190.50	133.35

¹⁾ Alternative extension

Dimensions | Circuit board

Dimensions

The printed board dimensions are defined as the base of the Euro card form factor (H = 100 x D = 160 mm).



Height:

The height increments are in correspond to the units of the subrack (1 U = 44.45 mm). The table shows the most popular board formats.

Thickness:

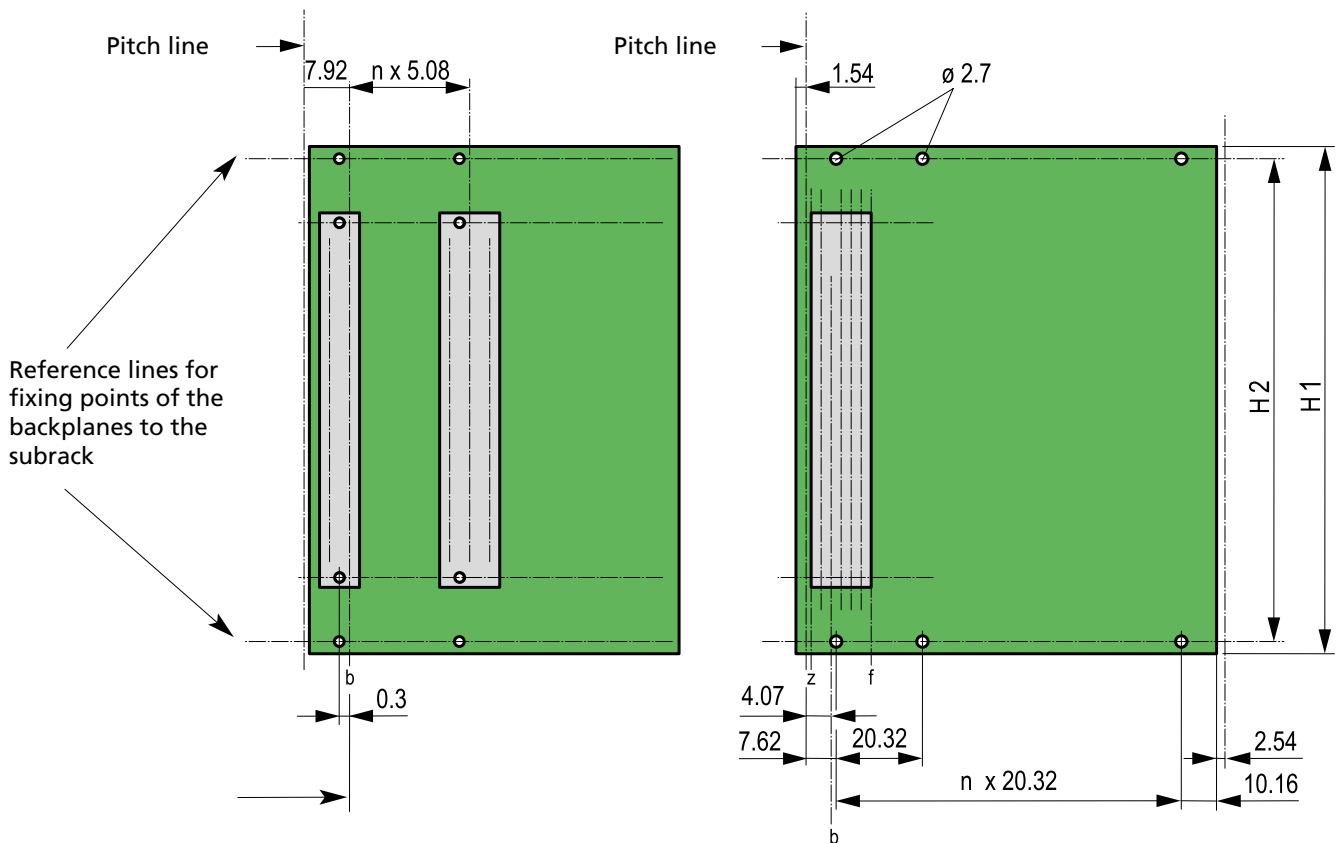
Unless otherwise specified, the thickness of a board is 1.6 mm. Thicker boards should be agreed between user and vendor with respect to the accessories used, e.g. guide rails.

Printed board

Height H +0/-0.3	Depth D +0/-0.3
3 HE = 100	80
6 HE = 233.35	100
9 HE = 366.70	160
	220
	280

Dimensions | Connectors & backplane

Front view



First position of the connectors of IEC 60603-2 and 61076-4-113 series (contact row b)

First position of the connectors of IEC 61076-4-101 series



The connectors of the above described IEC series fit on the backplane within the same slot width but with different reference dimensions of the contact grids to the pitch line.

The contact grid in illustration 1 is 2.54 mm and 2 mm in illustration 2.

Typical applications for the IEC 60603-2 and IEC 61076-4-113 series are VME64 and VME64x. IEC 61076-4-101 series connectors are used for Compact PCI.

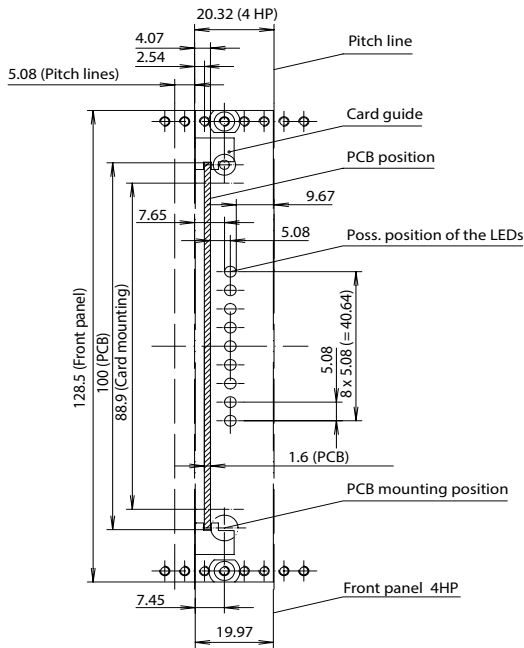
The formula for H 1: $n \times U - 4.8$
 (Example for 3 U = $3 \times 44.45 - 4.8 = 128.55$)

The formula for H 2: $n \times U - 10.85$
 (Example for 3 U = $3 \times 44.45 - 10.85 = 122.5$)

Dimensions | Front panel, circuit board & backplane

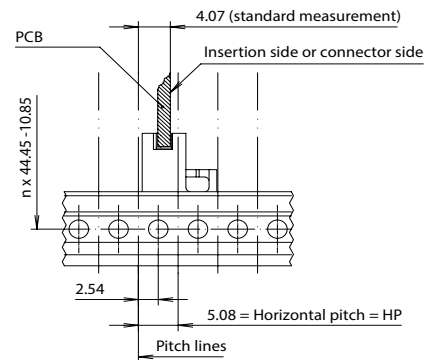
Dimensional dependencies

Front panel view 1:1



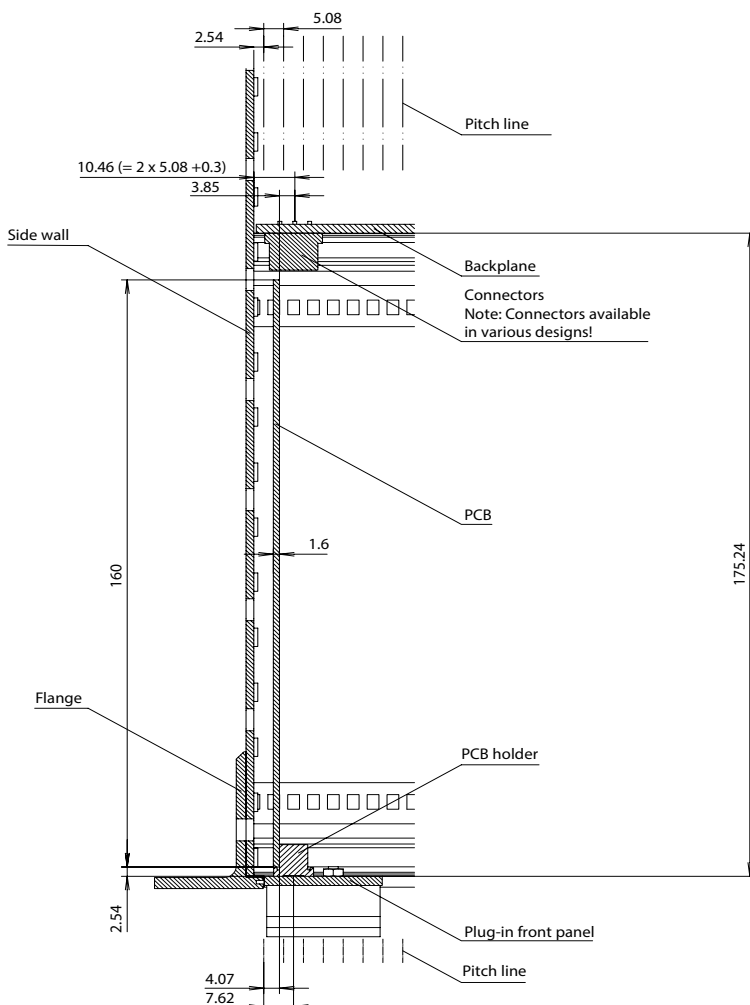
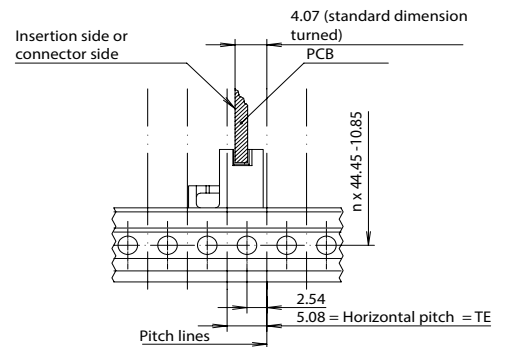
Detail X 2:1

Standard application

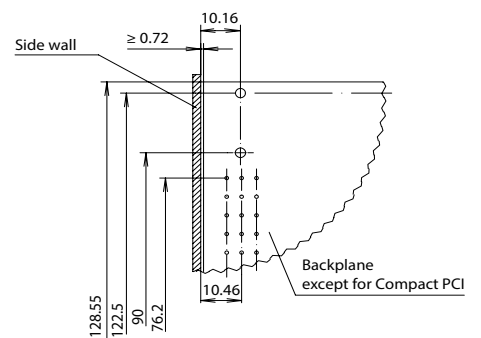


Detail X 2:1

Application for frame-type plug-in units etc.



Backplane view 1:1



Dimensions | Depth subrack

Test dimensions

For the subrack front depth D

The formula for connectors type IEC 60603-2 and 61076-4-113 (application example VME is the same as for connectors type IEC 61076-4-101).

Application example CPCI

$D = \text{printed board depth} + 15.6$
(e.g. $160 + 15.6 = 175.6$).

For the subrack rear depth D_R

Inspection dimensions for the subrack rear depth D_R from the rear attachment plane to the backplane attachment plane

Application example VME

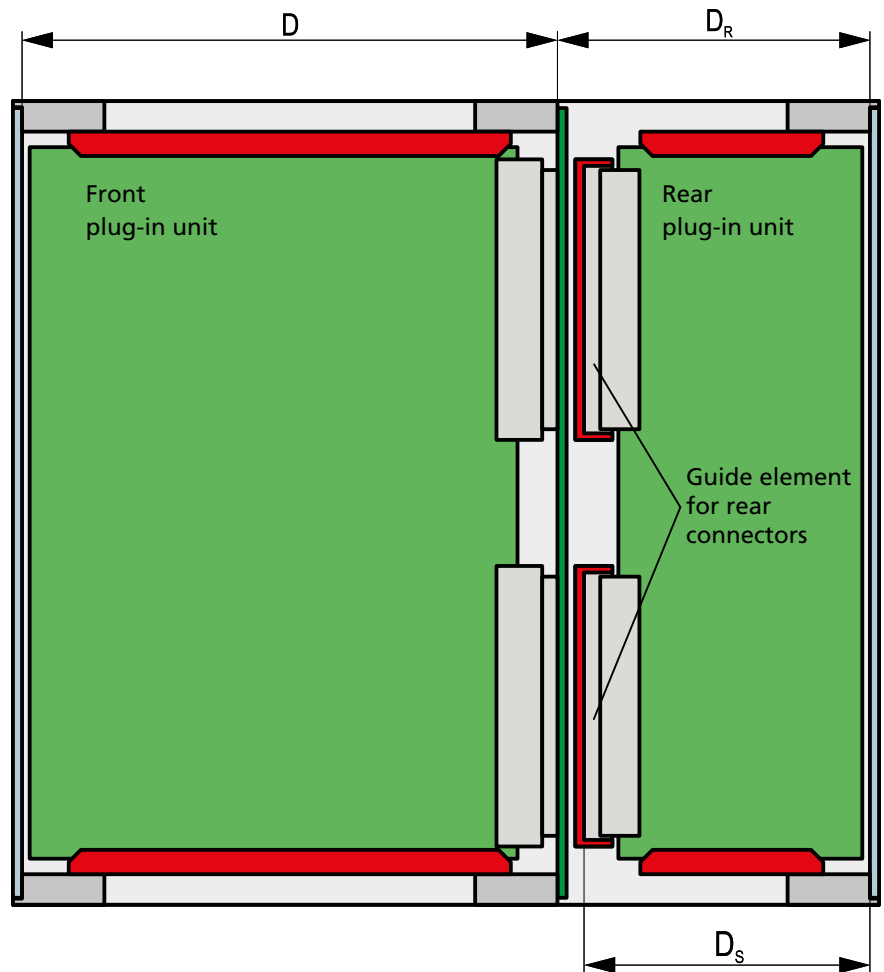
The formula for connectors type IEC 60603-2 and 61076-4-113 is:

$D_R = \text{printed board depth} + 22.48$
(e.g. $80 + 22.48 = 102.48$).

Application example CPCI

The formula for connectors type IEC 61076-4-101 is:

$D_R = \text{printed board depth} + 20$
(e.g. $80 + 20 = 100$).



For the guide element D_S

Inspection dimensions for the shroud D_S from the rear attachment plane to the bottom of the guide element.

Application example VME

The formula for connectors on the rear plug-in unit type IEC 60603-2 (inverted version) is:

$D_S = \text{printed board depth} + 10.28$
(e.g. $80 + 10.28 = 90.28$).

Application example VME64 extension

The formula for connectors type IEC 61076-4-101 is:

$D_S = \text{printed board depth} + 12.78$

Application example CPCI

The formula for connectors type IEC 61076-4-101 is:

$D_S = \text{printed board depth} + 12.14$

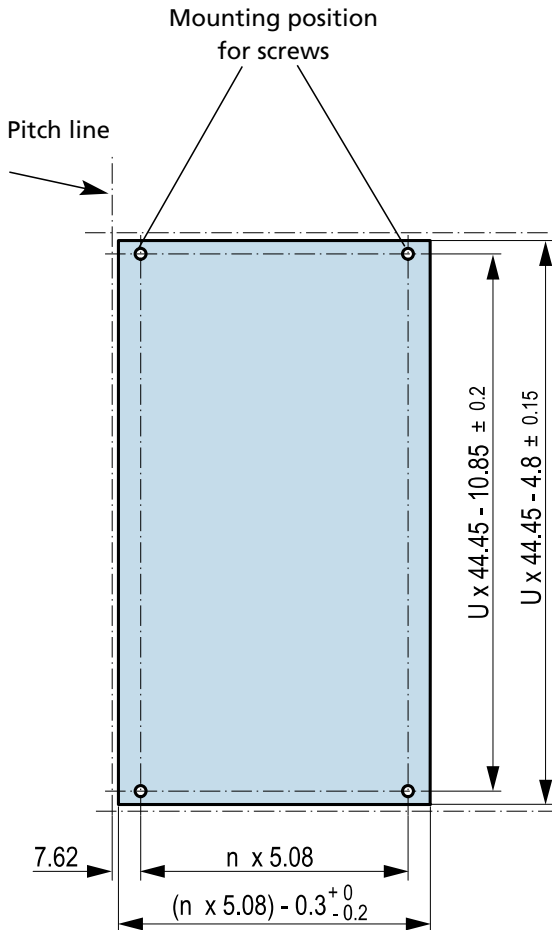
The max. thickness of the backplane should not exceed 6 mm.

Explanations for the rear arrangement of plug-in units

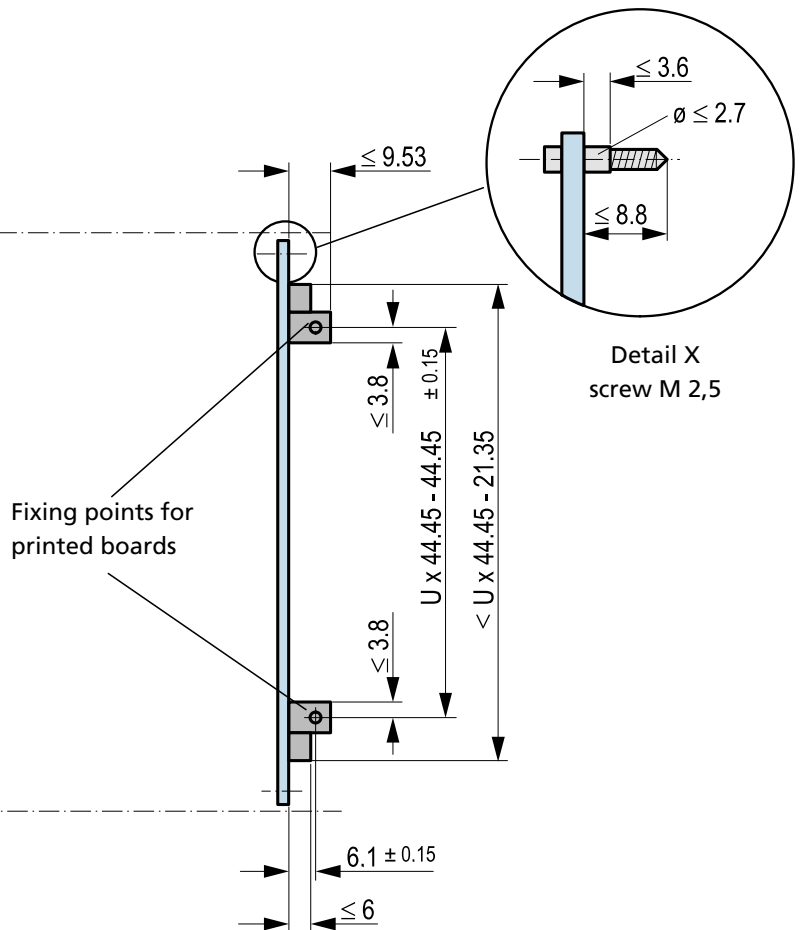
For I/O interface the rear plug-in units are fitted with the inverted versions of the connector types. This allows the plug-in function to be directly on the tails of the front connectors protruding from the backplane. The guide element is used as a mechanical support to align the rear plug-in function and to protect the tails from damage.

Dimensions | Plug-in assemblies

Front panel - front view



Front panel - side view



The box type plug-in unit usually consists of a metal housing in which one or more printed boards can be located.

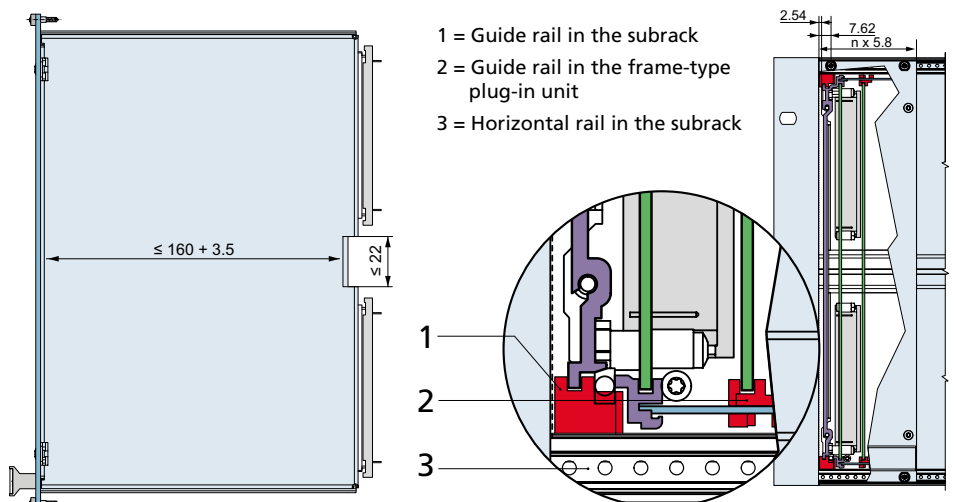
The drawings above illustrate the dimensional rules of the front panels within the pitch lines of a subrack and the reference fixing points for printed boards at the rear of a front panel. Detail "X" is the only standardised fixture but may be replaced by individual fasteners if agreed between vendor and user.

Plug-in units

Subrack-related plug-in units are the sub-assemblies of a subrack. There are principally two versions: The printed board-type and the box-type plug-in units.

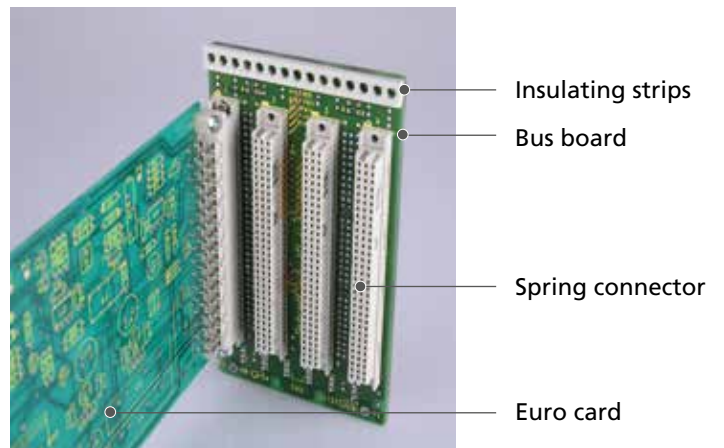
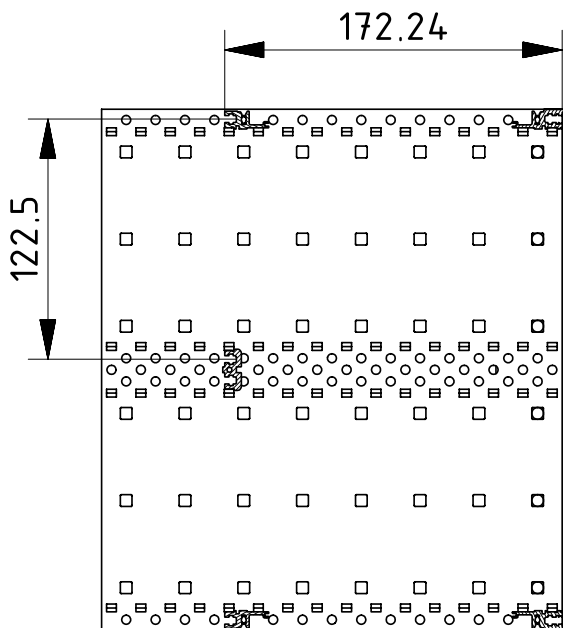
The box type plug-in unit

This usually consists of a metal housing in which one or more printed boards can be located. The front panel and the connector positioning follows the same dimensional rules as those applying to the printed board plug-in units.

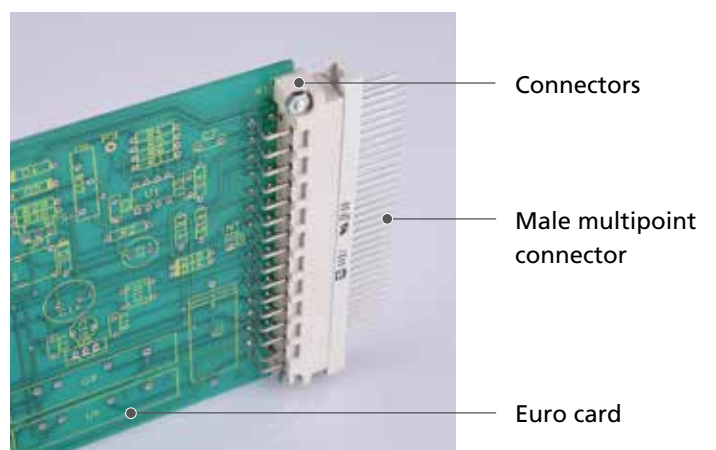
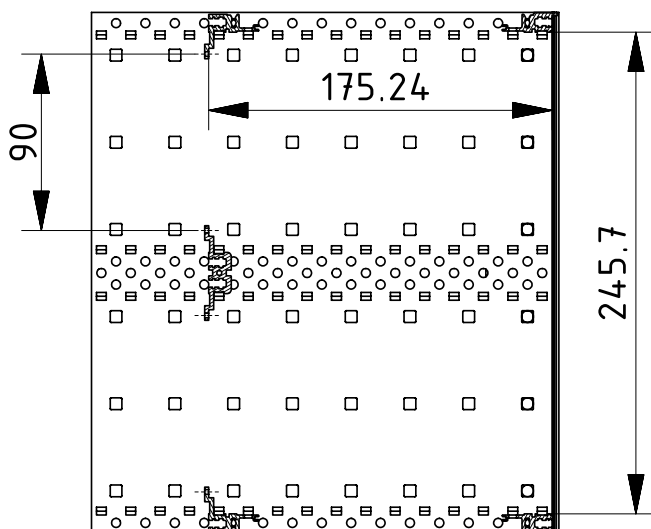


Subrack I Designs

Variant for bus boards (.Pi)



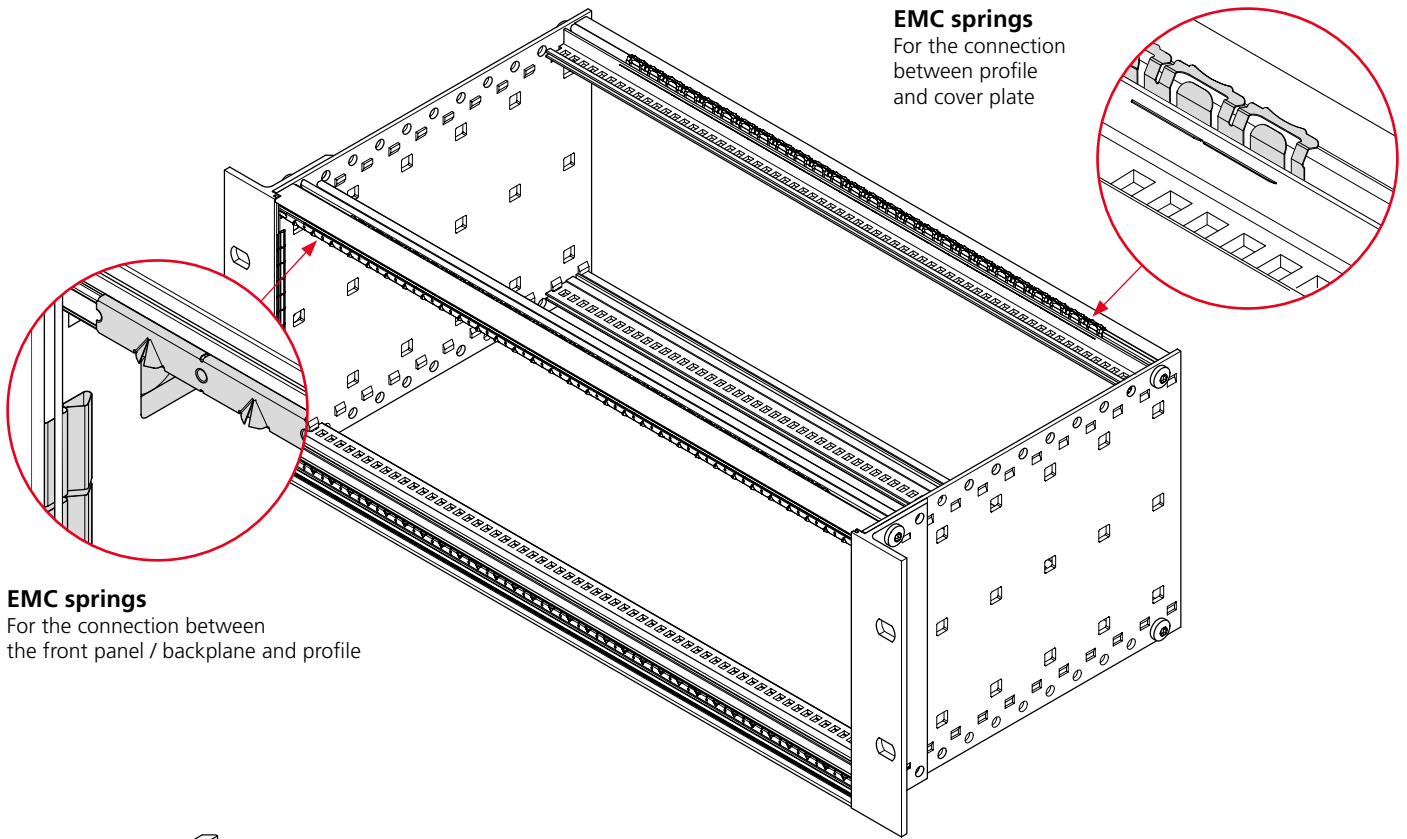
Variant for connectors (.12)



Subrack | EMC shielding

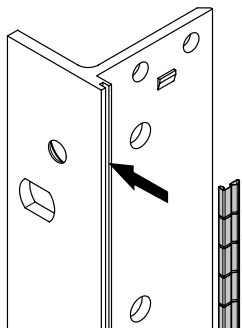
EMC

Electromagnetic compatibility – Measures for screening devices against electromagnetic interference radiation.



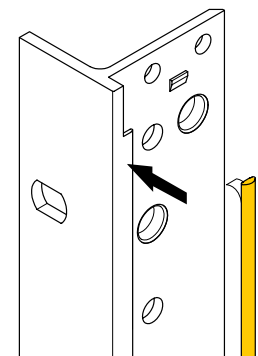
EMC springs
For the connection
between profile
and cover plate

EMC springs
For the connection
between
the front panel / backplane and profile



Subrack/front panel shielding

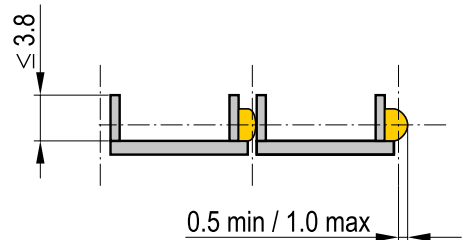
Shielding measures against high frequency interference are defined by standardised dimensions on the front area only. Other areas of a subrack are not critical regarding the compatibility of plug-in units and are therefore left to individual measures. If rear plug-in units are used, the dimensions of the front area should be mirrored.



The EMC textile seal

Alternative screening option using textile seals makes the contact possible using U-profile front panels. In this case, the EMC textile seals are glued-on on one side only and, by using a conductive fabric, make possible vertical contacting between each other.

Front panel, Top view



Subrack | ESD & grounding

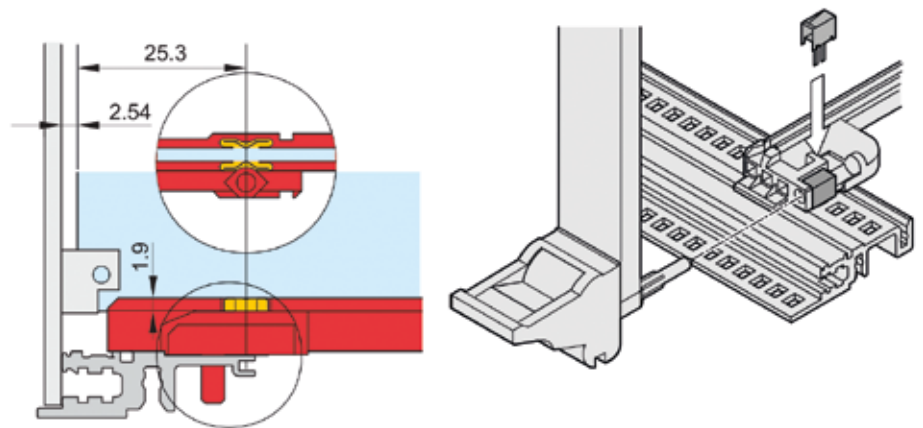
ESD

Electrostatic discharge measures for discharging electrostatic charges to protect the electronics against interference pulses and/o the destruction of components.

Electrostatic discharge

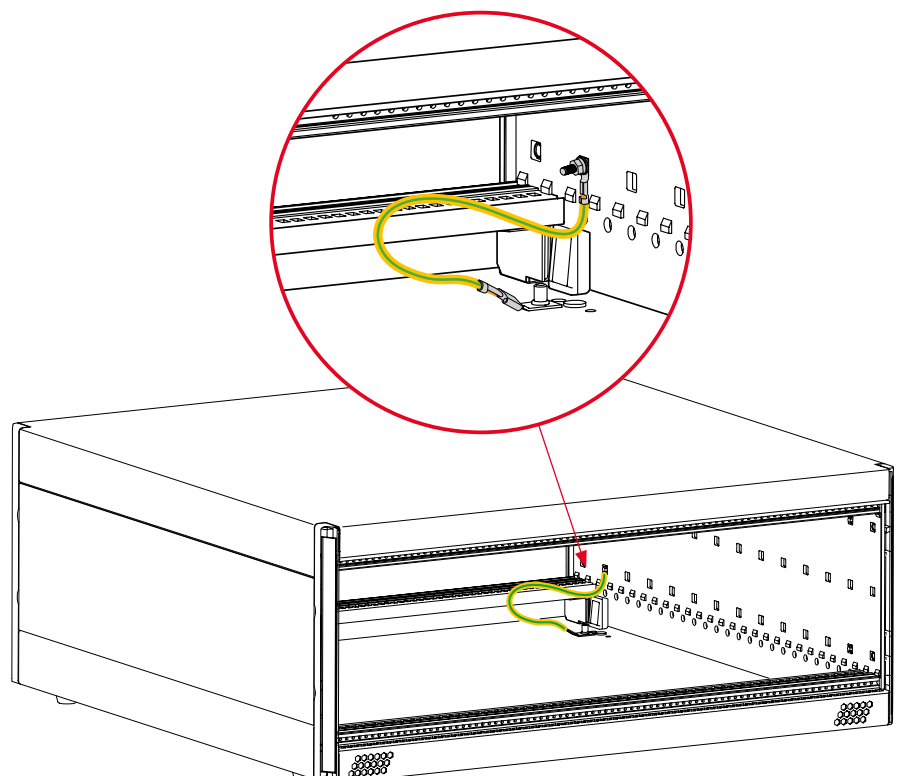
IEC 60297-3-101 describes an optional method of electrostatic discharge. It is a contact clip which can be placed in the guide rails, close to the front of the subrack. Usually the guide rails are made of insulating material and if prepared accordingly by the vendor, the same guide rails will mostly accept the ESD clip even when retrofitted.

For the proper function, the clip must connect to grounded parts of the subrack and to conductive sections on the printed board. In order to avoid discharge sparks, a discharge resistor should be used on the printed board.



Protective conductor (grounding):

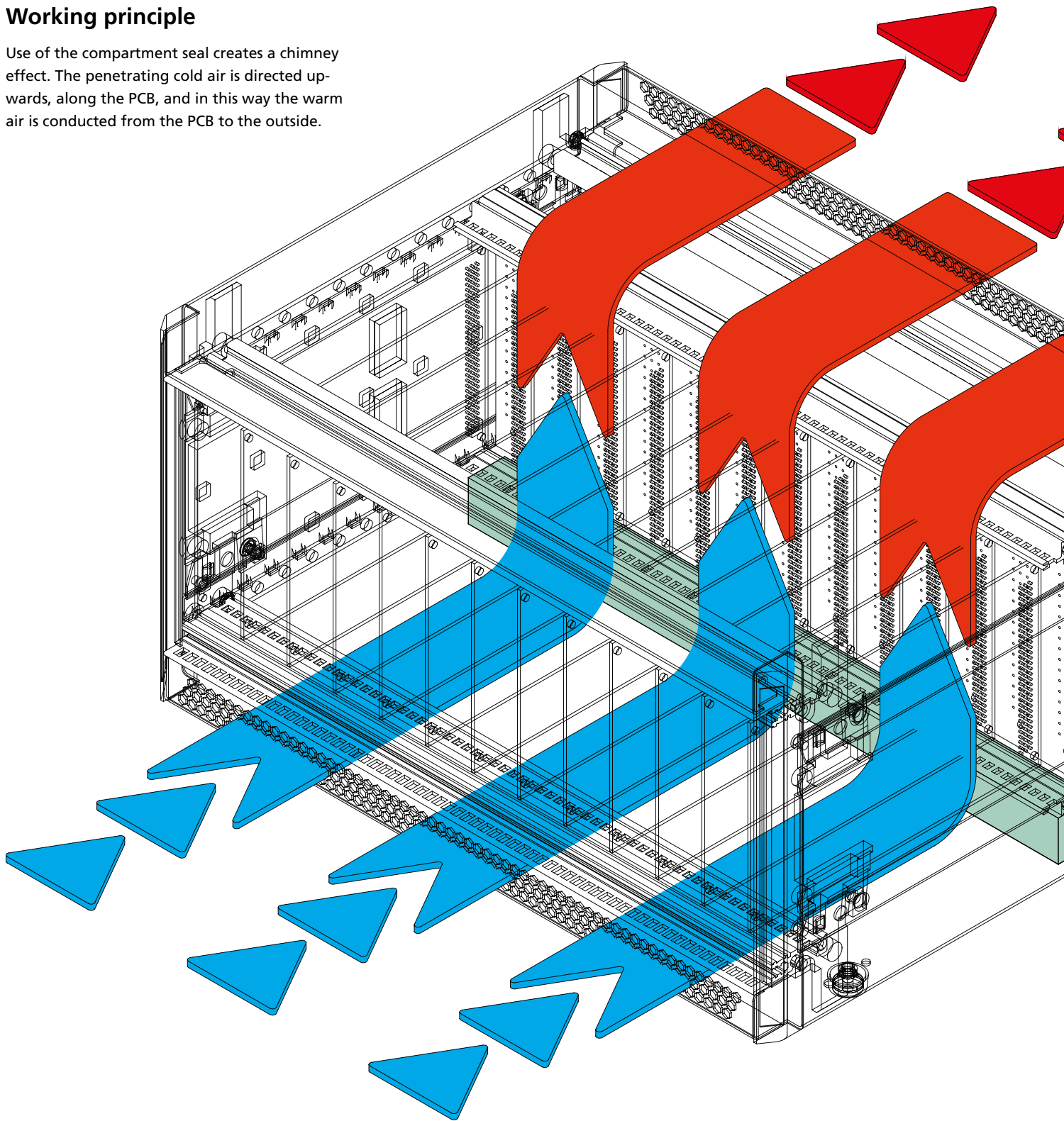
Measures to protect people from coming into contact with dangerous voltages.



Subrack | Ventilation concept

Working principle

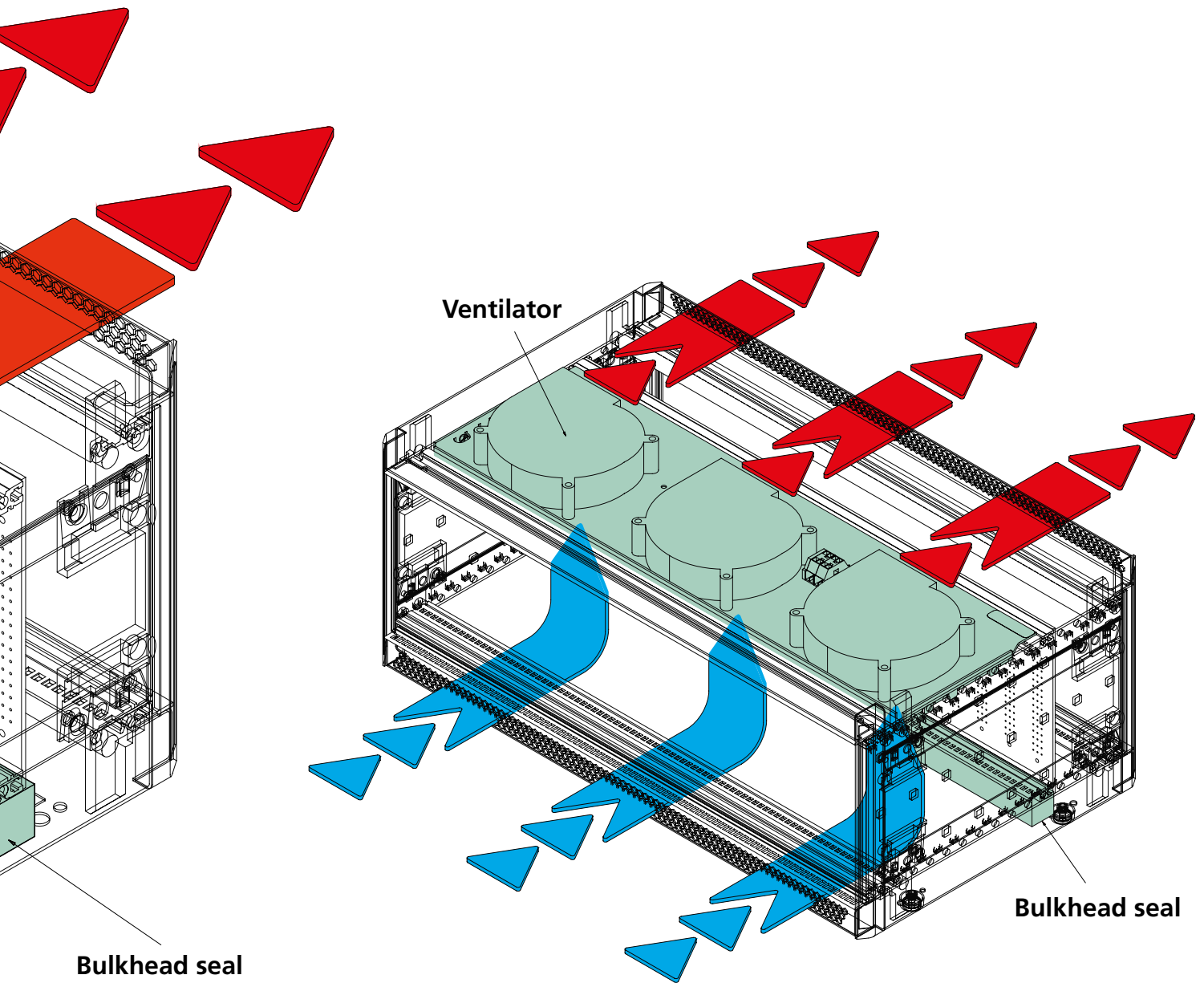
Use of the compartment seal creates a chimney effect. The penetrating cold air is directed upwards, along the PCB, and in this way the warm air is conducted from the PCB to the outside.





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Technical info | Protection classes

Important: We assume no liability for cited standards!

The degree of protection offered by an enclosure is shown by the letters IP (Ingress Protection) and two indexes. The first index indicates two factors (protection for persons and equipment), the second index indicates only one factor (protection against water).

Example: IP 54

┌ = protection against splashing water
└ = protection against dust and wire contact with dangerous parts

DIN EN 60529; VDE 0470-1 : 2014-09

First index: Protection against contact and foreign objects

Symbol	Index	Protection against contact		Protection against foreign objects	
		Brief description	Definition	Brief description	Definition
	0	Not protected	–	Not protected	–
	1	Protection against the back of the hand touching dangerous parts	The object probe, a >50 mm diameter sphere, must be at a sufficient distance from dangerous parts	Protection against a solid foreign object of 50 mm or more in diameter	The object probe, a >50 mm diameter sphere, must not fully penetrate
	2	Protection against a finger touching dangerous parts	The test finger, jointed, >12 mm in diameter and 80 mm long, must be at a sufficient distance from dangerous parts	Protection against a solid foreign object of 12.5 mm or more in diameter	Protection against a solid foreign object of 12.5 mm or more in diameter
	3	Protection against a tool touching dangerous parts	The object probe, >2.5 mm in diameter, must not be able to penetrate	Protection against a solid foreign body of 2.5 mm or more in diameter	The object probe, a >2.5 mm diameter sphere, must not penetrate at all
	4	Protection against a wire touching dangerous parts	The object probe, >1.0 mm in diameter, must not be able to penetrate	Protection against a solid foreign object of 1.0 mm or more in diameter	The object probe, a >1.0 mm diameter sphere, must not penetrate at all
	5	Protection against a wire touching dangerous parts	The object probe, 1.0 mm in diameter, must not be able to penetrate	Protection against dust	Dust penetration is not completely prevented ¹⁾
	6	Protection against a wire touching dangerous parts	The object probe, 1.0 mm in diameter, must not be able to penetrate	Dust-tight	No ingress of dust



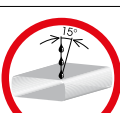
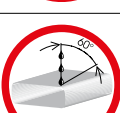
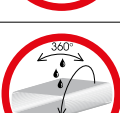
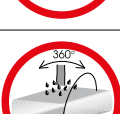
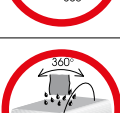
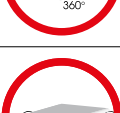
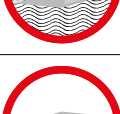
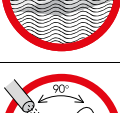
An enclosure must only be designated with the **first index** (protection against penetration) for a degree of protection when it also meets all lower degrees of protection.

1) Dust must not penetrate in sufficient quantities to prevent the equipment from operating satisfactorily or to impair safety.

Up to index 6, the **second index** (protection against water) must only be used for a degree of protection for an enclosure if it also meets all lower degrees of protection. However, an enclosure which is only designated with the second index 7, 8 (protection against immersion) or 9K (protection against a jet of steam) is considered to be unsuitable for use with a jet of water (index 5 or 6). This means that it does not need to meet the requirements indicated by indexes 5 or 6. Only an enclosure with a double designation meets the requirements regarding resistance to a jet of water and to immersion/jet of steam.

Important note: The degrees of protection given for the enclosures refer to unmachined enclosures as supplied. In the case of protection against water in particular (second index), the test conditions will be met if during the given time for the experiment no water has penetrated, or not in harmful quantities. The protection classifications do not take into account the effects of ageing and so cannot be guaranteed throughout the lifetime of the enclosure. Additionally, changes in temperature and atmospheric conditions can create loss of pressure in the enclosure, and moisture may be absorbed through the seal area. BOPLA can fit the enclosure with a pressure compensation element for enclosures to be deployed in these environments.

Second index: Protection against water

Symbol	Index	Brief description	Definition
	0	Not protected	–
	1	Protection against falling drops of water	Drops of water falling vertically onto the enclosure must not have any harmful effects.
	2	Protection against falling drops of water when the enclosure is tilted at any angle of up to 15°	Drops of water falling vertically onto the enclosure must not have any harmful effects if the enclosure is tilted at any angle of up to 15° on both sides of the vertical.
	3	Protection against spraying water, spray nozzle: 10 l/min; 5 min	Water sprayed onto the enclosure at an angle of up to 60° on both sides of the vertical must not have any harmful effects.
	4	Protection against splashing water, spray nozzle: 10 l/min; 5 min	Water splashed onto the enclosure from any direction must not have any harmful effects.
	5	Protection against water jets, jet nozzle: 12.5 l/min; 3 min	Water projected in jets against the enclosure from any direction must not have any harmful effects.
	6	Protection against powerful water jets, jet nozzle: 100 l/min; 3 min	Water projected in powerful jets against the enclosure from any direction must not have any harmful effects.
	7	Protection against the effects of temporary immersion in water 1 m; 30 min	Water must not enter in a quantity which results in harmful effects if the enclosure is temporarily immersed in water under standardised pressure and time conditions.
	8	Protection against the effects of continuous immersion in water > IPx7; definition acc. to agreement	
	9	Protection against high water jet temperatures and high water pressure from a flat jet nozzle	Water directed at high pressure and at high temperatures onto the enclosure from any direction must not have any harmful effects.

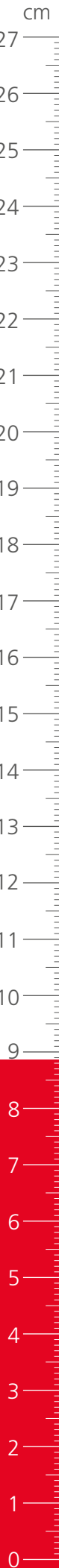
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