

INSTALLATION MANUAL

1 General information about shielded rooms

1.1 Range of application

Anechoic chamber for RF emission and susceptibility measurements. Closed, metallic room with special feed through for shielding against electromagnetic radiation in a specified frequency range. In correct use, the penetration of electromagnetic radiation into the absorber chamber, as well as the emission of electromagnetic radiation from the cabin are prevented within the specified shielding attenuation values (in dB) as well as within the specified frequency range.

1.2 Shielding attenuation range:

Magnetic field:

80 dB in the frequency range 14 kHz to 100 kHz

Electromagnetic field:

100 dB in the frequency range > 100 kHz to 1 GHz

1.3 Inexpert handling

Malfunctions which may influence the safety have to be eliminated without delay. Unauthorized changes of the installation as well as the installation of spare parts other than original ones will exclude any liability of the manufacturer for damage resulting there from.

1.4 System description

Standardized shielding components, built up in a modular concept. The modules are bolted together with an insert of RF-knitted wire mesh gasket. The different shielding components are matched in a way to allow variations of length, width and height, as well as lateral offsets, without any problem during later modifications.

In case of a cabin width of > 3.08m, additional steel supports are installed on the cabin ceiling in order to avoid any bowing of the ceiling panels. Alternatively, threaded rods may be used to fasten the ceiling panels at the ceiling of the surrounding room.

Material and construction:

The individual shielding modules are fabricated of hot-dip galvanized sheet steel of a constant thickness of 2 mm, and double-edged at the four sides. The corners are welded by a method assuring RF-shielding. All weld seams are spray-galvanized and thus protected against corrosion. Double metallic RF-knitted wire mesh gasket, inserted between the contact surfaces of the modules, assure an RF-shielding of the connection up to the specified GHz range. The individual modules are bolted together every 75 mm. The reduced screwing distance as well as the uniform tightening of the screws with a predefined torque guarantees permanent shielding attenuation characteristics, without requiring any maintenance efforts.

The installation starts always from the inside of the shielded room as the individual shielding modules are bolted from the inside so that they can be installed close to the walls of the building. At first the floor must be installed, afterwards the walls and finally the roof.

These assembly instructions are intended for the basic designs of enclosure system, but are applicable in principle to all possible special types. During assembly all sections of this instruction must be observed carefully.

2 Assembly preparation

2.1 Requirements regarding the building

The building has to be dried up and clean (well-swept). The site is accessible, closed & locked and the area is (water-)proof and dry (concrete moisture max. 3%). This is necessary to prevent rising damp. Otherwise, a heavy-duty plastic sheet has to be used under the floor shielding.

2.2 Requirements regarding the floor

The floor may have unevenness in accordance to DIN 18202 tables.

Distance of measurement points	1.0 m	4.0 m	10.0 m	15.0 m
Allowed unevenness	2.0 mm	5.0 mm	8.0 mm	10.0 mm

Especially the floor in the area around the wall panels must be even.

2.3 Storage area

The installation material (modules, mash, etc.) should be stored in a dry and clean place and be protected against physical damage.

2.4 Tools

The following tools are required for the assembly of the shielding cabins:

- Turpentine substitute or methylated spirits
- Lint free cloth
- Contact oil (WD 40)
- Metal scissor, aligning pin
- Torque wrench with extension adjustable 27Nm
- Drive Impact Wrench / electric screwdriver
- for handling the modules always wear leather gloves

2.5 Preparation of the panels

All contact surfaces of the panels must be cleaned shortly before or during assembly with a degreasing agent (e.g. turpentine substitute or methylated spirits) in order to remove oil and dirt from the panels.

Remark:

At the corners of the panels the welded seam is painted with zinc. This place is hot galvanized and should not be cleaned with a degreasing agent (e.g. turpentine substitute or methylated spirits or similar). Detachment of the zinc must be avoided. During storage and transportation white rust may have formed and it is essential to remove it. If the layer of galvanizing on the contact surface has been damaged over large areas due to the transportation and if there are any dents in the contact surface caused by physical means, the module should not be installed.

3 Assembly of the panels

3.1 General information about mesh fitting

Apply the contact mesh from the reel over the row of drill holes with 3-4cm overhang at the corner of the module. Pierce holes in the mesh with the hole punch. Fix the mesh at the corners and fit screws M8x16 from inside to the outside in the holes. Cut off the mesh at the end of the module edge or module row edge with an overhang of 3-4cm. Put the adjacent module into position and screw on the nuts loose (leave out the second screw of a module edge in each case so that the aligning pin can be inserted). At all the connecting points of the mesh must be over-lapped to achieve continuous shielding.

The packing cords of the mesh should only be covered by the thin intermediate mesh. Any crossing over of two cords may cause leakages. For this reason both overlapping parts of the mesh must first be positioned on a module with screws and then the second module may be fitted.

3.2 Pictures



1. Scissors, screws M8x16 and aligning pin



2. Make a hole into the mesh with the scissor



3. The first module:
Each side must be equipped with mesh



4. Detail mesh assembly



5. Connecting the modules



6. Connecting the modules



7. The mesh must overlap



8. The wall modules and the mesh



9. T-junction at the floor and wall / wall and ceiling connection 1



10. T-junction at the floor and wall / wall and ceiling connection 2



11. Adjust with the aligning pin



12. Before bolting together, the modules have to be aligned



13. Before bolted together, the modules have to be aligned



14. Before bolted together, the modules have to be aligned

3.3 Information's about aligning and bolting together

All the self-locking screws must be tightened with a torque of between 27 Nm!

When a screw has been tightened up it should be marked with a colored pen for final checking. Loose screws cause leakages.

After loosely setting up the parts (see pictures) the edges of the modules have to be aligned and can be bolted together.

3.4 Floor installation

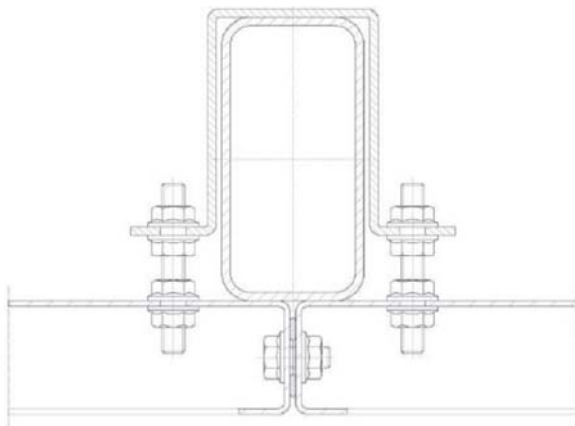
The recommended minimum distance between floor panels and the wall of the building should be 150 mm. When selecting a location for the enclosure take into account the space required for opening the door.

Assemble the floor in rows. As soon as the first panels have been equipped completely with the contact mesh fix it in place with screws (see picture 1 to 4). Insert the next module, place the mesh according to pic. 5 and bolt them together loosely. After aligning the modules (see pic. 12 to 14) tighten the screws with a torque of 27Nm. After finishing the floor installation cover the bolted joint with the delivered tape in order to prevent the entry of dirt.

3.5 Wall and ceiling installation

Wall and ceiling are assembled together. The picture shows how to connect the wall modules with the floor/ceiling. Before starting the assembly, make sure that the outer edges of the floor are all leveled to the floor or pad it with blocks if necessary. The blocks should be placed in a way that ensures that the wall modules are supported as well.

Set up a corner consisting of one module of the rear wall of the enclosure (opposite the door) and a side wall (screw the first panel to the floor loosely and position the second module to stabilize it). Insert the contact mesh according to the pictures and bolt the modules together. Fit the remaining modules of the rear wall. At long walls support the modules to prevent them fall over (e.g. parts of the wooden packaging). Finally fit the first module of the adjacent wall to obtain a second corner as stabilization. After assembly of the walls start the ceiling installation which is similar to the installation of the floor. After installation of the first line of roof modules fit the roof beam on the shielding as described in detail 1. Drill the first ceiling modules according to the assembly drawing ED6010 and bolt the screws with a torque of 27Nm! To fit the last roof module in a row, carefully press the side-wall module outwards and insert the roof module. Prepare the next roof module and fit in the same way. Take care to ensure that the contact mesh is not moved and all modules are aligned perfectly.



15. Detail 1 (roof beam)



16. Start installation of the ceiling

Finally check if all the module screws which have been marked with color are tightened up with the correct torque.



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3.6 Fitting doors



Due to the heavy weight of the door special care must be taken during assembly to ensure that when the door is fitted the contact mesh is not moved. The door may be opened only when the door panel has been completely fitted. When fitting the door the shielding must be prepared also as shown in the following picture.

The shielded door is a high-quality electrical equipment in which clean and intact contact surfaces have decisive significance for the attenuation and functionality. Use caution when working on doors with pneumatic closing mechanism! Switch off the compressed air supply. These installation instructions apply mainly to the basic types of doors, but are also generally applicable to all special types. All points in this

guide must be carefully observed during assembly.

All contact surfaces must be cleaned before installation of the door frame to the shielding. The contact face must be cleaned with plastic foam (e.g. Scotch-Brite by the 3M Company) to free the surface from oil and dirt. The use of sandpaper is not permitted, as this will destroy the exterior of the

contact surface. Finally, the contact faces are cleaned again with grease remover to remove the dust. It is possible that corrosion can occur during transport and storage under the influence of moisture, which must be thoroughly removed with Scotch-Brite. After cleaning, the contact surfaces are thinly coated with contact oil (commonly available WD 40) with a cloth. Only small residues of oil must remain on the skin in a finger test. The mesh must be equipped on the door frame with loose screws and mesh edge from the shielding has to be. After the frame is fixed with the shielding the tubes in the frame (tube 90x50x4) are drawing out and screwing on at the shielding with a metal.





Manual locking and opening:

The door wing has to be moved by hand to the frame until touching the contact spring system. The locking mechanism must be activated by turning the door lever; this movement will be converted into

a linear movement of the locking shaft. The contact spring system is locked, or closed, resp.. The locking mechanism of each door wing engages on at least 2 points of the door frame, thus avoiding any twisting of the door.

Pneumatic locking and opening:

The wings of the door, or gate, resp., are moved by hand to the frame until touching the contact spring system. The locking and opening process itself is then performed by the pneumatic locking, or opening device, resp., i.e. the spring system is locked, or opened, resp..

The locking mechanism engages at several points (locking shaft) which are located on the surround of the frame; any twisting of the gate is thus avoided.

The locking/opening mechanism is actuated by pneumatic cylinders integrated in the gate leaf. The control of the locking or opening device, resp., is performed by means of a dead man's circuit from the central door control.

3.7 Maintenance instruction for RF-shielded doors

(and shielded hole tapings with a knife contact system)

The beryllium finger-type springs of the contact systems have to be proved half-yearly on attrition and damage. Deformed knife contacts have to be repaired, as damaged spring supports have to be replaced.

For renewing you have to use only the exclusive original-spare-parts from Frankonia (spring contact clip on CL12, 500 mm length, Part-No. 5130013) to maintain the shielding effect.

In intervals which depending on the local situations, the climatic conditions in the chamber, the application of the installation and resulting dirt accumulation the contact system have to be cleaned with Scotch-Brite and sprayed thinly with WD40-Spray.

The mentioned cleaning agents can be ordered by Frankonia with the following order description:

Scotch-Brite 7558, 158 x 224 mm, Part-No. 7101503

Spray „Vielzweck“ WD 40, 400 ml box, Part-No. 7501009

Fine zinc dust on the contact surfaces is a sign for the self cleaning mechanism of the contact system to maintain the shielding effect and not an indication for attrition.

More coursed zinc dust or scorings in the contact system pointed to damages caused by dirt accumulation and for insufficient treatment with WD-40-Spray.

Doors used as a emergency exit and therefore only opened or closed rarely have to be proved and cleaned as above mentioned because on this gates the self cleaning mechanism of the contact surfaces is not provided with opening and closing processes.

All parts of the closing equipment are maintenance free if they will use in a normal way and normal dirt accumulation.

A higher class of dirt accumulation can cause more attrition therefore it is absolute necessary to check the locking mechanism (closing roles, manual lever, hinges) in a. m. intervals. For doors which equipped with additional operating mechanism like electromotive machineries, hydraulic locking or mounted platform lifts for spanning the gate in the pit as well as read contacts for the interlock and entrance control have to observe according to corresponding maintains instructions.

In addition to that, doors with pneumatically operation had to prove monthly the emergency functions

as well as the liquid levels of the water separator and the oil cup. Besides that the visual laid



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pneumatic wires should be proved on damages and leaks (hissing sound if the gate doesn't operate).

The installation must be used in a perfect technical condition only. Malfunctions which may influence the safety have to be eliminated without delay.

4 Instruction to assembly of beryllium-contact springs

4.1 Assembly material (Pic. 1):

- contact springs (clip-on CL12, 500 mm, part no. 00415004)
- abrasive (Scotch-Brite 7558, 158 mm x 224 mm, part no. 07005001)
- lubricant (general purpose spray WD40, 400 ml can, part no. 07513001)
- shears
- gloves
- cleaning fabric

4.2 Assembly preparation:

Before assembly, the contact surfaces of the contact spring system have to be cleaned carefully for optimizing the electrical conductivity between metal sheets and beryllium contact springs. It is important to clean the metal surfaces both under the spring's and the counter surfaces, which press the springs if the door is closing (Pic. 2). For cleaning the surfaces, it is enough, to polish them with abrasive Scotch-Brite. Remove the grit with a clean and dry fabric.

4.3 Assembly steps:

1. The contact springs can be assembly in the contact spring system with the hands, without any additional auxiliaries. For protecting the contact surfaces and springs against corrosion one should use gloves during the assembly. With low pressure the contact spring will lock in the assigned groove (Pics. 4, 5, 6).
2. Assemble the contact springs one after the other in the triple series circumferential contact system. Please pay your attention, that the slotting in the single contact springs must be located back-to-back and staggered in the triple contact series springs (Pic. 7).
3. The start of the assembly should be respectively in a corner. First cut the contact spring with a shear to bevel and after push it in the right position on the contact surface (Pic. 3). One after another, further contact springs are added. At the corner the contact springs will be sized and cut to bevel (Pics. 7, 8). When cutting, it is not allowed to fall shorter of the minimum length of 150 mm. If the occasion should arise, the needed length must be formed out of 2 sub-pieces with a length more than 150 mm.
4. After assembly, the contact springs can be treated with above mentioned lubricant. This should not be sprayed, but coated thinly with the support of a clean fabric.

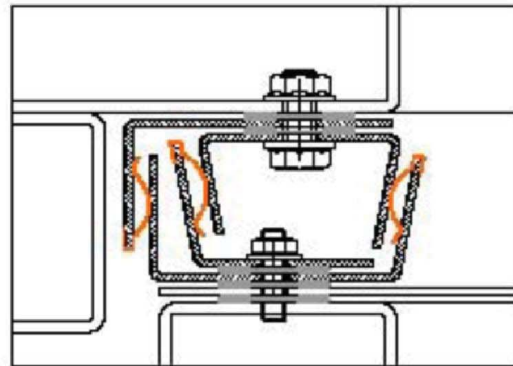


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Pic. 1: Assembly material



Pic. 2: Overview. knife contact system



Pic. 3: Cut to bevels



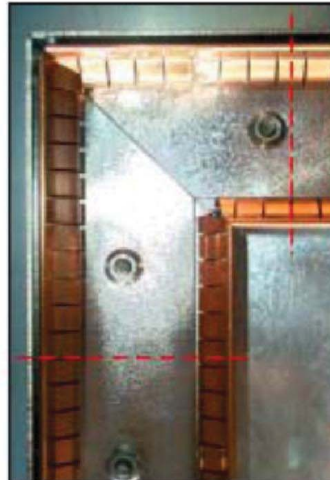
Pic. 4: A ssembly



Pic. 5: Assembly



Pic. 6: Lock in the groove



Pic. 7: View. door leaf



Pic. 8: View. door frame

5 Earthing of shielded rooms and cabins

For reasons of electrical safety, shielded rooms and cabins must be connected to earth!

This measure has no influence on the shielding effect of the shielded rooms and cabins, but only serves to prevent dangerous voltages with respect to the earth potential.

A poor connection to earth may, for example, lead to dangerous voltages caused by high leakage currents of the electric mains filters, or also by faulty insulation, short circuits and shorts to earth as well as by lightning strikes.

As regards the mains filters, high leakage currents flow through the filters to earth even in normal operation mode, due to the interference-eliminating capacitors which are connected to ground. Since the filters are solidly connected to the shielding via their shielded housing and the respective connecting flanges, a poor connection to earth can lead to dangerous voltages of the shielded room or the shielded cabin against the environment (building etc.). In such a case any person touching the shielding is in danger of electric shock. The shielding becomes close to mains potential.



For this reason, the operation of shielded rooms and cabins must be secured by special protection measures! The protection measures must fulfil the regulations of the standard DIN VDE 0100.

Since even in normal operation there is a constant flow of capacitive leakage current of the filter capacitors to earth, the earthing must guarantee a discharge path so that the permissible contact voltage is not exceeded.

A voltage of $> 50V\sim$ was determined on an international level to be dangerous to personnel. For special applications, this limit of permanently acceptable contact voltage may be too high. For rooms which are used for medical purposes, for example, the value is $25 V\sim$.

Even in case of a fault, the allowed contact voltage must not be higher than $50 V\sim$, or $25 V\sim$, resp.. A fault presents itself, for example, if the earth wire in the feed cable of the mains filter is broken. In this case, the filter capacitors would cause the shielded room or cabin to become mains potential. It is therefore imperative to earth the shielded room or the shielded cabin via a second independent earth wire. For this purpose, the shielding is provided with an earthing bolt (close to the filters) to which a second earth wire can be connected. This earth wire has to be kept separate from the other cabling.

6 Lighting and electric installation

To avoid resonances resulting from exposed cables, the electric lines as well as the cabling of lighting fixtures have been installed either behind the absorber lining or in the floor. The electric installation and the lighting are installed in a common electric distribution with fuse protection and FI (false current) safety switch of the individual electric circuits.

Emergency lighting is assured by means of battery-operated emergency lamps, which are buffered via mains during normal operation and which are installed above each door of the anechoic hall. In case of mains failure, the emergency lamps automatically change to battery-operation. The operation

after mains failure amounts to at least 1 hour. After mains return the installed batteries are automatically charged again. An over-discharging of the batteries is avoided by an electronic circuit. The illumination, measured at a height of 1 m from the floor, amounts to 200 lux. The lost heat and radiant heat produced correspond approximately to the connection power of the respective lighting fixtures.

7 Electric filters for power supply and lighting

The electric filters for mains and control lines are designed for a Stopband attenuation 14kHz to 40GHz. For mains supply application, filters in low leakage current version are used.

The insertion loss of these filters is adapted to the respective application, or the shielding attenuation, resp., of the shielded room. The electric filters are installed directly on the wall. To take up the weight of larger filters, the wall may be reinforced at the respective place.

Special connecting flanges are provided for the perfect RF-shielded connection of the filter cases and the shielding.



8 FRANKONIA honeycombs

Honeycomb inserts (WKE) are installed for assuring the RF-shielding of the ventilation. There are two honeycomb inserts which are designed for a limit frequency of 18 GHz and 40GHz. In standard version, the honeycomb inserts are equipped with a joining edge for connecting ventilation channels.

