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Perfect shielding

Rittal EMC range



FRIEDHELM LOH GROUP



Perfect shielding

The ultimate in shielding for all frequencies

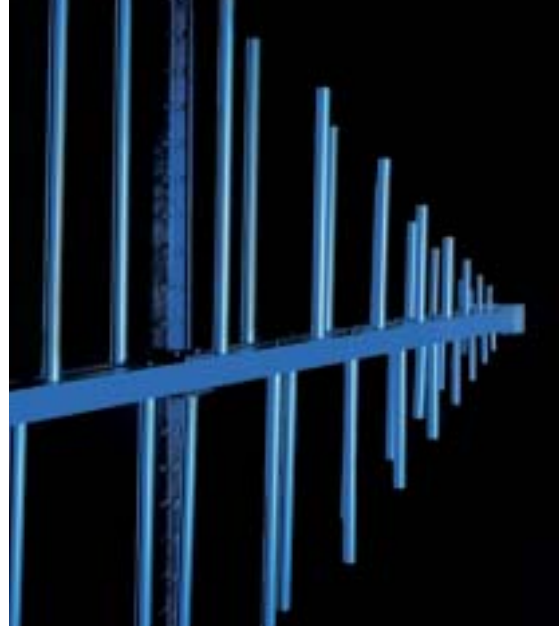
Today's technical measurement and control, communication and data technology systems are extremely powerful, as they contain large numbers of complex electronic components which can be highly sensitive to electromagnetic influences. Good, professional planning of electromagnetic compatibility (EMC) from the outset is therefore crucial to the lasting functional reliability of equipment and systems.

Put your trust in the expert advice and wide range of practically tested solutions from Rittal, one of the world's leading suppliers of enclosure and case technology. We have decades of expertise in the handling of various materials and are therefore able to translate the latest findings quickly and reliably into practical solutions.

Your perfect partner – from analysis to problem-solving

It's a familiar dilemma: Your product needs EMC, but you're not an EMC expert. We offer the ideal solution: Our specialists will provide you with expert assistance and advice. From obtaining initial information, to theoretical training, through to practical implementation.

An analysis of the EMC risks of your application allows us to discuss the proposed solutions and the range of products available for selection. Rittal gives you the peace of mind needed to confirm compliance with specified EMC protection targets. It's reassuring to know that you are also ideally equipped to meet the requirements of the future.





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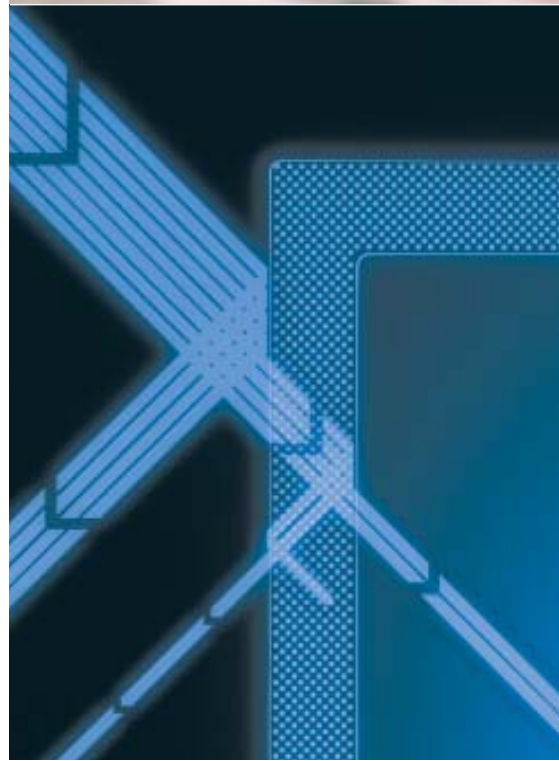
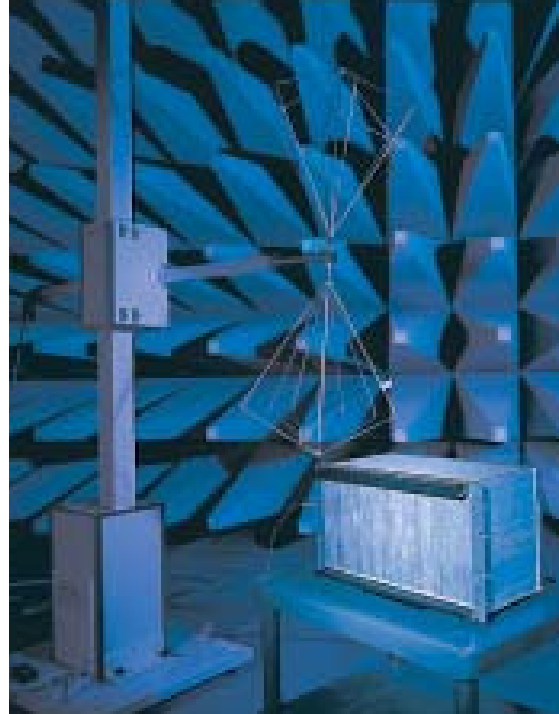
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The Rittal EMC concept

Interference can be fatal

Rittal offers excellent pre-requisites for EMC enclosure configurations with its standard sheet steel enclosures, EMC-shielded enclosures, and a practical range of EMC accessories. Even the standard enclosures offer a good shielding effect against electrical fields which is sufficient for many applications. Depending on the individual application, anything is possible, be it closely intermeshed potential equalisation in a standard enclosure to prevent conducted interference, or extra shielding to protect against high-frequency electromagnetic fields. For large enclosures in the ES 5000 series, standard version, we can even offer fast, simple upgrades of the screening attenuation up to a maximum of 20 dB.

Rittal EMC enclosures with a high level of shielding are based on the following concept: Conductive sealing edges offer maximum protection against corrosion, thanks to aluminium zinc coating of sheet steel enclosures or chromate conversion of aluminium enclosures. In conjunction with low-resistance EMC seals, this produces a largely slot-free, electrically conductive surface, which in turn leads to excellent attenuation levels and good value for money.



Partial shielding

It is not always necessary to provide a high level of shielding for the entire enclosure. When it comes to shielding a single source of interference in the system or protecting a particularly sensitive assembly, an “enclosure-within-an-enclosure” structure can often provide a viable alternative. The efficient use of EMC enclosures is not only a question of materials, but also a design issue. With this in mind, Rittal offers a wide selection of small enclosures and subracks which can be used for partial shielding in standard enclosures. There is an almost unlimited choice of combination variants with large enclosures and wall-mounted enclosures.

The influence of holes and slots

Openings in the structure may severely impair the local shielding effect of the highly shielded enclosure. The interference depends on the type of field, and the size and geometry of the openings. EMC viewing windows, EMC cable entry glands, EMC fan-and-filter units, wire screens and standard commercial perforated plates for the shielding of cutouts for heat dissipation and other components mean that the effects of such unavoidable leaks may be significantly reduced. The attenuation levels given were ascertained by accredited test centres to VG 95373, part 15 and the former MIL STD 285, and should be seen as orientation guidelines for sealed empty enclosures with no cutouts or other modifications. Deviations are possible, particularly with customised designs.

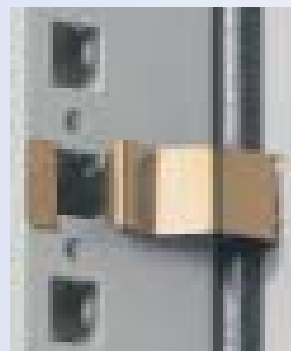
EMC – Standard protection

Standard enclosures of sheet steel offer adequate EMC protection in many cases, thanks to their electrically conductive material. A zinc-coated mounting plate offers the option of large-scale potential equalisation. For large enclosures in the TS 8 series, the standard protection will match or exceed the average protection levels of the predecessor model PS 4000.



EMC – Medium protection (EMC retrofitting)

In standard enclosures, medium levels of EMC protection are achieved via additional electrical connections between the enclosure and the doors/walls. Depending on the EMC requirements, contact clips may be retro-fitted to the profiles of ES enclosures to improve the EMC shielding effect. In this way, attenuation can be increased by up to 20 dB. EMC earthing straps ensure optimum potential equalisation. In TS/ES enclosures, EMC gland plates may be used for the entry of shielded cables. Shield buses for contacting the cable shields or EMC cable glands may additionally be used in all enclosures.

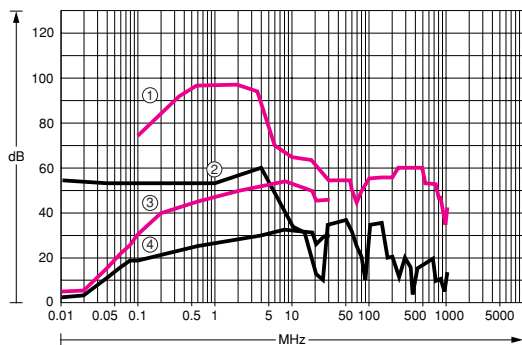


EMC – High protection

A high level of shielding is afforded by an enclosure body or enclosure frame of sheet steel with an aluminium zinc surface finish, spray-finished on the outside. The roof, base, door and sides likewise have an uncoated aluminium zinc interior finish, and therefore offer excellent slot-free contact via self-adhesive, low-resistance EMC seals to the enclosure or enclosure frame.



■ EMC terminal boxes KL



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

Width mm	Height mm	Depth mm	Model No. KL
300	300	120	1507.710

Other sizes available on request.

Material/surface finish:

Sheet steel with aluminium zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

Supply includes:

Enclosure, cover with special seal and cover screws.

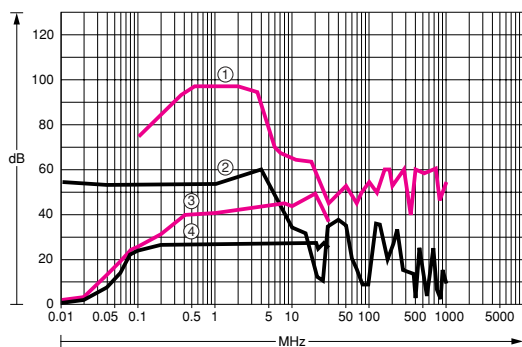
Protection category:

IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.



■ EMC E box EB



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

All sizes available on request.

Material/surface finish:

Sheet steel with aluminium zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

Supply includes:

Enclosure with mounting plate, door with special seal including 180° hinge and cam lock with double-bit insert.

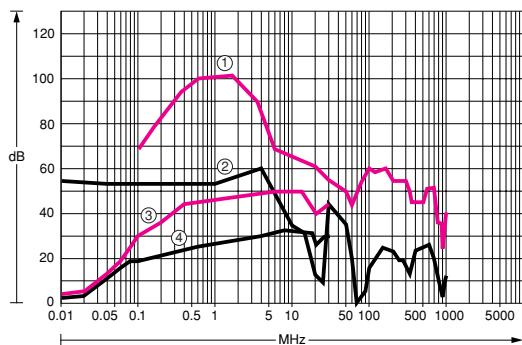
Protection category:

IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.



■ EMC compact enclosures AE



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

Width mm	Height mm	Depth mm	Model No. AE
380	380	210	1380.700
600	380	210	1039.700
600	600	210	1060.700
800	1000	300	1180.700

Other sizes available on request.

Material/surface finish:

Sheet steel with aluminium zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

Supply includes:

Enclosure with mounting plate, door with special seal (130° hinge) including cam lock with double-bit insert.

Protection category:

IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.





We have opted to eliminate gland plates from EMC enclosures, in order to achieve maximum shielding effectiveness.

EMC wall-mounted enclosures KL, EB, AE have the following approvals:

- UL
- CSA
- TÜV
- Norske Veritas
- Lloyds Register of Shipping
- VDE



- 1 EB:**
Opening angle 180°.
- 2 KL/EB/AE:**
The combined, self-adhesive EMC/IP seal provides reliable, long-lasting EMC/IP protection with low-resistance conductance values.
- 3 EB/AE:**
The double-bit insert is easily exchanged for standard lock inserts.
- 4 KL:**
Profile strips with mounting holes on both sides.
- 5 KL:**
Removable cover, paint-free on the inside, with cover screws. Cover screws may be exchanged for quick-release fasteners or hinges.
- 6 KL/EB/AE:**
The holes drilled in the rear panel are sealed by blind rivet nuts, thereby preserving the EMC protection when wall mounting.
- 7 KL/EB/AE:**
In all wall-mounted enclosures, the enclosure edges are kept paint-free in order to ensure contact with the door or cover via the EMC seal.



Accessories:

EMC accessories, see page 14 – 19.
EMC fan-and-filter units, see Climate Control brochure, page 142/143.
Ripac Vario EMC, see page 8 – 9.

- 8 AE:**
Opening angle 130°.
- 9 AE:**
Perforated mounting strips are spot-welded to both inner sides of the door.
- 10 EB/AE:**
The zinc-coated mounting plate installed in all EMC enclosures permits large-scale earthing of components, thereby making a direct contribution towards reducing EMC interference.

■ Ripac Vario EMC

The Ripac Vario EMC subrack system was developed with a view to EMC aspects. The subracks are equipped with a conductive surface and may be supplemented with additional EMC components such as gaskets and extrusions. This allows individual EMC requirements to be met, depending on the specific application in question.

Technical specifications:

Overall depth: 245, 285, 305, 345, 405, 465, 525, 585 mm
Installation width: 84 HP
Height: 3 U, 4 U, 6 U, 7 U, 9 U

Material:

Side panels:
2.5 mm aluminium plates
Flanges and horizontal rails:
Extruded aluminium section
Cover plates: Aluminium

Surface finish:

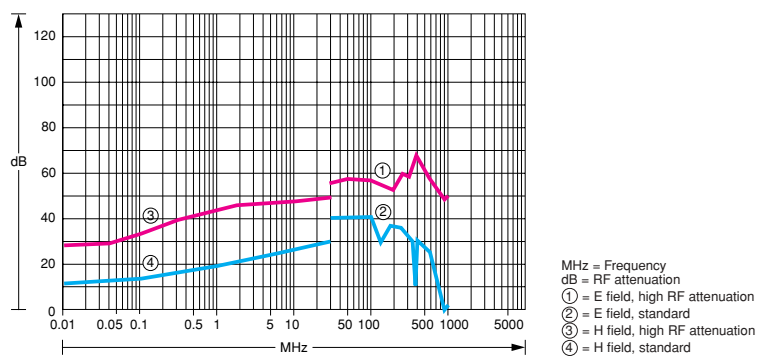
Clear chromated

Testing:

Vibration and shock-tested to:
IEC 600-68-2-6 test Fc
IEC 600-68-2-27 test Ea

Standards:

Ripac Vario subracks are based on the system dimensions to DIN 41 494, part 5 and IEC 60 297-3.



■ EMC gaskets, vertical



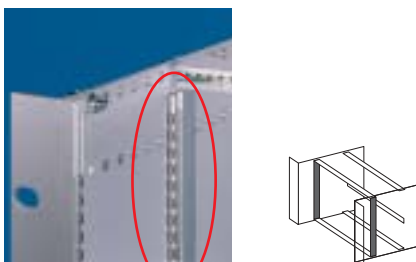
To ensure EMC protection between the subrack side panel and the front/rear panels. Both segmented and one-piece versions are optionally available.

■ EMC gaskets, horizontal



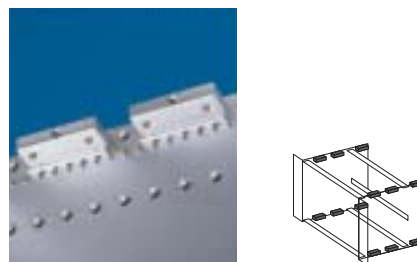
For horizontal EMC protection. For snap-fastening onto the front horizontal rails.

■ EMC contact strip



To ensure EMC protection with recessed horizontal rails. Integral channel to accommodate vertical EMC gaskets. 2 extrusions are required for each subrack.

■ Mounting blocks

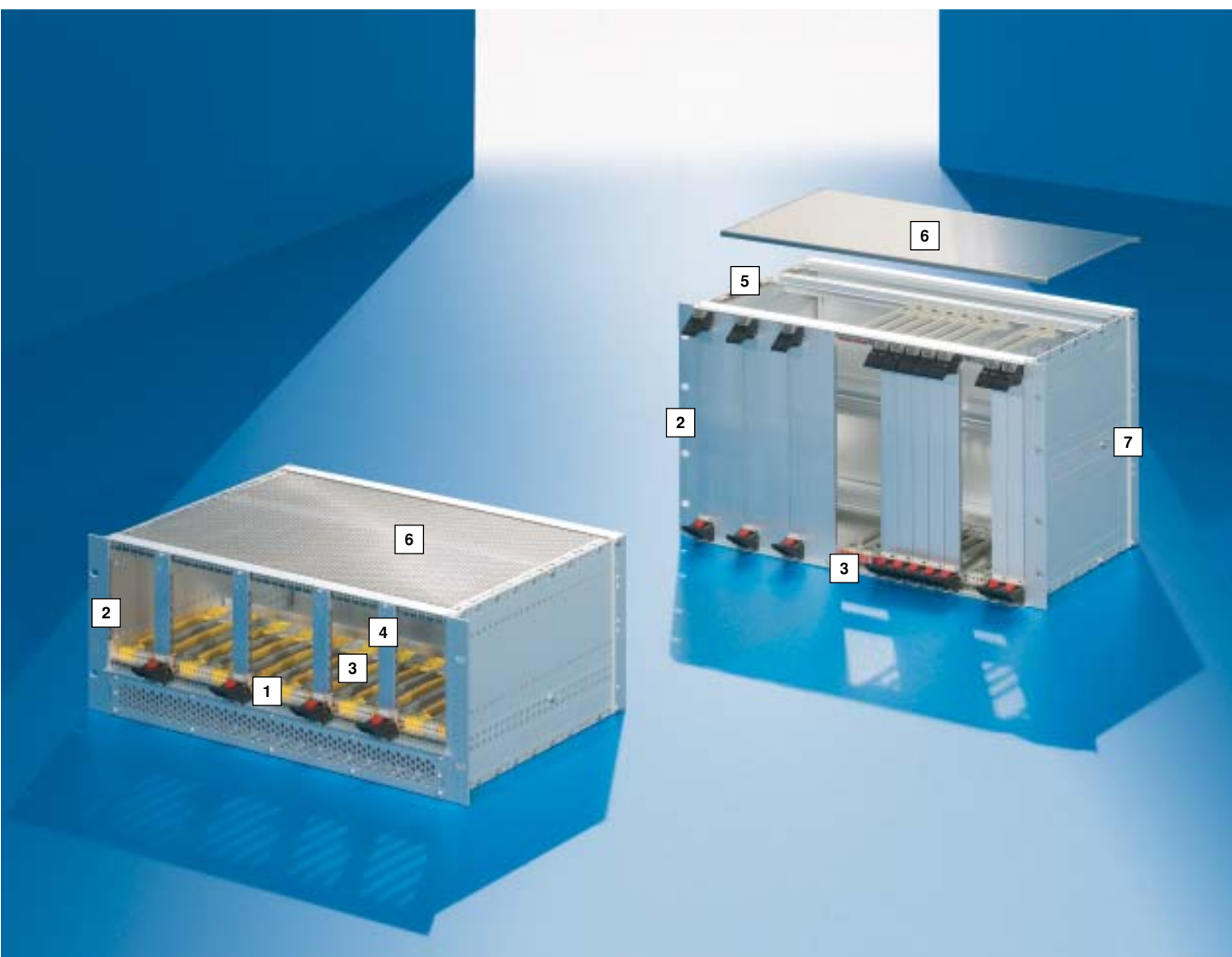


For mounting the cover plates on the subrack side panel. For EMC applications, mounting blocks must be fitted across the entire subrack depth.

■ EMC gaskets for cover plates



For EMC shielding between the horizontal rails and cover plates.



The EMC subracks in the Rittal range provide shielding for assemblies which may emit, or be sensitive to external influence.



Accessories:

Other accessories for EMC configuration may be found in the Rittal Electronics Catalogue.

- 1 Horizontal EMC gaskets for horizontal rails (optional).
- 2 EMC gaskets, vertical (optional).
- 3 Keyable plastic guide rails.
- 4 U-shaped EMC front panels with ejector/retainer handles.
- 5 Mounting blocks for covers.
- 6 Covers, punched or solid, with EMC gaskets.
- 7 Trim for rear 84 HP termination.



ESD clip in the PCB guide for reliable discharge of static charges.

■ EMC baying systems TS 8

The enclosure frame is of sheet steel with an aluminium zinc surface finish. All externally mounted parts likewise have a conductive aluminium zinc surface finish. The TS 8 Top Enclosure is painted on the outside, including rear panel, roof and door. There are self-adhesive EMC/IP combination seals on the zinc-plated interior surfaces, which ensure slot-free all-round contact. The base is sealed by standard gland plates with a zinc-plated surface finish, which contact the same EMC/IP seal.

Material:

Sheet steel with an aluminium zinc surface finish

Door: 2.0 mm

Rear panel: 1.5 mm

Mounting plate: 3.0 mm

Surface finish:

Framework, door, rear panel and roof plate of sheet steel with an aluminium zinc surface finish, painted in RAL 7032 on the outside and unpainted on the inside.

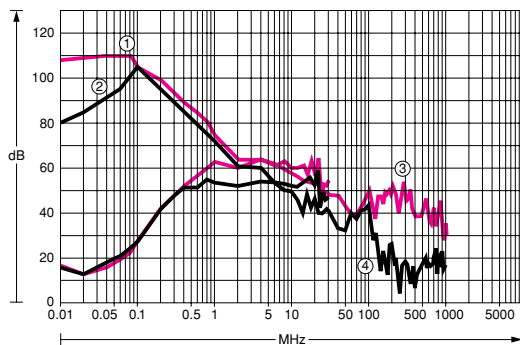
Protection category:

IP 55 to EN 60 529/10.91.

Supply includes:

Enclosure frame with removable door, rear panel and roof plate, r/h door hinge, can be changed to opposite side, 4 eyebolts, fitted, mounting plate, three-part gland plates.

The EMC version ("high RF attenuation") has been certified by the VDE.



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

Approvals:



All sizes and side panels available on request.



Also required:

EMC baying seal TS 8800.690, see page 16, for bayed enclosures.

■ EMC free-standing enclosure ES 5000

The enclosure body is of sheet steel with an aluminium zinc surface finish. The door and rear panel likewise have a conductive aluminium zinc surface finish. The ES 5000 free-standing enclosure is painted on the outside, including the rear panel and the door. There are self-adhesive EMC/IP combination seals on the zinc-plated interior surfaces, which ensure slot-free all-round contact. The base is sealed by standard gland plates with a zinc-plated surface finish, which contact the same EMC/IP seal.

Material:

Sheet steel with an aluminium zinc surface finish

Enclosure body: 10-fold profiled

Door: 2.0 mm

Rear panel: 1.5 mm

Mounting plate: 3.0 mm

Surface finish:

Enclosure body, door and rear panel of sheet steel with an aluminium zinc surface finish, painted in RAL 7032 on the outside and unpainted on the inside.

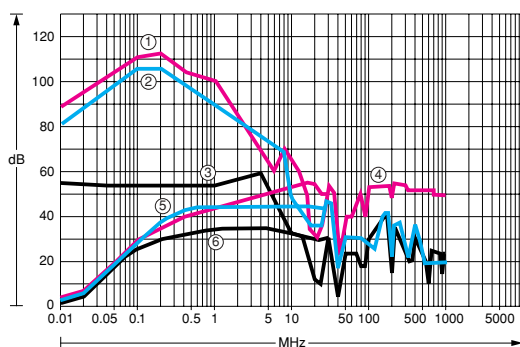
Protection category:

IP 55 to EN 60 529/10.91.

Supply includes:

Enclosure, closed top and sides, removable rear wall, r/h door hinge, can be changed to opposite side, 2 eyebolts, not fitted, mounting plate, three-part gland plates.

The EMC version ("high RF attenuation") has been certified by the VDE.



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, medium RF attenuation
③ = E field, standard
④ = H field, high RF attenuation
⑤ = H field, medium RF attenuation
⑥ = H field, standard

Approvals:



All sizes available on request.



Also required:

EMC contact clips are required in order to achieve the medium attenuation level shown in the diagram with standard enclosure, see page 17.



Accessories:

EMC accessories,
see page 14 – 19.
EMC fan-and-filter units,
see Climate Control brochure,
page 142/143.
Ripac Vario EMC,
see page 8 – 9.

German utility model
no. 295 21 087
European patent
no. 0 857 406 with validity for
CH, ES, FR, GB, IT, NL, SE
US patent no. 6,384,323
Jap. patent no. 3 193 059

The cost-cutting alternative to large EMC enclosures is the high shielding of potential sources of interference or sensitive components using EMC subracks or EMC small boxes.

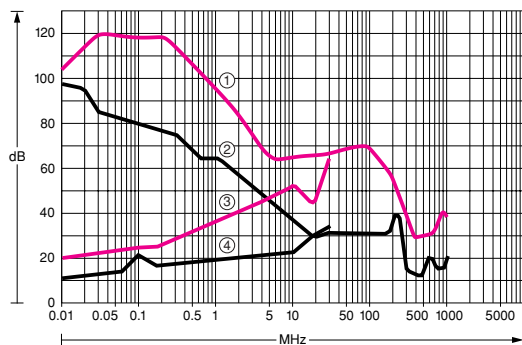


EMC E box EB on the mounting plate.



EMC cable entry – for fast, inexpensive, reliable contact. Model No. see page 14.

■ EMC flexRack



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

Material:

Base frame: Aluminium
Cover sections:
1.5 mm sheet steel

Surface finish:

Base frame: Zinc plated, passivated
Cover sections: Yellow passivated on the inside, painted in RAL 7035 on the outside.

The EMC version ("high RF attenuation") has been certified by the VDE.



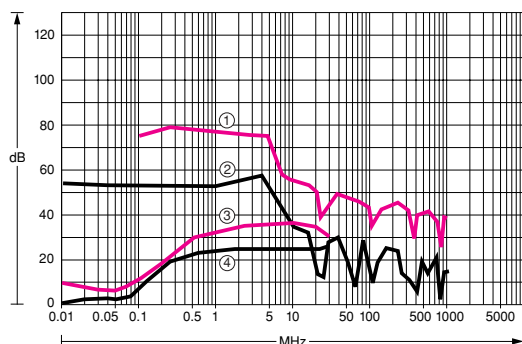
U	Width mm	Height mm	Depth mm	Model No. FR
33	600	1600	600	2100.260
42	600	2000	600	2100.360
33	600	1600	800	2100.460*
42	600	2000	800	2100.560*

* Delivery times available on request

Supply includes:

1 base frame,
1 rear door, solid,
1 front door, solid,
(door with Ergoform-S handle and security insert),
2 side panels,
1 gland plate, one-piece,
1 roof plate, solid,
4 levelling feet,
EMC seals.

■ EMC electronic Kombi system EL, 3-part



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = E field, standard
③ = H field, high RF attenuation
④ = H field, standard

Material:

Wall unit and centre part:
1.5 mm sheet steel, yellow passivated on the inside
Mounting plate:
2.75 mm sheet steel
Front door:
Extruded aluminium section,
die-cast aluminium corner connectors,
4 mm safety glass, with EMC mesh.

Surface finish:

Textured stove enamel, enclosure RAL 7032, interior surfaces zinc plated and yellow passivated, door frame RAL 7033.

Protection category:

IP 55 to EN 60 529/10.91

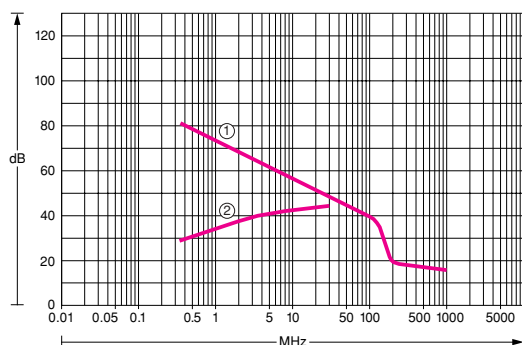
U	Width mm	Height mm	Depth mm	Model No. EL
3	600	212	415	2243.700*
6	600	345	415	2246.700*
9	600	478	415	2249.700*
6	600	345	515	2256.700*
9	600	478	515	2259.700*
15	600	746	515	2265.700*
21	600	1012	515	2271.700*

* Delivery times available on request

Supply includes:

1 wall unit, solid,
2 gland plates, solid,
1 centre part, hinged,
2 x 482.6 mm (19") mounting angles, fitted,
1 mounting plate, zinc-coated, passivated,
1 front door with EMC safety glass.

■ EMC Vario-Case iS



MHz = Frequency
dB = RF attenuation
① = E field, high RF attenuation
② = H field, high RF attenuation

Instrument case for 482.6 mm (19") modules and modular assemblies to DIN 41 494, part 5
Width: 534 mm

Material:

Side panels:
Extruded aluminium section, chromated on the inside, painted on the outside
Cover trays:
Plastic to UL 94-V0 (self-extinguishing), with conductive coating on the inside

Rear panel:

2 mm aluminium, chromated

Front panel:

2 mm aluminium, chromated

Surface finish:

Chromated/painted, RAL 7030/7035.

HP	U	Height mm	Depth mm	Model No. VC
84	4	208.10	300	3743.700*
84	7	341.40	400	3774.700*
84	3	163.65	300	3733.700*
84	3	163.65	400	3734.700*
84	6	297.00	400	3764.700*
84	6	297.00	500	3765.700*
84	9	430.50	500	3795.700*

* Delivery times available on request

Supply includes:

2 plastic cover trays,
8 enclosure feet (12 with 400 mm depth),
2 side panels,
1 rear panel,
1 front panel,
4 x 482.6 mm (19") mounting angles,
4 threaded inserts,
4 plain inserts,
assembly parts.



EMC flexRack has the following approvals:

- UL
- CSA



EMC electronic Kombi system EL, has the following approvals:

- TÜV
- Norske Veritas
- Russian Maritime Register of Shipping
- Lloyds Register of Shipping
- VDE
- UL – Underwriters Laboratories Inc. For USA and Canada



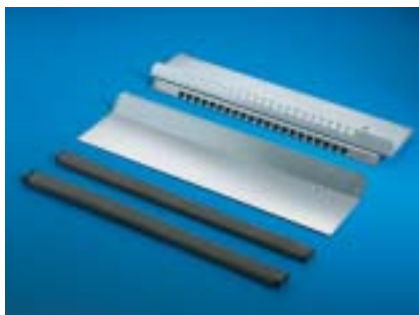
- 1** Front door with EMC safety glass.
- 2** Aluminium door frame.
- 3** Lock system, may be exchanged for Ergoform-Mini handle.
- 4** 482.6 mm (19") mounting angles, depth-adjustable.
- 5** Continuous knife edge.
- 6** Centre part of 1.5 mm sheet steel, multi-folded, yellow passivated on the inside.
- 7** Wall unit locked from the front.
- 8** Removable cable gland plate top and bottom.
- 9** Bonded EMC seal for protection category IP 55.
- 10** Extruded aluminium section side panels, interior surface chromated.
- 11** Plastic base and cover tray, coated in aluminium. Conductive connection to the side panels via RF spring seal system.
- 12** Removable side panel, yellow passivated on the inside.
- 13** One-part solid roof panel, removable.



Accessories:

EMC accessories, see page 14 – 19.
EMC fan-and-filter units, see Climate Control brochure, page 142/143.
Ripac Vario EMC, see page 8 – 9.

- 14** Depth-adjustable 482.6 mm (19") or metric mounting angles (accessories).
- 15** Torsionally rigid aluminium section.
- 16** Removable, one-part gland plate.
- 17** Solid, removable front/rear door with EMC seal and Ergoform-S handle.



EMC gland plates

For shielded cables with a maximum diameter of 20 mm. EMC cable shield contact over a conductive rubber cable clamp strip. Combined EMC/IP seal provides low-resistance contact between cable shield and gland plate. For all enclosures with a depth of 400, 500, 600 and 800 mm.

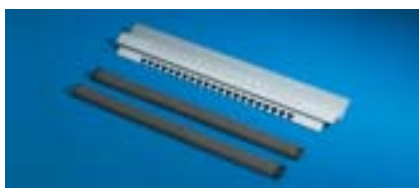
German patent no. 196 04 219

Width mm	Model No. TS		Model No. PS single-row ²⁾
	single-row	twin-row	
600	8800.660	8800.760	4314.060
800	8800.680	8800.780	4314.080
1000	8800.600 ¹⁾	8800.700 ¹⁾	4314.100
1200	8800.620 ¹⁾	8800.720 ¹⁾	4314.120 ¹⁾

Packs of 1 kit

¹⁾ For one enclosure half only

²⁾ For installation in ES, PC enclosures based on ES and PS, universal console with contact clip PS 4313.000, see page 17.



Single-row version (upper illustration):

For one cable entry level in conjunction with standard gland plate.

Supply includes:

- 1 gland plate with twin hammer-head punching,
- 1 sliding gland plate,
- 2 IP/EMC gaskets.

Twin-row version (bottom illustration):

May only be used in conjunction with single-row EMC gland plates. Provides a further cable entry level.

Supply includes:

- 1 gland plate with twin hammer-head punching and integral sliding gland plate,
- 2 IP/EMC gaskets.



Metal cable ties

For 360° contact of shielded cables on the EMC gland plate. The cable ties are not toothed, thereby eliminating the risk of damage to insulation and braided screens.

Length mm	Width mm	Packs of	Model No. SZ
125	4.6	50	2598.125
200	4.6	50	2598.200

Material:

AISI 316 (similar to V4A), anti-magnetic and rust-proof.



Tightening tool

For simple tightening of metal cable ties SZ 2598.125 and SZ 2598.200.

Material:

- Handle: Polypropylene
- Blades: Chrome vanadium steel, tempered, nickel-plated.

	Packs of	Model No. SM
Tightening tool	1	2585.000



EMC cable entry gland

The EMC cable entry gland permits super-fast, EMC-compatible cable entry into the zinc-plated gland plates. Simply lock into position and voilà!

Other benefits include:

- 360° contact.
- Fastens without lock nuts.
- May be used with PG or metric holes.
- Adapts flexibly to existing cable diameters.

- Contact directly at the point of cable entry on the enclosure.
- The spring action means permanent contact pressure.
- The cable insulation is only stripped off at the shielded point of contact.

Material:

Stainless steel

Supply includes:

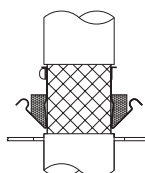
Cable entry glands including seals and cable ties.

German patent no. 197 01 959

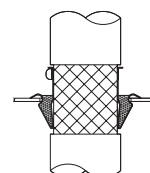
Cable shield diameter in mm		Hole diameter in mm		Packs of	Model No. SZ
from	to	from	to		
13	16	25	29	5	2491.150
18	22	30	34	5	2491.200
23	27	35	39	5	2491.250
28	32	40	44	5	2491.300

Installation diagram:

Before snap-fastened



Spring-loaded piece snap-fastened, seal compressed





EMC cable glands

The cable sheathing may optionally be interrupted at the contact point or removed completely inside the enclosure. The cable shield in the enclosure is retained.

The supplied lock nut cuts automatically into the paint when screwed down, thus creating a conductive connection.

Protection category:
IP 68 to EN 60 529/10.91

Cable glands, PG

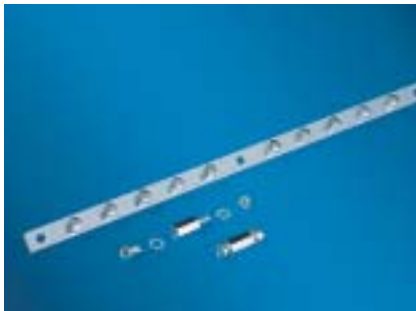
PG size	Cable diameter mm	Minimum* shield diameter mm	Packs of	Model No. SZ
9	4 – 8	3	5	2411.090
11	5 – 10	4	5	2411.110
13.5	6 – 12	5	5	2411.140
16	10 – 14	8	5	2411.160
21	13 – 18	10	1	2411.210
29	18 – 25	15	1	2411.290
36	22 – 32	19	1	2411.360
42	30 – 38	27	1	2411.420

* Minimum shield diameter = cable diameter less cable sheathing

Cable glands, metric

Size	Cable diameter mm	Minimum* shield diameter mm	Packs of	Model No. SZ
M16	4 – 8	3	5	2843.160
M20	6 – 12	5	5	2843.200
M25	10 – 14	8	5	2843.250
M32	13 – 18	10	1	2843.320
M40	18 – 25	15	1	2843.400
M50	22 – 32	19	1	2843.500
M63	34 – 44	30	1	2843.630

Other sizes available on request.



EMC shield bus

EMC shield bus of yellow passivated steel strip, 75 mm² cross section, for cable shield contact. 10 (16) connections for cable shield contact.

Supply includes:

1 shield bus,
2 (3) slotted screws M6 x 12 mm,
2 (3) M6 nuts,
4 (6) serrated lock washers,
2 (3) spacer bolts.
Figures in brackets for SZ 2413.550

Rail length mm	Packs of	Model No. SZ
375	1	2413.375
550	1	2413.550



EMC earth clamps

The clamps may be used directly on the consumer or operating equipment on the mounting plate for cable shield contact.

Material:

Sheet steel, zinc plated, passivated.

Size mm	Packs of	Model No. SZ
4	50	2367.040
6	50	2367.060
8	50	2367.080
12	50	2367.120
16	50	2367.160
20	25	2367.200*
25	25	2367.250*

* 2 assembly brackets



Central earthing point

For connecting

- Earth straps
- Earthing braids

to the vertical and horizontal enclosure profile. The connection bracket is connected to the enclosure frame with 2 screws and is securely contacted. Earth connection is carried out via the threaded bolt M8 x 20 mm.

Material:

Sheet steel, zinc plated, passivated.

Packs of	Model No. DK
1	7829.200

Supply includes:

1 connection bracket,
2 screws BZ 5.5 x 13 mm,
2 serrated washers,
1 nut M8,
1 contact washer M8,
1 washer.



Assembly parts

For the attachment of earth straps and earthing straps to:

- Horizontal TS 8 enclosure sections
- PS/ES/universal console AP rail systems using captive nuts, see below.

Size	Packs of	Model No. SZ
M6	10 set	2570.000
M8	10 set	2559.000

Captive nuts/ threaded blocks

For rectangular system punchings (10.5 x 12.5 mm) in:

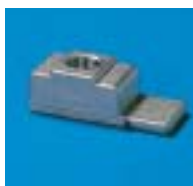
- Horizontal TS 8 enclosure sections
- PS/ES/universal console AP rail systems



Captive nuts

The compression spring, designed as an insertion aid, ensures reliable mechanical and electrical connection in the system punchings.

Thread	Packs of	Model No. PS
M6	50	4164.000
M8	50	4165.000



Threaded block

With snap-off insertion aid, die-cast zinc.

Thread	Packs of	Model No. PS
M6	50	4162.000
M8	50	4163.000



Captive nuts

The nuts are inserted from the outside, thereby enabling the use of attachment points of the same height or width around corners. The spring cage also ensures electrical connection in the system punchings.

Thread	Packs of	Model No. TS
M6	50	8800.340
M8	50	8800.350



EMC baying seal

For baying enclosure systems. Seal with all-round, electrically conductive sheathing.

For enclosures	Diameter (mm)	Model No.
TS	6.3 x 6.3	TS 8800.690
PS	6.4 x 3.2	PS 4346.000

Packs of 1 set consisting of 3 seals, each 2 m long



EMC divider panel seal

This seal ensures optimum contact in bayed EMC enclosure systems and when using a zinc-plated divider panel.

Material:

PU foam with electrically conductive sheathing.

Supply includes:

1 roll (12.7 x 12.7 x 5300 mm)

Packs of	Model No. PS
1	4348.000

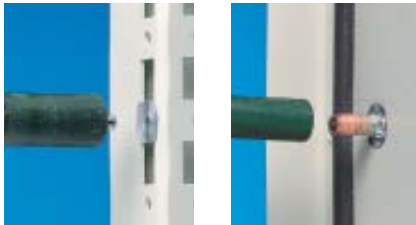


Contact cutter

The contact cutter enables EMC-compatible preparation of the contact point e.g. for earthing straps. Plastic-bound abrasive with guide pin for round system punchings. With location point for drill, grinder etc.

	Model No. SM
For frame section	2414.000
For earthing bolts*	2414.500

* Not necessary with TS 8

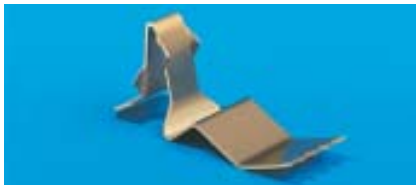


Contact paint

Contact paint prevents the corrosion of conductive, unprotected contact points.

Contents:
12 ml

Packs of	Model No. SZ
1	2415.000



PS 4312.000

Clip for roof, side panel and rear panel
Joule heat value $I^2 \cdot T = 0.13 \cdot 10^6 A^2 \cdot s$

Contact clips

for exclusive enclosures ES 5000

There's no faster, cheaper way of connecting a PE conductor/upgrading EMC shielding:

- Potential equalisation of the panels and the frame of the switchgear enclosure.

- PE conductor connection in accordance with EN 60 439, part 1, VDE 0660, part 500 and IEC 60 439-1 on panels to which no electrical equipment is fastened.
- Multiple-contacting increases the shielding effect by up to 20 dB, raising it to a medium shielding level.

Material:

Rust-proof spring steel



PS 4332.000

Clip for doors with square frame, with conductive surface.

Contact clips for	Increases the shielding effect	PE conductor connection (potential equalisation)	Packs of	Model No. PS
Roof Side panel Rear panel	•	•	50	4312.000
Door	•		50	4332.000
Mounting plate	•	•	50	4334.000
Gland plate	•	•	50	4313.000
Baying connection	•		50	4337.000



PS 4334.000

Clip for mounting plates with conductive surface when installed in the rearmost position. May also be retrofitted to an installed mounting plate.



PS 4313.000

Clip for gland plates
Joule heat value $I^2 \cdot T = 0.06 \cdot 10^6 A^2 \cdot s$



PS 4337.000

Clip for baying connection



EMC viewing windows

are designed to prevent weakening of the shielding effect in enclosures with a high protection level, even with cutouts, and preserve this high standard of protection. Further information available on request.



Rail for EMC shielding bracket and strain relief

Combined rail for strain relief and EMC contacting of inserted cables.

Mounting options:

- On the horizontal/vertical TS, PC, ES enclosure section
 - On a mounting plate
- May also be fitted without a retaining bracket. Additional contacting on the left or right of the rail via existing holes (9 mm diameter).

Material:

Sheet steel

Surface finish:

Zinc plated, passivated

Supply includes:

- 1 rail,
- 2 retaining brackets,
- 8 screws.

Width	Model No. SZ
600 mm	2388.600
800 mm	2388.800



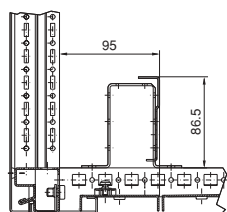
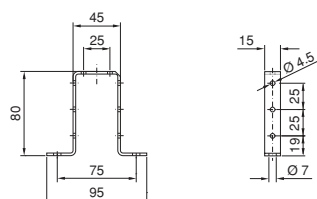
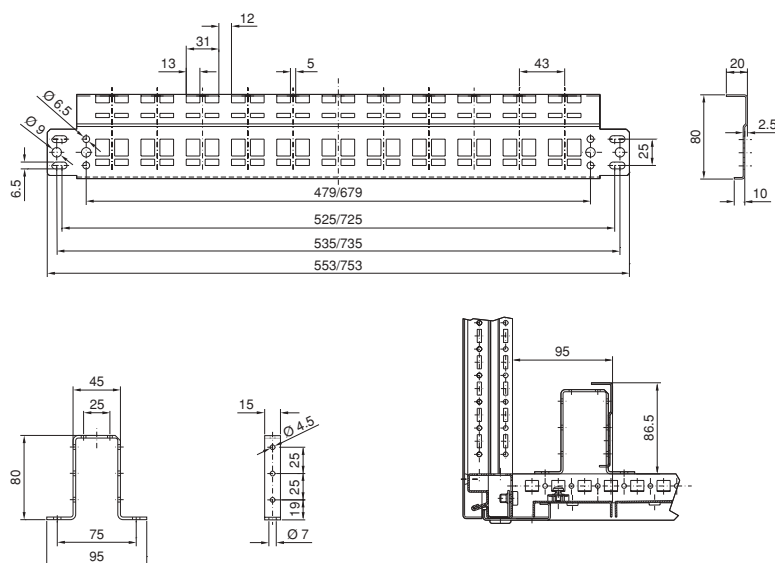
Also required:

EMC shielding bracket, see below.
Cable clamps for strain relief, see page 19.



Accessories:

Earth straps, see page 19.
Earthing strap, see page 19.



EMC shielding bracket

Diameter changes are compensated in full by the spring of the EMC shielding bracket. To attach without using tools: Press the EMC shielding bracket against the cable shield and clip into the rail.

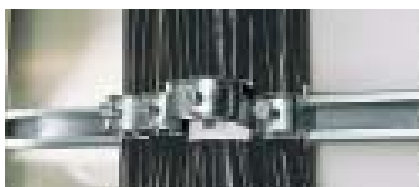
Material:

Sheet steel

Surface finish:

Zinc plated, passivated

For shield diameter	Packs of	Model No. SZ
3 – 10 mm	10	2388.100
4 – 15 mm	10	2388.150
10 – 20 mm	10	2388.200
15 – 28 mm	10	2388.280



Cable clamps

For strain relief of cables on rail SZ 2388.XXX, with plastic insert.

Material:

Sheet steel, zinc plated, passivated.

For cable diameter	Packs of	Model No. DK
6 – 14 mm	25	7077.000
12 – 18 mm	25	7078.000
18 – 22 mm	25	7097.000
22 – 26 mm	25	7097.220
26 – 30 mm	25	7097.260
30 – 34 mm	25	7097.300
34 – 38 mm	25	7097.340
38 – 42 mm	25	7098.000
56 – 64 mm	25	7099.000



Earth straps

Choose from 6 ready-to-use earth straps in various lengths and cross-sections. For screws M6 and M8.

Cross-section mm²	Packs of	Model No. SZ	
		Length 170 mm	Length 300 mm
4	5	2564.000	2567.000
16	5	2565.000	2568.000
25	5	2566.000	2569.000



Earth straps

10 mm²

For configuring a reliable earthing connection with perfect contact.

- With ring terminals in M6 and M8 to match the earthing screw
- Length-optimised and ready to install.

For	Door/lid	Enclosures
KL, EB, AE 1032.XXX, AE 1035.XXX	M6	M6
AE, AP	M6	M8
TS, ES, PC, AP universal console, KEL	M8	M8

Connection	Length	Packs of	Model No. SZ
M6 – M6	200 mm	5	2565.100
M6 – M8	300 mm	5	2565.110
M8 – M8	300 mm	5	2565.120

Possible alternative:

Earth straps, see above, or earthing straps, see below.



Earthing strap

Tin-plated copper, in various lengths and cross-sections with press-fitted contact rings. Earthing straps counteract the current displacement effect at high frequencies, whilst at the same time offering highly flexible connection opportunities.

For	Cross-section mm²	Length mm	Packs of	Model No. SZ
M6	10	200	10	2412.210
M8	16	200	10	2412.216
M8	25	200	10	2412.225
M6	10	300	10	2412.310
M8	16	300	10	2412.316
M8	25	300	10	2412.325

+ Accessories:

Central earthing point, see page 15.

Basic EMC information



What is meant by EMC?

Electromagnetic compatibility (EMC) is the ability of an electrical appliance to operate satisfactorily in its electromagnetic environment without adversely affecting this environment, which may also contain other equipment. High packaging densities in electronic assemblies and ever-increasing signal processing speeds often cause faults in complex electronic equipment, measurement and control systems, data processing and transmission systems, and communications technology, which are attributable to electromagnetic influences. There are fundamental requirements for:

- Defined immunity to interference
- Prevention/reduction of interference emissions.



Legal foundations, standardisation

EMC legislation, as national implementation of European Directive 89/336/EEC, regulates the marketing, siting and operation of equipment which may cause electromagnetic interference or whose operation may be impaired by such interference. Since 1 January 1996, the compliance of a device or system with the protection requirements of EMC legislation must be documented by the CE symbol. The contribution of enclosures to the EMC of a device or system lies primarily in the shielding effect from field-bound interference, which in the case of Rittal enclosures is measured at external laboratories to VG 95 373, part 15 and documented in the corresponding attenuation diagrams. These diagrams facilitate qualitative statements in themselves. Testing of the finished enclosure, including installed equipment, whilst in operation is indispensable for compliance with and documentation of certain limits under international regulations (e.g. radio interference suppression in accordance with EN 55 011).



Technical foundations

Basic terminology

Electromagnetic influence is the effect of electromagnetic factors on circuits, appliances, systems or living creatures.

- **Interference source** refers to the origin of interference.
- **Potentially susceptible equipment** refers to electrical equipment whose function may be affected by interference factors.
- **Coupling** refers to the interaction between circuits, where energy can be transmitted from one circuit to another.
- **Interference** is the electromagnetic factor which may induce an undesirable influence in an electrical installation (interference voltage, current or field strength).

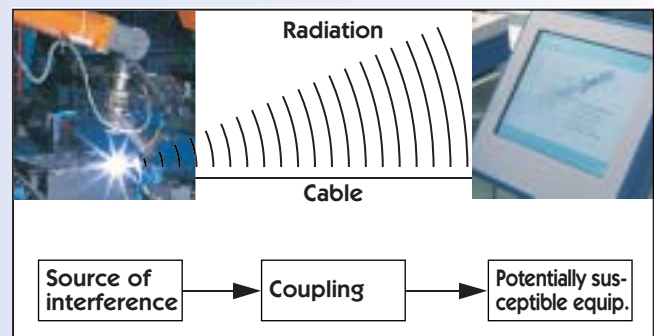
Definition of immunity to interference

An item of electrical equipment is said to be immune to interference if interference factors (up to a certain limit) do not lead to malfunctions:

- **Functional impairment:** A permissible impairment to proper functioning.
- **Malfunction:** An impermissible impairment to proper functioning. The malfunction ends when the interference factor subsides.
- **Functional failure:** An impermissible impairment to proper functioning and which can only be eliminated e.g. by means of repair.

Emitted interference, interference model

Electrical devices which operate in an electromagnetic environment with other devices may be both transmitters (sources of interference) and receivers (potentially susceptible equipment) of interference energy. The transmission of electrical energy from one circuit to another is known as coupling.



Interference sources and interference

Interference sources may be divided into:

- **Internal sources of interference:**
 - Artificial, i.e. technically induced
- **Internal sources of interference:**
 - Natural, e.g. lightning, electrostatic discharges
 - Artificial, i.e. technically induced.

In the case of technically induced interference sources, a distinction must be made between the effects of electromagnetic factors created and used for business purposes (such as radio transmitters, radar etc.), and electromagnetic factors which occur within the context of business or in the event of a failure which are not generated deliberately for the purpose of use (e.g. spark discharges on switch contacts, magnetic fields around heavy currents etc.).

Interference may be either continuous, periodic or randomly occurring and pulse-shaped.

- The most interference-intensive temporary events are caused in low-voltage networks by the switching of inductive loads, e.g. power tools, household electrical appliances, fluorescent lamps.
- The most dangerous overvoltages (in terms of level, duration and power content) are caused by deactivating fuses in the event of a short-circuit (duration in the millisecond range).

Technical foundations

Electrostatic discharges

When solid materials rub against one another, electrostatic charges may arise which are rapidly discharged on conductive surfaces but which may persist for a long time on less conductive surfaces. Upon contact with conductive parts, the electrostatic voltages associated with such charges in non-conductors may cause interference or even destruction in electronic components as discharge current (conducted interference). Also, during discharge, an electromagnetic pulse is irradiated, representing field-bound interference. Electrostatic discharges from humans onto control components and enclosures are particularly significant. The voltages occurring in such cases may be up to 15000 V, with discharge currents of up to 5 A, and current rise rates of up to 5 kA/ μ s. The risk of malfunctions or damage is increased by poorly conductive floor coverings and low air humidity.

Influence mechanisms and counter-measures

A distinction may be made between the following coupling influences:

- Conducted interference
- Field-bound interference
 - Low-frequency field interference
 - Radiation interference (high frequency)

Conducted interference

refers to interference voltages and currents. The principal causes lie in the mechanical switching of electrical equipment (particularly inductive loads such as motors, transformers, throttling via electronic systems). Coupling of interference source and potentially susceptible equipment can occur via various "routes": conductive, inductive, capacitive or wave interference are the relevant terms.

Field-bound interference (low frequency)

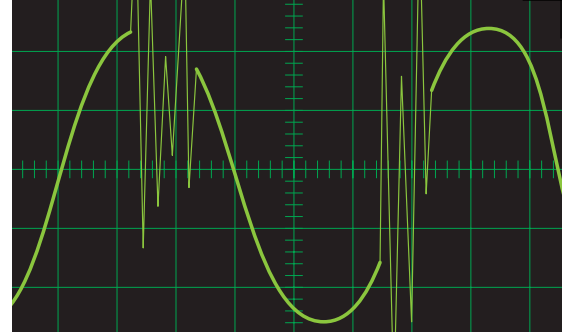
Very low-frequency currents cause a low-frequency magnetic field which may induce interference voltage or initiate interference via direct magnetic effects (magnetic memory in computers, monitors, sensitive electromagnetic test equipment such as EEG). Low-frequency electric fields of high intensity may be generated by low-frequency high voltages (high-voltage overhead cables), resulting in interference voltage (capacitive interference). Of practical significance are magnetic fields, the effects of which can be reduced via

- Shielded cables
- Shielding enclosures (the decisive material property is that of permeability, which is too low in the case of sheet steel; nickel iron, for example, is much better).
- Distance from the field source

Radiation interference (high frequency)

Interference can be reduced via:

- Shielded cables
- Shielding enclosures (Faraday cage!).

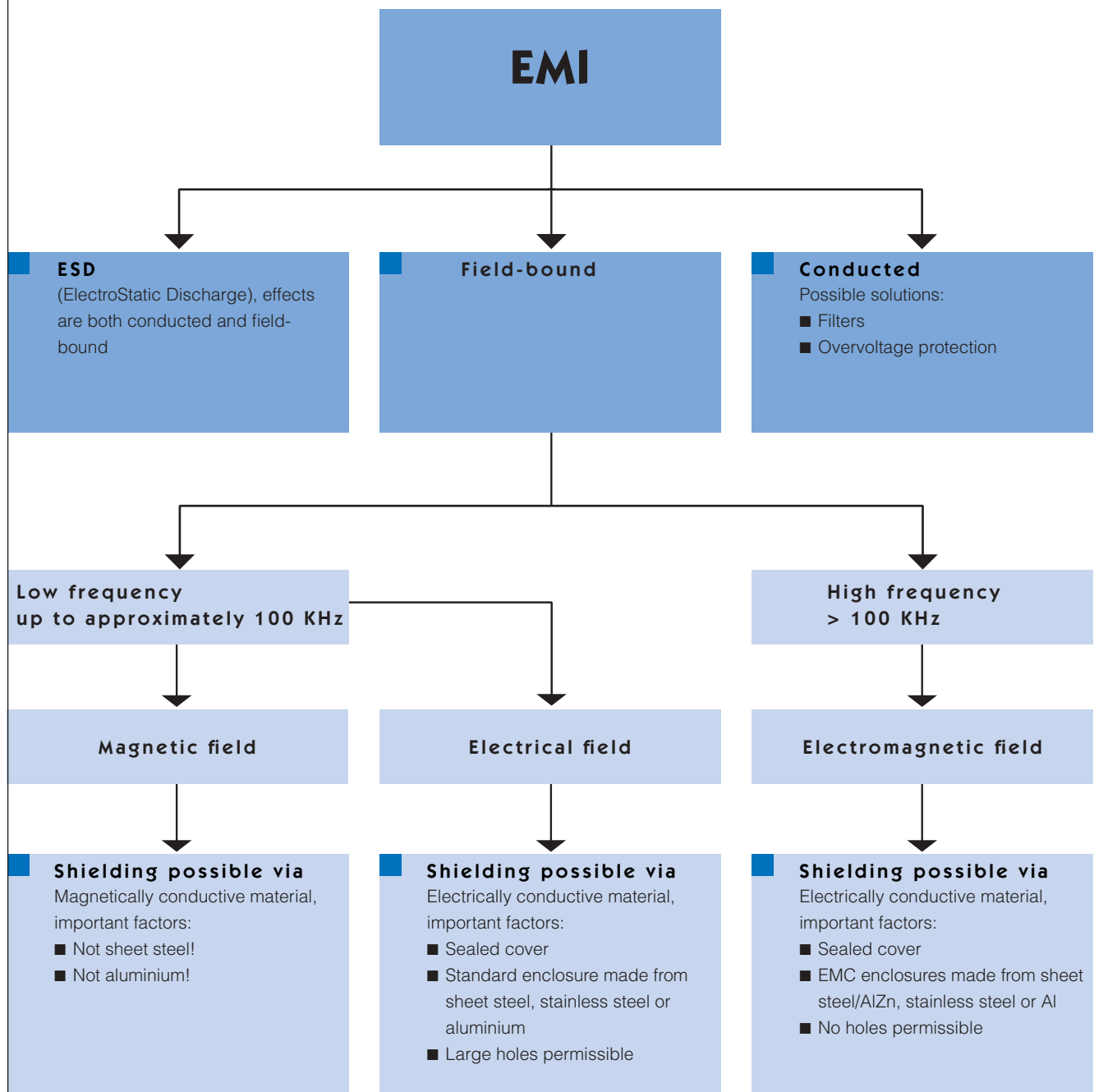


Electromagnetic interference (EMI)

Enclosure/RF shielding

High-frequency electrical currents and voltages in electronic circuits may initiate electromagnetic waves (e.g. mobile radio transmission stations, radar, as well as industrial high-frequency installations such as microwave drying, bonding and welding). These, in turn, may generate interference voltage in cables or directly in electronic assemblies via enclosure openings. Every metal enclosure already offers good basic shielding within a broad frequency range,

i.e. attenuation of electromagnetic fields. High shielding attenuation levels in the frequency range above approx. 5 MHz can be achieved via special seals which conductively connect the conductive inner surfaces of doors and removable panels, roof and gland plates to the conductive sealing edges of the enclosure body or frame, largely in a slot-free manner. The higher the frequencies occurring, the more critical openings in the enclosure become.



Basic EMC information

■ Practical EMC tips when handling components that emit interference

- With the inverters available on the market today, it is impossible to maintain a level of radio interference suppression without a radio interference suppression filter at the mains input. Line filters also boost a system's resistance to interference.
- Cables between the inverter and motor must be shielded: Shield contact on both sides.
- Metallic components in the enclosure must have a large surface area and should be connected to one another with a high level of RF conductivity. Avoid surface finishes such as eloxal which have very high resistance levels.
- Relays, contactors and magnetic valves installed in the same circuit must be connected via arc extinguishing combinations or overvoltage-limiting components.
- Analog control leads should be shielded on one side and contacted inside the enclosure where possible. Ensure low-resistance connections across a large area!
- Digital signal cables should be shielded on both sides across a large area with low-resistance contact. In case of differences in potential, an additional equalising conductor should be laid parallel. Separable connections must always be equipped with metal-cased connectors!
- Avoid spare loops on all connection cables! These could result in RF short-circuiting of the above measures. Unassigned strands in the cable should be connected to potential equalisation at both ends.
- Unshielded cables in a circuit, i.e. outward and return conductors, should be twisted against symmetrical interference sources.
- Physically separate "hot" and "cold" cables at the planning stage. Pay special attention to the motor cable. The area around the shared terminal strip for the mains input and motor output is particularly at risk.
- The cable routing in an enclosure should be as close as possible to the reference potential; "free-floating cables" act as both active and passive antennae!
- When operating more than one inverter on a shared network, EMC problems are to be expected. System planners should integrate interference emission of high frequency as well as interference sensitivity amongst the frequency inverters into their concept from the outset, and take appropriate counteractive action.





How do I interpret a shielding attenuation diagram?

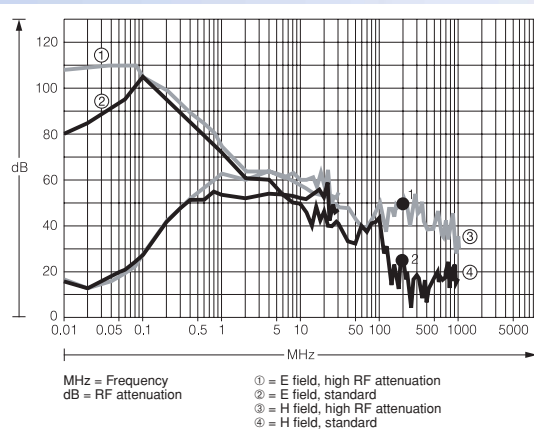
In all diagrams, the attenuation value of an enclosure is obtained from the anticipated interference frequency and the nature of the interference field (electrical field E, magnetic field H or electromagnetic field). For example, in the diagram below, the following attenuation values are obtained with a frequency of 200 MHz.

Point 1: Electrical field, high:

$a_1 = 50$ dB

Point 2: Electrical field, standard:

$a_2 = 25$ dB



In all diagrams, the level of attenuation "a" is shown on the Y axis (vertical) in the unit "dB". This unit indicates the logarithmic ratio between the field in the environment and the field in the enclosure interior. The frequency band is entered on the X axis (horizontal) on a logarithmic scale. Attenuation "a" is obtained using the following equation:

$$a = 20 \log \frac{E_0}{E_1} \text{ and } a = 20 \log \frac{H_0}{H_1} \quad \left\{ \begin{array}{l} \text{where:} \\ \text{index 0 is for} \\ \text{unshielded values} \\ \text{index 1 is for} \\ \text{shielded values} \end{array} \right.$$

Material labelling

Enclosures with aluminium zinc coatings are manufactured from hot-dip galvanized metal to DIN EN 10215.

Material specifications of steel: DX51D + AZ 100-B-C

Material parameters of surface coating:

Alloy coating 100 g/m²

Improved surface finish (B)

Surface chemically passivated (C)

Sendzimir zinc-coated mounting plates are manufactured from continuously hot-galvanized metal to DIN EN 10 142.

Material specifications of steel: DX51D + Z 140-B-C

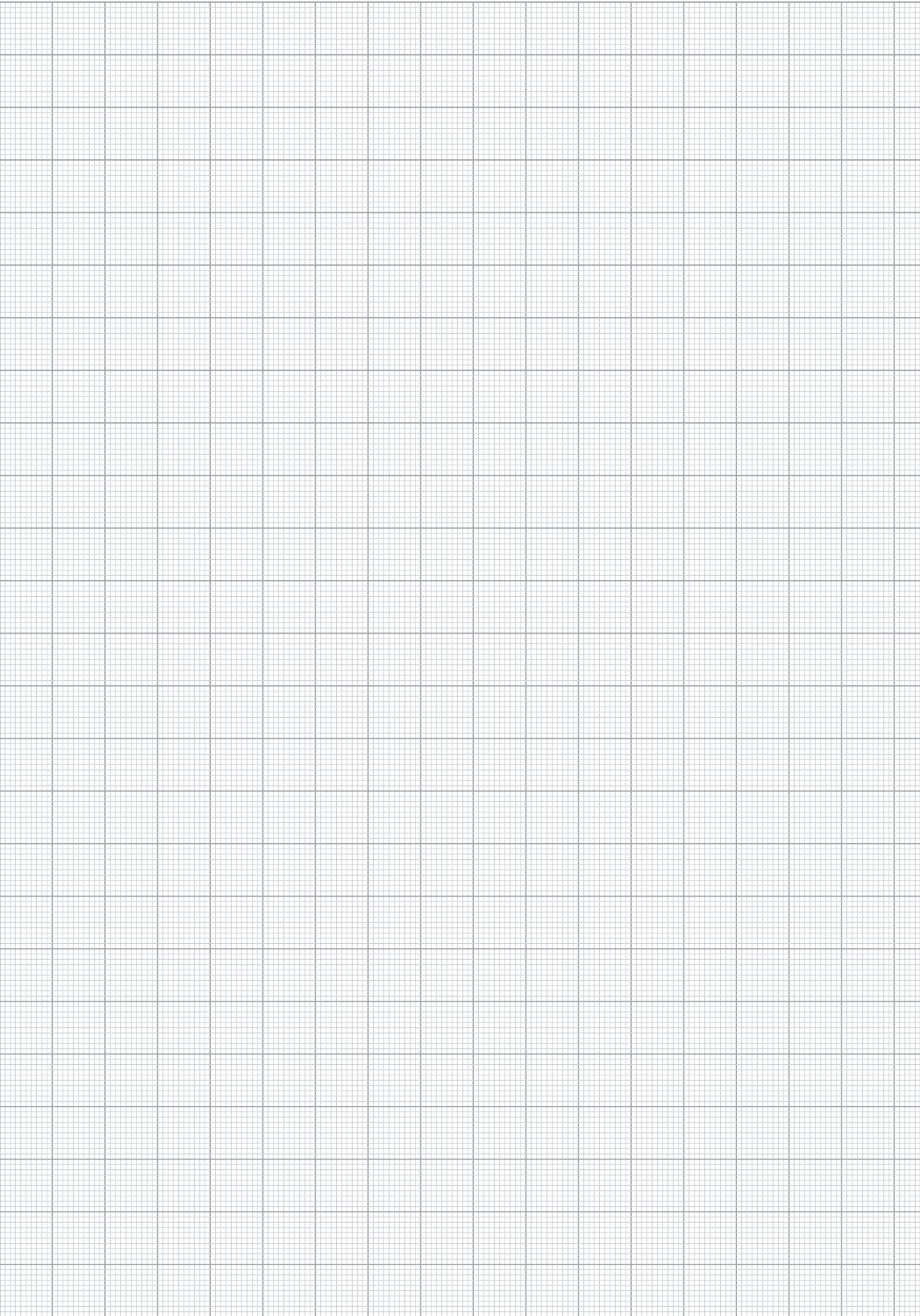
Material parameters of surface coating:

Zinc coating 140 g/m²

Improved surface finish (B)

Coating implemented with a small flower of zinc (M)

Surface chemically passivated (C)



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