Earthing · Lightning protection · Overvoltage protection

Deep earthing system with copper electrodes

corrosion-resistant · flexible · cost-effective

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certificated management system
ISO 9001
SQS reg. no. 10946

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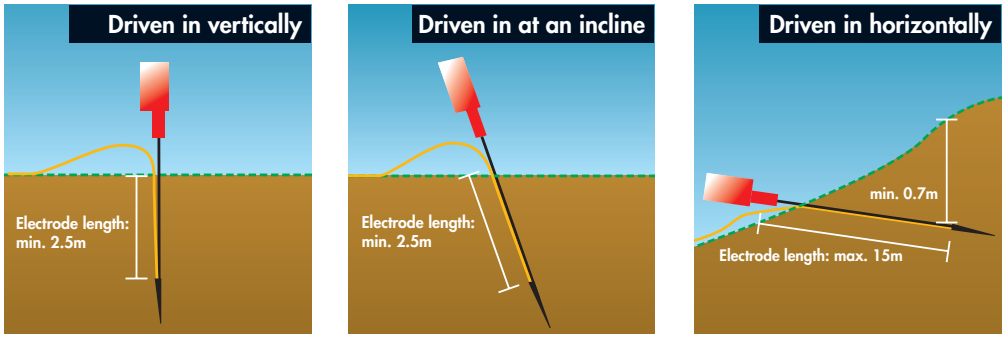
Deep earthing system • The system of your choice

The principle

The technical and economic advantage of this deep earthing system is that the driving pipe assembly (made of steel) and the earthing electrode (made of copper) are separate. This enables the deep earthing system to meet every conceivable requirement; it conforms to the standards and can also be used in any driving direction without risk of breakage.



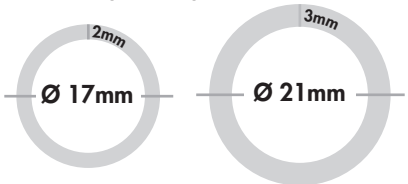
1 The earthing electrode

Special copper cable 50mm², stranded plain, with single wire Ø 3mm

2 The driving pipe assembly

Tip of the driving head made of hardened steel, guide pipe and extension pipe made of steel

Two strength categories



3 The shaft / adpator set

Insert for mechanical driving

4 The impact head

Impact head for manual driving

Copper electrodes offer these benefits

- total resistance against corrosion, ensuring uniform earth contact resistance throughout the entire lifetime of the installation
- optimal electrical conductivity and mechanical strength
- continuous electrode to connection points
- allows connection to other earthing systems (such as foundation earthing)

The driving pipe assembly offers these benefits

- choice of two pipe assemblies: standard (Ø 17 mm) and reinforced (Ø 21 mm). The soil quality and the driving tool are the decising factors when making your choice
- the pipe assembly can be extended as required
- fast, easy driving is possible with all commonly used chisel hammers, and also manually
- working height is always ideal (10 – 110cm above the ground)
- the last extension pipe can be withdrawn and used again
- the steel pipe assembly has a protective effect as a sacrificial anode

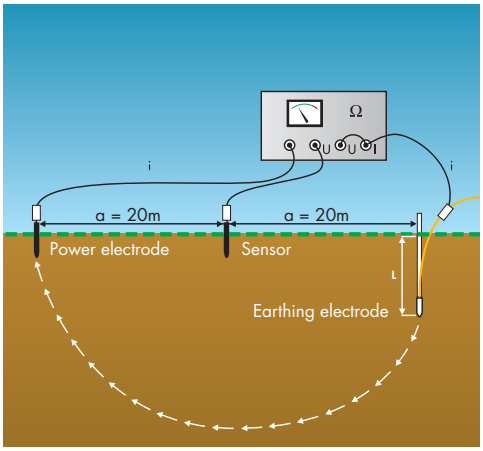
The deep earthing system connection with copper electrode can be used as …

… a single earth
Structures such as masts, antennas, chimneys, towers, transformer stations and electrical housings, etc. call for high-performance earthing that meets the requirements for electrical engineering and lightning protection technology. The deep earthing system is ideal for this purpose, as well as for subsequently installation for existing small houses.

… an additional or replacement earth
The deep earthing system can easily complement or replace inadequate earth connections such as water pipes (old ones made of cast iron or new ones made of plastic), old and corroded earthing on existing structures or concrete earth connections that are too small.

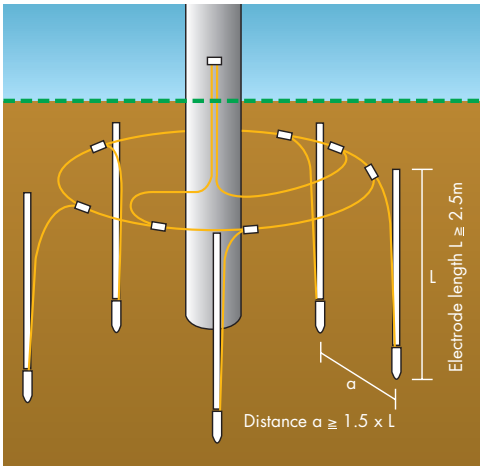
… a compensating earth connection
The deep earthing system with the copper electrode is ideal for compensating missing sections of copper earthing rings in line with the lightning protection standard SEV SN 4022:2004 (earthing ring length to be compensated divided by two = total length of deep earthing system electrode).

Measure the earth wire contact resistance!
Target value ≦ 10 Ohm. This allows you to decide when driving should be finished, or when to connect a second deep earthing electrode in parallel – so you can cut your expenditure of time and materials.



Parallel connection halves the earth wire contact resistance
Connecting several deep earthing electrodes in parallel will reduce the earth wire contact resistance by factor k, as shown in the table. Distance a ≧ 1.5 x electrode length must be kept to the minimum. For this reason, it is generally more cost-effective to use several electrodes in parallel instead of one long one.
The elecotrode length must always be at least 2.5m.

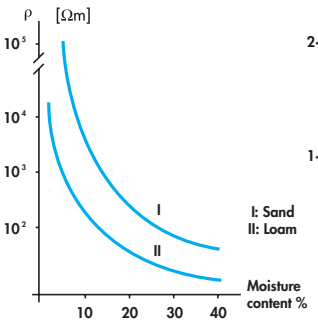
Number of parallel electrodes	Factor k
2	0.60
3	0.40
5	0.25
10	0.13



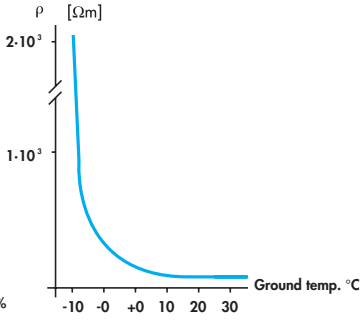
What basic factors determine the earth contact resistance?

The quality of the ground (or the specific resistance of the soil), the soil moisture and its temperature are the key defining factors for the earth contact resistance that can be attained.
Below a depth of 70cm, the temperature and moisture values are relatively constant. It follows that a soil with a low specific resistance (such as humus or loam) is decisive.

Specific resistance	
Humus	approx. 50 Ωm
Loam	approx. 50 Ωm
Sand	approx. 100 Ωm
Gravel	approx. 160 Ωm
Moraine	approx. 1000 Ωm



Specific resistance in relation to the moisture content



Specific resistance in relation to the temperature

Corrosion in the ground and in connection with other earthing systems

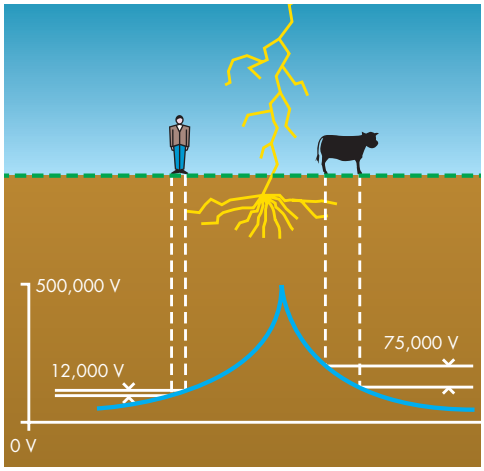
Moist soil acts as an excellent electrolyte, which means that it encourages severe corrosion of metal systems that are laid underground. As a noble metal, copper is resistant to this corrosion. Plain, galvanized or copper-plated iron components corrode and decompose. This is why various standards specify that only plain copper may be used for earth connections laid underground (earthing rings, deep earth connections and radiation-type earth connections). A copper earth is also electro-chemically neutral, as opposed to a foundation earth (steel in concrete).
As a result, no harmful corrosion can occur with this frequent combination of earthing systems.

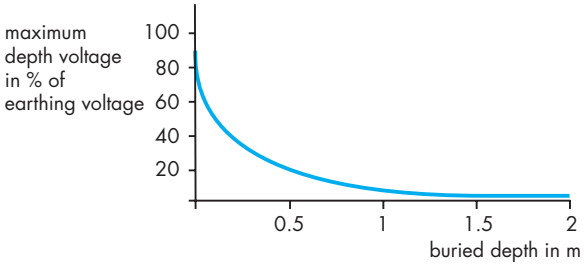
Copper cable as an earthing electrode

The special 50mm² copper cable (single wire ∅ 3mm) ideally satisfies every conceivable requirement for an earthing electrode. As a material, copper is resistant to corrosion and it has optimal electrical properties. The flexible cable also has the strength needed to withstand high mechanical loads without any damage.

How an deep earthing system electrode influences the step voltage

The greater the depth at which an earthing electrode is buried, the lower the step voltage will be on surface. This is the reason why deep earthing systems have such optimal characteristics.





Maximum step voltage in relation to buried depth for a straight strip-type earth connection (measured transversely to the earth).

1 **Did you make sure that there are no electrical cables, pipe systems or underground structures in the area where you want to drive in the deep earthing system?**

2 **Choose the correct driving pipe assembly**

Soil quality	Driving tool	Thickness of driving pipe assembly
normally grown, filled / back-filled	normal commercial chisel hammer	Ø 17mm
hard, stony	normal commercial chisel hammer	Ø 17mm or Ø 21mm
hard, stony, compacted	heavy chisel or percussion hammer	Ø 21mm

3 **First,** push the special copper cable, 50mm² (electrode) fully into the driving head and place it against the mouth.

4 **Then,** push the guide pipe with the notch against the copper cable into the driving head. Drive the guide pipe into the head with a hammer stroke so as to clamp the cable properly.

5 Position the guide pipe with the head and copper cable (electrode) at the location you want. Position the chisel hammer with the correct hammer insert, align it with the guide pipe, and drive it in.

6 Position the extension pipe and drive in a minimal electrode length of 2.5m. **Make sure that the copper cable (electrode) is carried along and drawn in without obstruction.**

7 Measure the earth contact resistance on the copper cable (electrode). You should aim for a value of ≦ 10 Ohm. (You must remove the chisel hammer from the pipe assembly to measure!)

8 Decide whether the same earth electrode should be driven in further, or whether a second earth electrode at the required minimum distance (1.5 x electrode length) would be better.

9 Withdraw the last extension pipe with the extraction tool and use it for the next deep earth connection.

10 An earthing measurement record should be compiled for each object. The electrode length and its earth wire circuit resistance should be recorded for each deep earth.

Article	Description	Article number	Selling unit	Type	E-number
	**Copper earthing electrode** Special stranded plain copper cable, 50mm², single wire Ø 3mm (20kg = approx. 44m / 1kg = approx. 2.2m)	265.017.552	20 kg	LR3	156 990 620
	**Driving head** made of plain hardened steel, a) standard version Ø 17mm b) reinforced version Ø 21mm	 261.002.020 261.034.000	 5 5	 TE1	 156 980 100 156 980 110
	**Guide pipe** made of plain mild steel, length 100cm a) standard version Ø 17mm b) reinforced version Ø 21mm	 261.003.513 261.035.000	 5 5	 TE2	 156 980 000 156 980 020
	**Extension pipe** made of plain mild steel, length 100cm a) standard version Ø 17mm b) reinforced version Ø 21mm	 261.004.021 261.012.069	 5 5	 TE3	 156 980 010 156 980 030
	**Shaft / Adaptor Set** for mechanical driving with a chisel hammer a) for standard version Ø 17mm Shaft SDS-max adaptor incl. Shaft Hilti TE-S adaptor incl. b) for reinforced version Ø 21mm Shaft Hilti TE-S adaptor incl. Shaft SDS-max adaptor incl. Shaft Bosch 1 1/8" hexagone, adaptor incl.	 261.040.000 261.041.000 261.044.000 261.043.000 261.045.000	 1 1 1 1 1	 TE9 	 156 981 000 156 981 100 156 981 110 156 981 010 156 981 210
	**Adaptor** fits to all shaft / adaptor sets as supplement a) for standard version Ø 17mm b) for reinforced version Ø 21mm	 261.038.000 261.039.000	 1 1	 TE9 	 156 989 000 156 989 010
	**Impact head** for manual driving a) for standard version Ø 17mm b) for reinforced version Ø 21mm	 261.036.000 261.037.000	 1 1	 TE63 	 156 988 000 156 988 010
	**Extraction tool** Tool to withdraw the last extension pipe	261.016.000	1	TE41	156 980 930
	**Hand-held cable cutter, mechanical** For Cu/Al conductors up to 120 mm² Weight 650g, length 370mm	413.080.415	1	ZU5	983 043 069
	**Earthing measurement instrument set** Measuring instrument and accessories to measure the earth contact resistance	429.002.000	1	ZU1	980 800 109
	**Earth wire clamp** for stranded and solid copper wire bolts: Inox M8x35 for wires Ø 6–8 mm and cable 50mm²	275.027.114	25	AV6	156 001 090