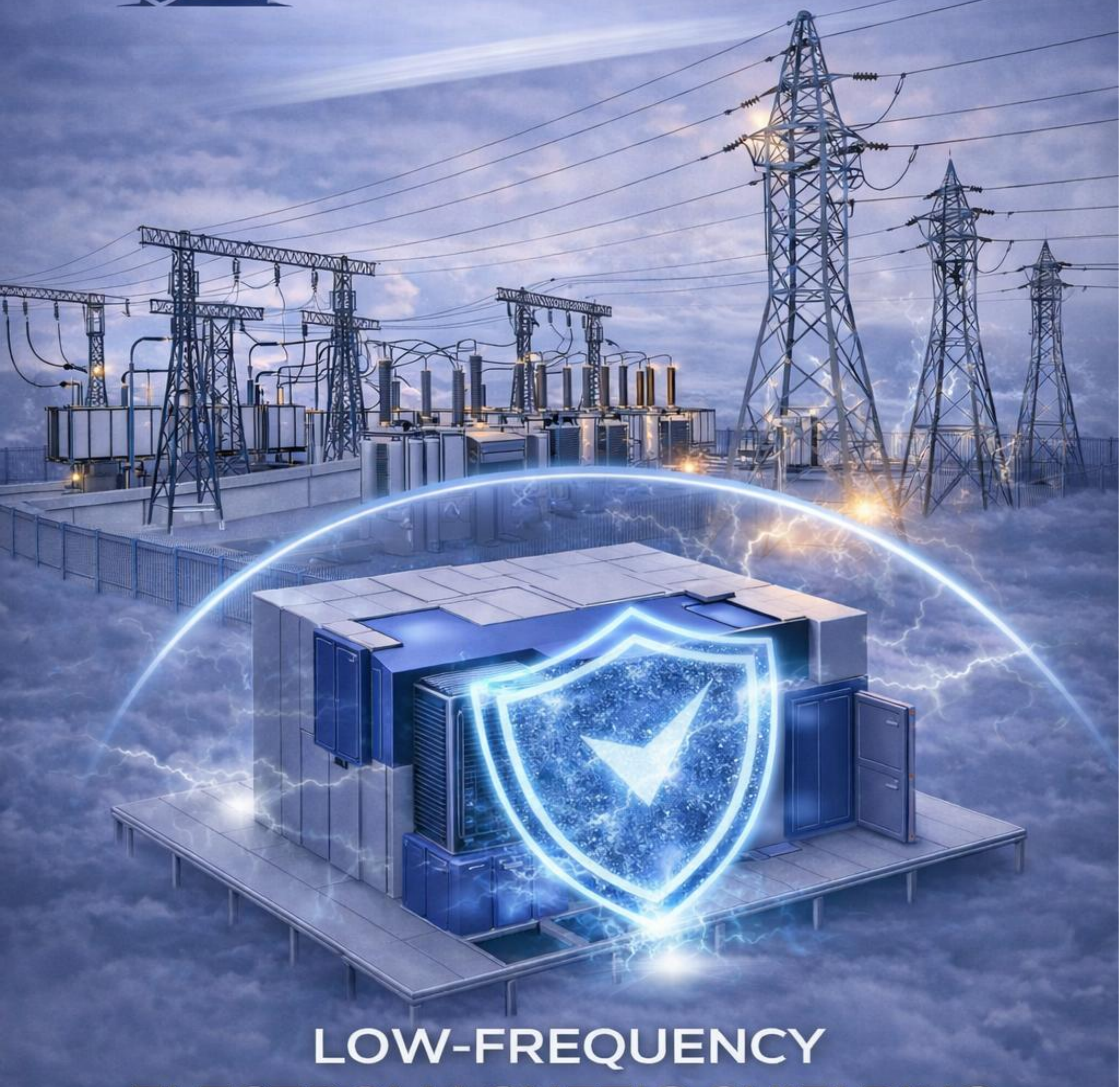
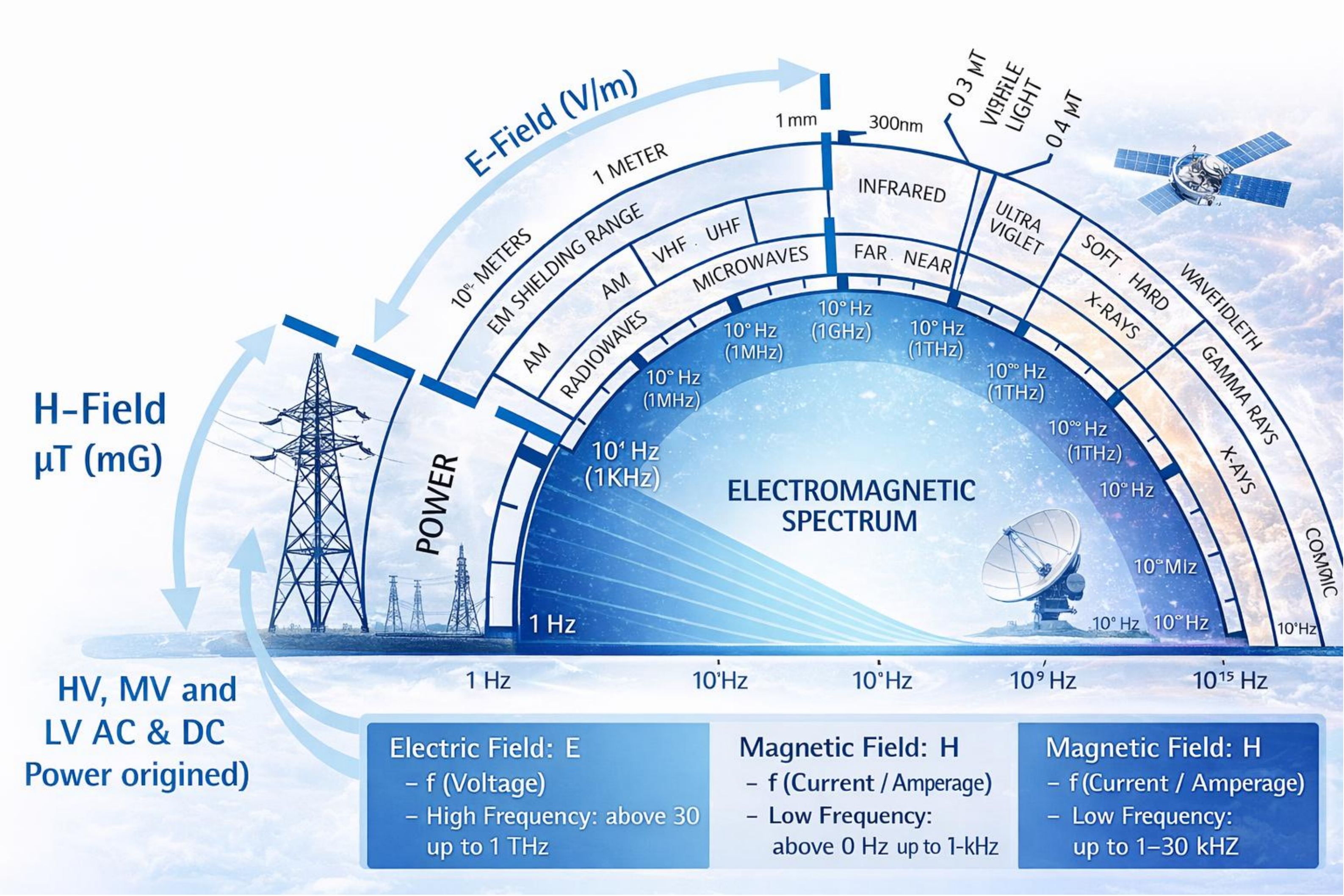
FlexShield



LOW-FREQUENCY ELECTROMAGNETIC SHIELDING

Ensuring Protection of Data Centers & Critical Loads Against Harmful Low-Frequency EMF



TUTORIAL

WHY SHIELDING

General Description

Electromagnetic Fields (EMF) are generated by a wide range of electrical installations and equipment, including:

Transformers

High-voltage overhead lines

Electrical panels and switchboards

High-power cables (High, Medium, and Low Voltage, both AC and DC)

Busbars

Other high-power electrical equipment (UPS systems, power converters, etc.)

EMF represent a growing concern and a significant technical challenge for consultants, facility managers, and end users worldwide. This challenge affects an increasing number of facilities and buildings as stricter EMF emission standards are introduced, limiting continuous exposure for both people and equipment due to health, safety, and performance requirements.

FlexShield technology is the result of more than 30 years of field experience and over 350 successful installations. This accumulated expertise has enabled the development and standardization of high-performance EMF shielding solutions designed to meet the most demanding technical, operational, and regulatory requirements. The products presented in this catalog are the direct result of this extensive know-how.

Continuous exposure to low-frequency electromagnetic fields, generated by high electrical loads such as power cables and busbars, can disrupt the normal operation of electronic equipment and may negatively affect human health.

It is estimated that up to 15% of electronic equipment failures including servers, electromechanical systems, PLCs, and communication networks are caused by EMF interference, leading to malfunctions, degraded performance, or reduced reliability.

EMF-related issues are increasing rapidly as overall power consumption in modern buildings continues to rise. This results in a higher number of EMF sources while, at the same time, people and sensitive equipment are located closer to these loads due to space constraints, higher power densities, and more compact installations.

Regulatory Limits and Standards

Electromagnetic field exposure is regulated by several mandatory international standards:

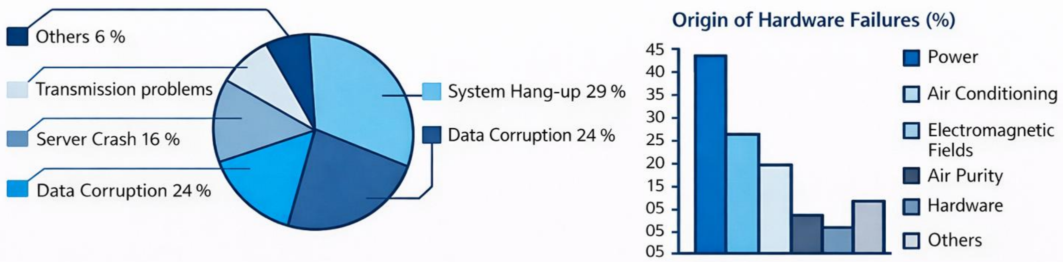
- **Electronic Equipment and Machinery**
  The IEC / EN 61000-4-8 standard establishes a magnetic field immunity limit of:
  - 1,25µT (microtesla): Level 1, Highly sensitive Lab electronic equipment.
  - 3,75µT: Level 2, computer servers / Data Centers.

Important Note: depending on the criticity of the computer servers and if these must be 24x7 operational, is likely that these can be categorized as Lavel 1 with 1,25uT maximum EMF exposure level.

Compliance with this limit is mandatory to ensure the reliable operation and long-term performance of increasingly sensitive electronic equipment and machinery.

Additionally, IEC / EN 61000-4-3 defines exposure limits for high-frequency EMF, setting a threshold of **< 1 V/m** for sensitive electronic systems.

- **Human Exposure**
  According to **NCRP recommendations**, continuous exposure to low-frequency magnetic fields must be limited to **1µT** to ensure personal safety and minimize potential health risks.



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 to Human Beings as per NCRP standard (in meters) <3.75µT
100 A	1,35	2,6
300 A	1,60	3,2
500 A	3,03	5,8
1,000 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 to Human Beings as per NCRP standard (in meters) <1µT	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	2,00
1,000 A	2,46	2,82
3,000 A	2,52	4,89
5,000 A	3,26	6,32

FlexShield

Electromagnetic fields (EMF) are present in all domestic and industrial environments. They may occur naturally, for example because of light itself, or be artificially generated by the widespread use of electrical installations, power distribution systems, and electrical devices.

Over the last decades, environmental exposure to **artificial electromagnetic fields** has increased significantly. This growth is directly linked to rising energy demand, the continuous development of wireless technologies, and evolving communication and work practices.

When people are exposed to electromagnetic fields, their bodies absorb energy. This may alter the body's natural equilibrium and, although the scientific and medical community continues to study the long-term effects of EMF exposure, it is widely acknowledged that preventive measures should be taken to limit potential risks and protect people from possible long-term effects.

Interest in **electromagnetic pollution** has increased substantially in recent years, driven by extensive research and scientific studies. As a result, standards, technical guidelines, and specific legislation have been developed to protect environments considered most at risk, particularly workplaces.

It is therefore essential to assess the risk associated with EMF exposure and to implement appropriate mitigation measures in order to guarantee **health and safety at work**. In addition to potential effects on human health, electromagnetic fields can also disturb electronic systems and cause interference or malfunction of sensitive equipment.

European legislation has established exposure limits to ensure the **safe and reliable operation of electrical and electronic instruments**. Consequently, the implementation of effective **EMF shielding systems** is essential in industrial environments involving high current levels or intense electric or magnetic fields.

These measures are necessary to protect both **personnel** and **electrical equipment** located near EMF sources.

Effect of Electromagnetic Fields on People

Time-varying electric and magnetic fields interact with electrically charged particles that constitute matter. Of relevance is their interaction with **biological systems**, ranging from basic cellular structures to complex organisms such as plants, animals, and human beings.

To properly quantify the energy absorbed by materials and by human tissue, **dosimetry quantities** are used. Dosimetry allows the evaluation of current density, power density, and the amount of energy absorbed per unit area, volume, or mass, as defined below:

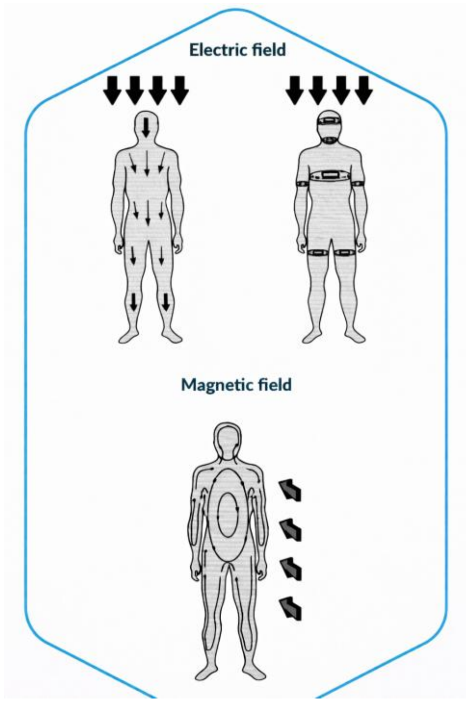
- **Current Density (J)**
  Represents the electric current flowing through a cross-section of a conductor, such as the human body or a part of it. It is expressed in $\mathbf{A/m^2}$.
- **Power Density (S)**
  Used primarily at very high frequencies, where the penetration depth of the electromagnetic field is limited. It is defined as the radiant power perpendicular to a surface divided by the area of that surface and is expressed in $\mathbf{W/m^2}$.

- **Specific Energy Absorption (SA)**
  Defined as the amount of energy absorbed per unit mass of biological tissue. It is expressed in **J/kg**.
- **Specific Absorption Rate (SAR)**
  Represents the rate at which energy is absorbed per unit mass of body tissue, averaged over the whole body or specific body parts. SAR is used to assess and limit excessive localized energy deposition resulting from particular exposure conditions. Both whole-body averaged SAR and localized SAR values are considered. It is expressed in **W/kg**.

The quantities described above are used as reference parameters to evaluate the effects of electromagnetic fields on the human body and to define **exposure limits**. However, these dosimetry quantities cannot be measured directly on an exposed individual to determine radiation intensity.

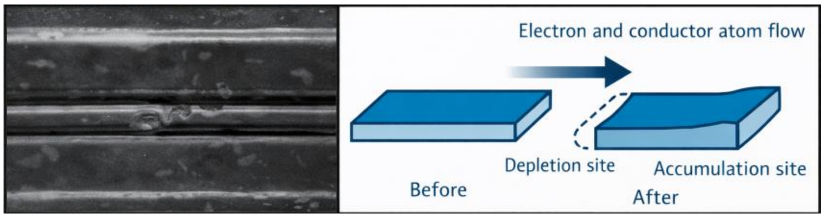
Instead, **measurable physical quantities**, such as electric and magnetic field strength, are used as indirect indicators and are correlated with the dosimetry reference values through established scientific models and standards.

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
1 < J < 10	Minor effects

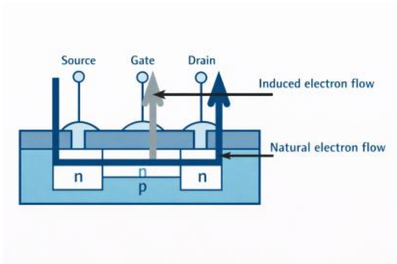


EMF Effects on Electronic Equipment

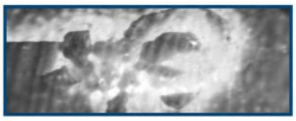
1. Electromigration: cause broken strips and communication problems.



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. Semi conductor degradation

5. Hardware degradation and destruction.

EMF Effects on Human Beings

Electromagnetic radiation can interact with the human body in different ways, depending on frequency and exposure conditions. The main effects associated with various types of radiation are summarized below:

- **Ultraviolet (UV) Radiation**
  Skin-related effects, including a reduction of Langerhans cells, as well as potential damage to the eyes.
- **Infrared Radiation**
  Primarily associated with **thermal effects** due to energy absorption by body tissues.
- **Radiofrequency (RF) Radiation**
  Thermal effects and bioelectric interference, with potential implications for genetic transmission, as well as the nervous and cardiovascular systems.

Relevant Scientific Studies

Several studies have investigated the relationship between electromagnetic fields and biological effects, including:

- **National Institute of Occupational Health**
  Magnetic Fields and Cancer: Cellular Study (Bo Holmberg)
  Research focused on the relationship between cancer development and EMF exposure.
- **National Institute for Occupational Safety and Health (NIOSH), Division of Biomedical and Behavioral Sciences (Cincinnati)**
  Magnetic Field Exposure in Skin Cells (J. Snawder, R. Edwards)
  Study analyzing tumor development under exposure to magnetic fields of **100 µT** over a **14-day period**.
- **Electric Power Research Institute (EPRI), Palo Alto**
  Magnetic Fields and Animal Cells (J. McCann, R. Kavet, C. Rafferty)
  Research evaluating the effects of magnetic fields on animal cell structures and tumor development.

Important Note
Although none of the studies conducted to date can establish an absolute causal relationship between EMF exposure and adverse human health effects, **FlexShield strongly recommends the application of the ALARA principle** (*As Low As Reasonably Achievable*), in accordance with **NCRP recommendations**, to minimize potential risks associated with electromagnetic field exposure.

Origin of EMF and Sources

Electromagnetic fields originate from a wide range of natural and artificial sources. Depending on their frequency, they are generally classified into **low-frequency** and **high-frequency** electromagnetic fields.

Low-Frequency Electric and Magnetic Fields

(0 Hz – 100 kHz)

Magnetic Field Sources:

- Power transformers
- Low-voltage switchboards and cabinets
- Low-voltage power lines, including busbars and subway power cables
- High-voltage transmission lines (overhead and underground)
- Railway and subway traction systems
- Uninterruptible Power Supply (UPS) systems
- Other sources: lightning, electric motors, engines, electric heaters, etc.

Electric Field Sources:

- High-voltage transmission lines

High-Frequency Electric Fields
(100 kHz – 10 GHz)

- Radar systems
- Radio transmitters
- Mobile phone base stations
- Variable frequency drives (AC drives)

Benefits

FlexShield solutions ensure full compliance with **mandatory EMF exposure limits**, while providing a safe and controlled environment for both **electronic equipment** and **people** near electromagnetic field sources.

Areas of Application

Effective EMF shielding for:

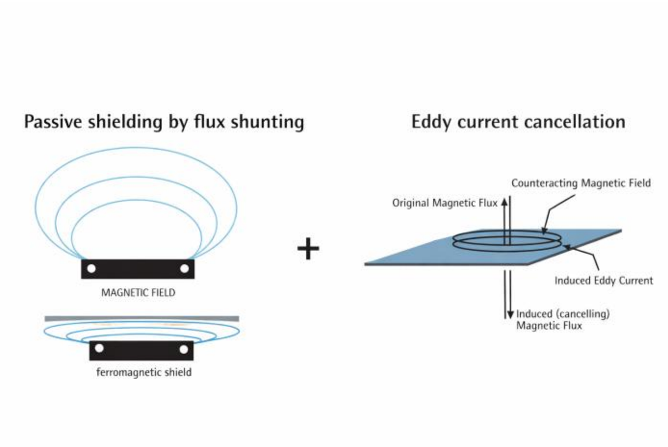
- Cable trays, combining **power distribution and EMF shielding** in a single system
- Electrical switch cabinets
- Transformers and power equipment

Key Advantages

- Fully **standardized product range**
- **Custom-designed solutions** available upon request
- Provides a **secure operating environment** for sensitive electronic equipment, machinery, and personnel
- **Certified EMF shielding performance** in accordance with IEC standards
- Suitable for all types of buildings and applications, including:
    - Office buildings
    - Hospitals
    - Data centers
    - Semiconductor manufacturing plants
- Complete **turnkey solution** from a single source, including trays, fasteners, supports, and accessories
- **Easy and fast installation**
- Suitable for both **horizontal and vertical cable risers**
- Shield-Tray design allows **efficient air cooling** of power cables
- Wide range of models, sizes, and shielding performance levels to meet different technical requirements
- **Maximum safety** for people and equipment
- **Easy product selection** through standardized configurations
- Overlapping Shield-Tray segments to minimize EMF leakage using the **belt technique**
- Fully **documented certification**
- **CE marked**
- Integrated **earthing connection points**
- **Heavy-duty construction** for industrial environments
- **10-year warranty**
- **Anti-corrosion / anti-rust treatment**

Shielding Technology

Magnetic Field Low Freq.: Hybrid Technology



The **FlexShield solution** is based on a **cost-effective hybrid shielding technology**. By combining **high-permeability** and **high-conductivity** materials, this approach delivers a dual shielding effect that significantly reduces electromagnetic fields.

The interaction of these materials enables **EMF absorption** while simultaneously minimizing the residual magnetic field through an **eddy current effect**, which counteracts and pushes the remaining field back toward the source.

A **smart mechanical design**, featuring overlapping cable tray segments, further minimizes potential EMF leakage, ensuring continuous and reliable shielding performance along the entire installation.

Limits and Standards

Magnetic and Electric Field Low Frequency

Norms and Recommendations	
Electronic Equipment	**Human Beings**
Magnetic Field – Low frequency ★ **EN/IEC 61000-4-8: Immunity for Electronic Equipment:** - **1,25µT (Level 1, Highly sensitive Lab electronic equipment)** - **3,75µT (Levels 2 , computer servers / Data Centers)** **Other standards:** **Recommendations NCRP: Max. magnetic field recommended 1µT** **Requirements Semicon Manufacturers: Magnetic field up to 0,03 µT** **Requirements MRI (magnetic resonance) Manufacturers: Magnetic field up to 1µT**	**Magnetic Field – Low Frequency** Recommended for long term people exposure (Home or Office) 0,4 **µT / 50 Hz** **ICNIRP: General public (short term) 100 µT / ACGIH:** ★ **NCRP:** Max. recommended level **1µT** ★ **AGNIR-HPA:** Max. recommended level **0,4µT** **Others:** Countries like Switzerland, New Zealand and some states of USA up to **1–2 µT** **Electric Field – Low Frequency** **ICNIRP / ACGIH:** Norm for people up to **5 kV/m** **ICNIRP / ACGIH:** Norm for heart problems people up to **1 kV/m**
★ Applicable Standard	★ Applicable Standard

STANDARD IEC/EN61000-4-8

Test	Specification (max. level)	Norm
Magnetic field at 50 Hz	- **1,25µT (Level 1, High sensitive Lab electronic equipment**) - **3,75** Ut (Levels 2 , **computer** servers **/ Data Centers**)	IEC/EN 61000-4-8: Immunity for Electronic Equipment:

Recommendations

NCRP Draft Recommendations on EMF Exposure Guidelines

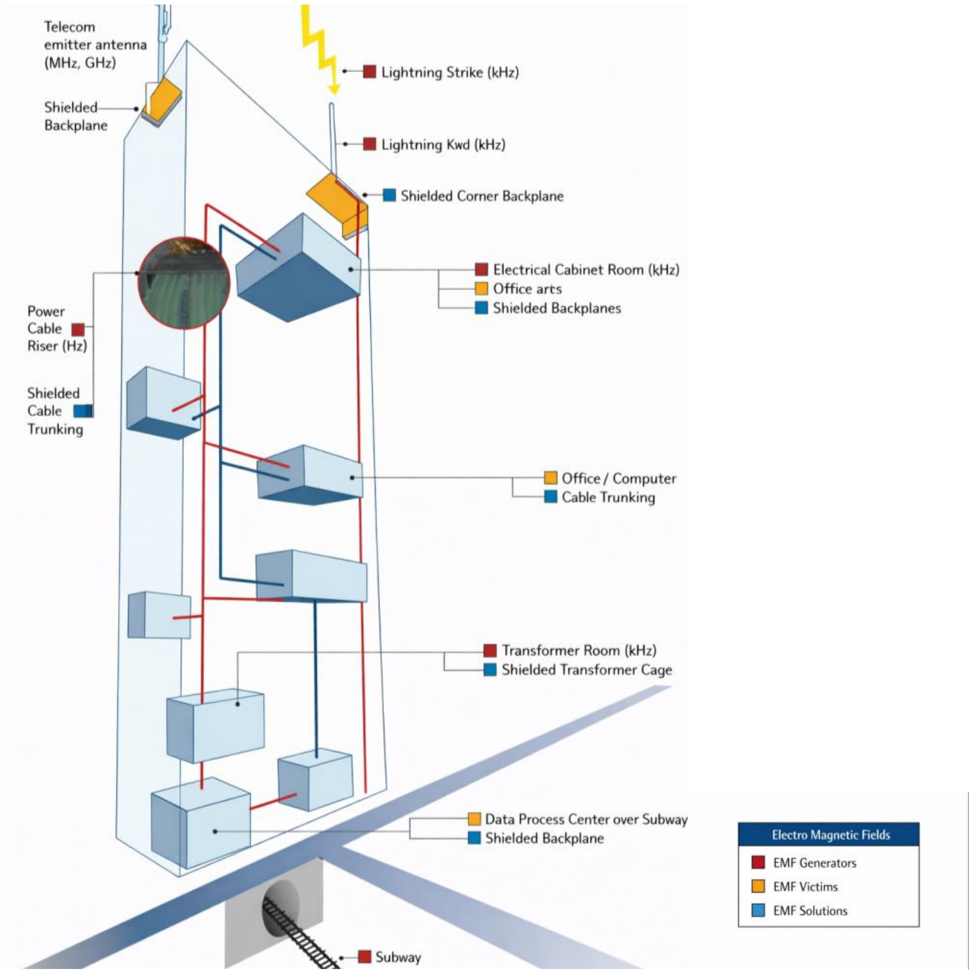
The following section reproduces **Section 8** of the **June 13, 1995, draft report** issued by the **NCRP (National Council on Radiation Protection and Measurements)**, prepared by **Scientific Committee 89-3** on **Extremely Low Frequency (ELF) Electric and Magnetic Fields**.

This section summarizes the committee's **conclusions and recommendations** regarding exposure guidelines for electric and magnetic fields, forming the basis for widely adopted reference limits used to assess EMF exposure and ensure the protection of people and sensitive environments.

" 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

An EMC-protected building provides comprehensive protection for **equipment, data, and people**, reducing the risks associated with electromagnetic interference and exposure.

Complete Protection for:

- **Hardware**
  Prevention of electronic equipment destruction or degradation, display flickering, hard disk damage, and malfunction of sensitive components.
- **Software and Data**
  Reduced risk of data loss, hard disk data corruption, system instability, and network performance degradation.
- **Human Beings**
  Limitation of short- and long-term health risks potentially associated with EMF exposure, including headaches, migraines, and increased sensitivity in vulnerable groups.

Output of MV / LV Transformers

One of the primary sources of **magnetic field exposure** in MV / LV electrical substations is the **low-voltage (LV) transformer output**.

As illustrated in **Figure 2**, the LV output can be modeled as three conductor sections. On the transformer side, these conductors are spaced at a distance corresponding to the transformer terminal separation (**D**). On the opposite side, the conductors converge at a shorter distance (**d**), forming a bundled cable arrangement directed toward the LV distribution substation.

The **installation height of the cables** is a variable parameter and depends on the specific installation configuration. Based on this geometry, the distances along the different axes (as referenced in Figure 2) at which the **magnetic induction reaches the ideal target of 3 µT** (defined as the quality target, which provides an additional tolerance Vs the 3,75 uT requested by the Standard) have been calculated. These calculations are derived from the **nominal transformer power**, and therefore from the corresponding **secondary LV currents**.

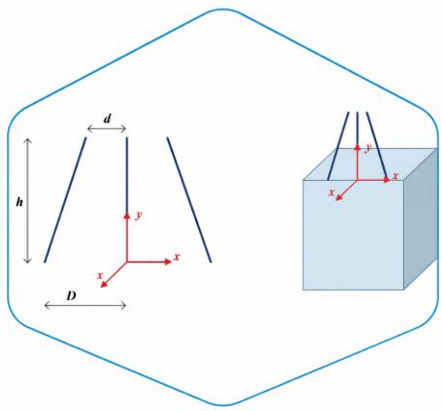


Fig. 2 - Graphic representation of a MV/LV transformer with the LV output pointing

The calculated results are presented in **Tables 1, 2, and 3**, corresponding respectively to the **x, y, and z axes**. The data clearly show that the LV transformer output represents a **significant source of magnetic field pollution**. In the case of high-power installations, the affected distances may extend to **well beyond 10 meters**.

When electrical substations and transformers are in proximity to **residential, commercial, or industrial environments** where the defined quality targets must be respected, it becomes necessary to implement **EMF shielding systems** across nearly all power levels in order to ensure compliance and safety.

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

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 center of the system's coordinates along the Y axis to obtain 3µT

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 center of the system's coordinates along the Z axis to obtain 3µT

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:

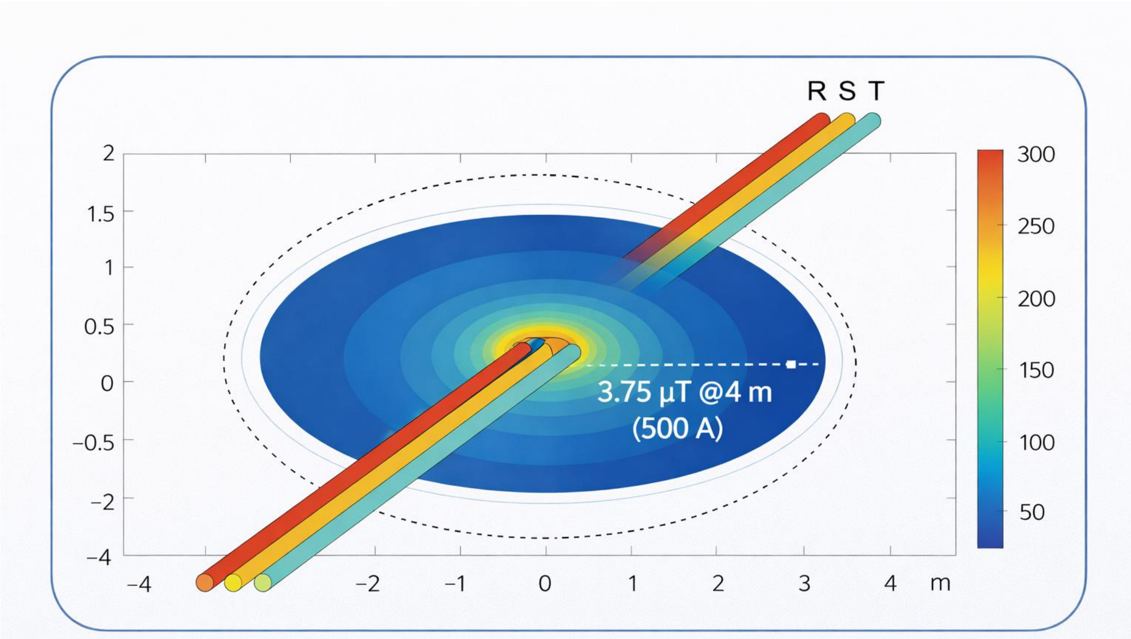
1. The **D parameter** represents an average value and is **not linked to any specific transformer manufacturer**.
2. The **d parameter** is calculated based on the **diameter of the LV output cables**.

Distribution Lines and Shielding Channels

Unipolar power cables are commonly used for **high-current distribution lines** in both industrial and civilian environments. A typical example is the power supply of **air-conditioning system motors**, where multiple cables are often installed in parallel, resulting in total currents of several **thousand amperes**.

The magnetic field exposure generated by these installations must be kept within the defined **quality target of 3 µT**. However, in certain sensitive environments, more stringent limits may be required, even down to **0.1µT** in areas near electronic microscopes or other highly sensitive equipment.

As shown in **Figure 3**, the colored map illustrates the magnetic induction produced by a **three-phase cable**s with an ampacity of **500 A**.



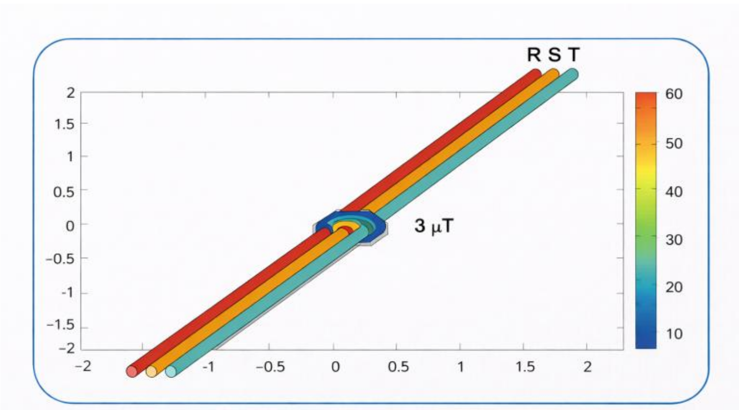


Fig. 4 - Coloured map of the magnetic induction of a three-phase line with 400 mm^2 cables, with an ampacity of 605 A, placed within a

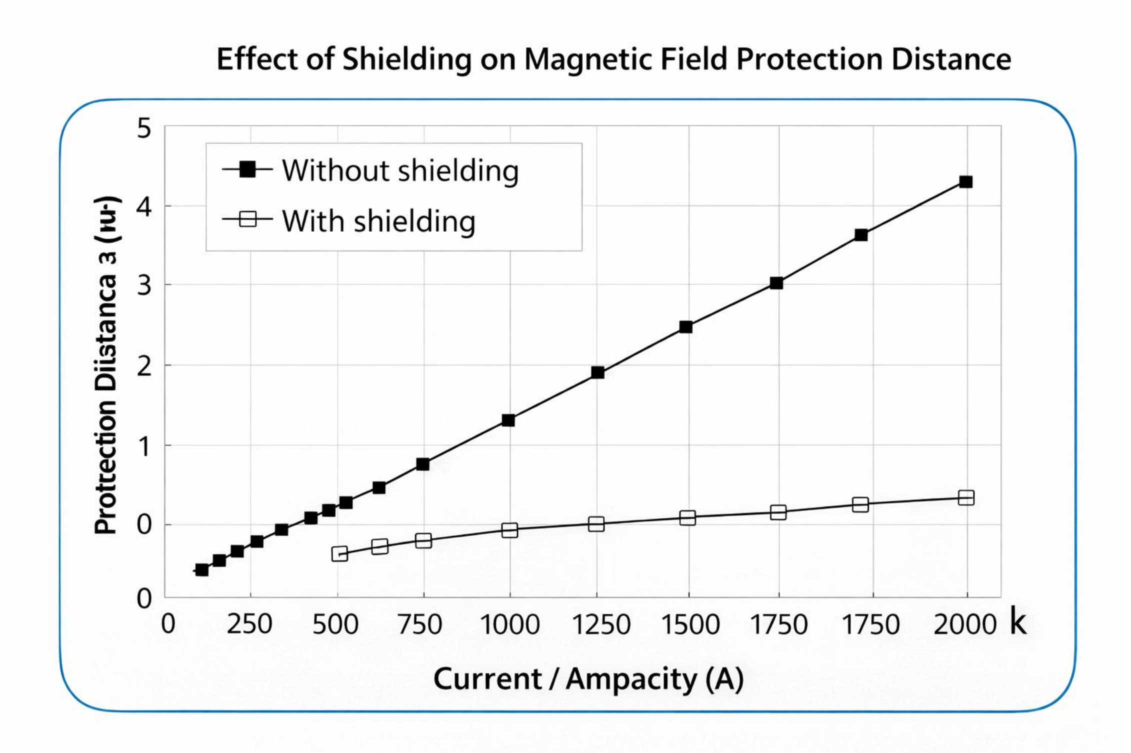
EMF Source: three phase POWER CABLE (Amps)	Minimum safe distance for computers, electronic equipment and machinery as per IEC/EN standard (in meters) <3.75µT	Minimum safe distance to Human Beings as per NCRP standard (in meters) <1µT
100 A	1,35	2,6
300 A	1,60	3,2
500 A	3,03	5,8
1000 A	4,29	8,31
3.000 A	5,26	10,1
5.000 A	9,6	18,6

EMF Source: three phase BUSBAR (Amps)	Minimum safe distance to Human Beings as per NCRP standard (in meters) <1µT	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	2,46	2,82
3.000 A	2,52	4,89
5.000 A	3,26	6,32

Shielding channels provide **high EMF attenuation**, with an average **shielding (screening) factor of approximately 30**.

As shown in **Figure 4**, the colored map illustrates the magnetic induction generated by a **three-phase line** using **400 mm² cables** with an ampacity of **500A** . When compared with the magnetic induction levels observed **in the absence of shielding**, the effectiveness of the shielding solution becomes evident.

The significant reduction in magnetic induction levels results in a **corresponding decrease of buffer zones**, allowing installations to comply with exposure limits in more compact spaces.



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

Description of Shielding Materials

Mitigation of **magnetic flux density** is achieved in both **shielding plates** and **shielding channels** using magnetic shields composed of two **complementary materials**:

- A material with **high magnetic permeability**
- A material with **high electrical conductivity**

The combined effect of these materials is clearly demonstrated through **numerical simulations** performed using specialized electromagnetic simulation software. These simulations allow visualization of the **evolution and distribution of magnetic field lines** when the shielding materials are exposed to a magnetic field generated by a coil.

As illustrated in **Figure 5**, which also shows the behavior of magnetic field lines **in the absence of any shielding system**, the effectiveness of the shielding materials is clearly demonstrated. The comparison highlights the **significant attenuation and redirection of the magnetic field** achieved through the **hybrid shielding approach**.

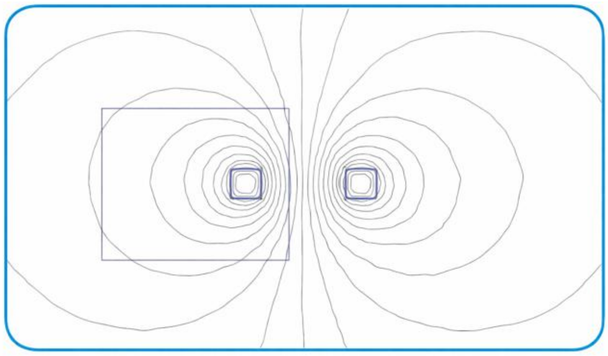


Fig. 5 - Magnetic field produced by a coil in the presence
and the absence of shielding.

The layer made of **high magnetic permeability material** reduces magnetic induction by **absorbing and guiding the magnetic field lines**. Its behavior can be compared to that of a **magnetic “umbrella”**, providing very high attenuation in areas close to the shield, while the shielding effectiveness gradually decreases with increasing distance from the protected surface.

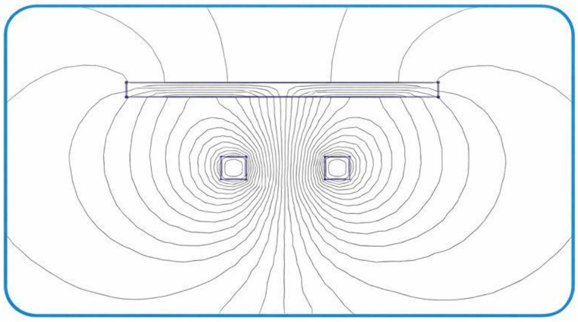


Fig. 6 - Magnetic field produced by a coil with
ferromagnetic shielding.

The layer made of **high electrical conductivity material**, when exposed to a **time-varying magnetic field (induction field)**, becomes the path for induced electric currents. These currents generate a **reactive magnetic field (induced field)** that opposes the original field.

The interaction between the **induction field** and the **induced field** results in a **significant reduction of the overall magnetic field intensity**, enhancing the effectiveness of the shielding system.

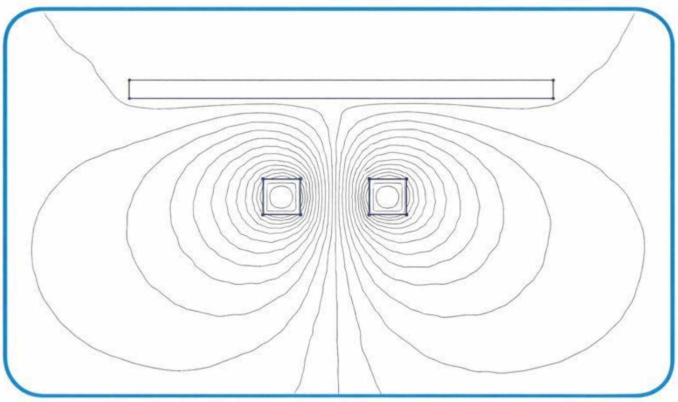
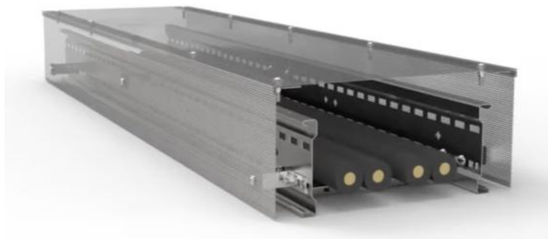


Fig. 7 - Magnetic field produced by a coil in with a conductive shield.

The layer composed of **high electrical conductivity material**, when exposed to a **time-varying magnetic field (induction field)**, allows the flow of induced currents within the material. These currents generate a **reactive magnetic field (induced field)** that opposes the original magnetic field.

The combined interaction of the **induction field** and the **induced field** results in a **reduction of the overall magnetic field intensity**, thereby enhancing the effectiveness of the shielding system.

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		1 Ka		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 to IEC 61000-4-8 (Protection for electronic equipment) < 3.75µT

Trays to protect Human Beings :

EMF Source / Distance from the source to exposed area	100 A	300 A		500 A		1 Ka		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	ST	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) < 1µT

Additional note
* Special products and dimensions available upon request

Pre-Installation Assessment: Magnetic Field Levels (Unshielded)

Reference Guidelines for Low-Frequency EMF (50/60 Hz) – Magnetic Flux Density
This table provides typical magnetic field emission levels before the installation of **FlexShield** solutions. Use these values as a baseline to determine the required attenuation performance and safety distance compliance according to **ICNIRP** and **IEC** standards.

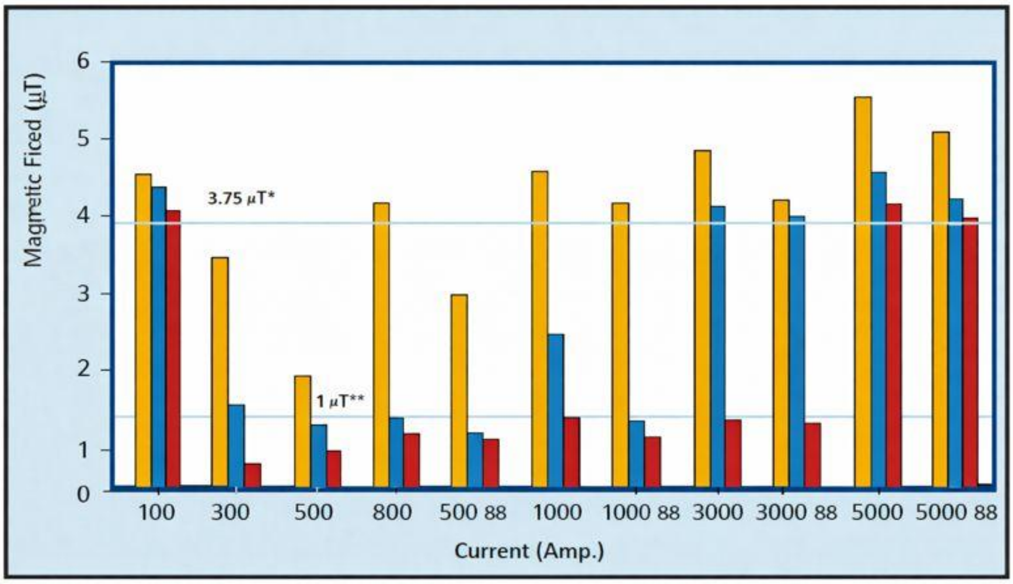
Table: Typical Magnetic Field Intensity Without Shielding
Units: µT (microTesla) | Conversion: 1µT = 10 mG (milliGauss)

EMF Source (3-Phase)	1 m	2 m	3 m	5 m	7 m	10 m	15 m
LV Transformer ≤ 1 MVA	50	30	15	6	3	1.5	0.8
MV / LV Transformer 1–5 MVA	100	60	30	12	6	3	1.5
HV Transformer > 5 MVA	200	120	60	25	12	6	3
HV Overhead Lines	30	15	8	4	2	1	0.5
MV Cables (tray / underground)	40	20	10	4	2	1	0.5
High-Current LV Cables ≥ 2 kA	80	40	20	8	4	2	1
Busbars (LV / MV)	120	60	30	12	6	3	1.5
Electrical Switchboards	15	8	4	2	1	0.5	0.3
UPS / Power Converters	25	12	6	3	1.5	0.8	0.4
Railway / Subway Lines	100	60	30	15	8	4	2

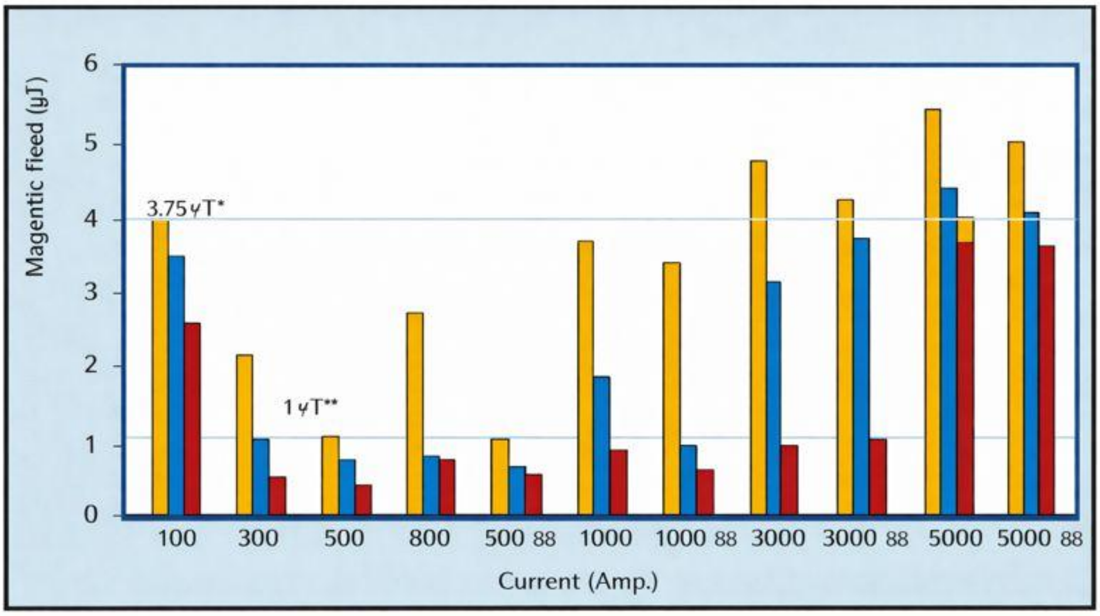
Attenuation Test

GRAFICAS MAS GRANES

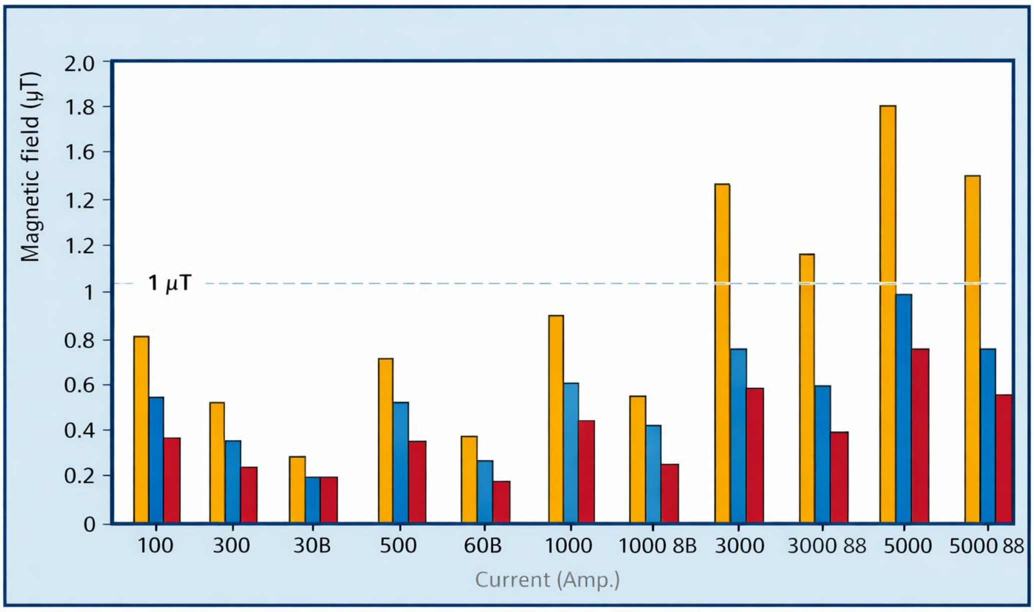
< 0,8 meters

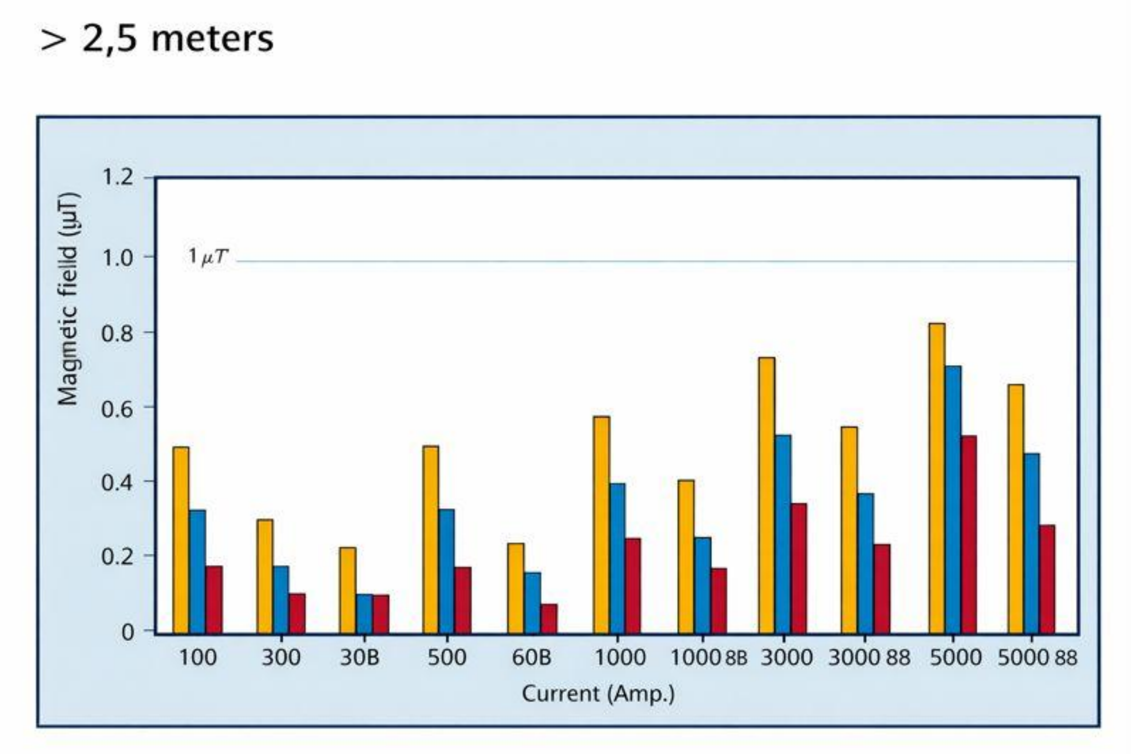

Magnetic Ficed (µT)
6
5
4
3
2
1
0
3.75 µT*
1 µT**
100
300
500
800
500 88
1000
1000 88
3000
3000 88
5000
5000 88
Current (Amp.)

0,8 – 1,5 meters



1,5 – 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

Note: All measurements are performed at a minimum distance of 1 meter from the EMF source, in accordance with standard safety practices and to ensure consistent and repeatable measurement conditions.

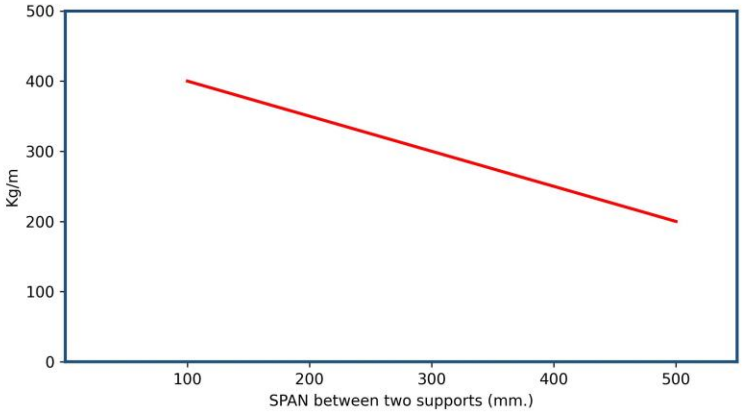
Table: Magnetic Field Reduction (Before vs. After)

Reference distance: ~1 meter from source (0.8m - 1.5m range used from provided image)

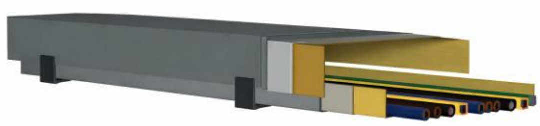
Frequency: 50/60 Hz

Carga de Corriente (Amperios)	Nivel Antes de Blindaje (Estimado)	Nivel Después de Blindaje (Medido en HPT/UHPT)	Atenuación Típica
100 - 300 A	8.0 – 15.0 µT	**0.5 – 1.0 µT**	**~90% - 95%**
500 - 1000 A	15.0 – 30.0 µT	**1.0 – 2.0 µT**	**~90% - 93%**
3000 - 5000 A	40.0 – 80.0 µT	**2.0 – 4.0 µT**	**~90% - 95%**

Mechanical Weight Performance

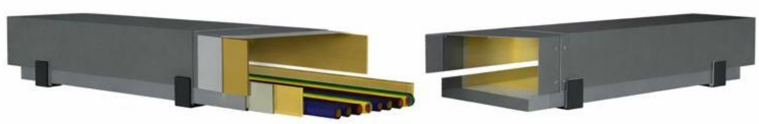


Design Highlights



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

Overlapping



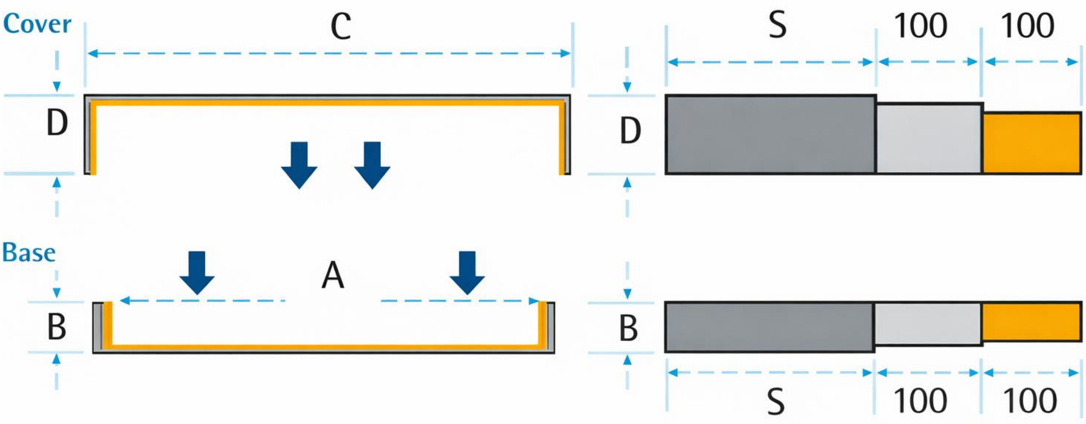
Ventilation

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

Current-Carrying Capacity Amps		
Conductor Cross Sectional – area (mm²)	Correction factor to reference method 11	
	2 cables Single-Pha	3 or 4 cables Three-Phase
>25	0.94	0.93

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	straight	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	Weight (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 / 8.90 / 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

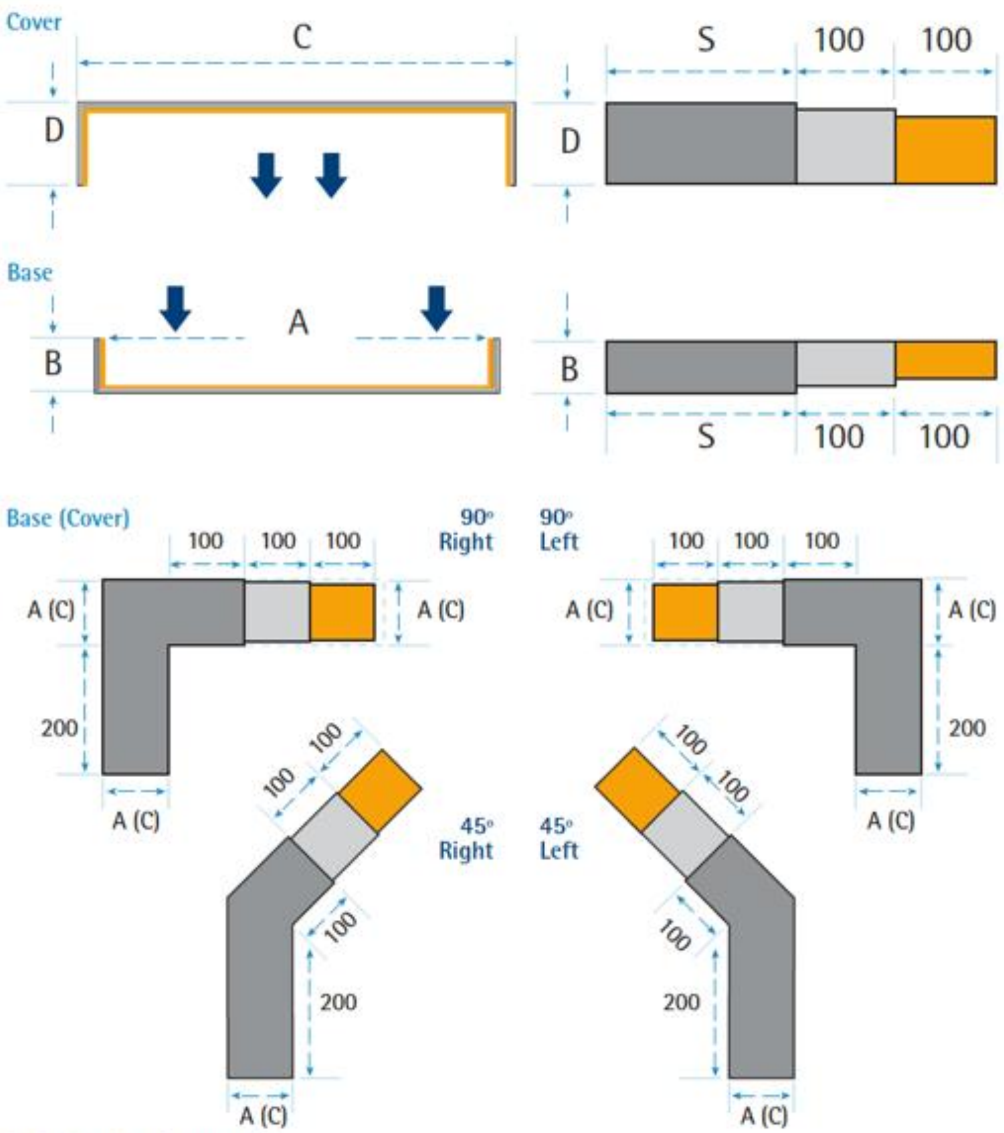
High Performance Tray (HPT): (all dimensions in mm)

S	A (Base)	B	C (Cover)	D	Weight (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 Performance Tray (UHPT): (all dimensions in mm)

S	A (Base)	B	C (Cover)	D	Weight (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

Standard Performance Tray – Curves: (all dimensions in mm)

T	A (Base)	B	C (Cover)	D	Weight (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

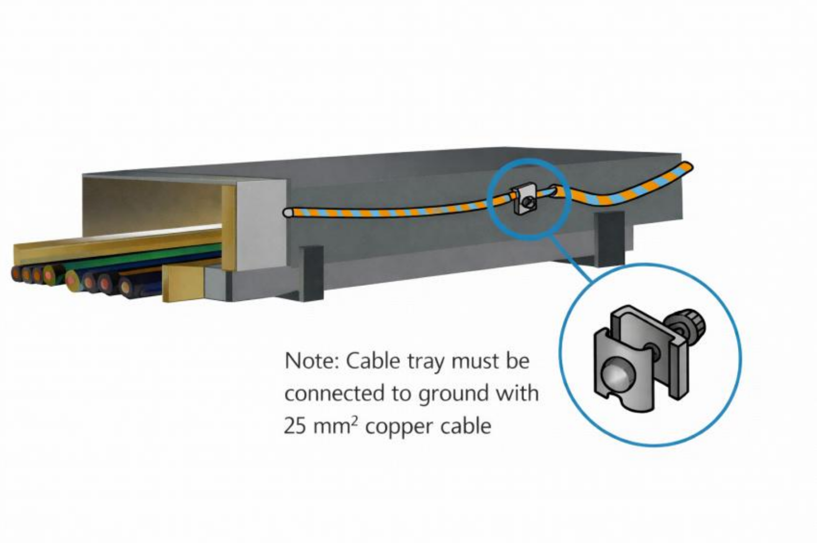
High Performance Tray – Curves: (all dimensions in mm)

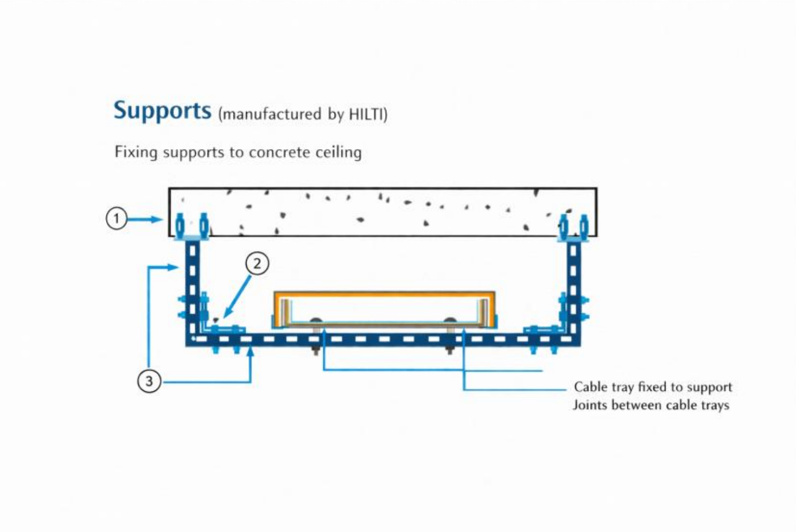
S	A (Base)	B	C (Cover)	D	Weight (kg.)
HPT 45 R / L	115	50 / 100 / 200	160	75 / 125 / 225	6.48 / 8.63 / 12.93
	215	50 / 100 / 200	260	75 / 125 / 225	10.24 / 12.39 / 16.69
	315	50 / 100 / 200	360	75 / 125 / 225	14.86 / 17.01 / 21.31
	415	50 / 100 / 200	460	75 / 125 / 225	20.35 / 20.50 / 26.80
	515	50 / 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 Performance Tray – Curves: (all dimensions in mm)

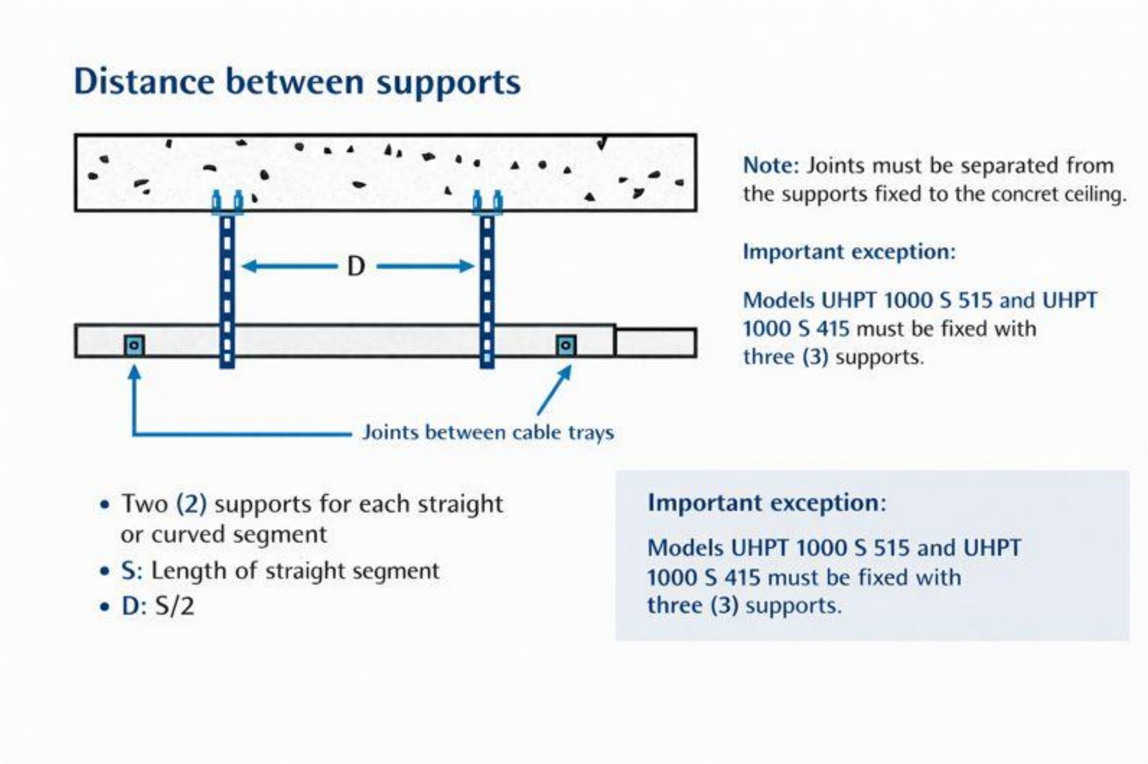
S	A (Base)	B	C (Cover)	D	Weight (kg.)
UHPT 45 R / L	115	50 / 100 / 200	185	85 / 135 / 235	8.98 / 11.68 / 17.08
	215	50 / 100 / 200	285	85 / 135 / 235	13.84 / 16.54 / 21.94
	315	50 / 100 / 200	385	85 / 135 / 235	19.78 / 22.48 / 27.88
	415	50 / 100 / 200	485	85 / 135 / 235	26.80 / 29.50 / 34.90
	515	50 / 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





	Description	Reference (HILTI)	Screws (Ref.)	Length (mm)	Screws
1	Fastener or concrete	ML-B-30/220	307129/7	220	M8×30 and M8×60 (incl.)
		ML-B-30/350	307130/5	350	
2	Corners support and screws	ML-A-90	307128/9	44	M8×10 (incl.)
3	Vertical and horizontal support	ML-C-30	307120/6	2000	NO



Applications and Installations Examples

Low-Frequency Magnetic and Electric Fields

FlexShield solutions are suitable for a wide range of environments where low-frequency electromagnetic fields must be controlled to protect both equipment and people:

1. **Data Centers:** Protection of critical IT infrastructure against electromagnetic interference generated by nearby high-power electrical systems.
2. **Hospitals**
   Protection of sensitive equipment and surrounding areas, such as **Magnetic Resonance Imaging (MRI) rooms**, X-ray rooms, and adjacent spaces, as well as patients and medical staff.
3. **Office and Residential Buildings**
   Protection of electronic equipment (computers, servers, communication systems) and occupants, particularly in environments exposed to **high-voltage lines**, substations, or **subway infrastructure**.
4. **Industrial Facilities and Factories**
   Offices are located near production lines, industrial machinery (e.g. electric welding equipment), transformers, and electrical switchboards.
5. **Telecom Rooms, Network Centers, Data Centers, and Backup Rooms**
   Protection of IT and communication equipment installed close to electrical switchboards or high-power distribution systems.
6. **Airports**
   Communication rooms, technical areas, and rack rooms where critical electronic systems operate in proximity to high electrical loads.
7. **Pharmaceutical and Biotechnological Laboratories**
   Protection of sensitive laboratory equipment and personnel, particularly in areas adjacent to electrical switchboards or power distribution rooms.

Shielded Backplanes

Selection guide

EMF Source / Distance to Source exposed area	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

EMF Source / Distance to Source exposed area	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

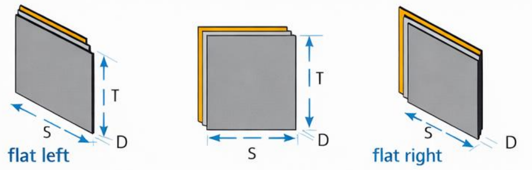
* special products and dimensions available under request

Selection guide

Models and Dimensions

(all dimensions in mm)

Flat Planes

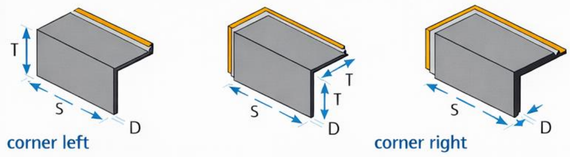


	S	T	D
SP	500	500	3
	500	1000	3
	1000	500	3
	1000	1000	3

	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
	1000	1000	3

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

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

* special products and dimensions available under request

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

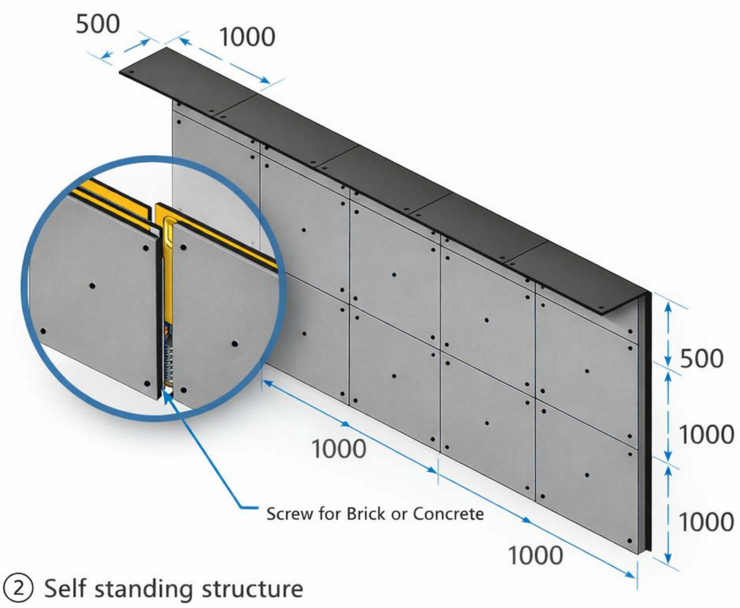
Installation Guide

The installation method depends on the **wall construction material**.

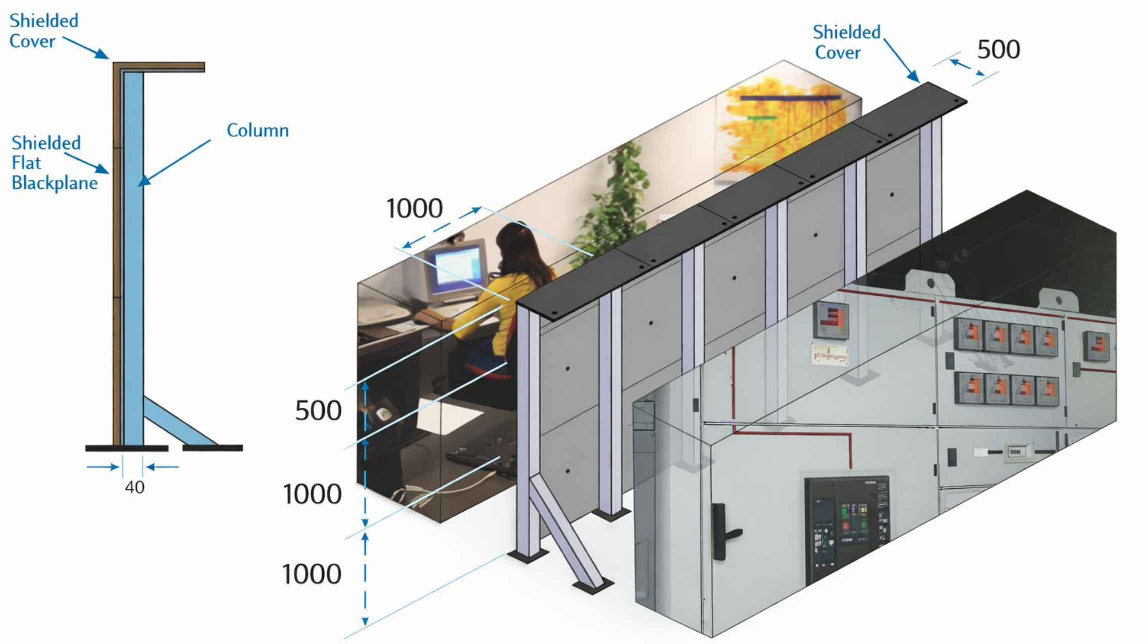
- If the wall is made of **brick or concrete**, the shielding panels are fixed **directly to the wall** using appropriate screws.
- If the wall is made of **gypsum board**, the panels must be fixed using screws together with **special fixing nuts** suitable for this type of structure.

Note:
All shielding panels must be **connected to ground** using a **25 mm^2 copper conductor**.

① Direct support wall



② Self standing structure



* Self standing structure quoted under request

(all dimensions in mm.)

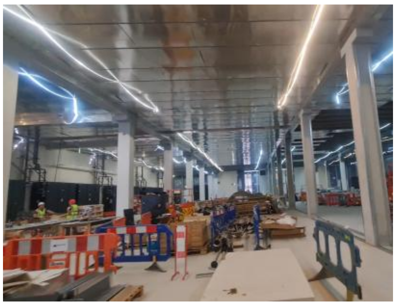
Applications and Installation Examples

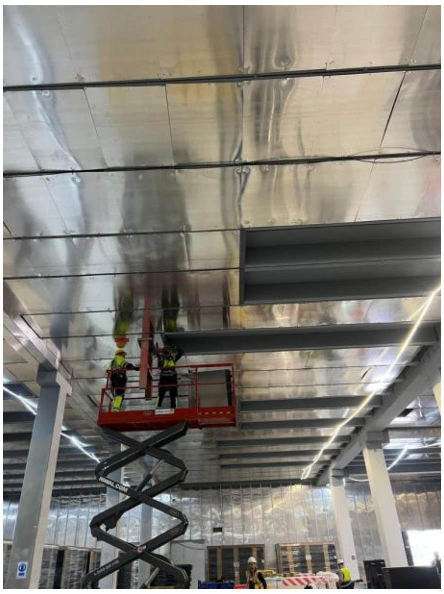
Magnetic and Electric Fields – Low Frequency

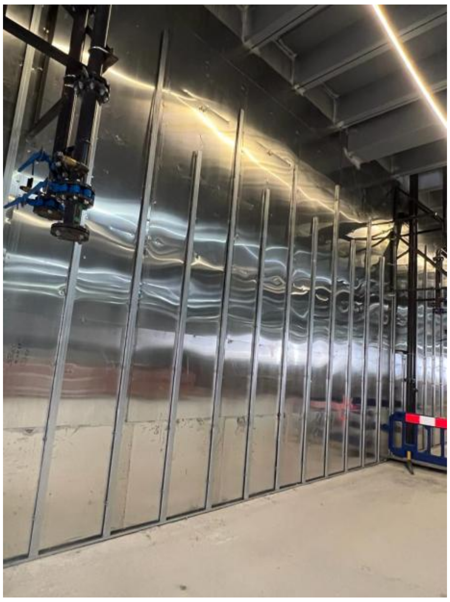
FlexShield solutions are suitable for applications requiring control and mitigation of **low-frequency electric and magnetic fields**, ensuring protection of both equipment and people in the following environments:

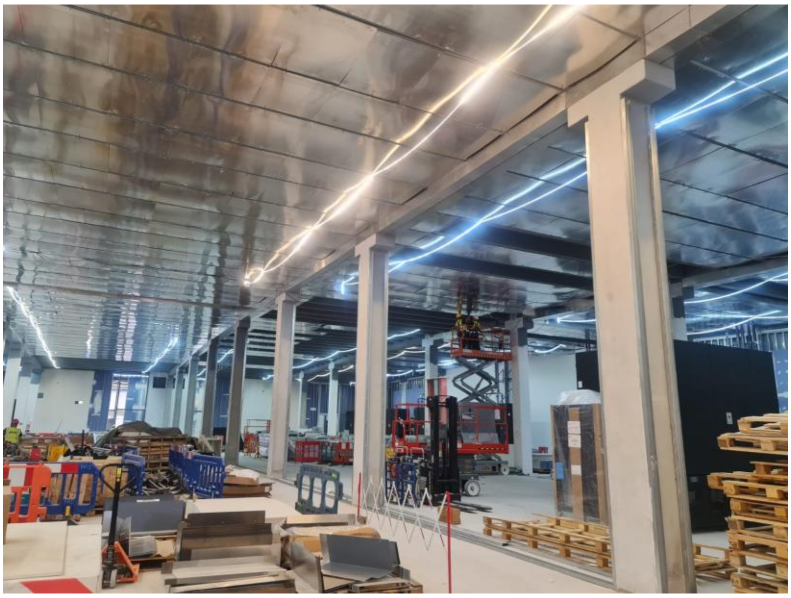
1. **Data Centers:** Protection of critical IT infrastructure against electromagnetic interference generated by nearby high-power electrical systems.
2. **Hospitals**
   Protection of sensitive equipment and surrounding areas, including **Magnetic Resonance Imaging (MRI) rooms**, X-ray rooms, and adjacent spaces, as well as patients and medical staff.
3. **Office and Residential Buildings**
   Protection of electronic equipment (computers, servers, communication systems) and occupants, particularly in environments exposed to **high-voltage lines**, substations, or **subway infrastructure**.
4. **Industrial Facilities and Factories**
   Offices located near production lines, industrial machinery (e.g. electric welding equipment), transformers, and electrical switchboards.
5. **Telecom Rooms, Network Centers, Data Centers, and Backup Rooms**
   Protection of IT and communication equipment installed close to electrical switchboards or high-power distribution systems.
6. **Airports**
   Communication rooms, technical areas, and rack rooms operating near high electrical loads.
7. **Pharmaceutical and Biotechnological Laboratories**
   Protection of sensitive laboratory equipment and personnel, particularly in areas adjacent to electrical switchboards.
8. **Buildings Exposed to High-Voltage Lines**
   Mitigation of electromagnetic fields generated by nearby **high-voltage power lines** to ensure compliance with exposure limits.

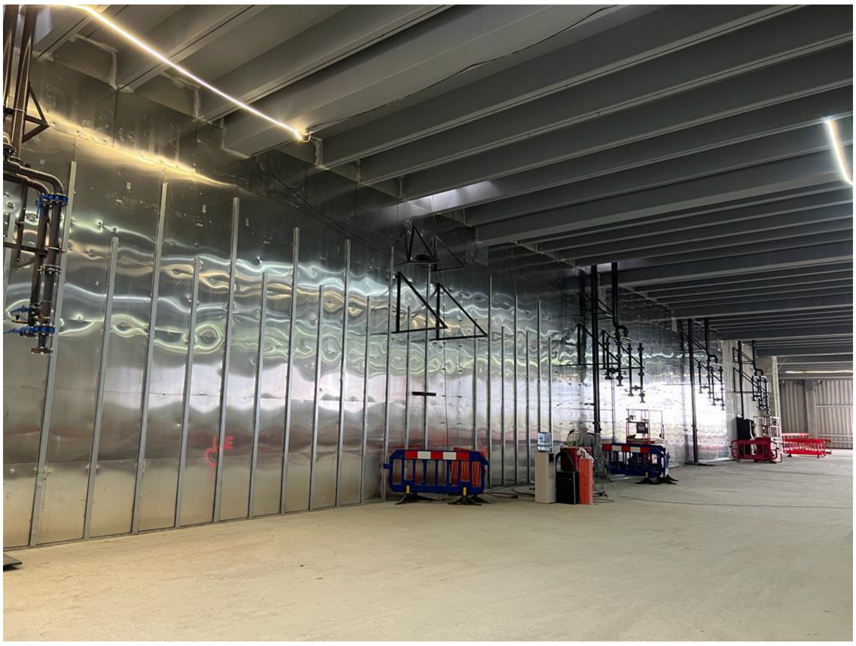
EXAMPLE 1: HYPERSCALER DATA CENTER – SERVERS ROOM SHIELDING (GERMANY)











EXAMPLE 2: BANK DATA CENTER - UPS ROOM AND POWER SWITCHBOARD ROOM (GERMANY)

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

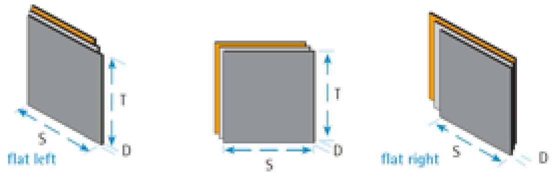
SPTC ~ Standard HPTC ~ High Performance UHPTC ~ Ultra High Performance

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

* special products and dimensions available under request

Models and Dimensions

Flat Planes

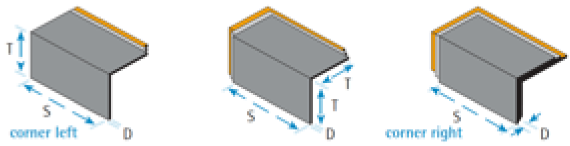


	S	T	D
STC	500	500	3
	500	1000	3
	1000	500	3
	1000	1000	3

	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)?

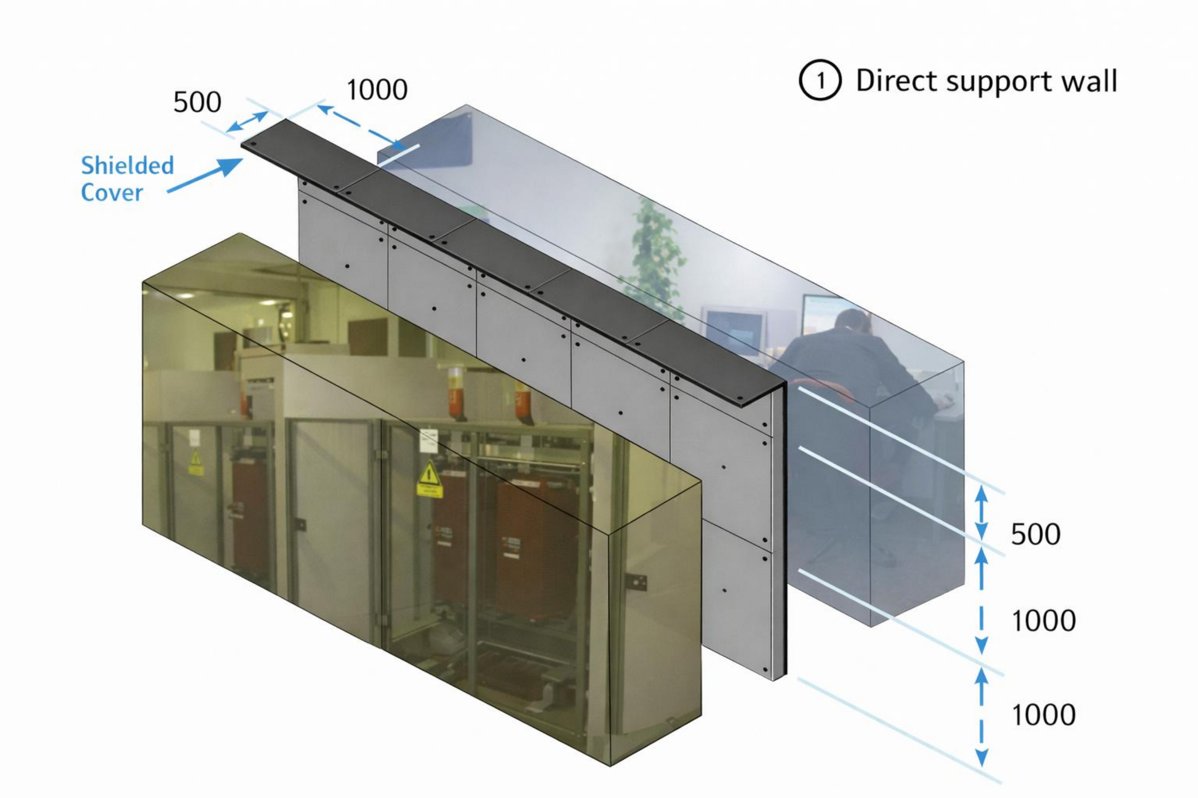
Answer:

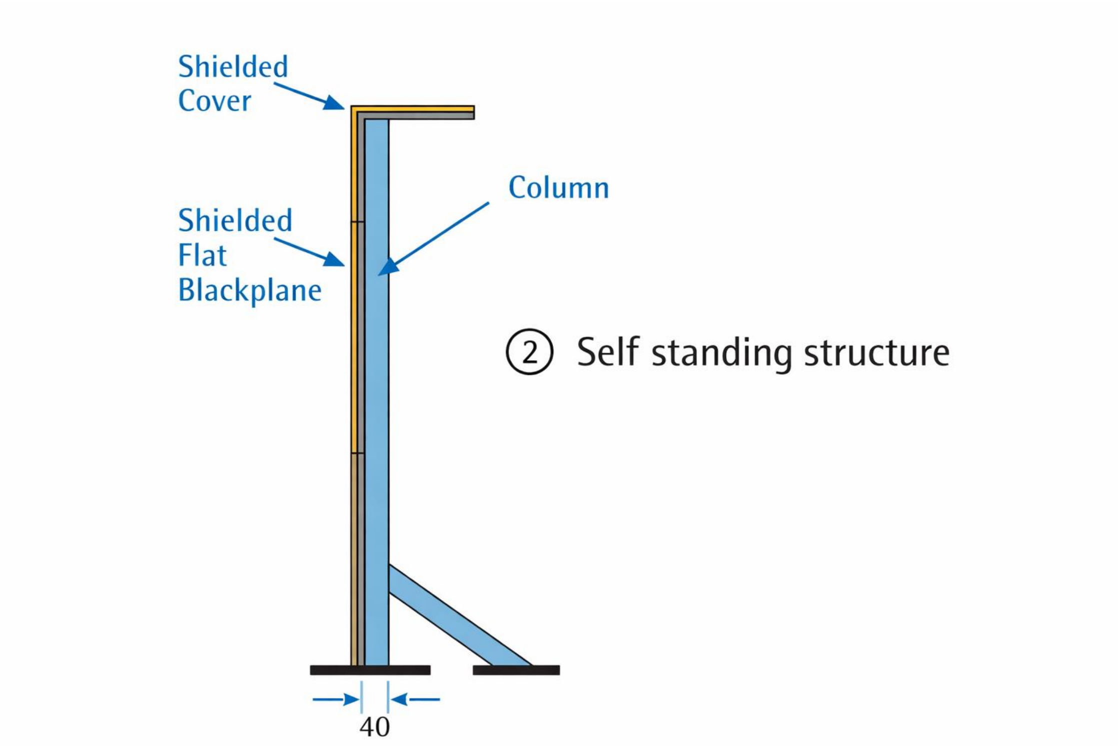
	Shielding performance	length (T)	Flat / Corner	width (S)
4 units x	UHPTC	1000	F	1000

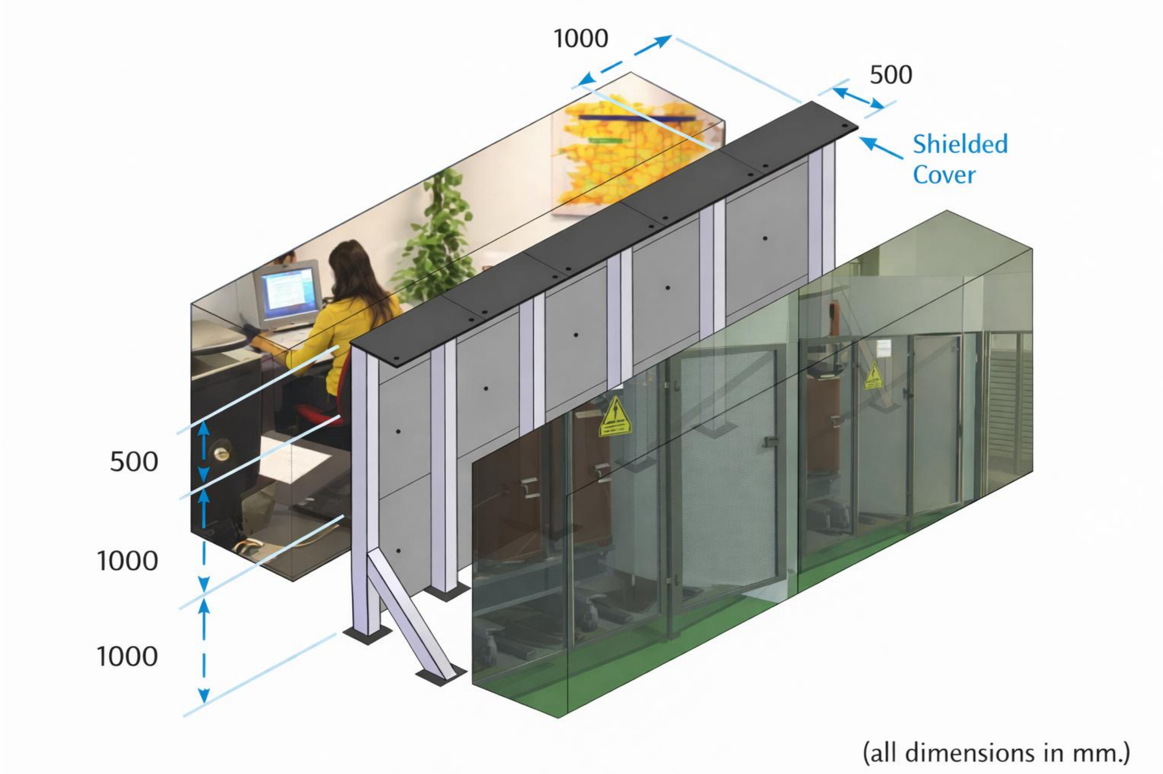
Installation Guide

There are **three different types of shielding installations** for transformers:

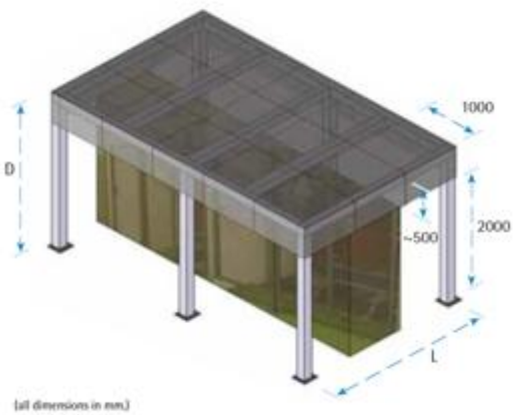
- **Wall protection (side shielding)**
- **Ceiling protection**
- **Complete protection** (walls and ceiling)


500
1000
Shielded
Cover
① Direct support wall
500
1000
1000


Shielded
Cover
Column
Shielded
Flat
Blackplane
② Self standing structure
40



** Self standing structure quoted under request*



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 mm^2 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.

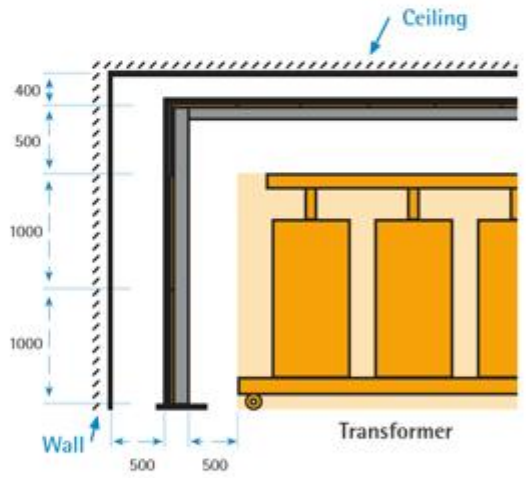
The steel beams are separated 1000 mm. aprox.

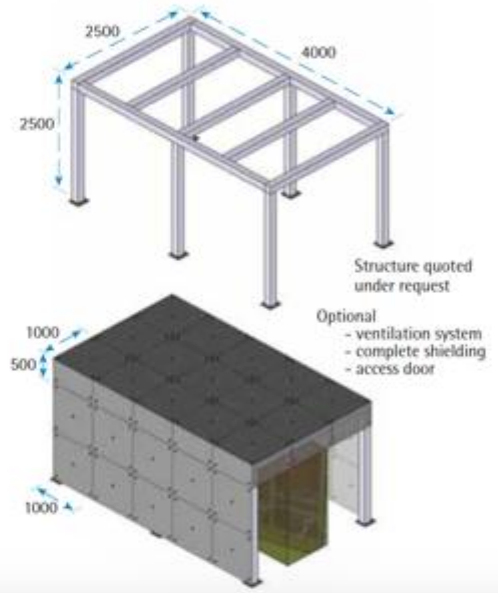
Wall panels must be fixed to structure with 6 screws and 6 nuts as minimum.

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 mm^2 copper wire.





(all dimensions in mm.)

Applications and Installation Examples

FlexShield solutions can be applied in a wide range of environments to protect both **sensitive equipment** and **people** from electromagnetic field exposure:

1. **Hospitals**
   Protection of sensitive equipment and surrounding areas, including **Magnetic Resonance Imaging (MRI) rooms**, X-ray rooms, and adjacent spaces, as well as patients and medical staff.
2. **Office and Residential Buildings**
   Protection of electronic equipment (computers, servers, communication systems) and occupants, particularly in areas exposed to **high-voltage lines**, substations, or **subway infrastructure**.
3. **Industrial Facilities and Factories**
   Offices located near production lines, industrial machinery (e.g. electric welding equipment), transformers, and electrical switchboards.
4. **Telecom Rooms, Network Centers, Data Centers, and Backup Rooms**
   Protection of IT and communication equipment installed close to electrical switchboards or high-power distribution systems.
5. **Airports**
   Communication rooms, technical areas, and rack rooms operating near high electrical loads.

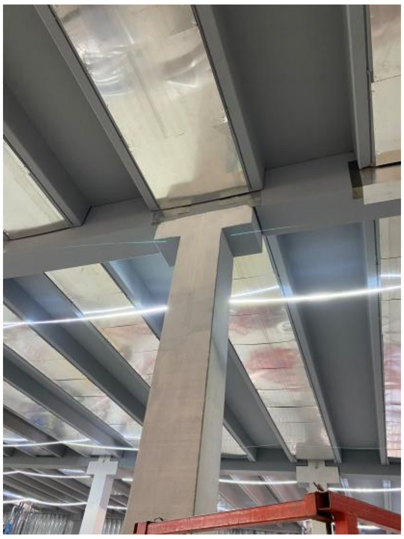
6. **Pharmaceutical and Biotechnological Laboratories**
   Protection of sensitive laboratory equipment and personnel, particularly in areas adjacent to electrical switchboards.

INSTALLATION EXAMPLE:

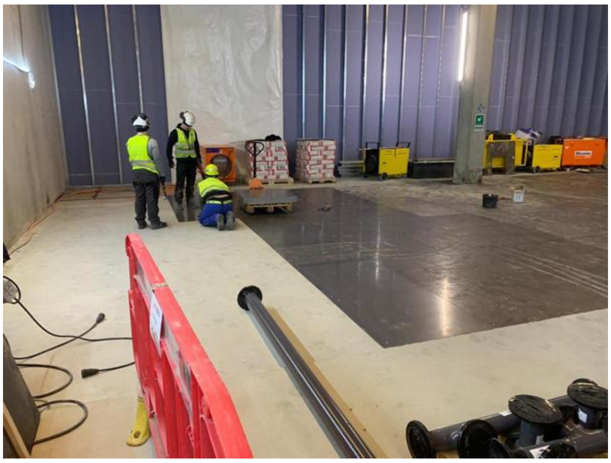
PROPIETARY "BELT" SHIELDED PLATES OVERLAP SYSTEM TO MINIMIZE EMF LEAK IN JOINTS AND CORNERS, REDUCING INSTALLATION TIME AND COST.

SPECIAL SHIELDING PLATES DESIGN, TO ADAPT TO COMPLEX ARCHITECTURAL SHAPES.

ON SITE PERFORMANCE MEASUREMENTS

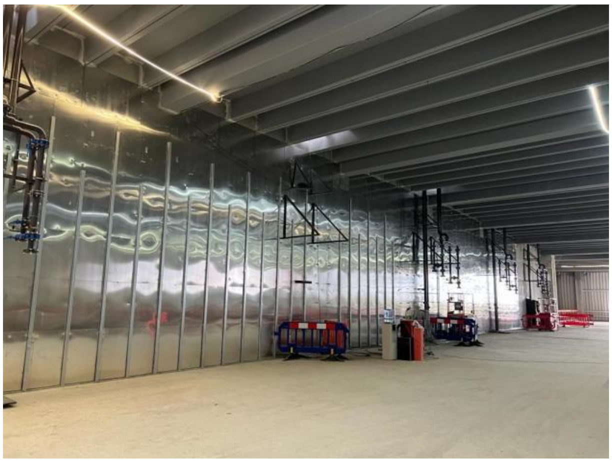


COMPLETE SOLUTION DELIVERY: MANUFACTURING, TRANSPORTATION, UNLOADING, STORAGE, INSTALLATION, HEALTH & SAFETY , PERFORMANCE TESTING.



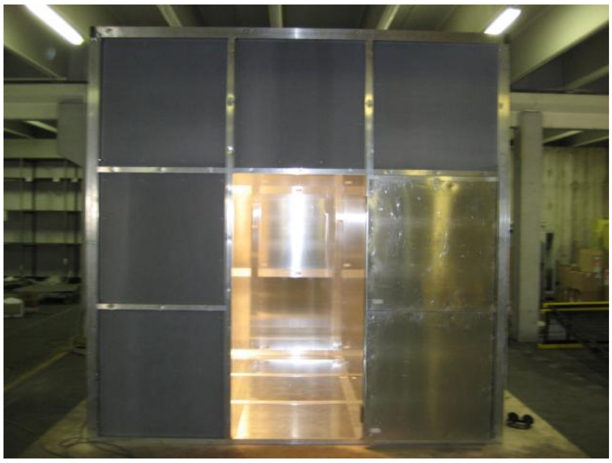








IMEFY
S.p.a. AREZZO - ITALIA
TRASFORMATORE A SECCO INGLOBATO IN RESINA
PRIMARIO
SECONDARIO



Electronic microscope c/o CSM Roma

Testing Environment FlexShield

All EMF attenuation tests are carried out under controlled laboratory conditions to accurately evaluate the performance of FlexShield shielding solutions.

The laboratory environment allows precise control of distances, current levels, and measurement positions, ensuring repeatability and reliability of the results.

Low-frequency magnetic fields are generated to simulate real installation scenarios such as electrical rooms, substations, and high-current distribution systems located near sensitive areas.

Laboratory Test Setup

The laboratory test configuration consists of the following main components:

- **EMF Generator**
  Used to generate a controlled low-frequency electromagnetic field at predefined current levels.
- **Loop Antenna**
  Connected to the EMF generator to reproduce the magnetic field distribution equivalent to high-current electrical conductors.
- **Shielding Panels**
  FlexShield SPP or HPP shielding plates installed between the EMF source and the measurement point to evaluate attenuation performance.
- **EMF Meter**
  A calibrated EMF measurement device used to record magnetic field levels before and after shielding.

All distances between the EMF generator, shielding panel, and EMF meter are precisely defined (typically 40 cm) to replicate real-world installation conditions.

Methodology and Structure tests

The test methodology follows a structured and repeatable process:

1. The EMF generator is adjusted to produce a predefined magnetic field level, measured at a fixed distance from the loop antenna.
2. Baseline EMF measurements are recorded without shielding.
3. Shielding panels are installed between the source and the measurement point.
4. EMF measurements are repeated under identical conditions.
5. The attenuation factor is calculated by comparing measurements before and after shielding.

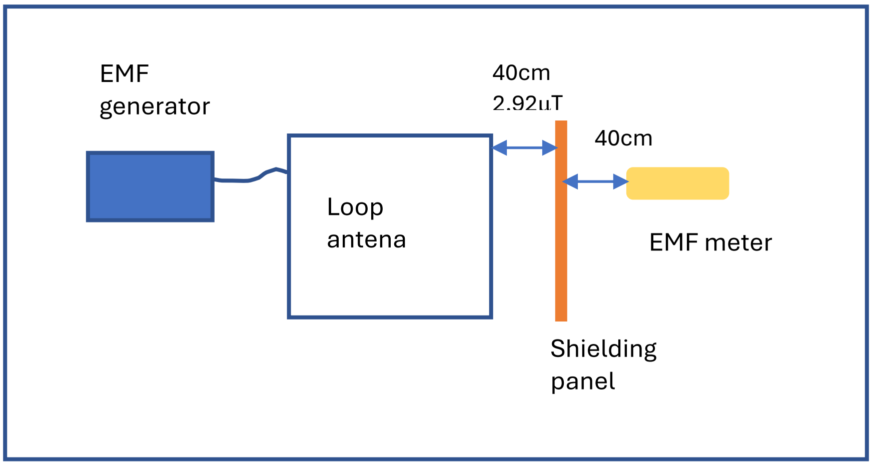
Different current levels and shielding configurations are tested to assess performance under varying electromagnetic exposure scenarios.

Laboratory Images

Photographic documentation is taken during laboratory tests to illustrate:

- The complete test setup and instrumentation
- The positioning of the loop antenna and EMF meter
- The installation of shielding panels
- Measurement procedures and distances

These images provide visual confirmation of the test conditions and support the traceability and credibility of the laboratory results.



Purpose of Laboratory Testing

Laboratory testing allows FlexShield to:

- Validate shielding performance prior to on-site installation
- Compare different shielding technologies (SPP vs HPP)
- Ensure compliance with applicable EMF exposure standards
- Provide documented and repeatable performance data

The results obtained in the laboratory serve as a reliable reference for real-site applications and on-site validation measurements.

FLEXSHIELD Lab is equipped with:

- EMF Generator HAEFFLY MAG 100
- EMF loop antenna HAEFLY MAG 100
- EMF high precision meter PMM
- Real-scale rooms for shielding testing.

• All our EMF solutions are thoroughly testes to validate shielding performance prior to on-site installation

• We test different shielding technologies to stay at the forefront of technology.

• Ensure compliance with applicable EMF exposure standards

• Provide documented and repeatable performance data with external certification validation (TUV).

The results obtained in the laboratory serve as a reliable reference for real-site applications and on-site validation measurements.

On-Site EMF Tests

On-site EMF tests are performed after installation to verify the effectiveness of the shielding solution under real operating conditions. These measurements confirm that the installed FlexShield system performs as designed and that EMF exposure levels are reduced to safe and compliant values within the protected areas.

On-site testing is a key step in validating the project and ensuring long-term reliability of the shielding solution.

Field Testing (On-Site Measurements)

Field measurements are carried out directly at the customer’s facility, typically in Data Centers, electrical rooms, or adjacent sensitive areas.

Measurements are performed:

- In operational conditions, with real electrical loads
- At predefined locations and heights
- At critical points such as walls, ceilings, corners, and areas closest to EMF sources

This approach ensures that all relevant exposure scenarios are evaluated.

Quality Assurance Verification

On-site EMF measurements form part of the Quality Assurance (QA) process and are used to:

- Verify correct installation of shielding panels and channels
- Confirm proper overlap and continuity of shielding elements
- Check grounding and bonding effectiveness
- Ensure no unexpected EMF leakage points are present

Measured values are compared against design targets and applicable standards to confirm compliance.

Completion of Work – Final Check Measurements

Upon completion of the shielding installation, final EMF measurements are carried out as part of the project handover process.

These final checks include:

- Verification of residual EMF levels inside the protected area
- Confirmation that exposure levels are below defined acceptance thresholds
- Documentation of measurement locations, distances, and results

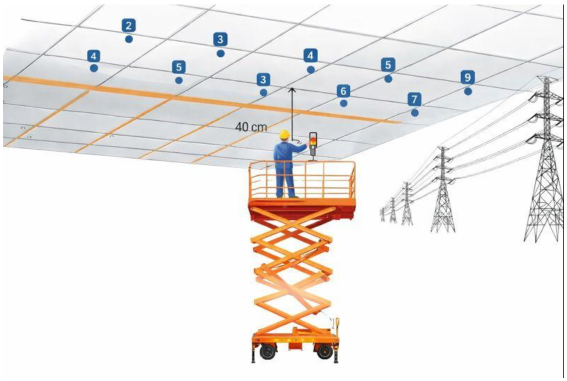
The final measurement report serves as objective evidence that the shielding system is fully operational and meets the project requirements.

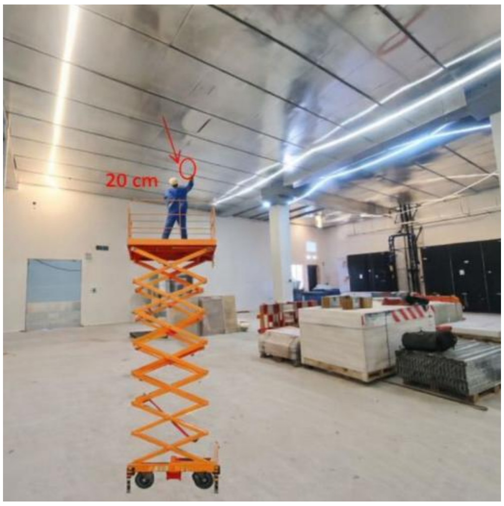
On-Site Test Images

Photographic documentation is taken during on-site testing to support measurement results and provide full traceability of the validation process. Images typically include:

- Test engineer performing EMF measurements
- Measurement setup and instruments in use
- Test locations (walls, ceilings, soffits, and critical areas)
- Distance and positioning relative to shielding elements
- General view of the protected area and surrounding EMF sources

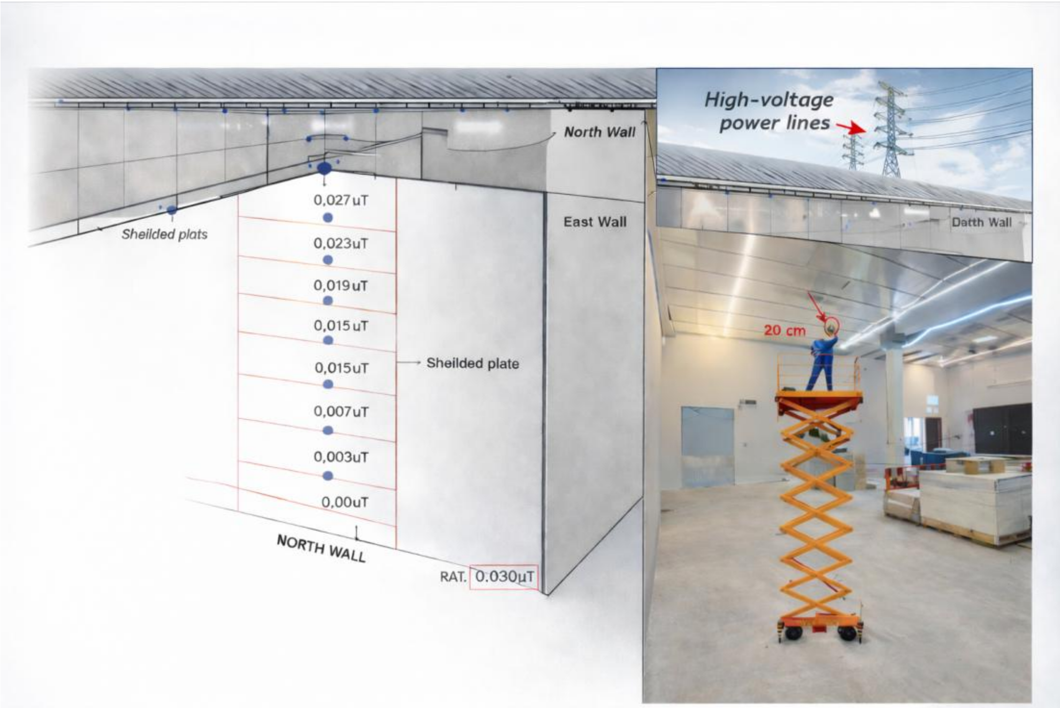
These images serve as visual evidence of correct testing procedures and are included in the final project documentation.

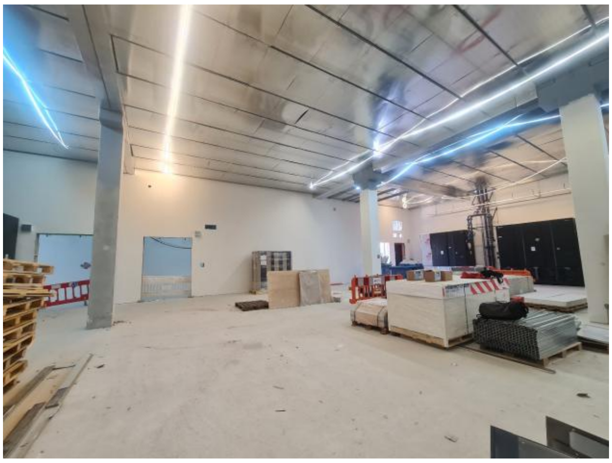


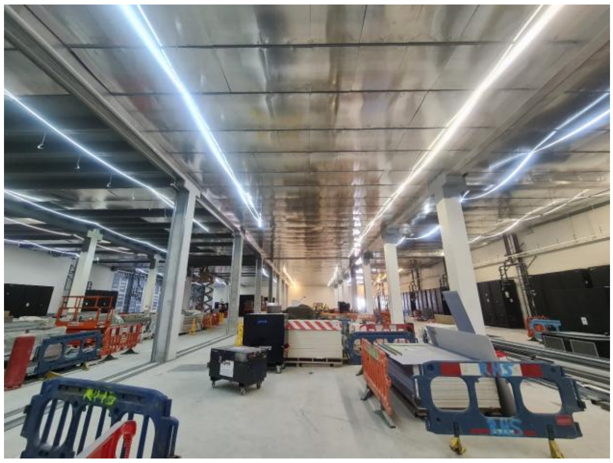


Unshielded Shielded

FlexShield


High-voltage power lines
North Wall
East Wall
Datth Wall
Sheilded plats
0,027uT
0,023uT
0,019uT
0,015uT
0,015uT
0,007uT
0,003uT
0,00uT
Sheilded plate
NORTH WALL
RAT. 0.030μT
20 cm






0.022


0.016


0.012

Documentation and Reporting

All on-site test results are documented and included in the project dossier, typically comprising:

- Measurement tables and diagrams
- Photographic evidence of test locations
- Description of test methodology
- Compliance statement against relevant standards

This documentation provides transparency, traceability, and confidence to the client regarding the performance of the installed shielding solution.

Customer References

FlexShield solutions have been successfully implemented across a wide range of industries and applications, including Data Centers, industrial facilities, public infrastructure, transportation hubs, research laboratories, and government buildings. Our customer base includes leading global corporations, public authorities, and critical infrastructure operators.

- **IBM**
  EMF mitigation solutions for critical IT and technical environments.
- **Intel**
  Protection of sensitive electronic and industrial equipment.
- **Mercury Engineering**
  EMF shielding solutions delivered as part of complex engineering and construction projects.

- **ProSiebenSat.1 Group (Munich, Germany)**
  Protection of broadcast and technical facilities against electromagnetic interference.
- **Port of Hamburg Authority (Germany)**
  EMF mitigation in industrial and infrastructure environments.
- **University of Göttingen (Germany)**
  Shielding solutions for electronic microscope rooms and high-sensitivity research laboratories.
- **Digital Realty**
  EMF protection solutions for Data Center environments.
- **Biogen / Biotechnology Facilities (Switzerland)**
  EMF mitigation for transformer and power-related installations supporting sensitive laboratory equipment.
- **Fraport AG (Frankfurt Airport)**
  Protection of technical and communication areas within airport infrastructure.
- **Government of Spain**
  EMF shielding solutions implemented in public and government-owned facilities.
- **WISKA**
  Industrial and electrical environments requiring controlled EMF exposure.
- **Schneider Electric**
  Collaboration and projects involving electrical infrastructure and EMF-sensitive environments.
- **Banco de España**
  Protection of critical banking and technical installations.
- **Endesa**
  EMF mitigation solutions related to power distribution and electrical infrastructure.

Certificates

TÜV

DECLARATION OF CONFORMITY

The company

Flexvpc, SL FlexShield

Declare that the product

SHIELD TRAY & BACKPLANES

Complies with the following standards and normative documents:

IEC 61000-4-8	*Electromagnetic equipment immunity from electromagnetic fields.*
IEC 61637	*Cable tray systems and cable ladder systems for cable management.*
IMPA 79	*IMPA 79 and National Electrical Code Article 292 specify that cable trays provide UL classification and labeling*
NEMA VE1 & CSA C22.2 NO. 126.1	*Metal cable tray systems for material sizes and configurations, providing certificates.*

FlexShield a brand of FlexVPC

FlexShield

C/ Albert Einstein 43, 08940 Cornellà de Llobregat, Barcelona, Spain

TÜV International
Grupo TÜV Rheinland

Subject: Shielded Trays and Backplanes Electromagnetic Fields Attenuation Test According to the levels required by the standards UNE-EN 61000-4-8 and NCRP.

This is to certify that the undersigned inspector of TÜV International Catalunya, TÜV INTERNATIONAL GROUP Rheinland, S.L, has witnessed and inspected the test conducted by AST, S.L. according to the test protocol "5-2004/05-STD" regarding the shielding effectiveness of the products.

Shield Trays

And

Backplanes)

The results of the test have been favorable in achieving the attenuation levels required by both the standard IEC/EN 61000-4-8 and recommendations by NCRP.

The present statement letter is signed in Barcelona on the 5th Jul, 2024

* For more details, please refer to the Complete Test Report Results 35709529/05.

Subject: Shielded Trays and Backplanes Electromagnetic Fields Attenuation Test According to the levels required by the standards UNE-EN 61000-4-8 and NCRP.

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Shield Trays

And

Backplanes)

The results of the test have been favorable in achieving the attenuation levels required by both the standard IEC/EN 61000-4-8 and recommendations by NCRP.

CE DECLARATION OF CONFORMITY

The company

FlexVPC, SL

Declare that the product

SHIELD TRAY & BACKPLANES

Complies with the following standards and normative documents:

IEC 61000-4-8	*Electromagnetic equipment immunity from electromagnetic fields.*
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AST S.L C/ Albert Einstein 43, 08940 Cornellà de Llobregat, Barcelona, Spain,
Phone: +34 93 112 25 38 Email: info@flexvpc.com web: www.flexvpc.com

info@flexvpc.com

T +34 931 122 538

www.flexshield.flexvpc.com

FlexShield