



Nuclear power stations

OBO as a reliable partner
from planning through to implementation



Nuclear power stations

That is OBO	4
Building Connections	4
Represented around the world: The international OBO locations	6
OBO in numbers	7
Our products for your project	8
The BET Test Centre: Tested quality	9
Surface competence	12
Surfaces	13
Materials	15
Corrosivity categories according to DIN EN ISO 12944-2:2018	16
Expected protection length of the galvanisation	17
Definition of electromagnetic compatibility (EMC)	18
Guaranteeing EMC	19
Magnetic shield insulation of cable support systems	20
Transfer impedance of cable support systems	23
OBO CAD Support	24
Customers	26
Hamm-Uentrop power station	27
Niederaussem power station	29
Timeline: OBO in power stations	30
Certified safety	32
OBO solutions for the future: Focus on the power station industry	33
Product and (production) process development	34
National and international regulations	36
Batch tracing	38
Requirements for the portfolio	39
Here to help: OBO Support	40

Connections

For us, connections mean: Building Connections

Our corporate considerations and actions are taken for the long term and embrace change. The core of our success is based on mutual trust and the committed interaction between our employees, customers and suppliers. As an independent family company, we stand by these connections. They represent the benchmark of our everyday activities and are lived and also supported by all employees. As a partner to our customers, it is our aim to be the first port of call for the best and most innovative connections for electrical and data technology infrastructure.

The focus in the development of our products is on expanding existing product systems further and matching them exactly to the requirements of modern electrical installations. As such, our connections create effective, modern electrical installations, which are discreetly integrated into the architecture of the building.

As a globally active company, we use digital technologies to expand these links in many ways – between people and products and over distances and cultural barriers.

At the heart is the OBO phrase::
Conducting electricity. Routing data. Controlling energy.

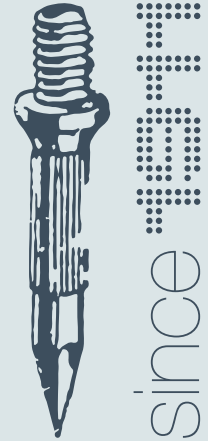


Building Connections



Ohne BOhren – OBO

The first metal OBO anchor gave the company, 40 years after its foundation, the additional name OBO – ohne Bohren (without drilling). Up to that point, it was accepted that an anchor had to be drilled into the wall. However, an OBO engineer had a groundbreaking idea: He developed a metallic anchor, the innovative construction of which permitted it to be knocked directly into the wall without any drilling. This was a huge mounting advantage, considerably simplifying the work of the tradesmen of the time and, as such, becoming one of the biggest milestones in the history of the company. Only the continuous dedication and spirit of innovation of each individual employee has made it possible to expand the product range to more than 30,000 products today.



Customer service and credibility

Our sales and mixed companies in the different countries, who have local employees for the individual market segments, guarantee the highest possible customer proximity. Providing competent regional advice, reliability and friendliness creates a high level of acceptance and credibility, and leads to lasting working relationships. The basis of these shared values is the continuous alignment of our company to the requirements of our customers.

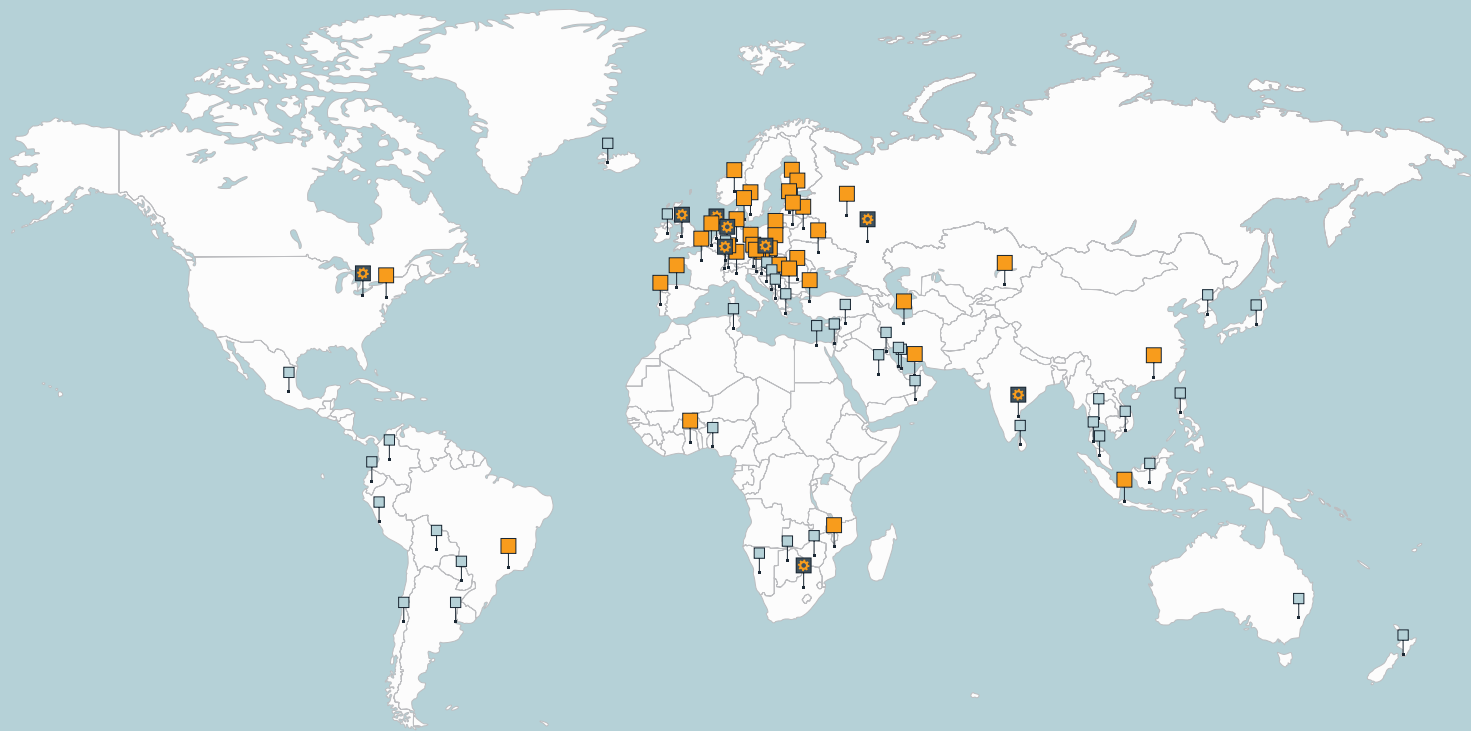
Transparency and flexibility

We strive for the greatest possible transparency for our divisions and companies. To this end, all of the company's objectives, processes and data are continuously measured, modelled and, if necessary, improved on. Organic growth – organised de-centrally – is at the heart of this.

Speed and reliability

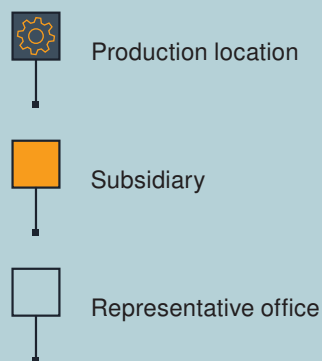
Optimum processes ensure that OBO products around the world are in the right place at the right time. The focus is on an optimum article analysis, combined with high availability and supplier loyalty. Segment and sales locations in more than 60 countries give us the flexibility our customers require.





Represented around the world: The international OBO locations

New solutions to improve functionality and the ease of installation – OBO employees all around the world use their abilities and creativity to make this happen. Because we know that each individual market has its special characteristics and that the requirements for our products change within each market, we have paid particular attention to the compatibility of products in their place of use. We always offer our customers intelligent, well-thought-out solutions. Our brands always keep this promise. The global OBO team offers planners, architects and the executive installation engineers every possible support in the selection of the correct solutions.



OBO in numbers

30,000 

products are produced by OBO for electrotechnical infrastructures.

35% 

of all OBO products are less than five years old.

3 

OBO installation areas: Industrial, Building, and Safety and Protection installations.

832 

patents are owned by OBO for its products.

4,200 

employees around the world.

60 

countries around the world in which OBO is represented.



9,800

tonnes reduction in CO₂ emissions per year at our location in Menden.

45% 

less paper use in the last ten years!

5,900,000,000



OBO anchors® have been produced since 1952.

2,000 

kilometres of cable ladders are produced every year at the Menden site.

111 

years of enthusiasm! OBO has a long history of success.

15 
years

that is the average length of employment at OBO.

Our products for your project



The OBO installation areas – towards the future

Because, for us, product features such as installation speed, load capacity, functionality and availability are at the forefront of every innovation, OBO systems are always reliable, safe and of the highest quality. A high production depth and strong process automation also allow us to deal with the requirements of our customers in a targeted manner.

As a progressive, flexible company, we work with the most effective structures and processes, in order to meet project requirements 'right on time'.

In the Industrial installations segment, you will find all the products you need for the simple, rapid implementation of your industrial project. Within Building installations, we can supply to numerous application areas, from private homes to football stadia. The products for this installation area stand out through their first-class functionality and design. Lightning, surge and fire protection systems can be found in Safety and protection installations.

Here, your safety is the engine that drives our efforts in product development.



Industrial installations

Cable support systems and connection and fastening systems for industry and construction project infrastructure



Building installations

Cable routing and underfloor systems for administrative and functional buildings including architectural solutions



Safety and protection installations

Lightning, surge and fire protection systems

The BET Test Centre: Tested quality

OBO products stand for the highest quality. To guarantee this, besides comprehensive external tests, we also rely on our in-house BET Test Centre.

Here, the quality, resilience and load capacity of the OBO products are subjected to comprehensive testing. Amongst other things, our highly qualified specialists test lightning and surge protection components, lightning protection structures and surge protection systems. In addition, the impacts of events involving lightning are scientifically investigated.

A further core testing area is the resilience and load capacity of our cable support systems (KTS). The state-of-the-art testing systems in the OBO Test Centre allow simulations of tonnage loads.

Here, the OBO testing engineers perform tests not only to accompany product development, but also as part of certifications, as required or on special customer request.



The following tests can be carried out on the KTS testing system according to DIN EN 61537:

- Tests of a safe working load of cable support lengths, mounted horizontally and running in a horizontal direction with different support spacings
- Tests of a safe working load of cable support lengths, mounted horizontally and running in a horizontal direction with variable support spacings
- Testing of safe working loads (SWL) of brackets
- Testing of safe working loads (SWL) of supports





Zertifikat zur Anerkennung Certificate of acceptance

von / of

OBO Bettermann Holding GmbH & Co. KG
Hüingser Ring 52, 58710 Menden, Germany

LAB 1: OBO Bettermann Holding GmbH & Co. KG,
BET Testcenter
LAB 2: OBO Bettermann Produktion Deutschland GmbH & Co. KG,
BET Testcenter Langware

durch die / by the

VDE Prüf- und Zertifizierungsinstitut GmbH
VDE Testing and Certification Institute

für das / for the

Test Data Acceptance Program

in der Stufe 2 / in the Stage 2

ID Nummer <i>ID number</i>	40046136, Revision 5
Gültig bis <i>Valid until</i>	2025-04-01
Aktenzeichen <i>File number</i>	5022908-9501-0001/295322

Dieses Zertifikat ist nur gültig zusammen mit dem gültigen Dokument „TDAP SCOPE“. Es berechtigt nicht zur Nutzung eines markenrechtlich geschützten Zeichens des VDE.
This certificate is valid only in conjunction with the valid document „TDAP SCOPE“. It does not authorize to use any of the legally protected VDE marks.

VDE Prüf- und Zertifizierungsinstitut GmbH
VDE Testing and Certification Institute
Zertifizierung Produkte / *Certification Products*

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VDE Zertifikate sind nur gültig bei Veröffentlichung unter: www.vde.com/zertifikat

VDE certificates are valid only when published on: www.vde.com/certificate

Version 1, 2016-04-01

VDE
INSTITUT

VDE certification: BET Test Centre standard for quality and safety

As part of the Test Data Acceptance Programme, OBO was certified to Level 2 by the VDE Testing and Certification Institute. This allows us to carry out various VDE tests in our BET Test Centre.

To obtain the certification, OBO had to fulfil strict requirements with regard to quality and technology. The VDE certificate guarantees the high level of work of the BET team. For our customers, the VDE certification shows once again that, with OBO products, they can rely on tested and certified quality and safety.

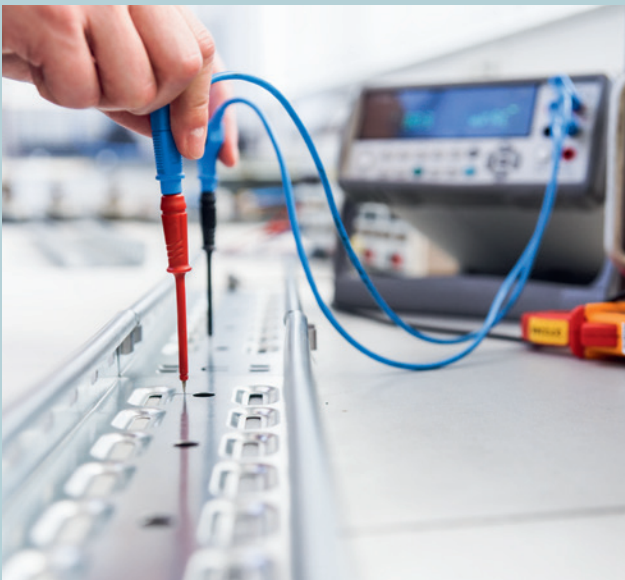
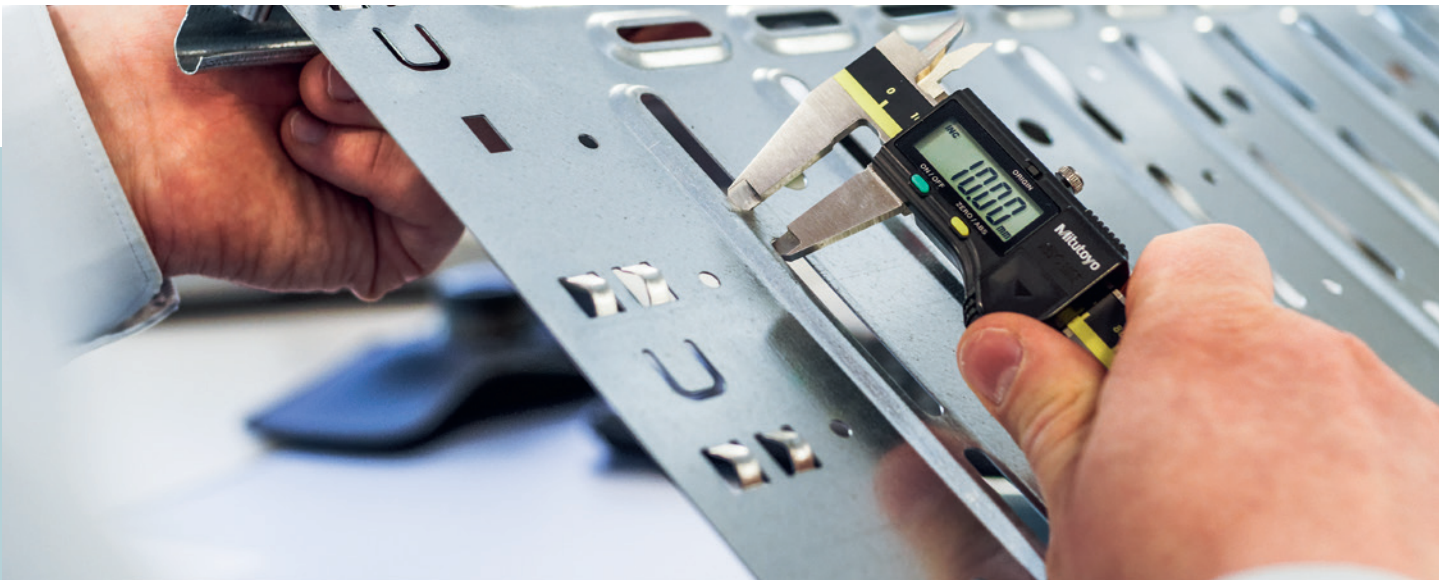
Tested quality

The BET Test Centre is optimally equipped both for the testing of standard products and of special solutions, for example for the special requirements pertaining to use in power stations.

Standardised tests are the speciality of the BET Test Centre and we can offer a large range of such tests. In addition, numerous customer-specific tests can be implemented here.

Our list offers an overview:

- Lightning protection components to EN 50164-1
- Spark gaps to EN 50164-3
- Surge protective devices to EN 61643-11
- Data cable protection devices to EN 61643-21
- Cable support systems to EN 61537
- Electrical installation duct systems to EN 50085-1
- Connection sockets and housings to EN 60670-1 and -22
- Environmental testing to EN ISO 9227 (neutral continuous salt spray testing)
- Environmental testing to EN 60068-2-52 (cyclical salt spray testing)
- Environmental testing to EN ISO 6988 (SO₂ toxic gas testing)
- Protection rating to EN 60592
- Tensile strength to EN 10002-1



Customer-specific requirements and tests not covered by standards can be tested up to the following parameters:

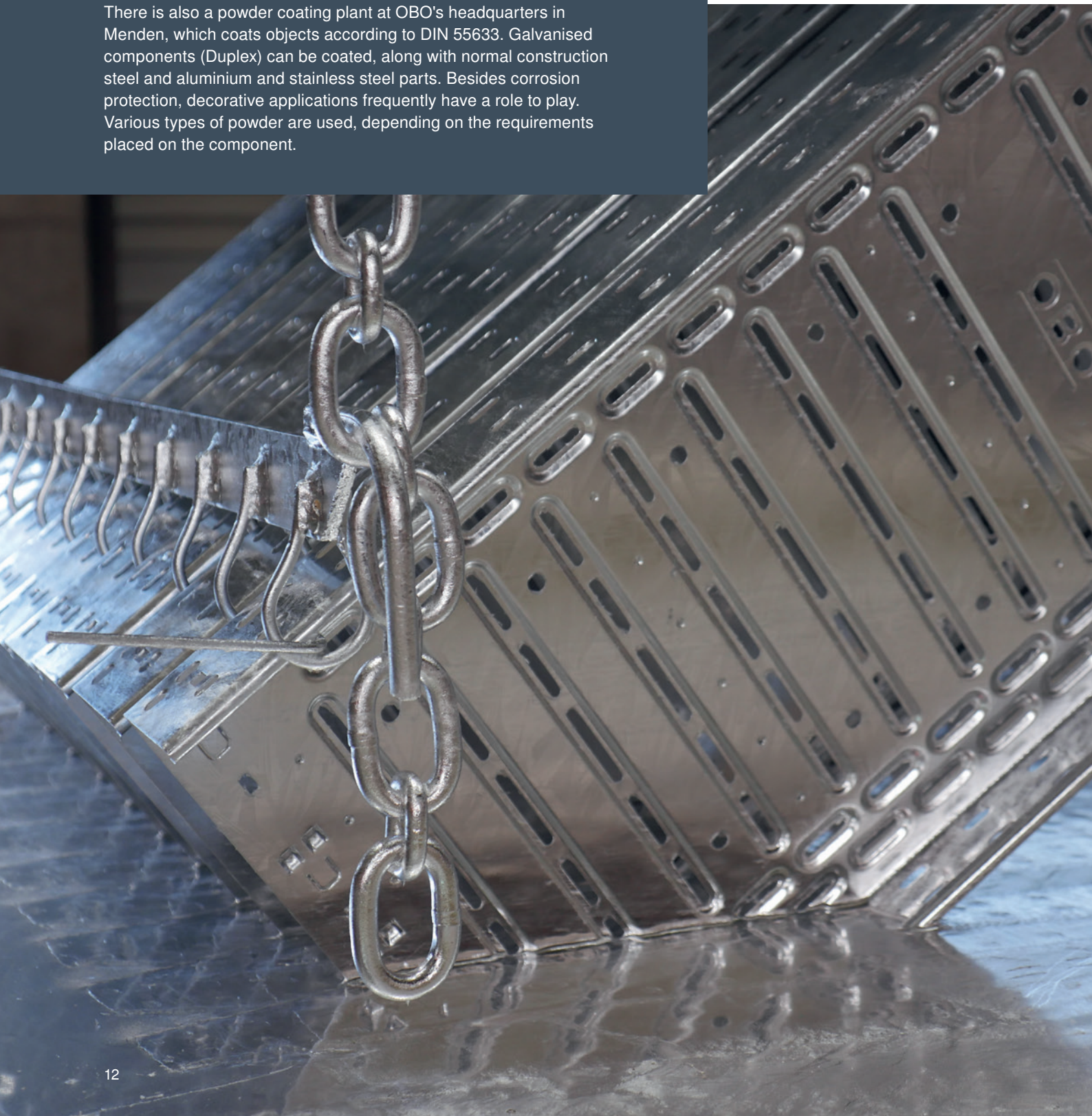
- Lightning current pulses up to 200 kA, 100 As and 10 MA²s
- Surge current pulses up to 200 kA 8/20
- Combined surges of up to 20 kV 1.2/50 and 10 kA 8/20 (Ri 2 Ω)
- Combined surges of up to 10 kV 10/700 and 250 kA 5/300 (Ri 40 Ω)
- Combined surges of up to 1 kV 10/1000 and 90 kA 10/1,000 (Ri 10 Ω)
- Follow current system 255 V, 50 Hz, up to 3 kA
- Insulation measurement up to 5 kV AC, 50 Hz
- Insulation measurement up to 6 kV DC
- Conductivity measurements up to 63 A, 50 Hz
- Load testing of cable support systems up to 10 m up to 70 kN
- Tensile and compression strengths up to 100 kN

Surface competence

Coating systems

At its production locations, OBO possesses its own high-end competence with regard to surface finish. Hot galvanisation is carried out according to the international standard DIN EN ISO 1461.

There is also a powder coating plant at OBO's headquarters in Menden, which coats objects according to DIN 55633. Galvanised components (Duplex) can be coated, along with normal construction steel and aluminium and stainless steel parts. Besides corrosion protection, decorative applications frequently have a role to play. Various types of powder are used, depending on the requirements placed on the component.



Surfaces

The following galvanisation surfaces can be applied to improve corrosion protection:

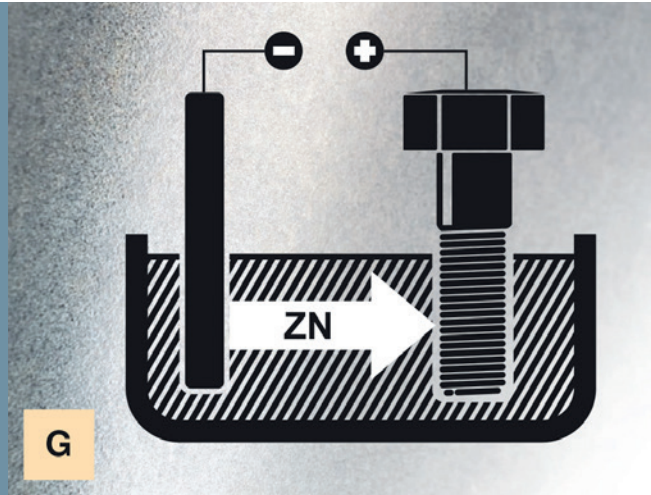
Electrogalvanisation

- Application of the zinc covering using an electrolysis method (direct current)
- Normal layer thicknesses, approx. 515 μm
- Retreatment normally in the form of passivation and/or sealing

Standards: DIN EN ISO 19598 & DIN EN ISO 4042

Applications: Interior areas without harmful substances, e.g. offices, sales areas – corrosivity category according to DIN EN ISO 12944-2: C1

Examples: Mesh cable trays and connection elements, requirements of the component



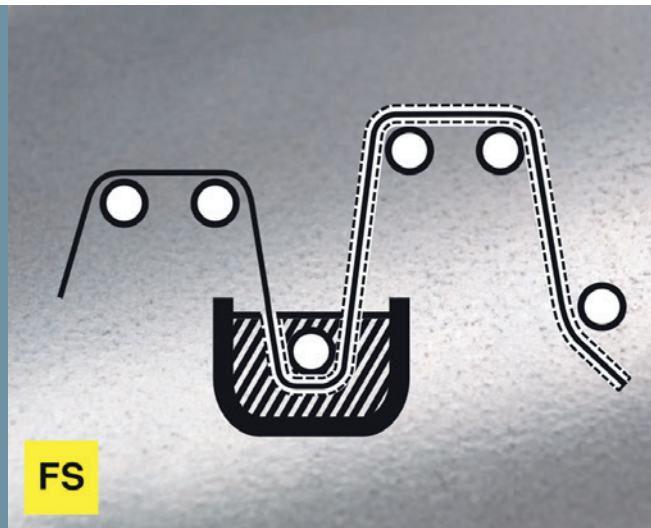
Strip galvanisation

- During the strip galvanisation process, also termed Sendzimir galvanisation, the steel strip is galvanised in a continuous process
- Materials: DX51D
- Normal layer thicknesses (Z 275), approx. 1,327 μm
- Retreatment of the coil possible in the form of passivation and/or sealing

Standards: DIN EN 10346

Applications: Indoor areas in which condensation can occur, e.g. sports halls or warehouses – corrosivity category according to DIN EN ISO 12944-2: up to C2

Examples: Cable trays, covers



Hot-dip galvanisation

- The fully formed product is coated using a dipping method
- Materials: C9D, DC01, DD11, S235JR
- Normal layer thicknesses, approx. 4,585 μm

Standards: DIN EN ISO 1461

Applications: Indoor areas with a certain level of moisture and impurity, outdoor areas with medium levels of contamination, e.g. laundries, urban atmosphere – corrosivity category according to DIN EN ISO 12944-2: to C3 (depending on layer thickness, up to C4)

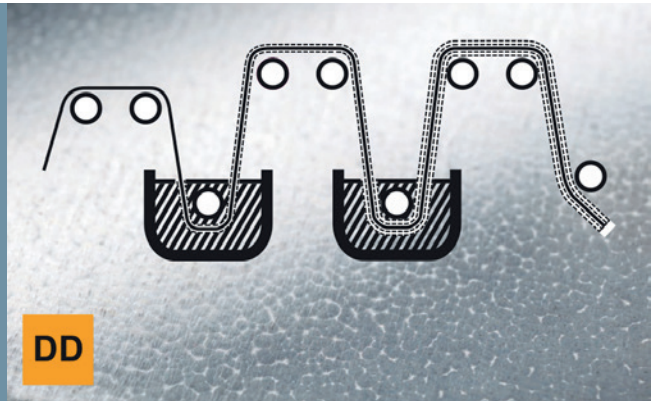
Examples: Cable ladders, mesh cable trays, suspended supports and brackets



Hot-dip coating (Double Dip)

- Zinc-aluminium coating according to DIN EN 10346
- The material to be galvanised then passes through two baths: The first contains pure zinc, the second a zinc-aluminium alloy

Standards: DIN EN 10346



Zinc slat coating

- Processing of untreated steel to small parts, such as screws or washers
- Subsequent coating in the immersion spinning method, with an anorganic, zinc- and aluminium-rich substance
- Layer thickness: 5–20 µm
- Cathodic corrosion protection allows small scratches, e.g. due to transport or mounting

Standard: DIN EN 13858, DIN EN ISO 10683

Applications: Interior, exterior

Examples: Connection elements, fastening elements



Plastic coating

- Plastic coating through electrostatically charged plastic powder
- Coating for reasons of corrosion protection or for decorative reasons
- Particularly good adhesion through pretreatment of the components with different fluids
- Plastic powder made of epoxy and/or polyester resins, as well as polyurethane
- Normal layer thicknesses, approx. 70,100 µm
- Coating of various system components possible with the following surfaces:
 - Strip galvanised (FS)
 - Hot-dip galvanised (FT)
 - Electrogalvanised (G)
 - Aluminium (Al)

Standards: DIN 55633/55634

Corrosion protection application:

- Hot-dip galvanised system components with coating (Duplex)
- Very resistant to moisture, impurities and chemical influences
- Buildings with continuous condensate formation and strong impurities
- Corrosivity category according to DIN EN ISO 12944-2: up to C5

Decorative reasons:

- Special visual requirements, appropriate to the colour design of the structure
- Coloured separation or assignment of different functions
- Available in all RAL colours



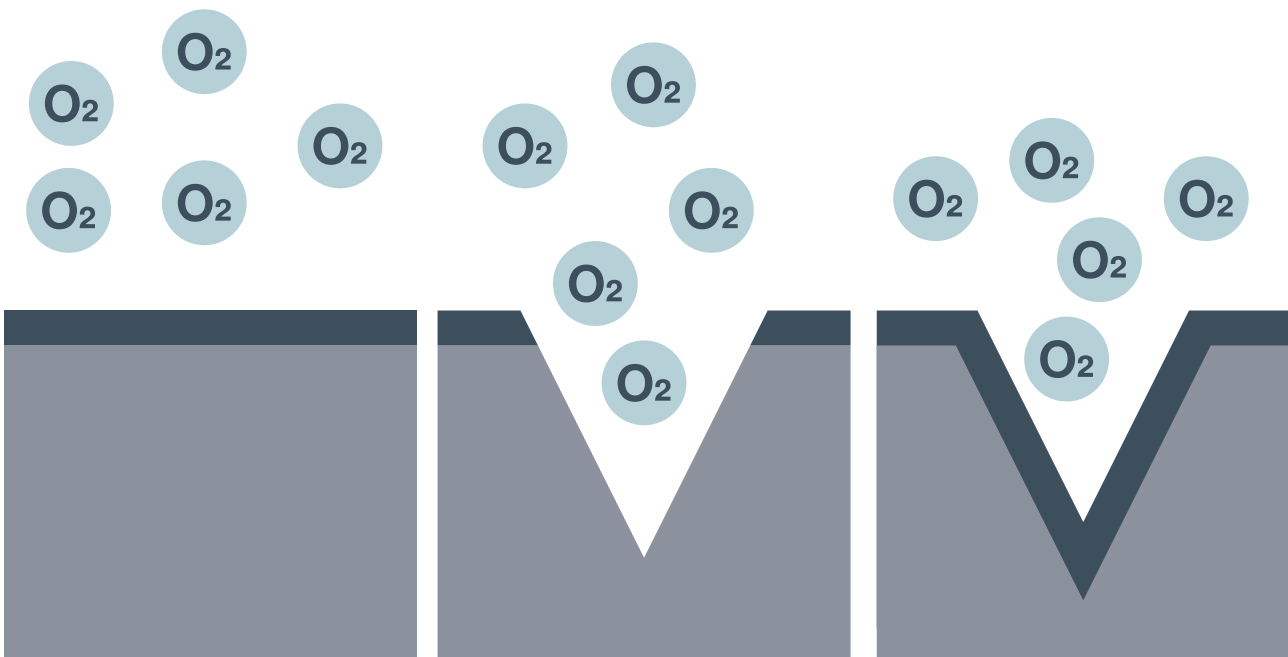
Materials

Stainless/rustproof steel

- The entry of oxygen causes a chromium oxide layer to form (passive layer), which protects against corrosion
- If the passive layer is damaged, e.g. by cutting, it forms again through further entry of oxygen
- Materials according to the alloy composition:
 - A2: 1.4301
 - A4: 1.4401, 1.4571
 - A5: 1.4529, 1.4547, 1.4462
- Standard: EN 10088
- Corrosivity category according to DIN EN ISO 12944-2:
 - A2: Up to C3
 - A4: Up to C4
 - A5: Up to CX

Overview of key alloy elements

Element	Properties in the steel
Nickel	<ul style="list-style-type: none">▪ Stabilises the structure (austenite former)▪ Increases stability and toughness▪ Increases the resistance to tension crack corrosion
Molybdenum	<ul style="list-style-type: none">▪ Increases the pitting resistance▪ Increases the resistance to tension crack corrosion
Titanium	<ul style="list-style-type: none">▪ Stabilises the structure (carbide former)▪ Increases resistance to inter-crystalline corrosion
Nitrogen	<ul style="list-style-type: none">▪ Stabilises the structure (austenite former)▪ Increases stability



Corrosivity categories according to DIN EN ISO 12944-2:2018

Corrosivity category	Mass loss/thickness reduction relative to the area (after the first year of warehouse removal)				Example of typical environments (only for information purposes)		Recommended systems
	Unalloyed steel		Unalloyed steel		Open air	Interior	
	Mass loss g/m ²	Thickness reduction m	Mass loss g/m ²	Thickness reduction m			
C1 Negligible	≤ 10	≤ 1.3	≤ 0.7	≤ 0.1	–	Heated building with neutral atmosphere, e.g. offices, sales areas, schools, hotels	G FS
C2 Low	> 10 to 200	> 1.3 to 25	> 0.7 to 5	> 0.1 to 0.7	Atmosphere with low degree of impurity: usually rural areas	Unheated buildings, in which condensation can occur, e.g. warehouses, sports halls	FS DD
C3 Medium	> 200 to 400	> 25 to 50	> 5 to 15	> 0.7 to 2.1	Urban and industrial atmosphere with medium sulphur dioxide load; and coastal atmosphere with low salt load	Production rooms with high humidity and a certain amount of air impurities, e.g. food processing plants, laundries, breweries, dairies	FT A2 DD FT A2 A4
C4 Heavy	> 400 to 650	> 50 to 80	> 15 to 30	> 2.1 to 4.2	Industrial atmosphere and coastal atmosphere with medium salt load	Chemical plants, shipyards near the coast and harbours	FT FT SO
C5 Very heavy	> 650 to 1,500	> 80 to 200	> 30 to 60	> 4.2 to 8.4	Industrial areas with high humidity and aggressive atmosphere and coastal atmosphere with high salt load	Buildings or areas with almost continuous condensation and with high levels of impurities	A4 A5 FT SO A4
CX Extreme	> 1,500 to 5,500	> 200 to 700	> 60 to 180	> 8.4 to 25	Offshore areas with high salt load and industrial areas with extreme humidity and aggressive atmosphere, as well as subtropical and tropical atmospheres	Industrial areas with extreme humidity and aggressive atmosphere	A5 A5

Legend

G Electrogalvanised	FT Hot-dip galvanised	A2 1.4301
FS Continuously strip galvanised	FT SO Hot-dip galvanised with special layer thickness	A4 1.4571, 1.4401
DD Continuously strip galvanised with zinc/aluminium covering	FTK Duplex (zinc+powder)	A5 1.4529, 1.4547

Expected protection length of the galvanisation

Covering	Covering code	Covering density	Expected protection length (see DIN EN ISO 12944-1)																			
			C2				C3				C4				C5				CX			
			L	M	H	VH	L	M	H	VH	L	M	H	VH	L	M	H	VH	L	M	H	VH
Hot galvanized ^{a)} according to DIN EN ISO 1461	-	45	X	X	X	X	X	X	X	X	X	X	X	X	X							
		55	X	X	X	X	X	X	X	X	X	X	X	X	X							
		70	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
		85	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Zinc according to DIN EN 10346	Z275 ^{a)}	20	X	X	X	X	X	X	X	X	X	X										
Zinc/aluminium according to DIN EN 10346	ZA 255 ^{b)}	20	X	X	X		X	X			X											

a) Protection duration calculated with the minimum and maximum zinc removal rates in DIN EN ISO 9223

b) See DIN 55634-1

Low (**L**): Up to 7 years | Medium (**M**): 7 to 15 years | High (**H**): 15 to 25 years | Very high (**VH**): > 25 years

To evaluate the use of stainless steels, the effective sum of the steel (PREN = Pitting Resistance Equivalent Number) is a first guide. It is the sum of the alloy elements chromium, molybdenum, tungsten and nitrogen. It is used to estimate the corrosion resistance of the steel to pitting and gap corrosion.

It is calculated according to *DIN EN ISO 8044: Corrosion of metals and alloys – Vocabulary as follows:*

$$1 \times \%Cr + 3.3 \times (\%Mo + 0.5 \times \%W) + 16 \times \%N$$

Steels with an effective sum >32 are considered as resistant to seawater.

In addition, it is wise to perform an evaluation according to DIN EN 1993-1-4 Appendix A for use according to the corrosivity category.

Corrosion resistance class (CRC)	Steel types
I	–
II	14.301
III	1.4401, 1.4571
IV	14.462
V	1.4529, 1.4547

Definition of electromagnetic compatibility (EMC)

Recent years have seen the use of electronic circuits increase continually. Whether in industrial systems, medicine, households, in telecommunications systems or electrical building installations – we see powerful electric equipment and systems everywhere, which switch ever greater currents, achieve greater radio ranges and transport ever more energy in smaller spaces.

However, the use of state-of-the-art technology means that the complexity of applications also increases. The consequence of this is that ever more opposing influences (electromagnetic interference) can occur from system parts and cables, causing damage and economic losses.



Here, we talk of electromagnetic compatibility:

Electromagnetic compatibility (EMC) is the ability of an electrical unit to function satisfactorily in its electromagnetic environment, without inappropriately influencing this environment, to which other units also belong (VDE 0870-1). In terms of standardisation, electromagnetic compatibility is dealt with by the EMC Directive 2004/108/EC. This means that electrical resources emit electromagnetic interferences (emissions), which are picked up by other devices or units (immision) that act as receivers (interference sink). This in turn means that the function of an interference sink can be severely reduced and, in the worst-case scenario, result in total failure and economic losses. The interferences can then spread along cables or in the form of electromagnetic waves.

Path of faults

Fault source (transmitting emissions)	Coupling of interference variables (spreading of interference)	Fault sink (receiving emissions)
For example <ul style="list-style-type: none"> ▪ Radio telephones ▪ Switching units ▪ Ignition systems ▪ Frequency converters ▪ Lightning strike ▪ Welding devices 	<ul style="list-style-type: none"> ▪ Galvanic ▪ Inductive ▪ Capacitive ▪ Electromagnetic 	<ul style="list-style-type: none"> ▪ Process computer ▪ Radio reception systems ▪ Controllers ▪ Inverters ▪ Measuring devices

Guaranteeing EMC



Guaranteeing EMC

A systematic planning process is necessary to guarantee EMC. The interference sources must be identified and quantified. The coupling describes the spread of the interference from the interference source up to the device being influenced, the interference sink. The task of EMC planning is to ensure the compatibility at the source, coupling path and sink using suitable measures. During their daily work, planners and installation engineers are confronted with this subject on an increasingly regular basis. This means that EMC is a basic factor to be taken into consideration during the planning of installations and cabling systems. Due to the high complexity of electromagnetic compatibility, the problems of EMC must be analysed and solved using simplifying hypotheses and models, as well as experiments and measurements.

Cable support systems and their contribution to EMC

Cable support systems can make an important contribution to the improvement of EMC. They are passive and can thus make a safe, long-lasting contribution to EMC through the fact that cables are run within cable support systems or are shielded by them.

Routing cables inside cable support systems greatly reduces the galvanic decoupling and coupling due to electrical and magnetic fields in the cables. Thus, cable support systems can make a contribution to the reduction of coupling from the source to the sink. The shielding action of cable support systems can be quantified by the coupling resistance and the shield attenuation. This gives the planner important engineering parameters for cable support systems for EMC engineering.

Lightning discharge

From the analysis of the effectiveness of EMC in buildings (EN 62305-4), we know that lightning discharge is one of the greatest sources of interference to be expected. This causes a direct current feed into the entire equipotential bonding system in the building and/or to magnetic decoupling of interference currents in electrical cables. With regard to these couplings, cable support systems can offer an effective contribution to the reduction of interference voltages.

Magnetic shield insulation of cable support systems

General information

It may occur that cables have to be routed in areas with electromagnetic interference fields.

Sources of such electromagnetic interference fields can be, for example, electrical resources (motors) starting up, inverters, switching operations in electrical systems or lightning currents.

These interference fields can cause fault voltages and currents in cables, depending on their intensity, frequency and distance (Figure 1, left), which impede the function of the connected resources, or even destroy them.

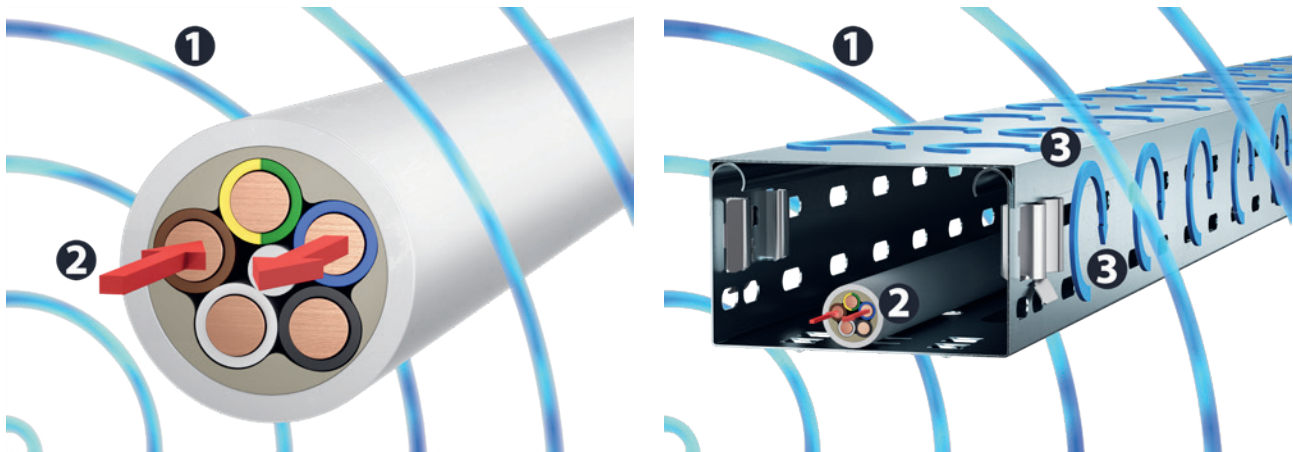
With their high current values of over 200,000 amps and fast ramps of less than $0.25 \mu\text{s}$ (corresponding to a frequency of 1,000 kHz), lightning currents represent the strongest interference fields, which alternate rapidly.

The electromagnetic interference field generally consists of two different fields: the electrical field and the magnetic field. The different fields require different measures as protection against their damaging impact.

As protection against interference from the electrical field, a partition of conductive material is required, which is to be included in the equipotential bonding, and thus must be earthed. Depending on the frequency of the electrical interference field, mesh partitions are sufficient.

As protection against interference from the magnetic field, shielding, completely closed on all sides with conductive material, is required. In this shielding, an alternating magnetic field generates Foucault currents, which act against their cause (law of induction), thus creating an interference-free area within the shielding. Electrically non-conductive areas in the shielding, such as slits and openings, interrupt the Foucault currents, thus reducing the magnetic shield impact.

Closed, metallic cable support systems, which are included in the equipotential bonding, such as cable trays, thus offer optimum protection of cables in areas with electromagnetic interference fields (Figure 1, right).

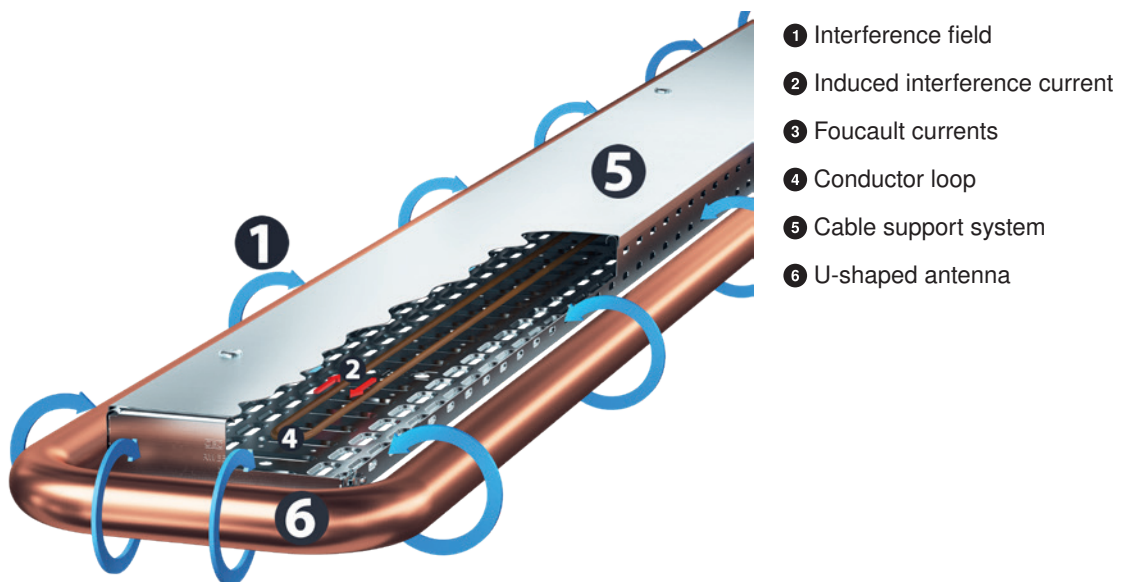


- ① Interference field
- ② Induced interference current
- ③ Foucault currents

DIN CLC/TR 50659:2020-08 (VDE 0604-2-200) describes a testing procedure to measure the magnetic shield attenuation of cable support systems.

A U-shaped antenna is used, through which a lightning current flows with a ramp of approx. 8 μs, creating a magnetic field of interference. In this arrangement, there is a closed conductor loop of two parallel cables in the centre.

The magnetic interference field generates an interference current in the conductor loop (induction law). The basic arrangement of the test structure is shown in Figure 2.



The magnetic shield attenuation (SE) is 20x the decadic logarithm from the ratio of the interference signal occurring without protective measures (I_{ref}) to the interference signal occurring with the protective measure (cable support systems) (I_{sample}) and is calculated as follows and stated in dB.

$$SE (dB) = 20 \times \log \left(\frac{I_{ref}}{I_{sample}} \right)$$

With a stated magnetic shield attenuation (SE) of 20 dB, this means that this protective measure (cable support systems) reduces the interference current in cables by 90%. 40 dB means a reduction of 99%.

Summary

Closed, metallic cable routing systems included in the equipotential bonding reduce the interference currents and interference voltages induced in a cable through an electromagnetic interference field, compared to routing without or in non-metallic cable routing systems. Here, closed, metallic cable routing systems offer the highest magnetic shield attenuation.

Perforated cable routing systems also offer a high magnetic shield attenuation, which, however, decreases with an increasing hole size.

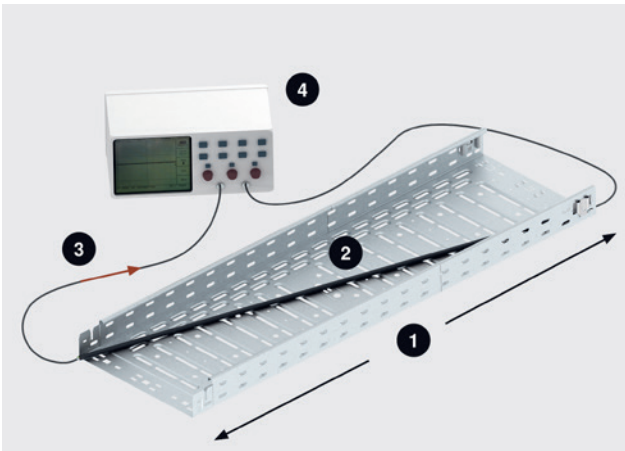
Therefore, mesh cable trays and cable ladders only offer low magnetic shield attenuation. If open cable routing systems (without covers) are used, the magnetic shield attenuation decreases accordingly.

The table provides an overview of the magnetic shield attenuation of various versions of cable routing systems.

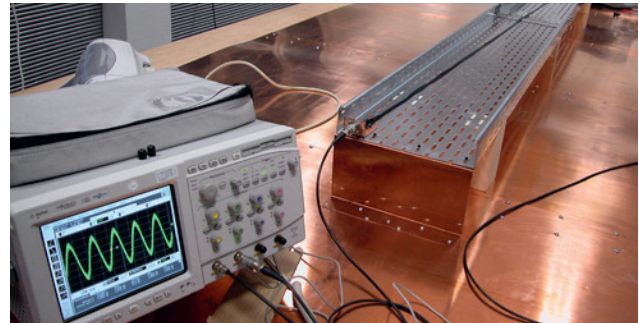
Version of the cable routing system	Closed (With cover)	Open (Without cover)
Without perforation/holes	40 dB (99%)	25 dB (94%)
15% perforation/holes	30 dB (97%)	20 dB (90%)
28% perforation/holes	25 dB (94%)	15 dB (82%)
Cable ladders	18 dB (87%)	11 dB (72%)
Mesh cable tray	14 dB (80%)	7 dB (55%)

Magnetic shield attenuation of various cable support systems (reduction of the interference current by %)

Transfer impedance of cable support systems



Experimental structure for transfer impedance:
1 = Length L, 2 = U, 3 = I, 4 = Pulse source 8/20



$$Z_T' = \frac{U_{Interference}}{I_{Interference} * L}$$

$V_{Interference}$: Interference voltage measured in cable
 $I_{Interference}$: Interference current, fed into the shield from outside (cable support system)
 L: Length of the cable support system

Transfer impedance (coupling resistance) of cable support systems

The transfer impedance of a cable support system is the ratio of the measured voltage $V_{Interference}$ measured in the lengthwise direction within the cable support system, to the coupled current $I_{Interference}$. The transfer impedance is determined in the same way as with the measurement of the electrical conductivity properties in Chapter 11.1. (DIN EN 61537). If there is a lightning strike in a building, partial currents will flow through the entire equipotential bonding system. Installed cables are best run within a cable support system. Installed cable support systems are always included in the equipotential bonding system. In so doing, the partial current flows via the cable support system. A very small part can therefore still flow along the cables laid within the cable support system. This part is determined by the transfer impedance of the cable support system. The following applies for the transfer impedance:

$$Z_T' = \frac{U_{Interference}}{I_{Interference} * L} [m\Omega/m]$$

Transfer impedance

Type, cable tray/cable ladder	Without cover	With cover
MKS 630 FS	1.14	0.71
MKS 630 FT	1.14	0.71
MKSU 630 FS	0.44	0.09
MKSU 630 FT	0.44	0.09
GRM 55/300 FS	6.17	5.5

The values given are based on measurements in which a pulse current of the wave shape 8/20 was passed through a defined length of a cable support system.

Experiment result:

The effect of the cable support against galvanic coupling was clearly proved by the experiments!

The best result was achieved with cable support systems (cable trays) with covers. Please refer to the information for the individual products to find the average measured values.

OBO CAD Support

Engineering and planning

Our support for your optimum planning



Make use of our expert knowledge for your planning: We will be happy to support you and simplifying the organisation of your project.

Have you got any questions?
Get in touch via
toi@obo.de

Accurate planning is essential for the maximum success of a project. Our team, consisting of engineers, construction engineers, structural engineers and technical draftspeople, knows the challenges of difficult projects and can support you during planning in the areas of:



Cable support systems



Lightning protection, earthing, surge protection



Underfloor systems



Cable routing systems



OBO Construct – smart planning

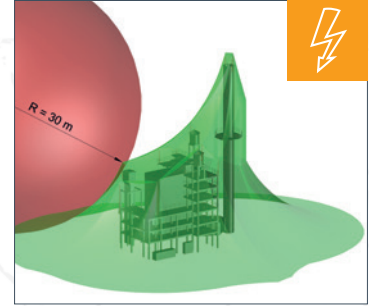
Using OBO Construct, plan electrical installations simply and faster than ever before.

Your OBO planning tool – available on all devices and terminals: obo-construct.com

OBO can offer support for your project in the areas of:

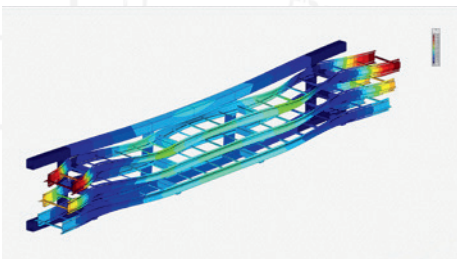
- Cable support systems
- Lightning protection and earthing systems
- Underfloor applications in screed and concrete and on floors
- Wall and ceiling duct and trunking installations

During the planning of your projects, profit from our expertise, the high quality of the data provided and the consideration of countless individual installation requirements.



We can support you in every phase of your project

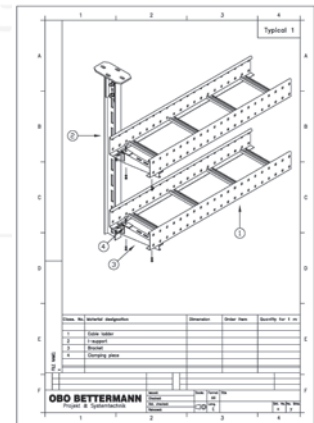
- Technical planner consultation
- Support in the creation of 3D and 2D planning (AutoCAD, REVIT, STEP and many more)
- Preliminary documentation work
- Material parts lists
- Invitation to tender, mounting detail drawings/typicals
- Static calculations
- Lightning protection: Protection area and risk analysis
- Mounting service for major projects
- Design for static replacement load for simple structures
- Modal analysis of combined structures
- Survey of the anchorings



We can offer individual typicals

We can provide you with customer-specific typicals for your projects.

- Detailed mounting drawings
- Individual to your requirements
- Support in mounting and planning



Use our 3D BIM models

We can offer you the BIM models of our OBO products on the website:

- In the online catalogue, directly by the product or
- at obo.eu/bim-daten

Or on the BIM platforms:

- MEPcontent
- BIMobject

Support in:
AutoCAD, Revit,
BIM, Inventor,
SOLIDWORKS



Customers

We are proud of the fact that we have been a partner to the electrical trade for more than 110 years and that, for this reason, there is a bit of OBO in so many construction projects around the world.

There are projects containing a bit of OBO all around the world. To give you an idea of the wide-ranging solutions, on the following pages you will find a selection of projects OBO was able to support with its products. Discover some of the buildings we have helped to create.



Hard coal power station, Lünen



Brown coal power station, Boxberg



Eemshaven Power Station, NL (partial delivery)

Hamm-Uentrop power station

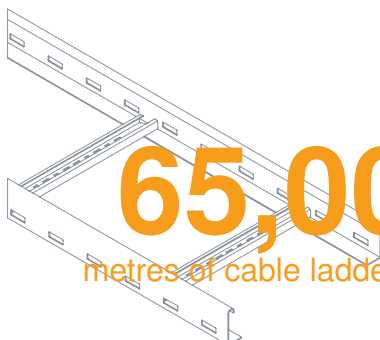


The power station of RWE Power AG at Hamm-Uentrop is one of the most modern in the world.


For power station blocks D and E, OBO supplied 65,000 metres of cable ladder systems and 7,000 metres of vertical ladder systems.

The total output of both blocks is 1,600 megawatts. To guarantee this and ensure that the plant functions perfectly, countless power cables have to be run through the blocks.

This is why it is good to have a reliable partner like OBO at your side. In the power station at Hamm-Uentrop, the OBO products were installed in the blocks themselves, as well as in the auxiliary plants and switching system buildings.



65,000
metres of cable ladder systems



7,000
metres of rising section systems

Hamm-Uentrop power station



View of the old plant, the high temperature reactor and the new building



Construction phase, second cooling tower



View of the stair towers, the first of two boiler frames and the machine building behind



Switching room floor in switching system building



View of the supply duct from the switching systems building to the stair tower/boiler house

Niederaussem power station



The power station with the highest cooling tower in Europe uses OBO products

In the suburb of Niederaussem of the Rhineland town of Bergheim is the power station with Europe's highest cooling tower: It is a massive 200 metres high.

That is not the only thing that is special about Niederaussem power station. It stands out through its phenomenal power data and it was the first brown coal power station to be commissioned with optimised systems technology (BoA).

In the imposing plant, OBO laid around 90 kilometres of cable routes with rising sections of up to 160 metres. As the schedule for the project was very tight, 50 kilometres of the cable routes had to be installed within just nine months. At peak times, around 50 installers were working simultaneously.

But, you can rely on OBO. Even if time is tight, we will do everything to deliver punctually and are available to advise customers in every project phase.



Approx. **50** 
mounting engineers were
employed in the plant at peak
times.

Historical overview










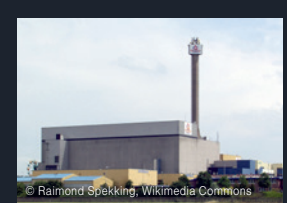
Our competence for your project

OBO Bettermann can look back on a long history and experience in the creation of technical building equipment in nuclear power in the field of electrical installations. This applies both to the procurement of specially required special solutions and to all the necessary qualifications and certifications.

The history of OBO with regard to power stations goes back to the 1960s.

Both then and now, the highest level of accuracy and precision, based on the requirements of the industry, were of paramount importance to us. With decades of experience in the field of nuclear and fossil fuel power stations, we can state confidently: We know what we're doing.

Our timeline offers an impression of the long history of projects and customers:

<p>ITALY Garigliano nuclear power station</p>		<p>1960</p>		<p>BAVARIA Gundremmingen nuclear power station</p>
<p>EMSLAND nuclear power station</p>		<p>1964</p>		<p>FRANCE Fessenheim nuclear power station</p>
<p>BADEN- WÜRTTEMBERG Philippsburg nuclear power station</p>		<p>1970</p>		<p>BAVARIA Isar 1+2 nuclear power station</p>
<p>NORTH RHINE- WESTPHALIA THTR 300 Hamm nuclear power station</p>		<p>1971</p>		<p>SWITZERLAND Leibstadt nuclear power station</p>
<p>RHINELAND- PALATINATE Mülheim-Kärlich nuclear power station</p>		<p>1973</p>		<p>LOWER SAXONY Kalkar nuclear power station</p>

BAVARIA
Grafenrheinfeld
nuclear power
station



1974

**SCHLESWIG-
HOLSTEIN**
Brokdorf
nuclear power
station



1975

**BADEN-
WÜRTTEMBERG**
Neckarwestheim
nuclear power
station



1976

LOWER SAXONY
Emsland
nuclear power
station



1982

LOWER SAXONY
Lingen
storage facilities



2002

**SCHLESWIG-
HOLSTEIN**
Brunsbüttel
storage facilities



2004

SLOVAKIA
Mochovce 2
nuclear power
station



2009

1975



LOWER SAXONY
Grohnde
nuclear power
station

1975



IRAN
Bushehr 1
nuclear power
station

1976



FRANCE
Super-Phénix
nuclear power
station

1982



LOWER SAXONY
uranium enrichment
plant / re-treatment

2004



**SCHLESWIG-
HOLSTEIN**
Krümmel
temporary storage
facility

2005



FINLAND
Olkiluoto 3
nuclear power
station

2017



ENGLAND
Hinkley Point C
nuclear power
station

Certified safety

OBO is the reliable partner at your side

With OBO, you have a reliable partner with many years of expertise at your side. With our experience from numerous projects and the high quality of our products, we can also provide you with competent support in installation projects in challenging environments, such as in the nuclear power sector. We are fully equipped to tackle these challenges through appropriate certifications, all of whose requirements we fulfil.

You can rely on them: All OBO products are subject to comprehensive internal and external testing. In addition, testing structures and installations are created. This applies both to products to be used in power stations and to the rest of our comprehensive portfolio.

True both now and in the past:

Right from the first project in the power station sector, in which we were able to stand out with our reliable OBO solutions, we have possessed all the required certificates and qualifications.

Together with TÜV Rheinland, OBO has developed a special testing facility for cable support systems for this purpose. This means that OBO products stand for tested, safe electrical installations. Each OBO product is developed, manufactured and tested with a high level of competence, from the idea through to the final check.



OBO solutions on which you can rely

Global customer proximity and project support for the industries of the future

Internationally, the power station sector is more in the spotlight than ever before. All around the world, there are stations being decommissioned, commissioned and reconstructed. The readiness of many countries to invest in nuclear energy, either for the first time or anew, shows how high the requirements for such sources of energy are.

For decades, OBO has been your partner for fossil and nuclear power stations with reliable solutions for cable management, the maintenance of electrical function and fire protection. External lightning protection as part of the Transient and lightning protection systems product unit is a further service with which we support our customers. The planning support offered by OBO and the extremely close cooperation with customers on the individual project specifications supplement our portfolio of services for your construction project.

OBO designs the future: Renewable energies and sustainable industries

For OBO, a further core area is in the further development of products for the expansion of sustainable industries, such as photovoltaics, wind energy, biogas and electromobility.

We develop innovative solutions for these industries, which lead, step by step, to a more sustainable future and help shape the energy revolution.

We are close by all around the world

For us, it is important to be where our customers and their projects are. We achieve this with 42 sales companies in over 60 countries, as well as with our own production locations around the whole world. We produce in Germany, Hungary, the United Kingdom, India, Russia, the USA, Switzerland and in South Africa. Our local presence around the world means that we can guarantee the highest possible customer proximity and can offer regional advice competency directly on-site.

OBO support from planning through to project implementation

OBO not only supplies the highest-quality products for the electrical infrastructure, but also supports you with well-founded technical knowledge and decades of project experience, also in the planning and implementation of projects and it does that in every phase of the project.

This means that we are your strong, certified partner for future projects and tasks. Always close by, there for you in every phase of the project, with innovative solutions and well-founded experience from projects around the world.



Product and (production) process development



At OBO Bettermann, product and process development is planned, controlled, executed and monitored in separate departments. At the production locations in Menden (Germany) and Bugyi (Hungary), well-trained and experienced engineers and technicians, whose core areas include mechanical construction, electrical engineering, production technology, statics and surface technology, develop new, sometimes individual, solutions for customers.

In addition, a major additional source of knowledge is tapped into through cooperation agreements with various technical colleges. During product development, the focus is on robustness, reliable product performance over the whole life cycle, safe product selection, error-free manufacture, simple and correct mounting of the systems and efficient production that takes care of resources. Additionally, OBO Bettermann has, for decades, regarded itself as a driving force in innovation in all fields of application. This is why the OBO Group currently holds more than 800 sets of industrial protection rights.

All activities, from product development to possible changes in the product life cycle, are carried out using specially designated, certified and established processes.

In preparation for product development, the requirements on the products to be developed are recorded in detail, prepared in a differentiated manner and are documented centrally. In addition, besides the requirements relevant to OBO Bettermann and those which are a statutory requirement, there are industry and customer-specific function and performance requirements. If necessary, these requirements can refer specifically to individual construction plans or projects, thus defining special conditions.

To meet these, close contact is maintained between the user, planner or operator and OBO Bettermann. During the development processes, the totality of the defined requirements can be used for continuous testing of the degree of fulfilment, thus controlling the development process. At specific points defined in the process, progress is investigated by a steering committee and continued execution is only approved when the results match the technical and economic criteria defined in the development phase. Changes or expansions to the catalogue of requirements are documented using the applied project management software and communicated in an ad hoc manner to all involved bodies, meaning that it is possible to react flexibly, efficiently and safely to changes the customer may make.

The theoretical calculations carried out during development are tested using prototypes accompanying development, but then in the laboratory using samples produced under real production conditions, during pre-series production. This verifies the product properties against the requirements. For this, the BET Test Centre – which is organisationally independent from production engineering and the Research & Development department – of the OBO corporate group is available.

The BET Test Centre has been certified by the VDE through the TDAP (Test Data Acceptance Program) to perform tests recognised by the VDE.

After the development and test phase, before market launch, the products are subjected to a validation under actual field conditions, so-called product testing, in selected monitored projects.

The results are always inspected and confirmed by independent bodies, which do not belong to product development. These processes create successive detailed production documents, such as drawings, parts lists, work schedules, work instructions, procurement texts and testing plans with acceptance criteria, using which safe products can be produced, subject to conformity with these documents.



National and international regulations

In a challenging environment, such as that in a nuclear power station, a high level of quality of the products installed here is of major significance. All the OBO products are subjected to continuous testing and inspection and thus fulfil the highest standards of quality. This is also proven by the wide range of approvals and certifications possessed by OBO.

Here, our integrated quality management system functions as the solid basis of our ISO 9001 certification, which we have held since 1994. OBO fulfils the system and product-related requirements of rule KTA 1401 without AVS D 100/50 (cf. Section 1.2. (3)).

To guarantee a high level of product quality, we at OBO produce almost all our products ourselves. This enormous depth of production is an expression of our demand for quality. From construction, and the materials used through production, right up to logistics, our employees personally guarantee the quality and availability of OBO products.

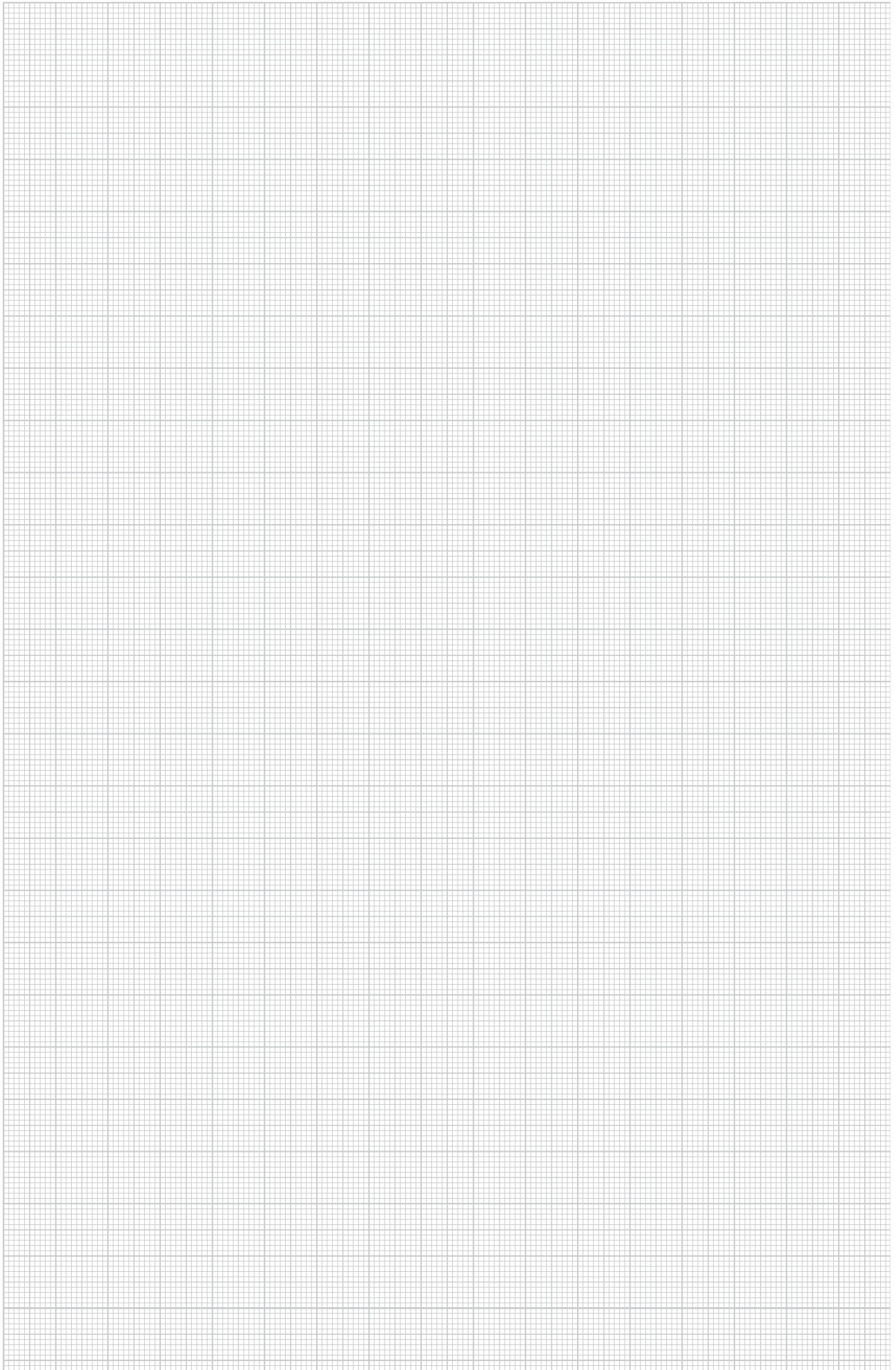
- DIN EN ISO 9001:2015 (Quality Management)
- KTA 1401 (Certificate of suitability of the suppliers for nuclear power stations)
- DIN EN ISO 14001:2015 (Environmental management)
- ISO 45001:2018 (Occupational health and safety management)
- DIN EN ISO 50001:2011 (Energy management)
- Federal Service for Environmental, Technological and Nuclear Supervision
- Central Interregional Territorial Administration on Supervision of Nuclear and Radiation Safety

DIN EN ISO 3834-2: The international series of standards DIN EN ISO 3834. specifies welding quality requirements, which are to be fulfilled by the manufacturers.

In addition, this series of standards regulates the basic principles of quality assurance for welded components and structures.

OBO Bettermann can certify that the welding quality requirements have been fulfilled according to DIN 3834-2.

During the production of our products, we use welding processes according to DIN EN ISO 4063.



Batch tracing

Flawless documentation as the basis for modern quality management

In the nuclear sector in particular, perfect traceability of the production and supply chains is essential. To ensure that you are always on the safe side, OBO can offer you flawless documentation of key components, production steps and processes. We compile this documentation individually according to your specifications.

Batch or component traceability is the basis of modern quality management and is thus essential. Even in the case of a call-back campaign, the significance of batch traceability can be seen clearly, as it allows the identification of faulty products before further use. The traceability of products can be guaranteed in various ways.

For example, through stamping, embossing or printing of individual characters, numbers and letters on the products. These individual markings then contain the numbers of the individual test certificates or approvals, for example.

No matter which variant you choose, the form you select is implemented accordingly by us during production. We are happy to advise you as to which technologies and codes best suit the products and applications you require. Simply get in touch with us.



Requirements for the portfolio



Separate storage for clear traceability



Raw materials are supplied with the corresponding plant certificates



Production processes are audited according to ISO 9001 (auditing according to ISO 19443 is in preparation)



The production batches of welded components or articles are tested before shipment



Batch traceability is possible, to react in cases of error

Here to help

OBO Support

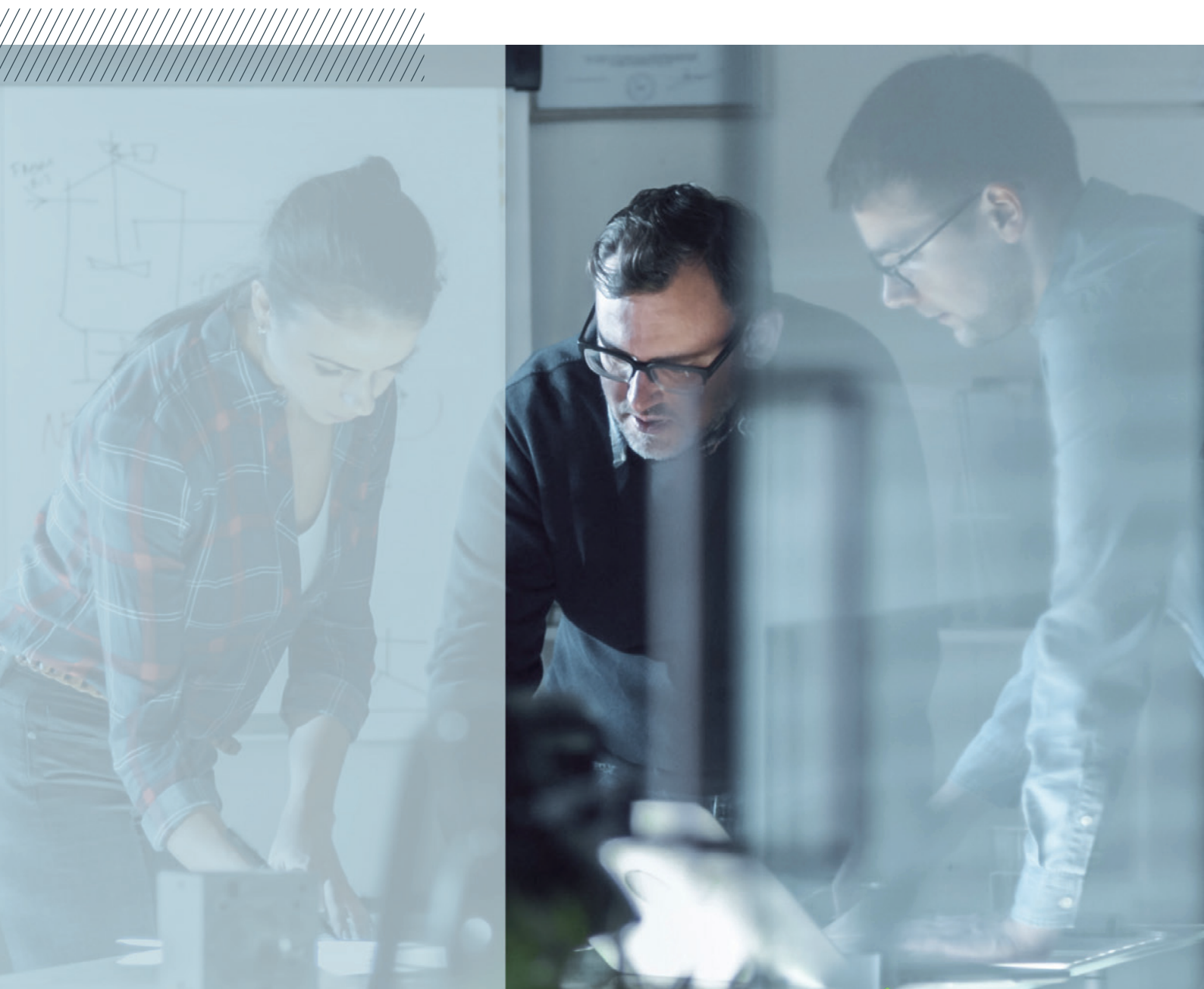
Do you have
a problem?
We have
the solution!

OBO Bettermann is more than the sum of its products. In every situation, we are the reliable partner at your side.

Do you have a problem? We have the solution! It doesn't matter in which area of industry our support is needed – from industrial and plant engineering to private, public and administrative buildings, as well as in the areas of mobility and renewable energies – we have everything you need.

OBO not only supplies the entire electrical infrastructure with the best possible products, but also supports you with well-founded technical knowledge and over a century of experience, also in the planning and implementation of your projects.

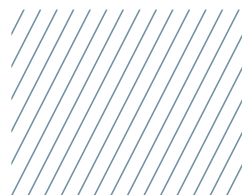
OBO – solutions you can rely on.





Industrial and general plant construction

Industry, switchgear cabinet construction, food industry, power stations, oil and gas



Renewable energies

Wind energy, photovoltaics, biogas

Building

Administration and offices, healthcare, private housing

Mobility

Ship construction, tunnel construction, airports and railway stations



Training



Service



Handling



Certification

Training courses from OBO

- Seminars and workshops
- Local consultation and training courses
- Planner days
- Webinars

Service – OBO can help

In every location and in every phase of a project.

- Highly competent hotline
- Product and system information, digitally or printed
- Selection and planning aids on the web, as an app, as a CAD application or in printed form
- 2D and 3D product data for planning
- Field service, branch offices and subsidiaries in 60 countries
- Engineering services for major projects

What is OBO Support?

Every OBO product carries a plus inside it, which only a branded product can offer. It is developed, manufactured and tested with a high level of competence, from the idea right through to the final check. In addition, our specialists are available for consultation and can offer you assistance and training courses for products at any time.

Together with you, we plan your project and help you choose the right products, and are also available to you at

Handling – OBO delivers reliably

With optimised delivery processes:

- Reliable logistics
- Practical transport systems and packaging
- Loading gear handling and disposal concepts

Certification and guarantee

OBO offers safety. Our products fulfil the most important country-specific regulations:

- Conformity (e.g. IEC, VDE, CE, KEMA, KEUR, UL)
- Certification (e.g. DIN EN, DGNB)
- 5-year guarantee for surge protection products
- Guarantee management

any time should you need us. From flawless logistics through to practical information – we can provide support at every level. We can offer security through certificates on the conformity of our products with the most important standards and directives.

We are as flexible as you are – because we know how practical people work and what is important to them. Each step is a plus – that is the OBO Support concept.

You can contact our Customer Service department on:

+49 (0)2373 89-2000

Monday–Thursday
07.30–17.00

Friday
07.30–15.00

info@obo.de



First consultation, concrete question or wide-ranging problem:

Via OBO's Customer Service, you can reach a direct contact who can help you in any matter. Our technically qualified Customer Service is in constant contact with our product managers and developers and can offer rapid help with practical solutions.

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Building Connections

