- *Shielded Cable Trays.*
- *Shielded backplanes for Transformer and Power rooms.*

LOW FREQUENCY ELECTRO-MAGNETIC SHIELDING SOLUTIONS

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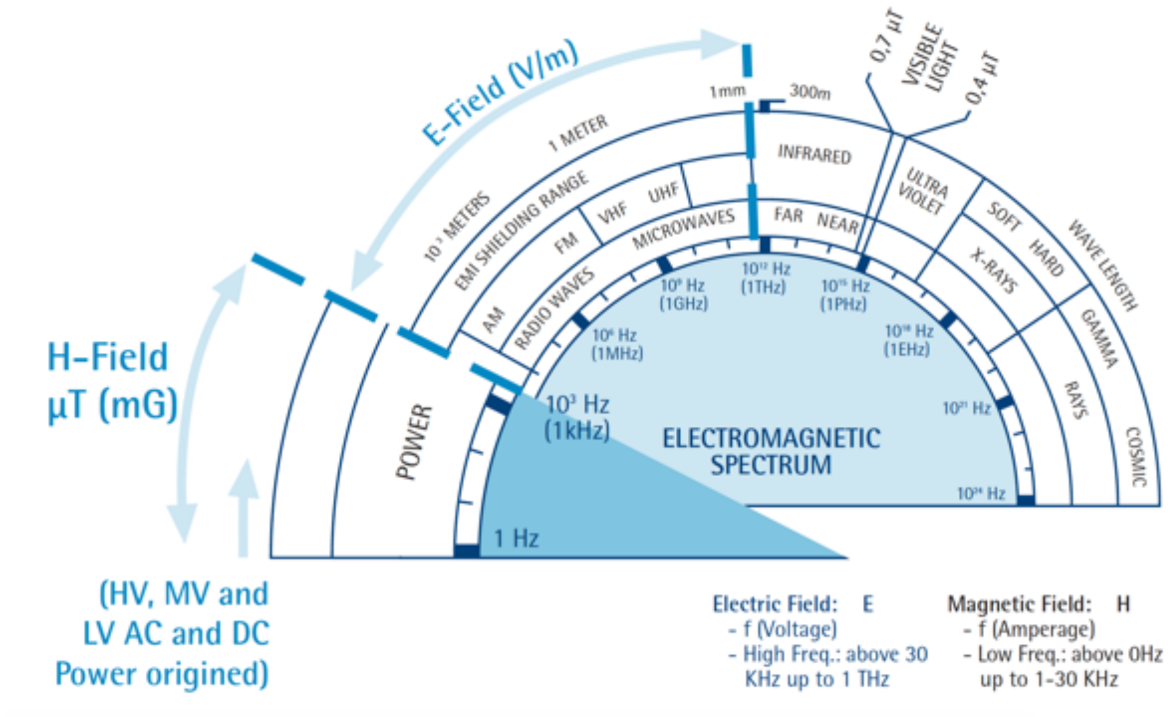


TUTORIAL

WHY SHIELDING

General Description

Electro Magnetic Fields (EMF) generated by high power cables and bus-bars are a growing concern and a technical challenge to Consultants, Facility Managers and people in general, world-wide, in many facilities and buildings, due to new restricting EMF emission standards that limit continous exposure to people and machines due to health and performance issues.

ShieldMax technology is the result of years of experience and over 500 successful installations that have provided the know-how to standarize high-performance EMF ShieldMax products presented in this catalog.

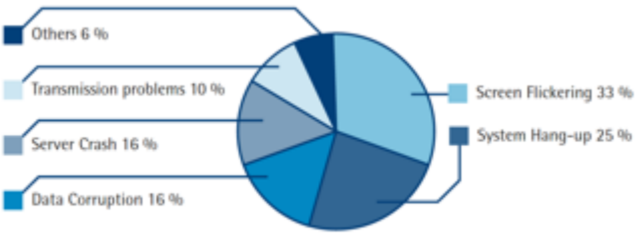
Continuous exposure to Low Frequency Electro Magnetic Fields (EMF), caused by high power electric loads, as high power cables, alter the normal functioning of electronic equipment and affects human beings health.

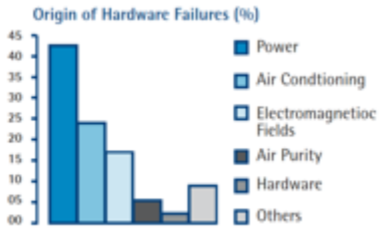
15% of electronic equipment failures (such as servers, electro-medical, PLCs... malfunction) or communication networksÅL underperformance are reported to be caused by EMF .

EMF related problems are growing rapidly as per increasing power consumption in any buiding, creating more EMF sources and at the same time, affecting more people, as per space scarcety and proximity to such loads.
EMF exposure is limited by various compulsory norms:

- Electronic equipment and Machinery: Limit of Magnetic Field exposure by norm IEC/EN 61000-4-8 is 3,75 uT (microTeslas) and is complusory to provide an environment with less than such level to ensure the secure and good performance of every-day-more-sensitive electronics and machinery. Norm IEC/EN 61000-4-3 establishes for sensitive electronics < 1 v/m limit exposure to high frequency EMF.

- Human Beings: limit of EMF continous exposure by NCRP to 1µT, must be observed to ensure peopleÅLs safety and
avoid any health risk.





EMF Source: three phase POWER CABLE (Amps)	Minimum safe distance for computers, electronic equipment and machinery as per IEC/EN standard (in meters) <3,75µT	Minimum safe distance for Human Beings as per NCRP standard (in meters) <1µT
100 A	1,35	2,6
300 A	1,60	3,2
500 A	3,03	5,8
1000 A	4,29	8,31
3.000 A	5,26	10,1
5.000 A	9,6	18,6

EMF Source: three phase BUSBAR (Amps)	Minimum safe distance for computers, electronic equipment and machinery as per IEC/EN standard (in meters) <3,75µT	Minimum safe distance to Human Beings as per NCRP standard (in meters) <1µT
100 A	0,46	0,89
300 A	0,8	1,54
500 A	1,32	2,0
1000 A	1,46	2,82
3.000 A	2,52	4,89
5.000 A	3,26	6,32

ShieldMax

In all domestic and business environments there are electromagnetic fields which may occur naturally, as a consequence of light itself, or which may be artificially generated by the extensive presence of electrical plants and devices. In the twentieth century, environmental exposure to artificial electromagnetic fieldshas steadily increased as a result of a huge increase in energy demand, the continuing development of wireless technologies and because of changes in communication and work practices.
When people are exposed to electromagnetic fields their body absorbs energy. This causes an imbalance to the body's natural equilibrium and, while the scientific and

medical community is still looking for conclusive evidence, it is important to protect people from the possible long-term effects of electromagnetic fields.

Interest in electromagnetic pollution has increased in recent years as a result of extensive research and studies. Standards and technical documents have been drafted and specific laws approved to protect the environments most at risk, such as the work place. It is important therefore that the risk to human health be evaluated and measures taken to limit electromagnetic exposure in order to guarantee health and safety at work. As well as possible effects on human health, electromagnetic fields can create disturbance and cause interference with electronic equipment.

European legislation has therefore set limits to guarantee the adequate and safe performance of instruments. As a result, the use of appropriate screening systems is essential in all industrial processes that involve high current intensity or the use of intense electric or magnetic fields.

This is to protect both workers and electric equipment near to the field sources

Effect of Electromagnetic Fields on People

Electric and magnetic fields that vary over time interact with the electrically charged particles which matter is made of. Of particular interest is the interaction with biological systems ranging from basic cellular structures to complex organisms such as plants and animals.

To properly quantify the energy absorbed by a material, especially by human tissue, dosimetric quantities are used. Dosimetry expresses the current and power density and the energy absorbed per unit area or volume as defined below:

• Current density ‘J’: is the current flowing through a cross section of a conductor such as the human body or a part of it. It is measured in terms of A/m2.

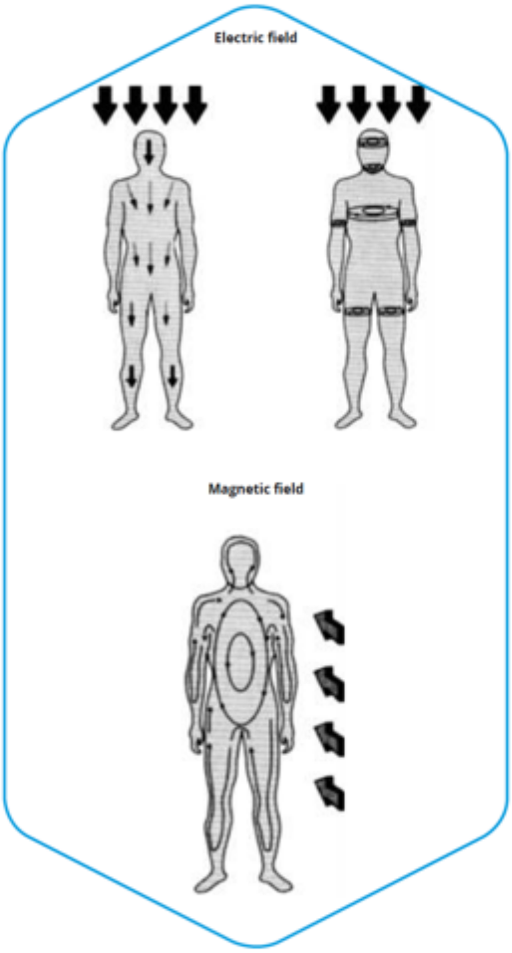
• Density of power ‘S’: is used for very high frequency types of current where depth of penetration is small. It is calculated as the radiant power perpendicular to a surface divided by the same surface area and is expressed in W/m2.

• Specific energy absorption ‘SA’: is defined as the energy absorbed per unit of mass of biological tissue and is expressed in Joule/kg.

• Specific Absorption Rate of energy ‘SAR’: This is the rate of absorption of energy per unit mass of body tissue averaged over the entire body or specific parts of it. It is used to assess and eventually limit excessive energy deposition in small parts of the body resulting from particular exposure conditions. Both SAR, averaged over the whole body, as well as local body part values are used. It is measured in W/kg.

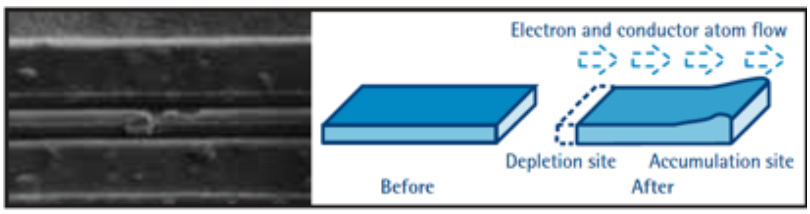
The quantities mentioned above are used as references to measure the effects on the human body and to define exposure limits. These, however, cannot be measured directly on the individual exposed to assess the intensity of radiation. Instead, measurable physical quantities

Current density J [mA/m²]	Symptoms
J > 1000	Extrasystoles and fibrillation
100 < J <1000	Tissues stimulation: possible risks
10 < J < 100	Possible symptoms on the nervous system
1 < J < 10	Minor effects

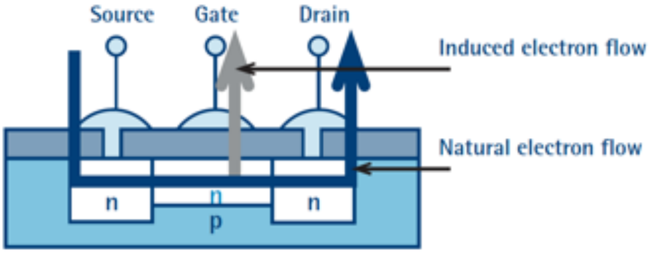


EMF Effects on Electronic Equipment

1. Electromigration: cause broken strips and communication problems.



2. Hot Electron Effect: induced transients, provoke logic errors and destroy transistors.



3. Antennae Effect:
EMF Interference and some of the electrons are radiated, transforming the narrow strip in an antenna.

Detail of a damaged strip in an integrated circuit.

4. Image Distortion

Image Non-distorsioned

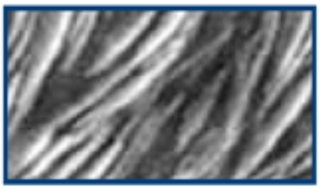


Image distorsioned by Electromagnetic Fields

5. Hardware degradation and destruction.

EMF Effects on Human Beings

-U.V. Radiations: skin problems (reduction of Langerhans cells) and eyes.
-Infrared Radiations: thermal effects
-Radiofrequency (R.F.): thermal effects and bioelectric interferences, genetic transmission problems, nervous and heart system.

Some relevant studies conducted to date:
-National Institute of Occupational Health (Magnetic Fields and Cancer: cellular study. Bo Holmberg): research on cancer tumors and EMF exposure.
-Division of Biomedical and Behavioral Sciences, National Institute for Occupational Safety and Health (OSHA) (Cincinnati) Magnetic Field exposition in skin cells, J. Snawder, R. Edwards): research on tumor and magnetic fields of 100 µT over a 14 day period.
-Electric Power Research Institute (Palo Alto) (Magnetic Fields and Animal Cells, J. Mc.Cann, R. Kavet, C. Rafferrty): research on tumor and magnetic field.

Note: Although none of the studies conducted to date can absolutely correlate EMF and human health effects. ShieldMax strongly recommends to apply the ALARA (As Low As Reasonable Achievable) principle in accordance with NCRP recomendation.

Origin of EMF and Sources

Magnetic and Electric Field Low Frequency (0Hz – 100 kHz)

Magnetic Fields:

- Transformers
- Low Voltage Cabinets
- Low Voltage Lines (including Bus-bar and Subway cables)
- High Voltage Lines (aerial, underground)
- Railways lines, Subway Lines
- UPS
- Others: lightning, engines, electrical heaters,...

Electric Field:

- High Voltage Lines

Electric Field High Frequency (100kHz - 10GHz)

- Radars, Radio emitters, Mobile Phone Substations, AC Drives

Benefits

Ensure the accomplishment of compulsory EMF limit standards and provide security and safety of any equipment or people nearby:

- Cable trays (providing shielding and power distribution at the same time)
- Switch cabinets
- Transformers

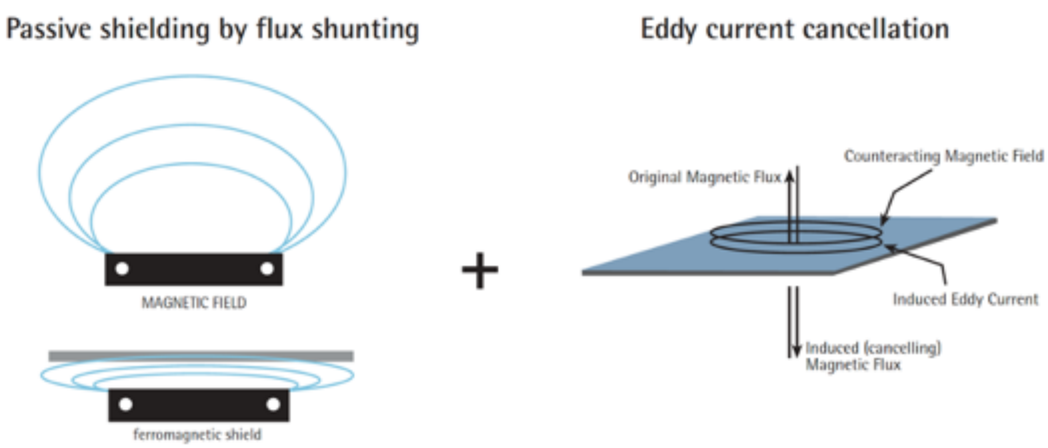
By

- Fully standardized products.
- Special solutions upon request.
- Provides secure environment for electronic equipment and machinery and for people.
- Certified EMF shielding performance according to IEC standards.
- Suited to any sort of building and applications: Officevbuildings, Hospitals, vSemiconductor plants,...
- Complete turn-key solution from one single catalogvand source (trays, fasteners, supports,...)
- Easy to install.
- Suited to install in horizontal or vertical cable risers.
- Shield-Tray provides convenient air-cooling to cables.
- Various models, sizes and Shielding performance suited to different needs and applications.
- Maximum safety

- Easy to select.
- Shield-Tray segments overlapped to minimize EMF leak by Belt technique.
- Documented certification.
- CE marked.
- Earthing connection points.
- Heavy duty construction.
- Warranty 10 years.
- Anti-rust treatment

Shielding Technology

Magnetic Field Low Freq.: Hybrid Technology



ShieldMax Solution consists of a cost-effective hybrid shielding technology that by the combination of high-permeability and high conductivity materials produce a double effect of EMF absorption minimizing the residual magnetic field by an “eddy current” effect that pushes back the residual field back-in.

A smart design, that overlaps all cable tray segments minimizes any EMF leakage.

ShieldMax

Limits and Standards

Magnetic and Electric Field Low Frequency

Norms and Recommendations	
Electronic Equipment	**Human Beings**
Magnetic Field - Low frequency * **EN/IEC 1000-4-8: Inmuty for Electronic Equipment up to 3,75 µT** Recommendations NCRP: Max. Magnetic Field recommended 1 µT Requeriments Semicon Manufacturers: Magnetic Field up to 0,03 µT Requeriments MRI (magnetic resonance) Manufacturers: Magnetic Field up to 1 µT Others: Real Worldwide Experience Cases: Computer Screens flicker form 0,4 µT Magnetic Field	**Magnetic Field - Low Frequency** ICNIRP: Norm for people up to 100 µT ICNIRP/ACGIH: Norm for heart problems people up to 50 µT * **NCRP: Max. recommended level 1 µT** * **AGNIR-HPA: Max. recommended level 0.4 µT** Others: Countries like Switzerland, New Zeland and some states of USA up to 1-2 µT **Electric Field - Low Frequency** ICNRIP / ACGIH: Norm for people up to 5 kV/m ICNRIP / ACGIH: Norm for heart problems people up to 1 kV/m
* Applicable Standard	* Applicable Standard

Norms: EN61000-4-8

Test	Specification (max. level)	Norm
Magnetic field at 50 Hz	3 A/m 3,75 µT	EN61000-4-8

Recommendations

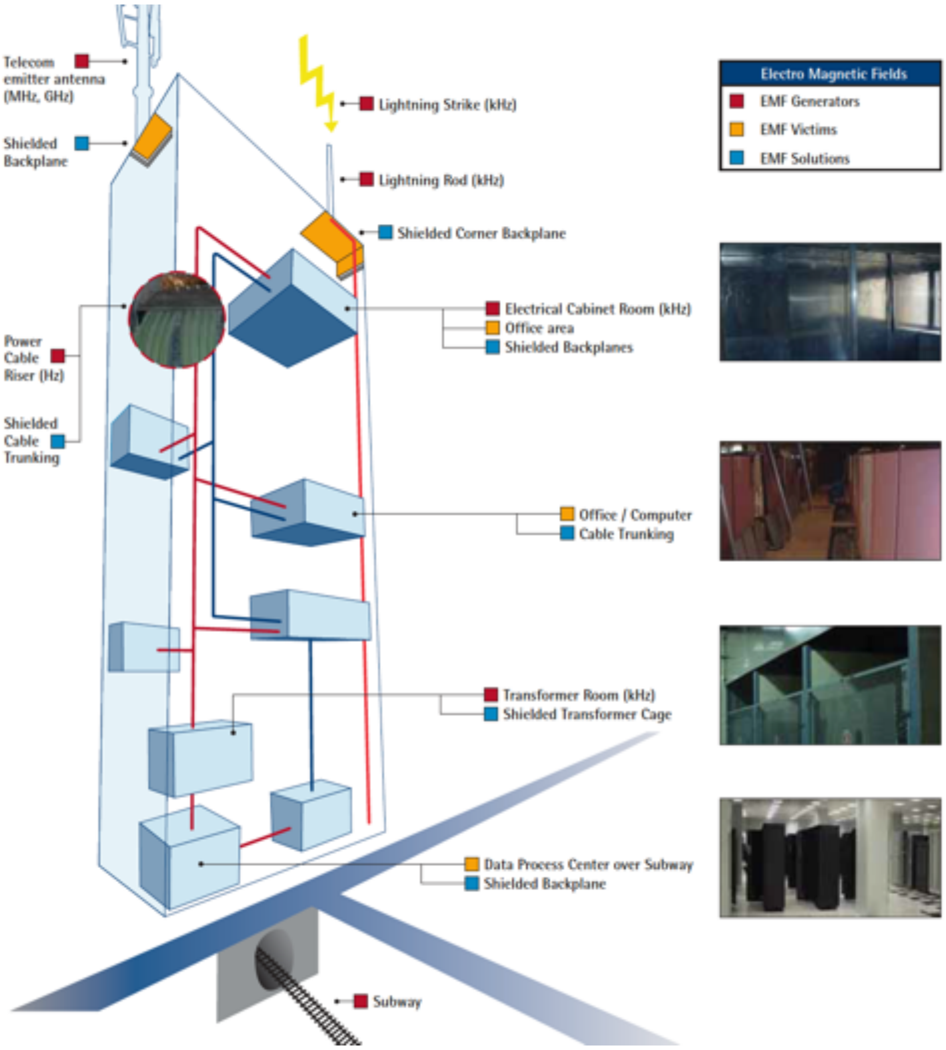
NCRP Draft Recommendations on EMF Exposure Guidelines

Here below is repoduced Section 8 of the June 13, 1995, draft of the report of NCRP (National Council Radiation of Protection) Scientific Committee 89-3 on Extremely Low Frequency Electric and Magnetic Fields, which contains its conclusions and recommendations.

“ 8.4.1.3 Option 3: An exposure guideline of 1 µT and 100 V/m: A considerable body of observations has documented bioeffects of fields at these strengths across the gamut from isolated cells to animals, and in man. (...) . Most homes and occupational environments are within these values, but it would be prudent to assume that higher levels may constitute a health risk ”

General Applications

How to protect people and electronics from ElectroMagnetic Fields



Benefits of EMC Building

Complete protection to:

- Hardware: electronics destruction, degradation, screen flickering, hard diskc damage, ..
- Software: data loss, data corruption, network speed decrease, ..
- Human Beings: short and long term diseases, headache, migraine, child leukemia ..

Output of MV / LV Transformers

One of the main causes of magnetic field exposure in MV / LV electrical substations is represented by the output of the LV transformer.

As shown in Fig 2, the output is equivalent to the three sections of the conductor which are spaced out the same distance as the terminals of the transformer (D) on the transformer side. They are closer together (d) on the other side, where they form the bundle of cables directed toward the LV distribution substation. The height of the cables is a parameter that can vary depending on the installation mode. The distances on the different axis (with reference to Fig 2) when magnetic induction is equal to 3 µT (quality target) have been calculated on the basis of the nominal power and therefore on the basis of the secondary LV currents.

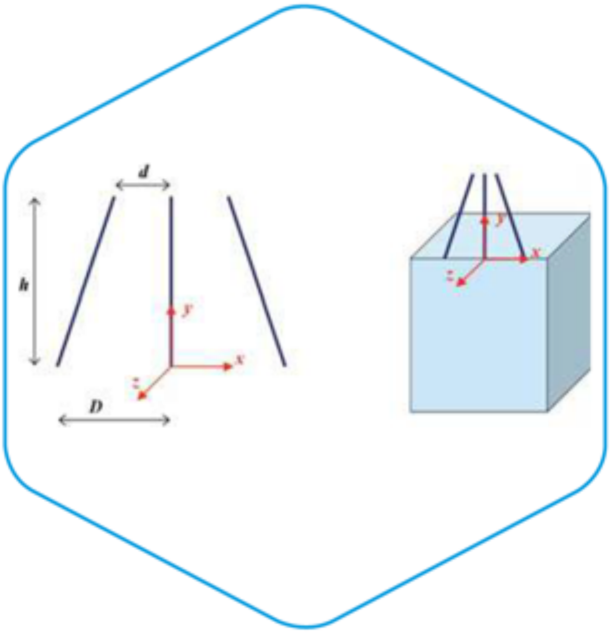


Fig. 2 - Graphic representation of a MV/LV transformer with the LV output pointing upwards.

The results are shown in Tables 1, 2 and 3 respectively for x, y and z. It is clear from the tables that the output LV is a substantial pollutant component and that in the case of major power supplies the distances affected can be significantly more than 10 metres.

When substations are located in the vicinity of civilian, commercial or industrial settings where the quality target must be satisfied, it is necessary to implement shielding systems for almost all power supply levels.

Table 1. Distance from the centre of the system's coordinates along the X axis to obtain 3 μT.

Rated power	Rated secondary power	h=0.5 (m)	h=0.6 (m)	h=0.7 (m)	h=0.8 (m)	h=0.9 (m)	h=1.0 (m)
250	361	2.47	2.69	2.90	3.09	3.26	3.43
315	455	2.77	3.03	3.25	3.47	3.68	3.86
400	577	3.13	3.41	3.68	3.92	4.14	4.36
500	722	3.49	3.81	4.11	4.38	4.64	4.88
630	909	3.91	4.28	4.61	4.92	5.22	5.49
800	1155	4.41	4.82	5.20	5.55	5.88	6.19
1000	1443	4.93	5.39	5.81	6.21	6.58	6.93
1250	1804	5.50	6.03	6.50	6.94	7.35	7.75
1600	2309	6.23	6.81	7.35	7.86	8.32	8.77
2000	2887	6.96	7.61	8.22	8.78	9.31	9.81
2500	3608	7.78	8.51	9.19	9.82	10.41	10.97

Table 2. Distance from the centre of the system's coordinates along the Y axis to obtain 3 μT.

Rated power	Rated secondary power	h=0.5 (m)	h=0.6 (m)	h=0.7 (m)	h=0.8 (m)	h=0.9 (m)	h=1.0 (m)
250	361	3.10	3.14	3.16	3.20	3.23	3.26
315	455	3.54	3.57	3.60	3.63	3.67	3.69
400	577	4.10	4.13	4.16	4.19	4.22	4.25
500	722	4.65	4.68	4.70	4.73	4.77	4.79
630	909	5.27	5.30	5.32	5.35	5.39	5.41
800	1155	6.05	6.08	6.11	6.14	6.16	6.20
1000	1443	6.87	6.90	6.93	6.96	6.99	7.02
1250	1804	7.86	7.88	7.90	7.94	7.96	7.99
1600	2309	9.05	9.07	9.09	9.12	9.14	9.18
2000	2887	10.37	10.39	10.42	10.45	10.47	10.50
2500	3608	11.94	11.96	11.98	12.01	12.04	12.07

Table 3. Distance from the centre of the system's coordinates along the Z axis to obtain 3 μT.

Rated power	Rated secondary power	h=0.5 (m)	h=0.6 (m)	h=0.7 (m)	h=0.8 (m)	h=0.9 (m)	h=1.0 (m)
250	361	3.26	3.36	3.47	3.59	3.70	3.82
315	455	3.72	3.83	3.95	4.07	4.21	4.33
400	577	4.29	4.41	4.54	4.68	4.81	4.96
500	722	4.86	4.99	5.14	5.28	5.43	5.59
630	909	5.51	5.66	5.81	5.97	6.14	6.32
800	1155	6.32	6.48	6.65	6.82	7.01	7.20
1000	1443	7.18	7.34	7.52	7.71	7.92	8.13
1250	1804	8.17	8.35	8.54	8.75	8.96	9.19
1600	2309	9.39	9.59	9.80	10.02	10.26	10.50
2000	2887	10.74	10.94	11.17	11.40	11.65	11.92
2500	3608	12.33	12.53	12.76	13.02	13.28	13.56

Notes:

(1) The D parameter is an average value which is not linked to any particular make of transformers.

(2) The d parameter is calculated on the basis of the diameter of the output cables.

Distribution Lines and Shielding Channels

Unipolar power cables are commonly used for high current distribution lines in industrial and civilian environments. A classic example is the power supply of air conditioning system engines where it is common to find more cables used in parallel, adding to thousands of amperes. The exposure level caused by induction is clearly to be kept within the quality target (3 μT), but sometimes more stringent limits are required (0.1 μT near electronic microscopes for example).

Figure 3 shows the coloured map of the magnetic induction of a three-phase line with 400 mm2 cables with an ampacity of 605 A.

It can be seen that in order to stay below 3 µT the distance from the centre of the line is about 1.4 m. Table 4 shows the buffer zone values associated with the induction of 3 µT for lines up to 2000 A consisting of single core cables in parallel.

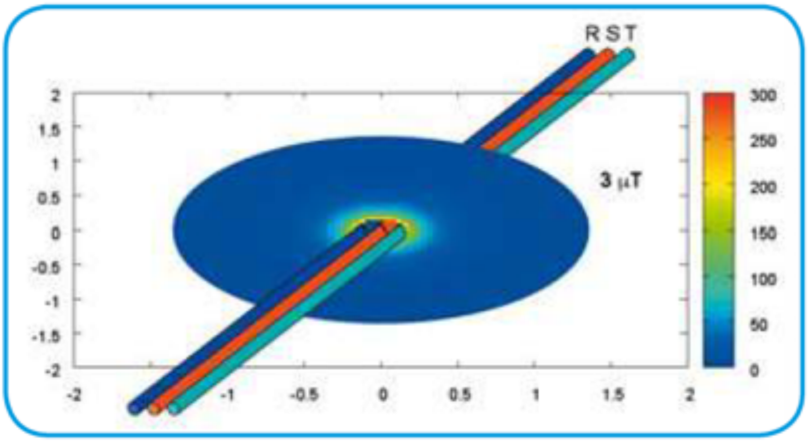


Fig. 3 - Coloured map of the magnetic induction of a three-phase line with 400 mm² cables with an ampacity of 605 A.

Table 4.

Thermal capacity of the line (A)	Nominal diameter of the conductors (mm²)	Phase layout	Protection distance 3 µT (m)
88	16	RST	0.24
117	25	RST	0.30
144	35	RST	0.37
175	50	RST	0.45
222	70	RST	0.55
269	95	RST	0.65
312	120	RST	0.74
355	150	RST	0.83
417	185	RST	0.95
490	240	RST	1.10
530	300	RST	1.21
605	400	RST	1.39
834	2x185	RRSSTT	1.90
980	2x240	RRSSTT	2.20
1251	3x185	RRRSSSTTT	2.85
1470	3X240	RRRSSSTTT	3.30
1668	4X185	RRRRSSSSTTTT	3.80
1960	4X240	RRRRSSSSTTTT	4.4

Shielding channels have a high shielding performance with an average screen factor of approx 30. Figure 4 shows a coloured map of the magnetic induction of a three-phase line with 400 mm2 cables with an ampacity of 605 A. The comparison with induction levels in the absence of shielding is obvious. The reduction in levels of induction involves a significant reduction in buffer zones. Table 5 shows the bands with respect to the different lines inserted into the shielding channel while Figure 4 shows the comparison between the buffer strips with and without channel shielding.

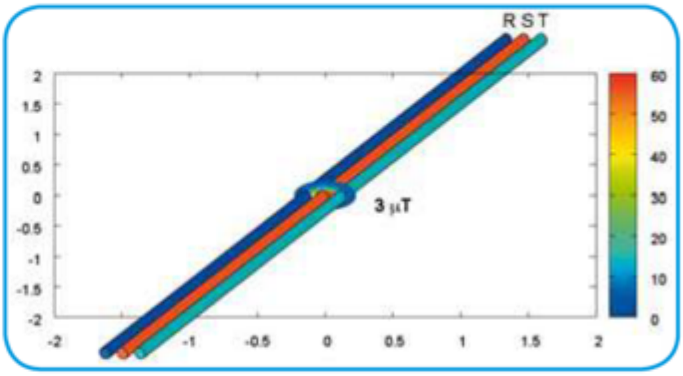


Fig. 4 - Coloured map of the magnetic induction of a three-phase line with 400 mm² cables, with an ampacity of 605 A, placed within a shielding channel.

Tabla 5.

Thermal capacity of the line (A)	Nominal diameter of the conductors (mm²)	Phase layout	Protection distance 3 μT (m)
88	16	RST	-
117	25	RST	-
144	35	RST	-
175	50	RST	-
222	70	RST	-
269	95	RST	-
312	120	RST	-
355	150	RST	0.15
417	185	RST	0.17
490	240	RST	0.20
530	300	RST	0.21
605	400	RST	0.25
834	2x185	RRSSTT	0.35
980	2x240	RRSSTT	0.40
1251	3x185	RRRSSSTTT	0.52
1470	3X240	RRRSSSTTT	0.60
1668	4X185	RRRRSSSSTTTT	0.69
1960	4X240	RRRRSSSSTTTT	0.80

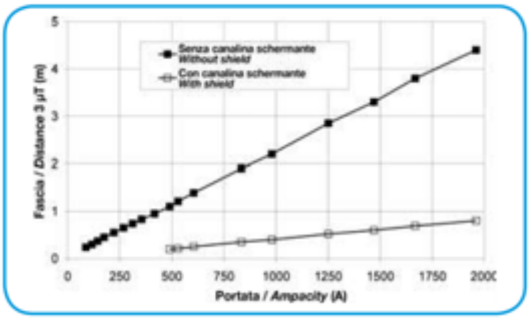


Fig. 4a - Comparison between the protection distance at 3 μT (m) with and without shielding channel.

Description of Shielding Materials

Mitigation of the magnetic flux density is achieved for both shielding plates and shielding channels by affixing

magnetic shields made of two different materials:
• Material with high magnetic permeability.
• Material with high electrical conductivity.

The effect of incorporating both materials is clearly visible from simulations carried out using specific software that allows viewing the evolution of the field lines for the shielding materials when they are affected by a magnetic field generated by a coil. Figure 5 which also shows the progress of the field lines in the absence of a shielding system clearly demonstrates the effectiveness of the shielding materials:

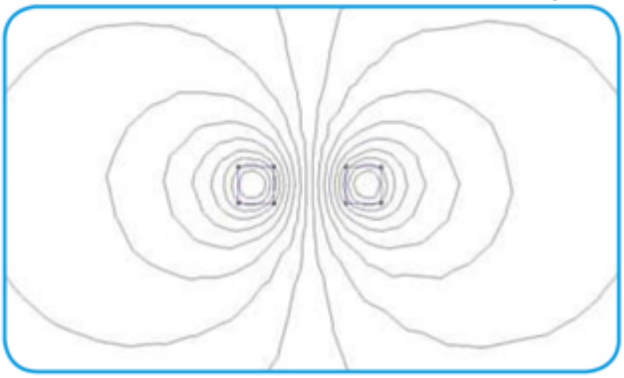


Fig. 5 - Magnetic field produced by a coil in the presence and the absence of shielding.

The layer of material with high magnetic permeability eliminates magnetic induction through absorption of the magnetic field. Its behaviour is similar to a shielding “umbrella” as protection from the intensity of the magnetic field can be very high close to the shield, but tends to decrease away from it.

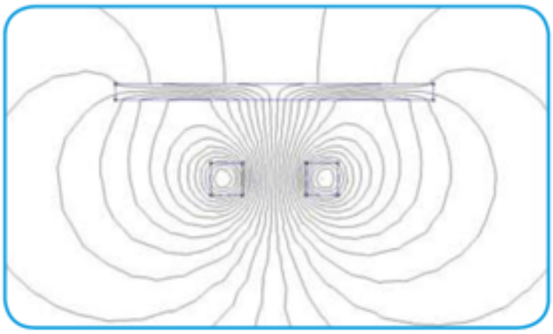


Fig. 6 - Magnetic field produced by a coil with ferromagnetic shielding.

The layer of material with high electrical conductivity in the presence of a variable magnetic field (induction field) becomes the site of current movement, which in turn generates a magnetic field of reaction (induced field). The combined effects of the fields, induction and induced, results in a reduction in the overall total magnetic field.

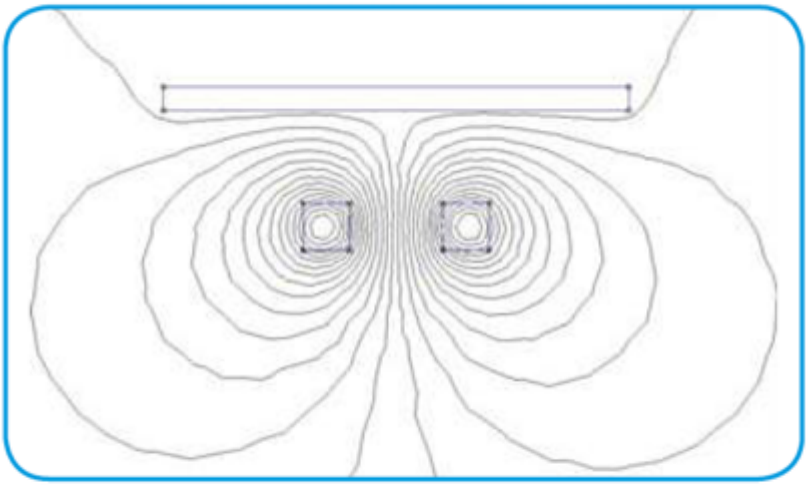


Fig. 7 - Magnetic field produced by a coil in with a conductive shield.

The layer of material with high electrical conductivity in the presence of a variable magnetic field (induction field) becomes the site of current movement, which in turn generates a magnetic field of reaction (induced field). The combined effects of the fields, induction and induced, results in a reduction in the overall total magnetic field.

ShieldMax

Shielded Trays (Power & Data)

Selection guide

Trays to protect Electronic Equipment:

EMF Source / Distance from the source to exposed area	100 A	300 A		500 A		1kA		3 kA		5 kA	
	Cable	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar
< 0,8 meter	upon request	ST	ST	HPT	ST	HPT	HPT	UHPT	UHPT	upon request	upon request
0,8 - 1,5 meters	ST	ST	ST	ST	ST	ST	ST	HPT	HPT	UHPT	HPT
>1,5 meters	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST

ST ~ Standard Tray HPT ~ High Performance Tray UHPT ~ Ultra High Performance Tray

note: chart according IEC 61000-4-8 (Protection for electronic equipment) <3,75 µT

Trays to protect Human Beings:

EMF Source / Distance from the source to exposed area	100 A	300 A		500 A		1kA		3 kA		5 kA	
	Cable	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar	Cable	Bus Bar
< 0,8 meter	upon request	HPT	ST	HPT	ST	UHPT	HPT	UHPT	UHPT	upon request	upon request
0,8 - 1,5 meters	upon request	ST	ST	HPT	ST	HPT	HPT	UHPT	UHPT	upon request	UHPT
1,5 - 2,5 meters	ST	ST	ST	ST	ST	ST	ST	HPT	HPT	HPT	HPT
>2,5 meters	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST

ST ~ Standard Tray HPT ~ High Performance Tray UHPT ~ Ultra High Performance Tray

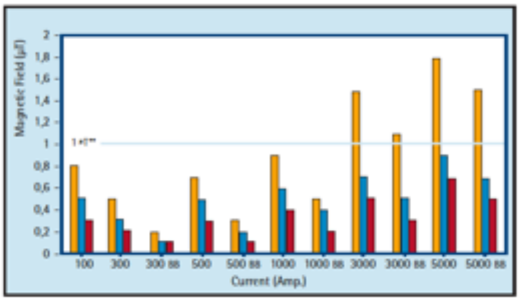
note: chart according NCRP Recommendation (Protection for people) <1 µT

* special products and dimensions available upon request

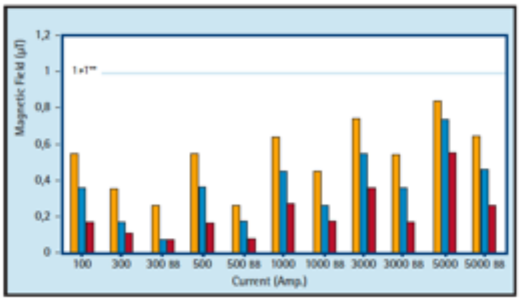
ShieldMax

Attenuation Test

1,5 - 2,5 meters

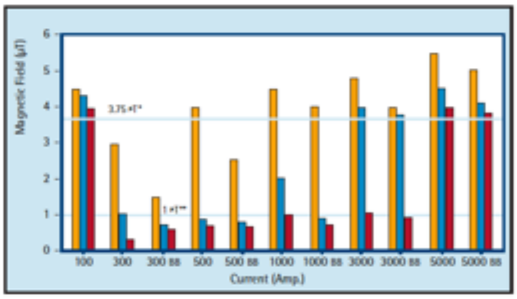


> 2,5 meters

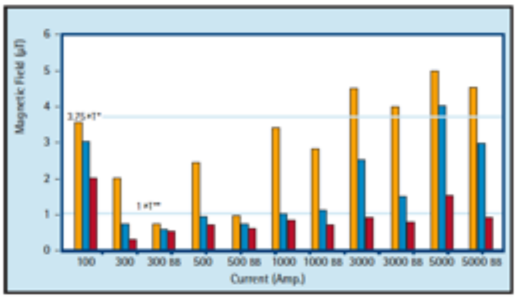


ST ~ Standard Tray HPT ~ High Performance Tray UHPT ~ Ultra High Performance Tray
* IEC61000-4-8 level from electronic equipment protection ** NCRP level from human beings protection

< 0,8 meters

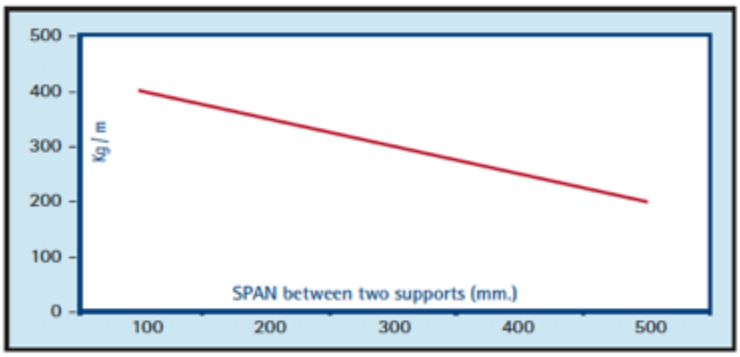


0,8 - 1,5 meters

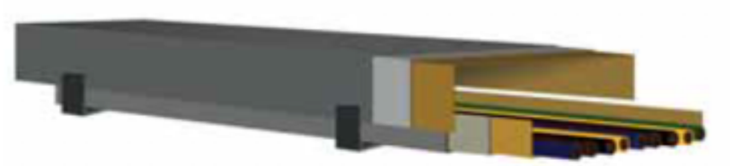


ST ~ Standard Tray HPT ~ High Performance Tray UHPT ~ Ultra High Performance Tray
* IEC61000-4-8 level from electronic equipment protection ** NCRP level from human beings protection

Mechanical Weight Performance



Design Highlights



- Easy Access
- Easy Installation
- Safe Cable Installation
- Maximum EMF Protection
- Cooling

Overlapping

Ventilation

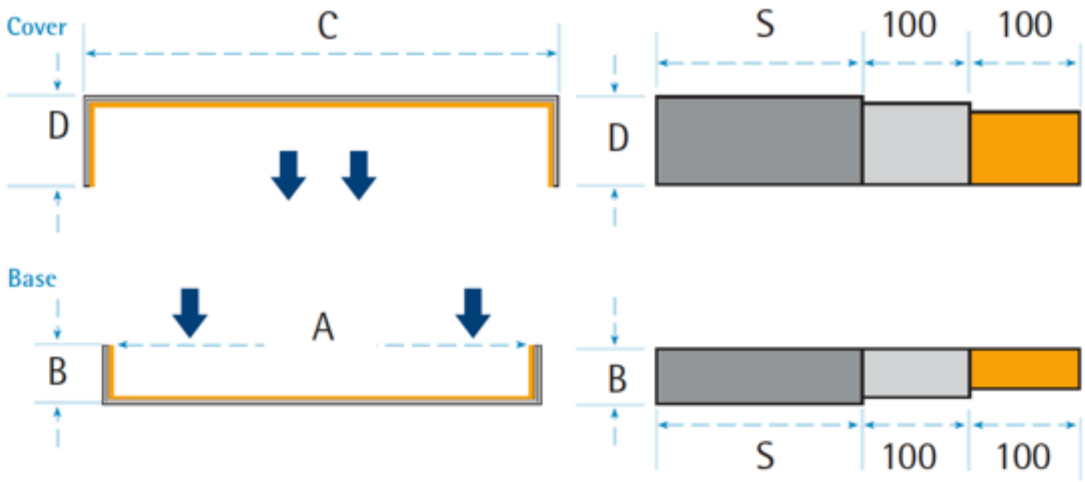
EN 66004 / 66231 / 66346	BS 6004 / 6231 / 6346

Current-Carrying Capacity Amps		
Conductor Cross Sectional - area (mm²)	Correction factor referred to reference method 11	
	2 cables Single-Phase	3 or 4 cables Three-Phase
>25	0,94	0,93

ShieldMax

Models & Dimensions

Straight Segments (all dimensions in mm)



Ref. Number (example)

Straight Segment

Problem: Three phases cable of 1000 Amps, 10 meters length (straight) running (at 1 meter distance) from office area.

Question: What shielded tray should be installed to protect people (human beings)?

Answer:

	Shielding performance	length	straigth	Width (A) - Height (B)
10 units x	UHPT	1000	S	515 - 100

Standard Performance Tray (all dimensions in mm)					
S	A (Base)	B	C (Cover)	D	Weigth (kg.)
ST 300	115	50 / 100 / 200	147	70 / 120 / 220	2,10 / 2,84 / 4,46 /
	215	50 / 100 / 200	247	70 / 120 / 220	2,85 / 3,65 / 5,27
	315	50 / 100 / 200	347	70 / 120 / 220	3,65 / 4,46 / 6,08
	415	50 / 100 / 200	447	70 / 120 / 220	4,46 / 5,27 / 6,89
	515	50 / 100 / 200	547	70 / 120 / 220	5,27 / 6,10 / 7,70
ST 500	115	50 / 100 / 200	147	70 / 120 / 220	3,39 / 4,74 / 7,44
	215	50 / 100 / 200	247	70 / 120 / 220	4,74 / 6,10 / 8,79
	315	50 / 100 / 200	347	70 / 120 / 220	6,10 / 7,44 / 10,14
	415	50 / 100 / 200	447	70 / 120 / 220	7,44 / 8,80 / 11,49
	515	50 / 100 / 200	547	70 / 120 / 220	8,79 / 10,15 / 12,84
ST 1000	115	50 / 100 / 200	147	70 / 120 / 220	6,77 / 9,50 / 14,88
	215	50 / 100 / 200	247	70 / 120 / 220	9,47 / 12,17 / 17,58
	315	50 / 100 / 200	347	70 / 120 / 220	12,17 / 14,87 / 20,28
	415	50 / 100 / 200	447	70 / 120 / 220	14,87 / 17,60 / 22,98
	515	50 / 100 / 200	547	70 / 120 / 220	17,57 / 20,30 / 25,68

ShieldMax

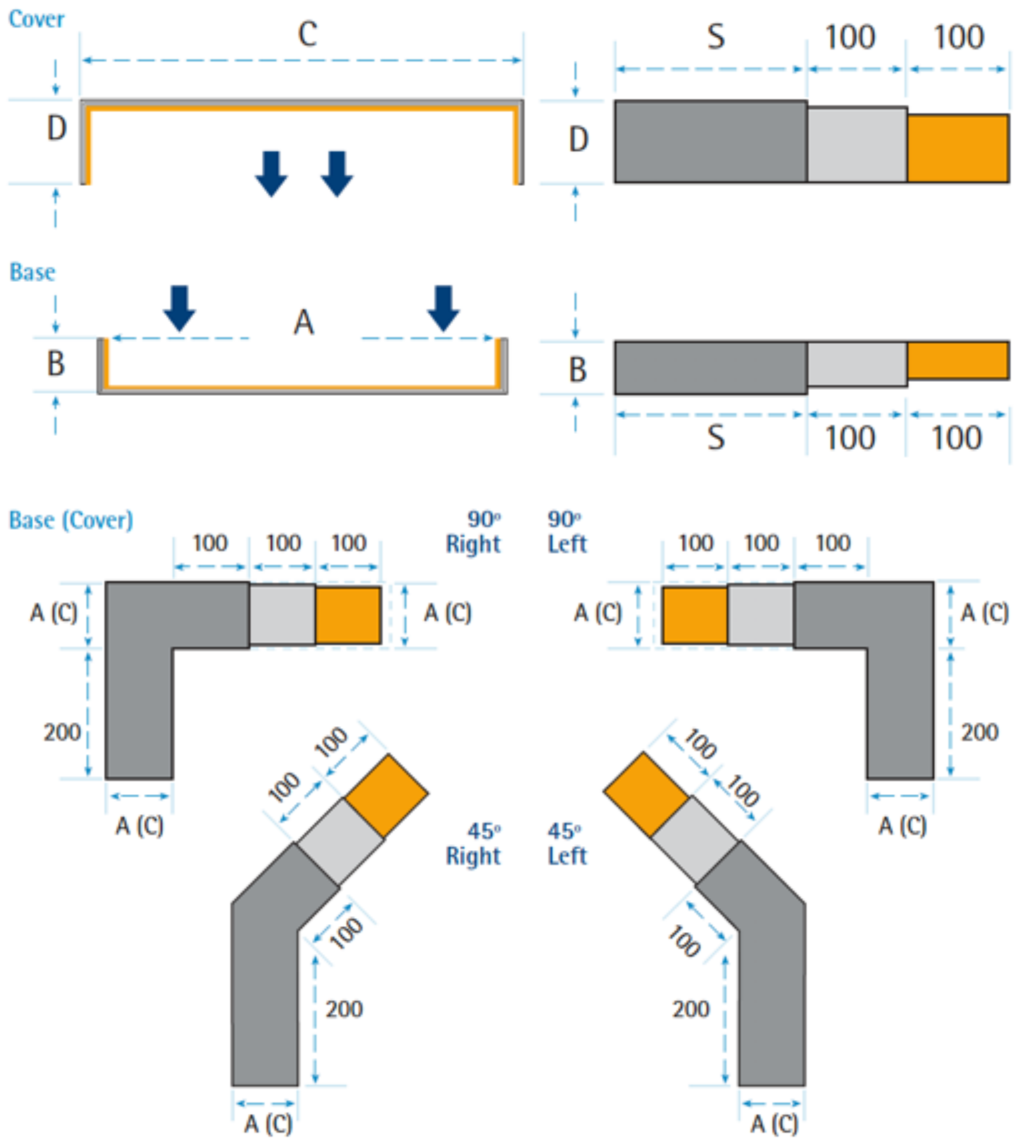
High Performance Tray (all dimensions in mm.)

S	A (Base)	B	C (Cover)	D	Weigth (kg.)
HPT 300	115	50 / 100 / 200	160	75 / 125 / 225	4,25 / 5,87 / 9,11
	215	50 / 100 / 200	260	75 / 125 / 225	5,87 / 7,50 / 10,73
	315	50 / 100 / 200	360	75 / 125 / 225	7,50 / 9,10 / 12,35
	415	50 / 100 / 200	460	75 / 125 / 225	9,11 / 10,70 / 13,97
	515	50 / 100 / 200	560	75 / 125 / 225	10,73 / 12,35 / 15,59
HPT 500	115	50 / 100 / 200	160	75 / 125 / 225	7,10 / 9,80 / 15,19
	215	50 / 100 / 200	260	75 / 125 / 225	9,80 / 12,50 / 17,89
	315	50 / 100 / 200	360	75 / 125 / 225	12,50 / 15,20 / 20,59
	415	50 / 100 / 200	460	75 / 125 / 225	15,20 / 17,90 / 23,29
	515	50 / 100 / 200	560	75 / 125 / 225	17,90 / 20,60 / 25,59
HPT 1000	115	50 / 100 / 200	160	75 / 125 / 225	14,17 / 19,57 / 30,38
	215	50 / 100 / 200	260	75 / 125 / 225	19,57 / 25,00 / 35,78
	315	50 / 100 / 200	360	75 / 125 / 225	25,00 / 30,37 / 41,18
	415	50 / 100 / 200	460	75 / 125 / 225	30,37 / 35,77 / 46,58
	515	50 / 100 / 200	560	75 / 125 / 225	35,77 / 41,20 / 51,98

Ultra High PerformanceTray (all dimensions in mm.)

S	A (Base)	B	C (Cover)	D	Weigth (kg.)
UHPT 300	115	50 / 100 / 200	185	85 / 135 / 235	9,23 / 12,50 / 18,95
	215	50 / 100 / 200	285	85 / 135 / 235	12,47 / 15,70 / 22,19
	315	50 / 100 / 200	385	85 / 135 / 235	15,71 / 19,00 / 25,43
	415	50 / 100 / 200	485	85 / 135 / 235	19,00 / 22,20 / 28,67
	515	50 / 100 / 200	585	85 / 135 / 235	22,20 / 25,40 / 31,91
UHPT 500	115	50 / 100 / 200	185	85 / 135 / 235	15,40 / 20,80 / 31,59
	215	50 / 100 / 200	285	85 / 135 / 235	20,80 / 26,20 / 36,99
	315	50 / 100 / 200	385	85 / 135 / 235	26,20 / 31,60 / 42,39
	415	50 / 100 / 200	485	85 / 135 / 235	31,60 / 37,00 / 47,79
	515	50 / 100 / 200	585	85 / 135 / 235	37,00 / 42,40 / 53,19
UHPT 1000	115	50 / 100 / 200	185	85 / 135 / 235	30,80 / 41,60 / 63,18
	215	50 / 100 / 200	285	85 / 135 / 235	41,60 / 52,40 / 73,98
	315	50 / 100 / 200	385	85 / 135 / 235	52,40 / 63,20 / 84,78
	415	50 / 100 / 200	485	85 / 135 / 235	63,20 / 74,00 / 95,58
	515	50 / 100 / 200	585	85 / 135 / 235	73,80 / 84,80 / 106,38

Curves (all dimensions in mm)



Ref. Number (example)
Curve Segment

Shielding performance	angle	curve (T)	width (A) - Height (B)
UHPT	90	R	515 - 200

ShieldMax

Standard Performance Tray (all dimensions in mm.)

T	A	B (Base)	C	D (Cover)	Weigth (kg.)
ST 45 R / L	115	50 / 100 / 200	147	70 / 120 / 220	5,36 / 7,23 / 10,98
	215	50 / 100 / 200	247	70 / 120 / 220	8,59 / 10,47 / 14,22
	315	50 / 100 / 200	347	70 / 120 / 220	12,57 / 14,45 / 18,20
	415	50 / 100 / 200	447	70 / 120 / 220	17,31 / 19,18 / 22,93
	515	50 / 100 / 200	547	70 / 120 / 220	22,79 / 24,66 / 28,41
ST 90 R / L	115	50 / 100 / 200	147	70 / 120 / 220	6,01 / 7,89 / 11,64
	215	50 / 100 / 200	247	70 / 120 / 220	10,60 / 12,48 / 16,23
	315	50 / 100 / 200	347	70 / 120 / 220	16,69 / 18,57 / 22,39
	415	50 / 100 / 200	447	70 / 120 / 220	24,28 / 26,16 / 29,91
	515	50 / 100 / 200	547	70 / 120 / 220	33,37 / 35,25 / 39,00

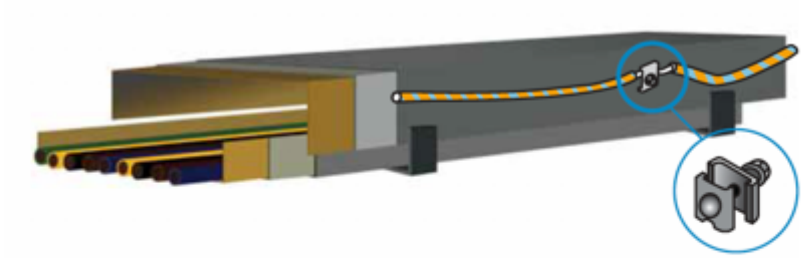
High Performance Tray (all dimensions in mm.)

T	A	B (Base)	C	D (Cover)	Weigth (kg.)
HPT 45 R / L	115	50 / 100 / 200	160	75 / 125 / 225	6,48 / 8,63 / 12,93
	215	50 / 100 / 200	260	75 / 125 / 225	10,24 / 12,39 / 16,69
	315	50 / 100 / 200	360	75 / 125 / 225	14,86 / 17,01 / 21,31
	415	50 / 100 / 200	460	75 / 125 / 225	20,35 / 20,50 / 26,80
	515	50 / 100 / 200	560	75 / 125 / 225	26,69 / 28,84 / 33,14
HPT 90 R / L	115	50 / 100 / 200	160	75 / 125 / 225	7,31 / 9,46 / 13,76
	215	50 / 100 / 200	260	75 / 125 / 225	12,69 / 14,84 / 19,14
	315	50 / 100 / 200	360	75 / 125 / 225	19,78 / 21,93 / 26,23
	415	50 / 100 / 200	460	75 / 125 / 225	28,60 / 30,75 / 35,03
	515	50 / 100 / 200	560	75 / 125 / 225	39,13 / 41,28 / 45,58

Ultra High PerformanceTray (all dimensions in mm.)

T	A	B (Base)	C	D (Cover)	Weigth (kg.)
UHPT 45 R / L	115	50 / 100 / 200	185	85 / 135 / 235	8,98 / 11,68 / 17,08
	215	50 / 100 / 200	285	85 / 135 / 235	13,84 / 16,54 / 21,94
	315	50 / 100 / 200	385	85 / 135 / 235	19,78 / 22,48 / 27,88
	415	50 / 100 / 200	485	85 / 135 / 235	26,80 / 29,50 / 34,90
	515	50 / 100 / 200	585	85 / 135 / 235	34,90 / 37,60 / 43,00
UHPT 90 R / L	115	50 / 100 / 200	185	85 / 135 / 235	10,26 / 12,96 / 18,36
	215	50 / 100 / 200	285	85 / 135 / 235	17,28 / 19,98 / 25,38
	315	50 / 100 / 200	385	85 / 135 / 235	26,46 / 29,16 / 34,56
	415	50 / 100 / 200	485	85 / 135 / 235	37,80 / 40,50 / 45,90
	515	50 / 100 / 200	585	85 / 135 / 235	51,30 / 54,00 / 59,40

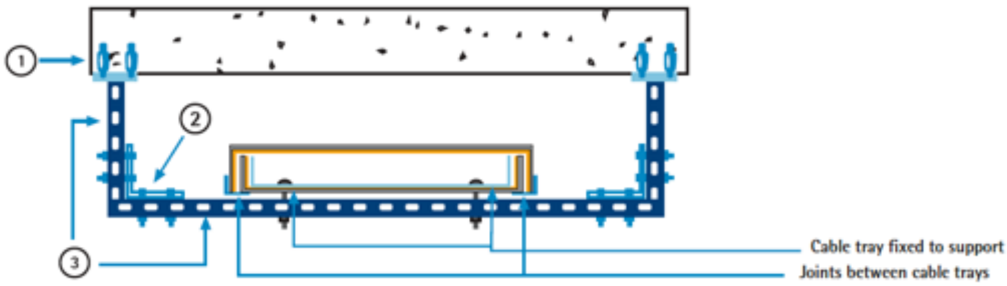
Installation guide



Note: Cable tray must be connected to ground with 25 mm^2 copper cable

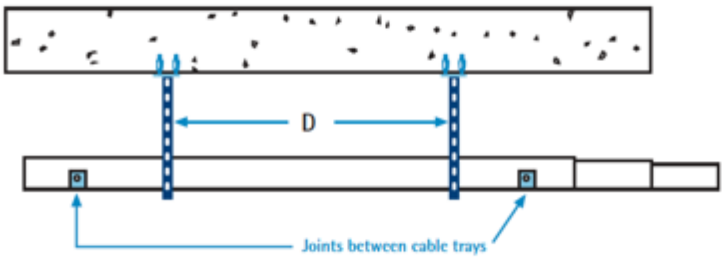
Supports (manufactured by HILTI)

Fixing supports to concrete ceiling



	Description	Reference (HILTI)	Screws	Length (mm)	Screws
1	Fastener or concrete	ML-B-30/220	307129/7	220	M8x30 and M8x60 (incl.)
		ML-B-30/350	307130/5	350	
2	Corners support and screws	ML-A-90	307128/9	44	M8x10 (incl.)
3	vertical and horitzontal support	ML-C-30	307120/6	2000	NO

Distance between supports



Note: joints must be separated from fixing supports to concrete ceiling

Important exception:

Models: UHTP 1000 S 515 or UHTP 1000 S 415 must be fixed with 3 supports

2 supports for each straight segment or curve segment
S: length of straight segment D: S/2

Applications and Installations Examples

Magnetic and Electric Field Low Frequency

1. Hospitals:
protection of the sensible equipment (Magnetic Resonance Room (MRI) and surroundings, X-Ray Room,...) and people.

2. Offices and Residential Buildings:
electronic equipment (computers, servers,...) and people protection (e.g. High Voltage Lines, Subway,...).

3. Factories:
offices near production lines, machines (e.g. electric welding), transformers, Electrical Switchboards,...

6. Airports:
communication rooms, racks rooms,...

7. Pharmaceutical and Bio-tech Labs.

Shielded Backplanes

Selection guide

Distance to Source exposed area \ EMF Source	200 amps	600 amps	1000 amps	2000 amps	3000 amps
< 0,8 meter	HPP	HPP	HPP	UHPP	UHPP
0,8 - 1,5 meters	SPP	SPP	SPP	HPP	HPP
> 1,5 meters	SPP	SPP	SPP	SPP	SPP

SPP ~ Standard HPP ~ High Performance UHPP ~ Ultra High Performance
note: chart according IEC 61000-4-8 (Protection for electronic equipment) <3,75 µT

Distance to Source exposed area \ EMF Source	200 amps	600 amps	1000 amps	2000 amps	3000 amps
< 0,8 meter	HPP	UHPP	UHPP	UHPP	UHPP
0,8 - 1,5 meters	HPP	HPP	HPP	UHPP	UHPP
> 1,5 meters	SPP	SPP	SPP	SPP	SPP

SPP ~ Standard HPP ~ High Performance UHPP ~ Ultra High Performance
note: chart according NCRP Recommendation (Protection for people) <1 µT

* special products and dimensions available under request

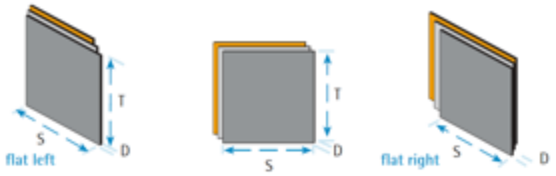
ShieldMax

Selection guide

Models and Dimensions

(all dimensions in mm)

Flat Planes

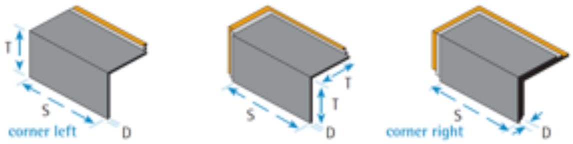


	S	T	D
SP	500	500	3
	500	1000	3
	1000	500	3
	1000	1000	3

	S	T	D
HPP	500	500	6
	500	1000	6
	1000	500	6
	1000	1000	6

	S	T	D
UHPP	500	500	12
	500	1000	12
	1000	500	12
	1000	1000	12

Corner Planes



	S	T	D
SP	500	500	3
	1000	500	3

	S	T	D
HPP	500	500	6
	1000	500	6

	S	T	D
UHPP	500	500	12
	1000	500	12

Ref. Number (example)

Flat and corner planes

Problem: Electrical cabinet (2x2 meters) 1000 Amps (at 1 meter distance) from office area.

Question: Which backplanes should be installed to protect people (human beings)?

Answer:

	Shielding performance	length (T)	Flat / Corner	width (S)
4 units x	UHPP	1000	F	1000

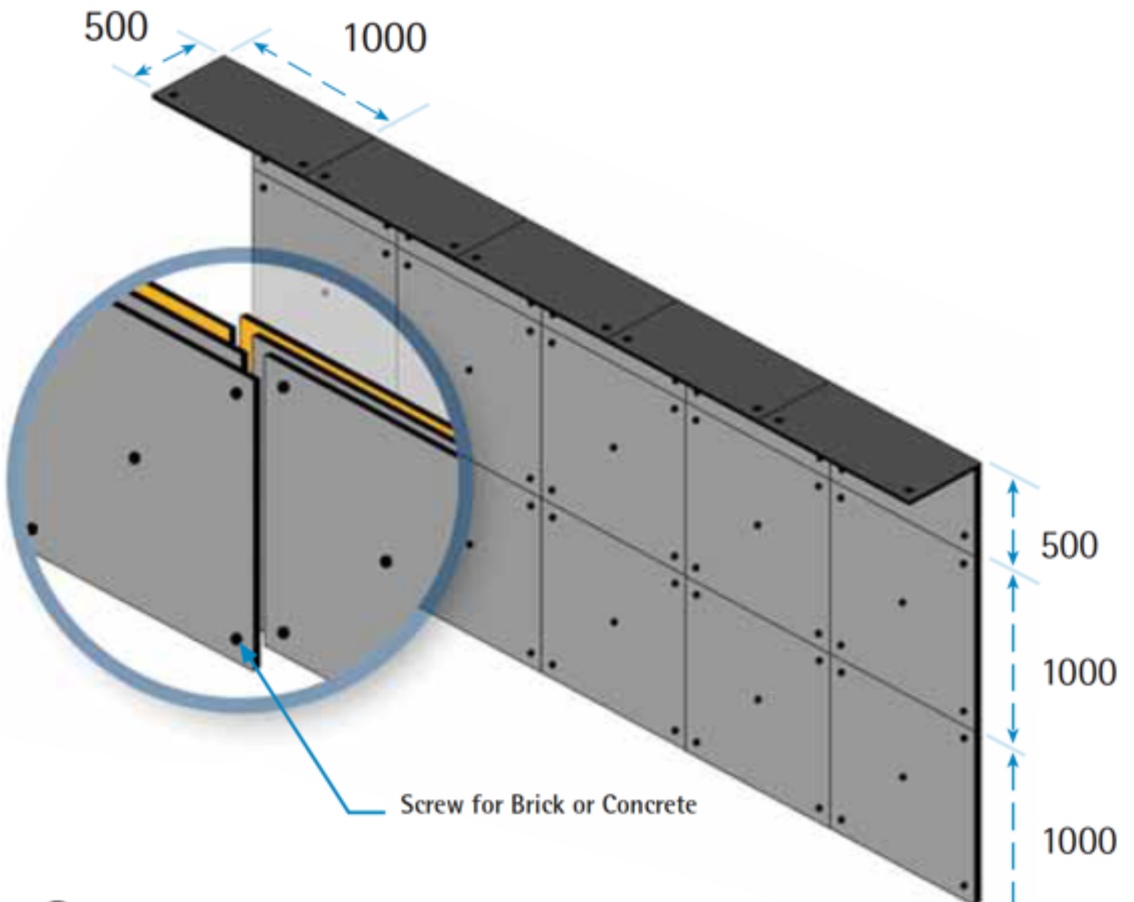
Installation Guide

Installation method depends on wall material.
If wall is made of brick or concrete, shielding panels will be fixed directly to wall with screws.
In case of wall is made of gypsum wall, panels must be fixed with screws and special nuts.

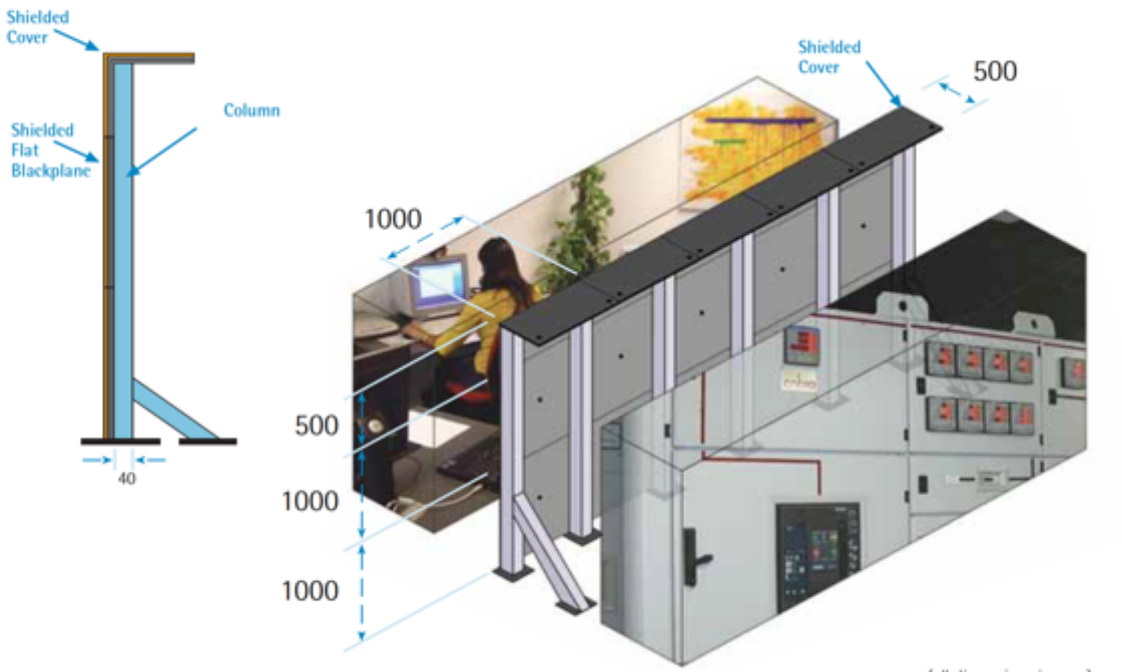
NOTE: Panels must be connected to ground with 25 mm2 copper wire.

ShieldMax

1 Direct support wall



2 Self standing structure



* Self standing structure quoted under request

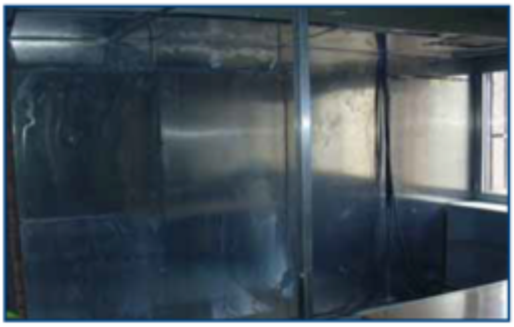
(all dimensions in mm.)

Applications and Installation Examples

Magnetic and Electric Field Low Frequency

1. Hospitals:
protection of the sensible equipment (Magnetic Resonance Room (MRI) and surroundings, X-Ray Room,...) and people.

2. Offices and Residential Buildings:
electronic equipment (computers, servers,...) and people protection (e.g. High Voltage Lines, Subway,...).



3. Factories:
offices near production lines, machines (e.g. electric welding), transformers, Electrical Switchboards,...

4. Telecom rooms / Network centers / Data Centers / Back-up Rooms
(with an electrical switchboards nearby)

5. Airports:
communication rooms, racks rooms,...

6. Pharmaceutical and Bio-tech Labs.
(electrical switchboards aside)

7. Buildings
(High voltage lines protection)

ShieldMax

Shielded Transformers Cages

Selection Guide

Distance to Source exposed area \ EMF Source	200 kVA	600 kVA	1000 kVA	2000 kVA	3000 kVA
< 0,8 meter	HPTC	HPTC	HPTC	UHPTC	UHPTC
0,8 - 1,5 meters	SPTC	SPTC	SPTC	HPTC	HPTC
> 1,5 meters	SPTC	SPTC	SPTC	SPTC	SPTC

SPTC ~ Standard HPTC ~ High Performance UHPTC ~ Ultra High Performance

note: chart according IEC 61000-4-8 (Protection for electronic equipment) <3,75 µT

Distance to Source exposed area \ EMF Source	200 kVA	600 kVA	1000 kVA	2000 kVA	3000 kVA
< 0,8 meter	HPTC	UHPTC	UHPTC	UHPTC	UHPTC
0,8 - 1,5 meters	HPTC	HPTC	HPTC	UHPTC	UHPTC
> 1,5 meters	SPTC	SPTC	SPTC	SPTC	SPTC

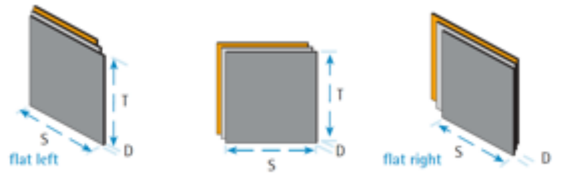
SPTC ~ Standard HPTC ~ High Performance UHPTC ~ Ultra High Performance

note: chart according NCRP Recommendation (Protection for people) <1 µT

* special products and dimensions available under request

Models and Dimensions

Flat Planes

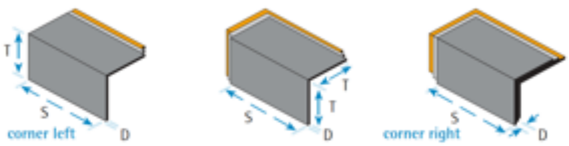


	S	T	D
STC	500	500	3
	500	1000	3
	1000	500	3
	1000	1000	3

	S	T	D
HPTC	500	500	6
	500	1000	6
	1000	500	6
	1000	1000	6

	S	T	D
UHPTC	500	500	12
	500	1000	12
	1000	500	12
	1000	1000	12

Corner Planes



	S	T	D
STC	500	500	3
	1000	500	3

	S	T	D
HPTC	500	500	6
	1000	500	6

	S	T	D
UHPTC	500	500	12
	1000	500	12

Ref. Number (example)

Problem: Transformer 2000 KVA (at 1 meter distance) from office area.

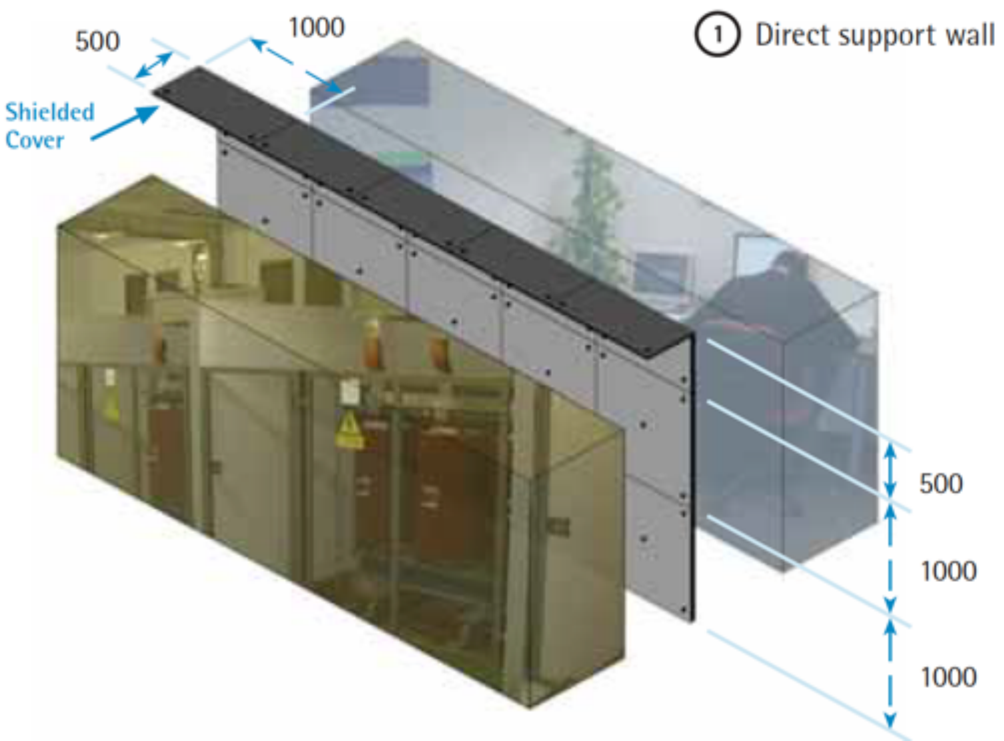
Question: Which backplanes should be installed to protect people (human beings)?

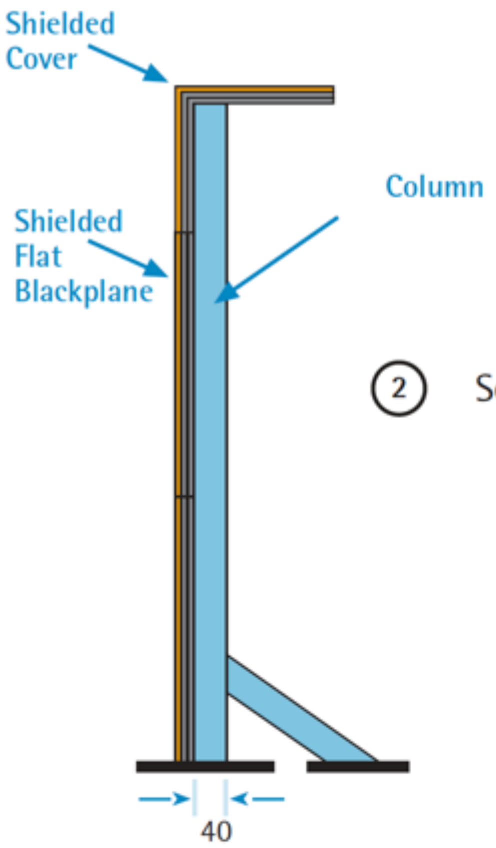
Answer:

	Shielding performance	length (T)	Flat / Corner	width (S)
4 units x	UHPTC	1000	F	1000

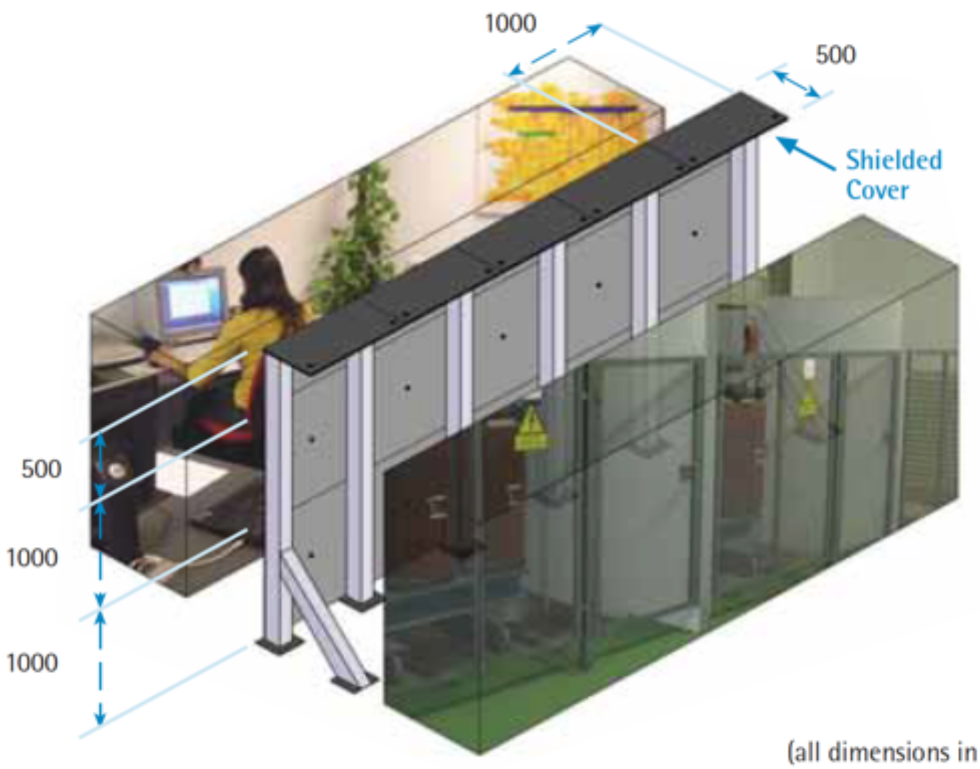
Installation Guide

There are 3 different kind of
installations for shielding transformers:
- Wall protection (side)
- Ceiling protection
- Complete protection (walls and ceiling)



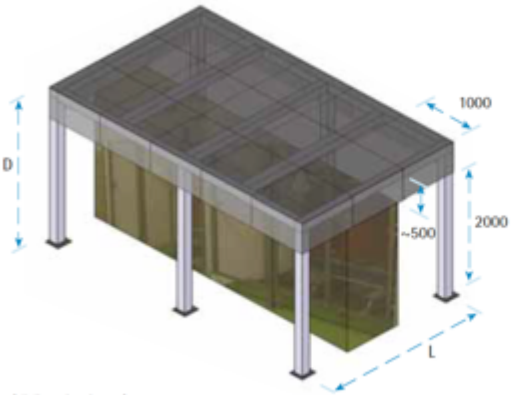


② Self standing structure



(all dimensions in mm.)

** Self standing structure quoted under request*



(all dimensions in mm.)

Ceiling protection

For ceiling installation, it will be necessary to mount some structure in order to support all pieces.

The distance between ceiling and structure must be at least 300 mm. and between transformer and structure at least 500 mm. in order to ensure good ventilation.

Structure consists in tubular galvanized steel with square section (80 x 80). Separation between beams is aprox. 1000 mm, same as width of pieces. See the picture beside.

NOTE: structure must be connected to ground with 25 mm² copper wire

Complete protection

The complete protection against magnetic fields in transformers consists on shielding walls and ceiling.

In order to support all shield panels is necessary to mount the appropiate steel structure.

The distance between ceiling and structure must be at least 300 mm. and between transformer and structure at least 500 mm. in order to ensure good ventilation. Distance between wall and structure must be at least 500 mm and between structure and transformer must be at least 500 mm in order to let free space for maintenance facilities.

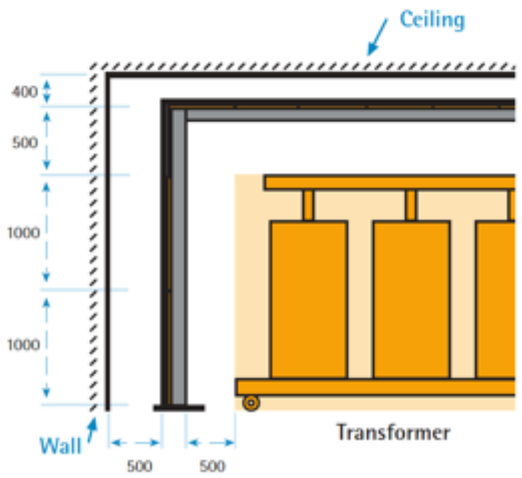
The steel beams are separated 1000 mm. aprox.

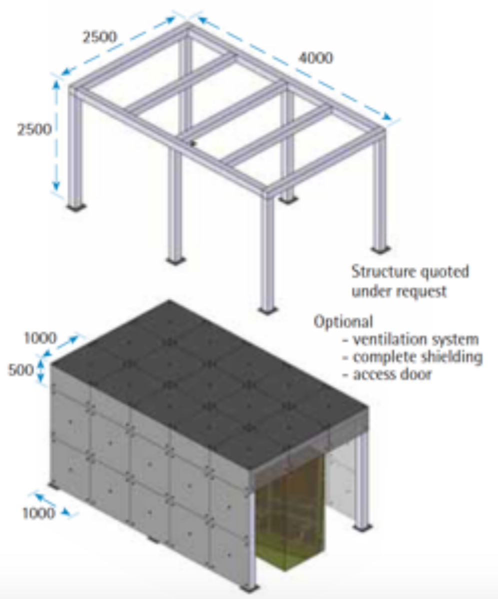
Wall panels must be fixed to structure with 6 screws and 6 nuts as minimum.

Ceiling panels must be fixed to structure with 4 screws and 4 nuts as minimum.

"L" shielded panels sections must be placed on structure corners.

NOTE: structure must be connected to ground with 25 mm² copper wire.





(all dimensions in mm.)

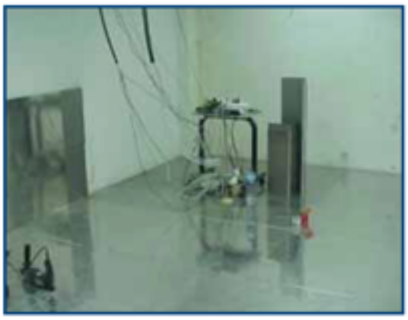
ShieldMax

Applications and Installation Examples

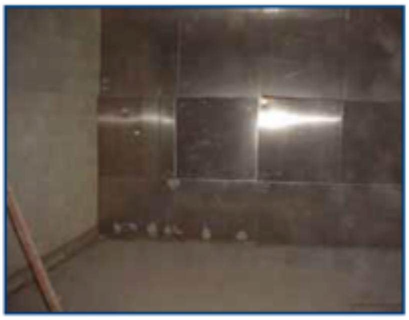
1. Hospitals:
protection of the sensible equipment (Magnetic Resonance Room (MRI) and surroundings, X-Ray Room,...) and people.

2. Offices and Residential Buildings:
electronic equipment (computers, servers,...) and people protection (transformer,...).

3. Factories:
offices near transformers



4. Telecom rooms / Network centers / Data Centers / Back-up Rooms
(transformer aside)



5. Airports and Banks:
communication racks, transformer room, ...

6. Pharmaceutical and Bio-tech Labs.
(transformer rooms)

Certificates

Certificate CE
(Safety)

DECLARATION OF CONFORMITY

The company:

ADVANCED SHIELDING TECHNOLOGIES EUROPE S.L

declare, that the product:

SHIELD TRAY & BACKPLANES

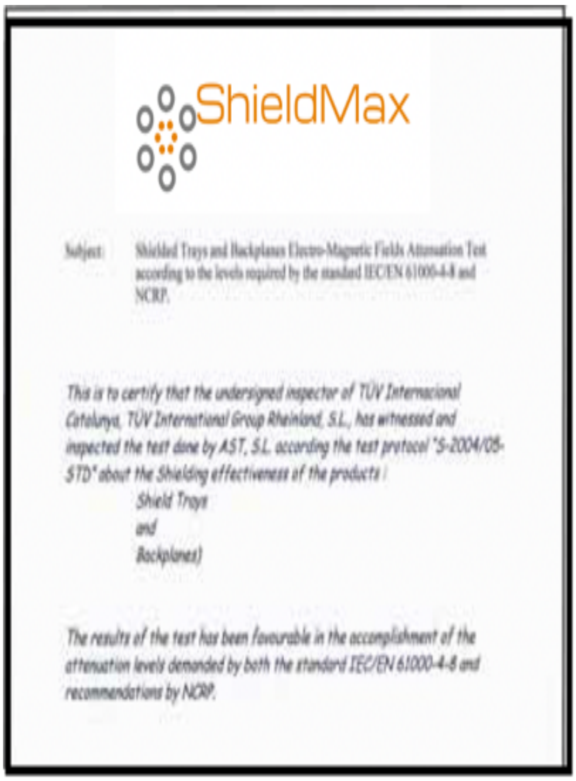
complies with the following standards or normative documents:

IEC 61000-4-8	Electronic equipment immunity from electromagnetic fields
IEC 61537	Cable Tray Systems and Cable Ladder Systems for Cable Management
NFPA 70	*National Electrical Code, Article 392: Cable Trays*; provide UL classification and labels.
NEMA VE 1/CSA C22.2 No. 126.1	*Metal Cable Tray Systems*, for materials, sizes, and configurations; provide cCSAus Certificate and labels.

ShieldMax a brand of FlexVPC

C/Albert Einstein 43 08940 Cornella del Llobregat

SHIELDING PERFORMANCE CERTIFICATE



Subject: Shielded Trays and Backplanes Electro-Magnetic Fields Attenuation Test according to the levels required by the standard IEC/EN 61000-4-8 and NCRP.

This is to certify that the undersigned inspector of TÜV Internacional Catalunya, TÜV International Group Rheinland, S.L., has witnessed and inspected the test done by AST, S.L. according the test protocol "S-2004/05-STD" about the Shielding effectiveness of the products :

Shield Trays
and
Backplanes)

The results of the test has been favourable in the accomplishment of the attenuation levels demanded by both the standard IEC/EN 61000-4-8 and recommendations by NCRP.

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