

**Earthing Catalogue**



**Earthing & Equipotential Bonding Systems**

**THINK CONNECTED.**



## Earthing system for protective and functional purpose

The earthing arrangements for an electrical system is used for protective and functional purposes according to the requirements of electrical installation. Protective purposes shall always take precedence. Earthing arrangements are intended to provide a connection to earth, which is

- a) Reliable and suitable for the protection requirements of the installation.
- b) Can carry earth fault currents and protective conductor currents to earth without danger from thermal, thermo-mechanical and electromechanical stresses and from electric shock arising from the currents.
- c) If relevant, is also suitable for functional requirements.
- d) Suitable for the foreseeable external influences like mechanical stresses and corrosions.

Standard	Contents
IEC 62305- 3	Protection against lightning - Part 3 : Physical damage to structures and life hazard
IEC 60364-5-54	Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors
IEC 62561, Part 1 - 7	Lightning protection system components (LPSC) : requirements and testing methods.
IS 3043 : 1987	Code of practice for earthing
NEC SP30 : 2011	National Electrical Code by Bureau of Indian Standards
UL 467	Grounding and bonding equipment

Table 1 - List of standards describes Earthing system.

For lightning protection, a single integrated structure earth termination system is preferable, and is suitable for all purposes (i.e. lightning protection, power systems and tele-communication systems). This earth termination system shall be connected to the main equipotential bonding bar of the building. Earth termination systems are designed for the conduction of the lightning current into earth, equipotential bonding between the down conductors also the potential control in the vicinity of conductive building walls. When dealing with the dispersion of the lightning current of high frequency behavior into the ground, the shape and the dimension of the earth termination system are important. This is to minimize dangerous over voltage due to lightning. In general a low earthing resistance (if possible lower than 10 Ω when measured at low frequency) is recommended.

Generally Earthing arrangement is classified into two:

- 1) Type A Arrangement
- 2) Type B Arrangement

### Type A earthing arrangement

This type of arrangement comprises horizontal or vertical earth electrode connected to each down conductor. A deep driven vertical earth electrode helps to improve the earth resistance as the deeper layers of earth will be with less resistivity and stable. In this condition electrode resistance remains stable even if the top layers of ground dry out. In Type A arrangements, the total no of earth electrode shall be not less than two. The minimum length of the electrode shall be selected according to the class of LPS and soil resistivity. Lightning protection class III and IV are independent of soil resistivity. Type A earth termination system is suitable for low structure (eg: family homes), existing structures or an LPS with rods or stretched wires or for an Isolated LPS.

The minimum length (refer figure 1) of each earth electrode at the base of each down conductor is

- $\ell_1$  - For horizontal earth electrodes
- $0.5 \ell_1$  - For vertical electrodes.

For combined (vertical and horizontal) electrodes the total length shall be considered.

### Type B earthing arrangement

In type B arrangement, the ring electrodes should preferably buried at a depth of 0.5 m and at a distance of about 1m away and around the external walls of the building structure. The Type B earth termination system is preferred for meshed air termination system and for LPS with several down conductors. This type of arrangement comprises either a ring earth electrode external to the structure in contact with the soil for at least 80% of its total length or a foundation earth electrode. The structure foundation of interconnected steel reinforced concrete should be used as foundation earth electrodes. They exhibit, very low earthing resistance and perform in excellent equipotentialization reference.

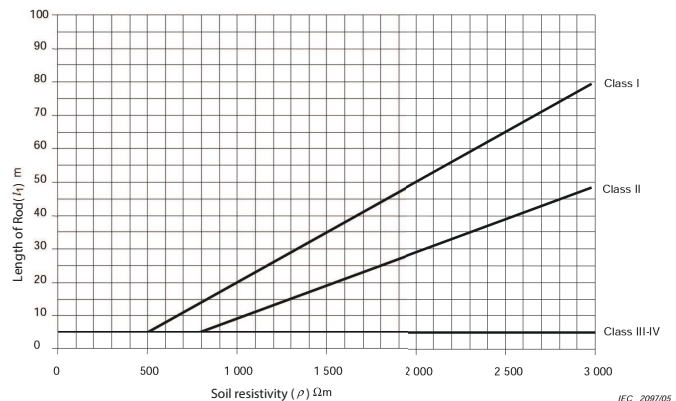


Fig 1 : Minimum length  $\ell_1$  of each earth electrode according to the class of LPS

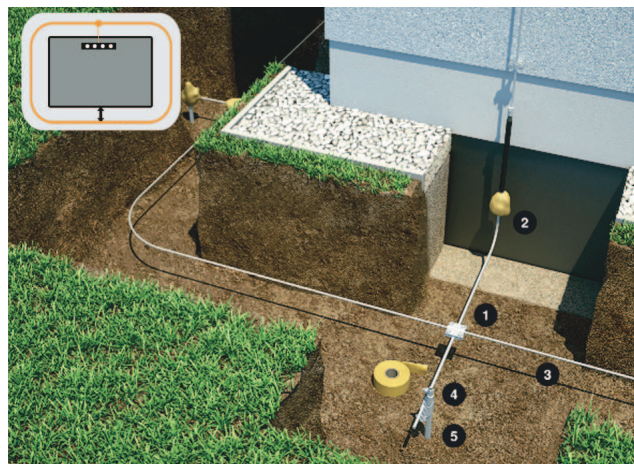


Fig 2 : Ring Earthing Installation

- 1- Cross Connectors
- 2- Flat Conductors
- 3- Round Conductors
- 4- Corrosion Protection Strip
- 5- Earth Entry Rod

Material and Surface	Shape	Diameter(mm)	Cross Sectional area (mm <sup>2</sup> )	Thickness(mm)	Weight of coating (g/m <sup>2</sup> )	Thickness of coating/sheathing (µm)
Steel embedded in concrete (bare, hot galvanized or stainless)	Round Wire	10				
	Sold Tape or Strip		75	3		
Steel hot-dip galvanized <sup>c</sup>	Strip <sup>b</sup> or shaped strip/ plate - Solid plate Lattice Plate		90	3	500	63
	Round Rod installed vertically	16			350	45
	Round wire installed horizontally	10			350	45
	Pipe	25		2	350	45
	Stranded (embedded in concrete)			70		
	Cross profile installed vertically		(290)	3		
Steel copper sheathed	Round rod installed vertically	(15)				2000
Steel with electro deposited copper coating	Round rod installed vertically	14				250 <sup>e</sup>
	Round rod installed horizontally	(8)				70
	Strip installed horizontally		90	3		70
Stainless Steel <sup>a</sup>	Strip <sup>b</sup> or shaped strip/plate		90	3		
	Round rod installed vertically	16				
	Round wire installed horizontally	10				
	Pipe	25				
Copper	Strip		50	2		
	Round wire installed horizontally		(25) <sup>d</sup> 50			
	Solid round rod installed vertically	(12) 15				
	Stranded wire	1.7 for individual strands of wire	(25) <sup>d</sup> 50			
	Pipe	20		2		
	Solid plate			(1.5) 2		
	Lattice late			2		

NOTE : Values in brackets are applicable for protection against electric shock only, while values not in brackets are applicable for lightning protection and for protection against electric shock.

a) Chromium ≥ 16 %, Nickel ≥ 5 %, Molybdenum ≥ 2 %, Carbon ≤ 0,08 %.

b) As rolled strip or slit strip with rounded edges.

c) The coating shall be smooth, continuous and free from flux stains.

d) Where experience shows that the risk of corrosion and mechanical damage is extremely low, 16 mm<sup>2</sup> can be used.

e) This thickness is provided to withstand mechanical damage of copper coating during the installation process. It may be reduced to not less than 100 microns where special precautions to avoid mechanical damage of copper during the installation process (e.g. drilled holes or special protective tips) are taken according to the manufacturer's instructions.

Table 2 : Minimum size of commonly used earth electrodes, embedded in soil or concrete used to prevent corrosion and provide mechanical strength.

## Resistance to Earth

The earthing resistance of an electrode in earth is made up of :

- Soil resistivity : Resistance of the soil from the electrode surface outward in the geometry setup for the flow of current outward from the electrode to infinite earth.
- contact resistance between the electrode and the soil.
- resistance of the electrode.

The last two factors are very small fraction of an ohm and can be rejected for all practical purposes. But the factor soil resistivity plays a major role in deciding the earth resistance value. Following factors determines the soil resistivity.

- Type of soil.
- Moisture content of the soil.
- Temperature of soil

Generally earth electrode of steel with electro deposited copper coating(copper bonded steel) is preferred due to its corrosion withstand behavior as well as mechanical strength to drive deep into the earth. Aluminium conductors shall not be used as earthing conductors in ground. As per NEC:SP 30-2011, usage of copper bonded steel wire of min 8mm below the ground ensures long life against corrosion.

The connection of an earthing conductor to an earth electrode shall be soundly made and electrically satisfactory. The connection shall be exothermic welding , pressure connectors, clamps or other suitable mechanical connectors.

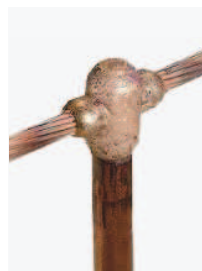


Fig 3a: Exothermic Welding



Fig 3b: Copper bonded earth electrode



Fig 3c: Clamp

## Artificial treatment of soil

Multiple electrodes even in large number, may some time fail to produce an adequately low resistance to earth. This condition arises in installations involving soil of high resistivity. The alternative is to reduce the resistivity of the soil, immediately surrounding the earthing electrode. Earth enhancing compound shall be so designed and constructed that in normal use, their performance is reliable and without danger to person and surrounding. The material of earth enhancing compound shall be chemically inert to the subsoil and shall not pollute the environment. It shall provide stable environment in terms of physical and chemical properties and exhibit low resistivity. The earth enhancing compound shall not be corrosive to the earth electrodes being used . Earth enhancing compounds shall be tested according to the requirements of IEC 62561-7.

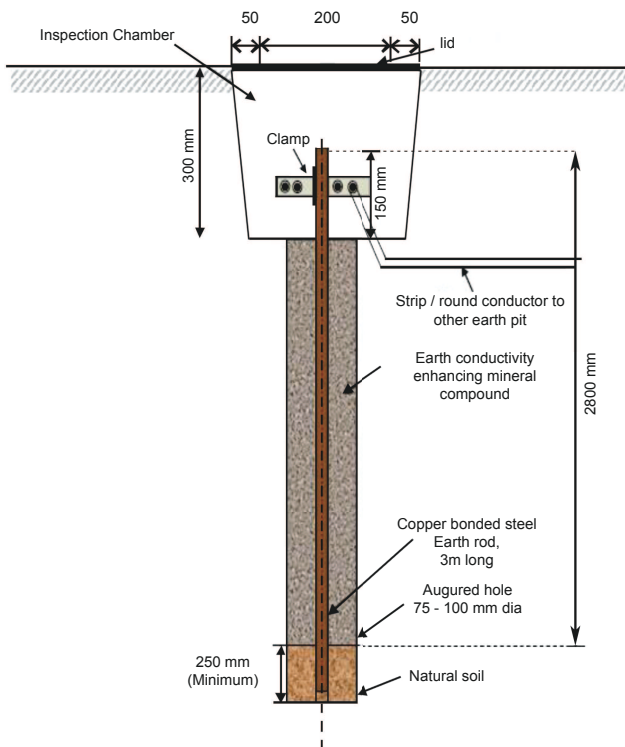


Fig 4 : Typical installation drawing of vertical electrode

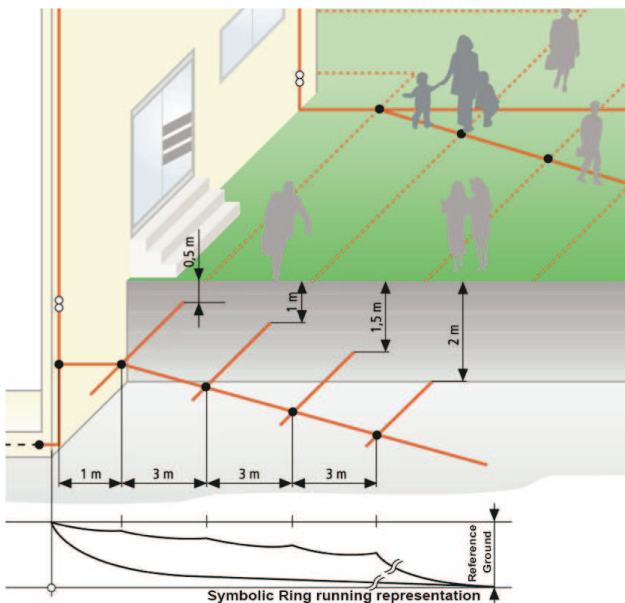


Fig 5 : Ring Earthing system

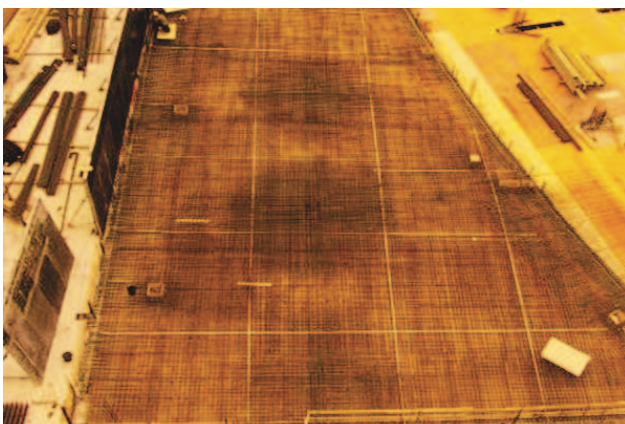


Fig 6 : Foundation Earthing

### Foundation Earth Electrodes

A foundation earth electrode comprises of conductors which are installed in the foundation of the structure. In Rock soil, a foundation earth electrode built into the concrete foundation is found useful and practically helps. This will act as an equipotential bonding conductor. In Industrial plants, a low earth impedance can be achieved by providing the structure with foundation earth electrodes and additional type B and type A earthing arrangement. The earth termination systems of such structures are very important for the protection of the electrical system. Down conductors or internal structural part used as down conductors, should be connected to an earth electrode and the reinforcement steel of the floor to avoid step and touch voltages. By inter connecting earth of nearby structures, a mesh earthing system is obtained, which is helpful in reducing step potential, there by increases the safety of people outside the building during lightning.

### Natural Earth Electrode

Interconnected reinforcing steel in concrete foundations or other suitable metal structures should preferably be used as an earth electrode. When the metallic reinforcement in concrete is used as an earth electrode, special care shall be exercised at the interconnections to prevent mechanical splitting of the concrete. An Industrial plant typically comprises of a number of associated structures, between which a large number of power and signal cables are installed. The earth terminations systems of such structures are very important for the protection of the electrical and electronic systems. A low impedance earth system reduces the potential difference between the structures and so reduces the interference injected into the electrical and electronic system. The reinforcing rods of the foundation, foundation slab and outer walls in the region below the soil surface of such structures form an excellent foundation earth electrode. The magnetic field generated by the current in the reinforcing steel mesh is weak due to the low current density and the parallel current paths opposing electromagnetic fields. Also, interference with neighboring internal electrical conductors is correspondingly reduced.

In addition the equipotential bonding bar connected to the steel reinforcement of the structure offers good potential references to the electric power supply, telecommunication and electronic installations of the structure.

For connecting metallic equipments / body earthing to the steel reinforcement, special corrosion resistant connectors need to be used. These connectors shall be installed in suitable location while casting the concrete. In order to reduce the step potential outside the building as well as to get low impedance and EMC advantages mesh / ring extended outside the building is helpful. In this case the size of the mesh near to the building shall be in the order of 20 x 20m. Beyond a 30m distance from the building they may be enlarged to the order of 40 x 40m



Fig 7 : Interconnection of reinforcement to be used as down conductor

## Vertical earthing system



### Copper coated earth rod (unthreaded)

Type	Length (L) mm	Outer Dia mm	Pack. pcs	Weight kg	Price
14 1250 CCER	1250	14.2	1	1.585	
14 2500 CCER *	2500	14.2	1	3.17	
14 3000 CCER *	3000	14.2	1	3.885	
17 2500 CCER *	2500	17.2	1	4.700	
17 3000 CCER *	3000	17.2	1	5.760	
18 2500 CCER *	2500	18	1	5.285	
18 3000 CCER *	3000	18	1	6.480	
20 3000 CCER	3000	20	1	8.140	
25 3000 CCER	3000	25	1	12.500	

- Copper bonded low carbon steel electrode, copper coating 250 microns.
- Tested as per IEC 62561 - 2.
- Meets the requirements of IS 3043 and IEC 60364 - 5 - 54.
- Tested for short circuit current withstanding capacity.

\* UL listed earth electrode



### Copper coated earth rod (self coupled)

Type	Length (L) mm	Outer Dia mm	Pack. pcs	Weight kg	Price
219 20 CU	1000	20	1	4.000	
219 25 CU	1000	25	1	6.175	

- Copper bonded low carbon steel electrode, copper coating 250 microns.
- Highly Resistant to Corrosion.
- High Tensile Strength.
- Self coupling Bore & Peg arrangement.



### Impact point for earth rod

Type	For Deep Earthers mm	Pack. pcs	Weight kg	Price
219 20 IP	20	1	0.350	
219 25 IP	25	1	0.350	

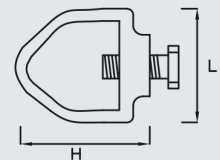


### Accessories

#### Rod to tape clamp

Type	Dia of Rod mm	Dimension of Tape	Pack. pcs	Weight kg	Price
14 25 RT	14.2	25 x 3	1	0.110	
17 25 RT	17.2	25 x 3	1	0.110	
14 30 RT	14.2	30 x 3	1	0.115	
17 30 RT	17.2	30 x 3	1	0.115	

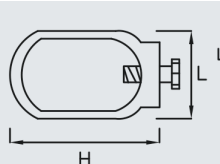
- Material - Copper Alloy



#### Rod to cable clamp

Type	Dia of Rod mm	Dimension of Cable Sq. mm	Pack. pcs	Weight kg	Price
14 95 RC *	14.2	95	1	0.050	
17 95 RC *	17.2	95	1	0.050	

- Material - Copper Alloy \*UL listed

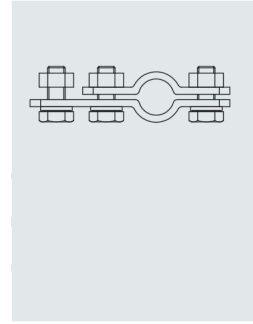




### Rod to tape / cable clamp

Type	Rod Dia mm	Pack. pcs	Weight kg	Price
14 25 RTC	14.2	1		
17 25 RTC	17.2	1		
18 25 RTC	18	1		
20 25 RTC	20	1		
25 25 RTC	25	1		
2730 20 VA	20	1		
2730 25 VA	25	1		

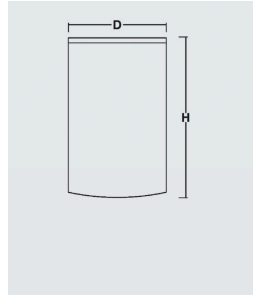
• Stainless Steel



### PROCEM - Earth conductivity enhancing mineral compound

Type	Pack. pcs	Weight kg	Price
PROCEM ECS PB 5	1	5	
PROCEM ECS PB 12.5	1	12.5	
PROCEM ECS GB 12.5	1	12.5	
PROCEM ECS GB 25	1	25	
PROCEM ECS GB 30	1	30	

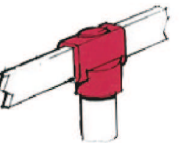
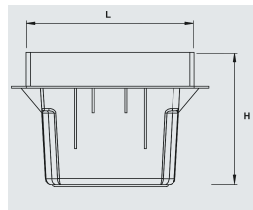
• To be used as a backfill compound for Earth Electrodes  
 • Highly conductive in all weather conditions. Tested according to IEC 62561 - 7.



### Under floor earth inspection pit

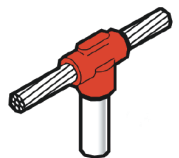
Type	Length (L) mm	Height (H)mm	Pack. pcs	Weight kg	Price
UFE	170	190	1		

• Lockable lid with more working area.  
 • Chemical resistant.



### Exothermic welding \*

Connections detail	Cat. no of exothermic welding	Weld metal Powder	Mould to be used
Cu bonded earth electrode with Cu bus bar 150x25x6mm	PLP-TV series	C-200	PLP-TV 190/25X6



Connections detail	Cat. no of exothermic welding	Weld metal Powder	Mould to be used
Cu bonded earth electrode with 35 sq mm Cu cable	CP-T series	C-65	CPT 90/135

\* Exothermic welding confirming to IEEE Std 837 - 2002

### PROCEM (ECEMC) filling calculation

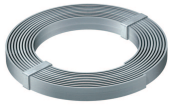
S.No	Dia. Of Augur hole (mm)	Qty of PROCESM in KG as per Depth of hole (m)					
		D = 1.10m	D = 2.35m	D = 2.85m	D = 3.85m	D = 4.85m	D = 5.85m
1	75	5	10	15	20	22.5	30
2	100	10	20	25	35	40	50

Table : 3

#### Installation Method :

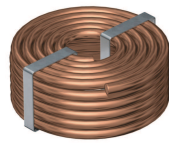
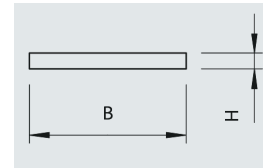
- 1) Auger a hole of min 75mm or larger diameter to a depth of approximately 15 cm shorter than the length of the electrode. Place the electrode into the augured hole and drive 25cm into the bottom of the hole.
- 2) Earth Conductivity enhancing compound shall be mixed in the ratio 1:1 with water in a slurry form.
- 3) Pour the required amount of slurry formed earth conductivity enhancing compound around the electrode and wait for 1 hour and then fill it with soil removed during auguring.

## Foundation earthing and equipotential bonding systems



Galvanized steel flat conductor for earth

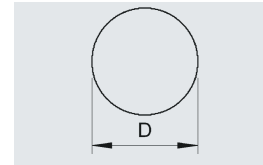
Type	Dimension mm	Cross section mm <sup>2</sup>	Normal Ring ca.m	Weight kg /100mt	Price
5052 DIN 30 x 3	30 x 3	90	71	70.650	
5052 DIN 25 x 3	25 x 3	75	84	59.700	



Copper bonded round conductor

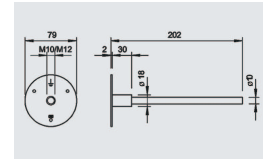
Type	Dimension mm	Cross section mm <sup>2</sup>	Normal Ring ca.m	Weight kg /100mt	Price
8CC RC	8	50			
10CC RC	10	78			

• Copper bonded low carbon steel conductor, copper coating 250 microns.



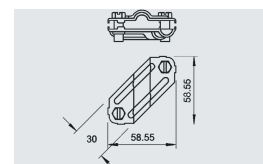
Earth fixed point for interconnection of protective conductor to steel reinforcement

Type	Thread	Pack pcs	Weight kg /100 pcs	Price
205 B-M10 VA	M10	25	25.50	
205 B-M12 VA	M12	25	25.50	



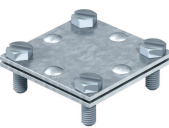
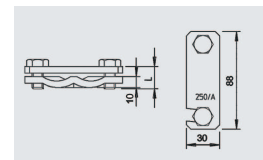
Cross connector for earth fixed point

Type	Fit mm	Pack pcs	Weight kg /100 pcs	Price
250	Rd 8-10/FL 30	25	10.26	



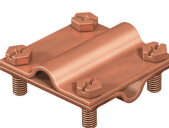
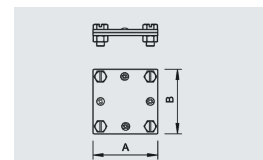
Diagonal clamp to connect flat with steel reinforcement

Type	Dimension mm	Fit mm	Pack pcs	Weight kg /100 pcs	Price
250 A - FT	40	Rd 6-22/max. FL50	25	28.8	



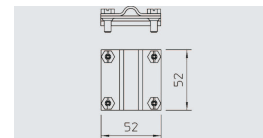
Cross connector for flat conductor

Type	Dimension mm	Fit mm	Pack pcs	Weight kg /100 pcs	Price
255 A - FL30 FT	60 x 60	max. FL30	20	11.5	



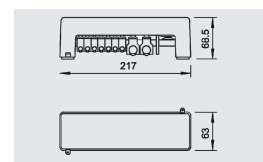
Cross connector for round conductor

Type	Fit	Pack pcs	Weight kg /100 pcs	Price
251 CU	Rd 8- 10	25	12.400	



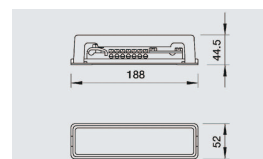
Equipotential bonding rail for indoors, VDE

Type	Color	Pack pcs	Weight kg /100 pcs	Price
1801 VDE	Grey	1	55.00	



Equipotential bonding rail for outside installation

Type	Color	Pack pcs	Weight kg /100 pcs	Price
1809 A	Black	1	23.00	



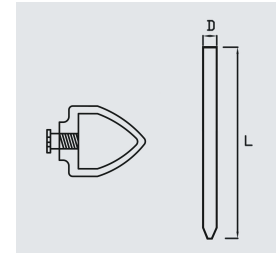


## Earthing kit



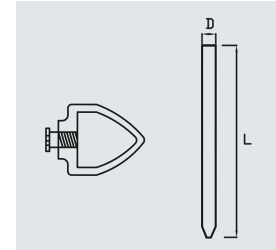
Type	Length (L) mm	Dia of rod (D) mm	Pack Pcs	Weight Kg	Price
OBO EK -12103	1250	12	1	5	

- Copper bonded low carbon steel electrode with connector and 3Kg earth conductivity enhancing mineral compound tested as per IEC 62561 - 7.
- Copper coating - 100 microns. Recommended for installation in augured hole.
- High resistance to corrosion and high tensile strength.



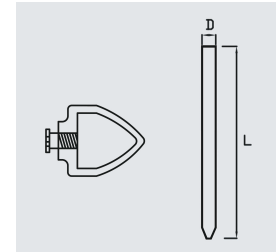
Type	Length (L) mm	Dia of rod (D) mm	Pack Pcs	Weight Kg	Price
OBO EK -14105	1250	14.2	1	7	

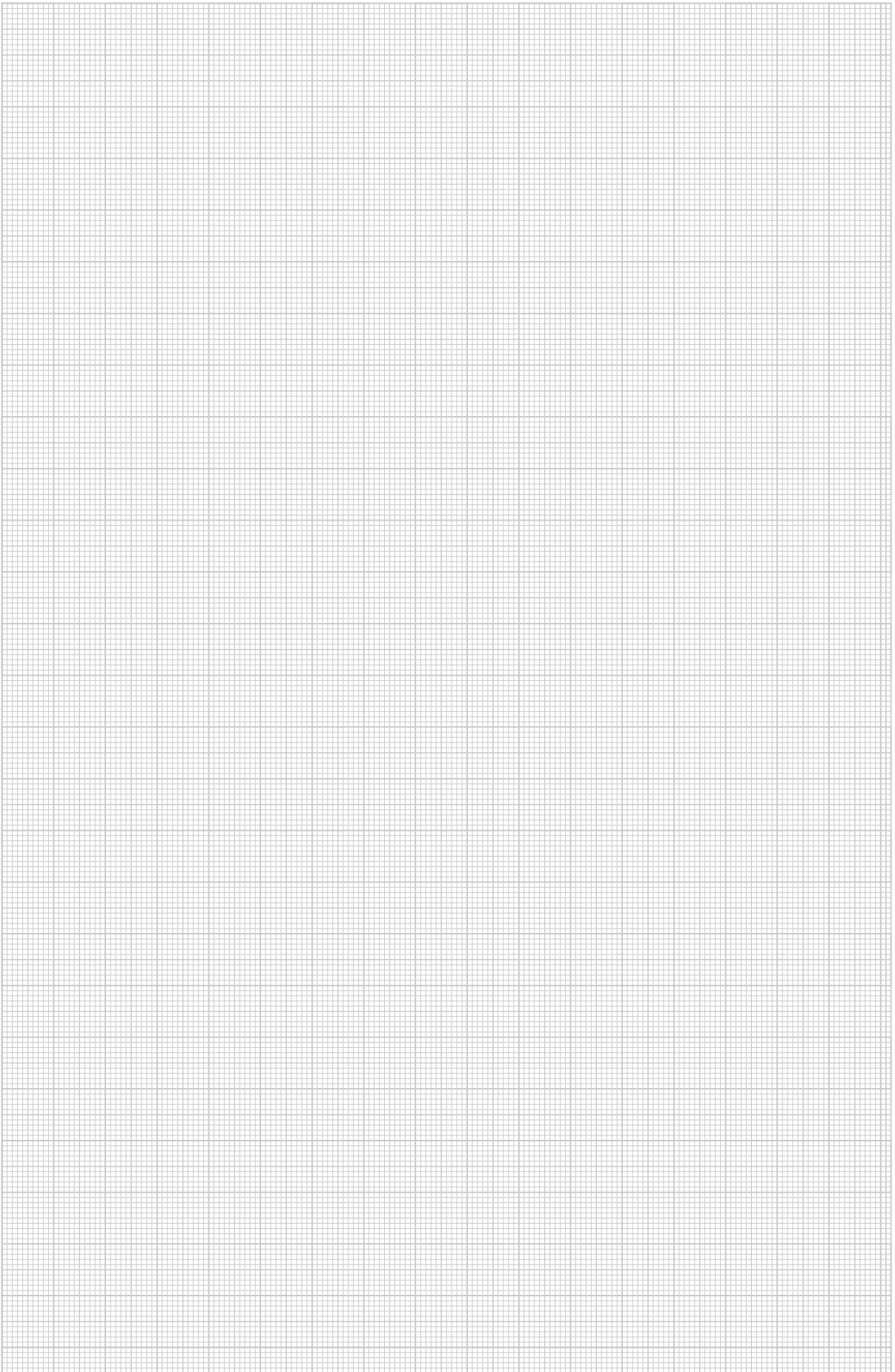
- Copper bonded low carbon steel electrode complies to IS 3043 with connector and 5Kg earth conductivity enhancing mineral compound tested as per IEC 62561 - 7
- Copper coating - 100 microns. Recommended for installation in augured hole.
- High resistance to corrosion and high tensile strength.

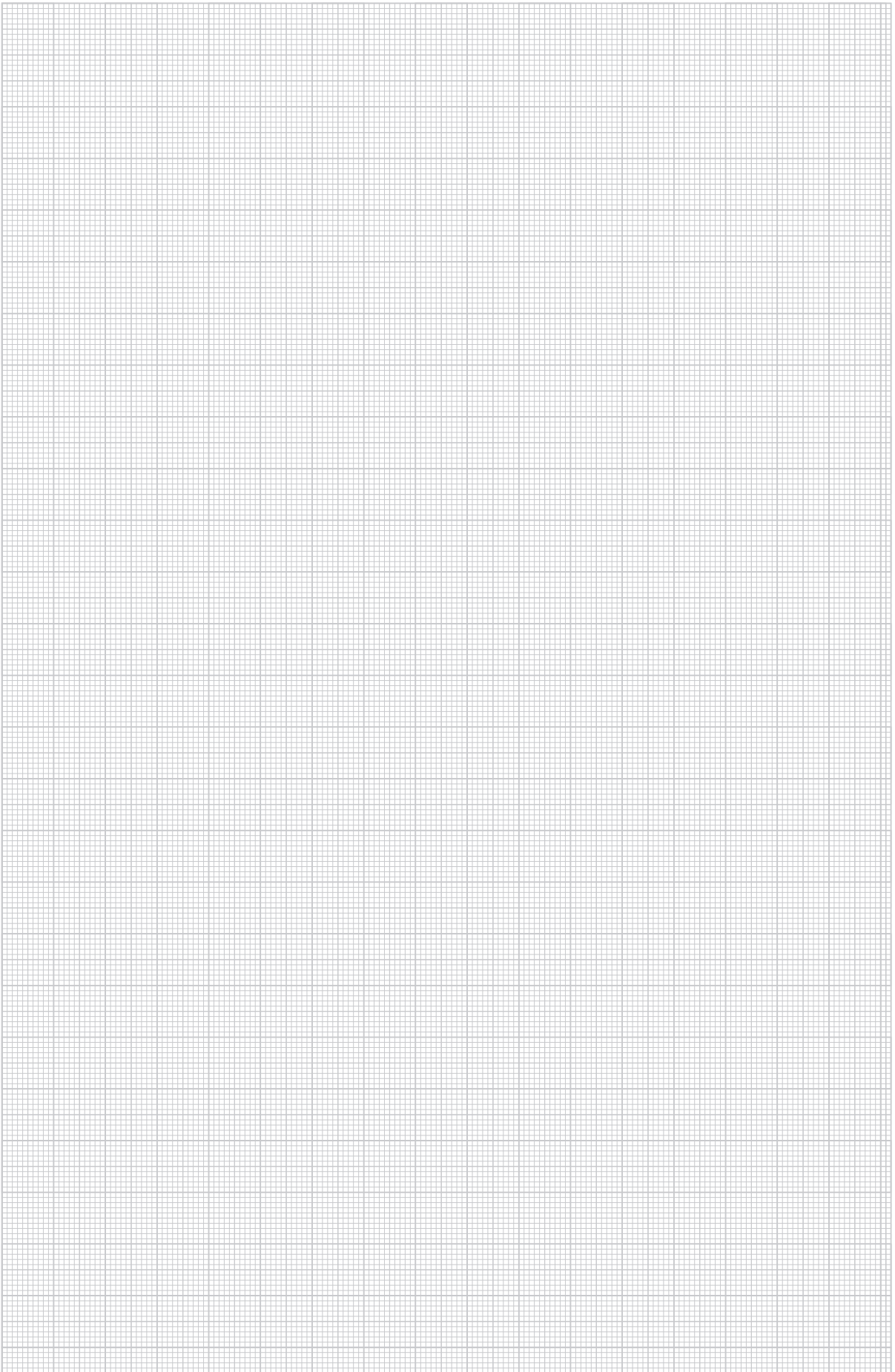


Type	Length (L) mm	Dia of rod (D) mm	Pack Pcs	Weight Kg	Price
OBO EK -14255	1250	14.2	1	7	

- Copper bonded low carbon steel electrode complies to IS 3043 and tested as per IEC 62561 - 2 with connector and 5Kg earth conductivity enhancing mineral compound tested as per IEC 62561 - 7
- Copper coating - 250 microns. Recommended for installation by hammering method as well as in augured hole.
- High resistance to corrosion and high tensile strength.







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