

# Equipotential Bonding For Metal Installations

Edvard



## Design of the earth-termination system for equipotential bonding

The electrical low voltage consumer's installation requiring certain earthing resistances (*disconnection conditions of the protective elements*) and the foundation earth electrode providing good earthing resistances at cost-effective installation, the foundation earth electrode is an optimal and effective complement of the **equipotential bonding**.

The design of a foundation earth electrode is governed in **Germany by DIN 18014**, which, for example requires terminal lugs for the earthing busbar. If a foundation earth electrode is used as lightning protection earth electrode, additional requirements may have to be considered.

Equipotential bonding conductors (*in future: protective bonding conductors*) Equipotential bonding conductors should, as long as they fulfil a protective function, be labelled the same as protective conductors, i.e. green/yellow.

Equipotential bonding conductors do not carry operating currents and can therefore be either bare or insulated.

The decisive factor for the design of the main equipotential bonding conductors in accordance with **IEC 60364-5-54** and HD 60364-5-54 is the cross section of the main protective conductor. The main protective conductor is the one coming from the source of current or from the service entrance box or the main distribution board.

**Table 1 – Cross sections for equipotential bonding conductors**

	Main equipotential bonding	Supplementary equipotential bonding	
<b>Normal</b>	0.5 x cross section of the largest protective conductor of the installation	between two bodies	1 x cross section of the smaller protective conductor
		between a body and an extraneous conductive part	0.5 x cross section of the protective conductor
<b>Minimum</b>	6 mm <sup>2</sup>	with mechanical protection	2.5 mm <sup>2</sup> Cu or equivalent conductivity
		without mechanical protection	4 mm <sup>2</sup> Cu or equivalent conductivity
<b>Possible limit</b>	25 mm <sup>2</sup> Cu or equivalent conductivity	-	-

**In any case, the minimum cross section of the main equipotential bonding conductor is at least 6 mm<sup>2</sup> Cu.** 25 mm<sup>2</sup> Cu has been defined as a possible maximum. The supplementary equipotential bonding ( *Table 1* ) must have a minimum cross section of 2.5 mm<sup>2</sup> Cu for a protected installation, and 4 mm<sup>2</sup> Cu for an unprotected installation.

For earth conductors of antennas ( *according to IEC 60728-11 (EN 60728-11)* ), the minimum cross section is **16mm<sup>2</sup> Cu, 25 mm<sup>2</sup> Al or 50 mm<sup>2</sup> steel.**

## Equipotential bonding bars

Equipotential bonding bars are a central component of equipotential bonding which must clamp all the connecting conductors and cross sections occurring in practice to have high contact stability; it must be able to carry current safely and have sufficient corrosion resistance.

**DIN VDE 0618-1: 1989-08** ( *German standard* ) contains details of the requirements on equipotential bonding bars for the [main equipotential bonding](#).

**It defines the following connection possibilities as a minimum:**

- 1 x flat conductor 4 x 30 mm or round conductor Ø 10 mm
- 1 x 50 mm<sup>2</sup>
- 6 x 6 mm<sup>2</sup> to 25 mm<sup>2</sup>
- 1 x 2.5 mm<sup>2</sup> to 6 mm<sup>2</sup>

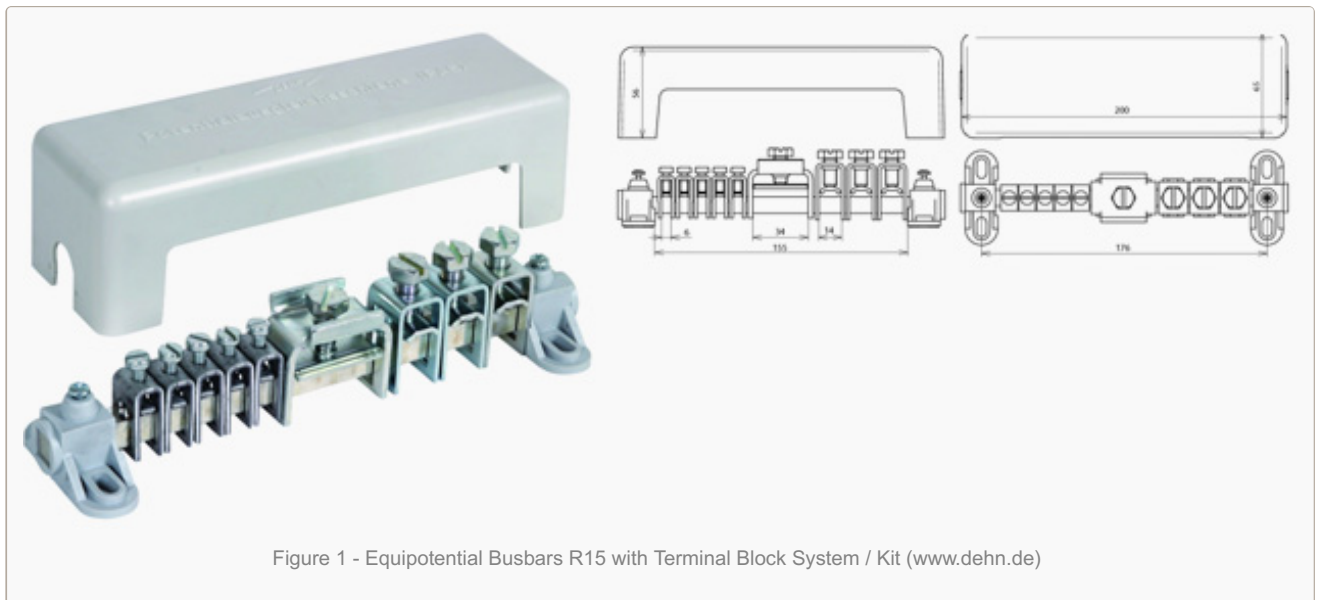
These requirements on an **equipotential bonding bar** are met by type K12 ( *Figure 1* ).

This standard also includes the requirements for the inspection of clamping units of cross sections above 16 mm<sup>2</sup> with regard to the lightning current ampacity. Reference is made therein to the testing of the lightning protection units in accordance with **EN 50164-1**.

If the requirements in the previously mentioned standard are met, then this component can also be used for lightning equipotential bonding in accordance with **IEC 62305-1 to 4 (EN 62305-1 to 4)**.

## Terminals for equipotential bonding

**Terminals for equipotential bonding must provide a good and permanent contact.**



Integrating  
pipes into  
the



equipotential bonding In order to integrate pipes into the equipotential bonding, earthing pipe clamps corresponding to the diameters of the pipes are used (**Figure 2, left and middle picture**).

Pipe earthing clamps made of stainless steel, which can be universally adapted to the diameter of the pipe, offer enormous advantages for mounting (**Figure 2, right picture**). These pipe earthing clamps can be used to clamp pipes that are made of different materials (e.g. steel, copper and stainless steel).

These components allow also a straight-through connection. **Figure 3** shows equipotential bonding of heating pipes with straight-through connections.

## Test and inspection of the equipotential bonding

Before commissioning the electrical consumer's installation, the connections must be inspected to ensure their faultless condition and effectiveness.

A low-impedance conductance to the various parts of the installation and to the equipotential bonding is recommended. A guide value of  $< 1 \Omega$  for the connections at equipotential bonding is considered to be sufficient.

## Supplementary equipotential bonding

If the disconnection conditions of the respective system configuration can not be met for an installation or a part of it, a supplementary local equipotential bonding is required. The reason behind is to interconnect all

simultaneously accessible parts as well as the stationary operating equipment and also extraneous conductive parts.

The aim is to keep any touch voltage which may occur **as low as possible**.

Moreover, the supplementary equipotential bonding must be used for installations or parts of installations of IT systems with insulation monitoring.

The supplementary equipotential bonding is also required if the environmental conditions in special installations or parts of installations mean a particular risk. The [IEC 60364 series Part 7](#) draws attention to the supplementary equipotential bonding for operational facilities, rooms and installations of a particular type.

**These are , for example:**

- **IEC 60364-7-701** Rooms with bathtub or shower
- **IEC 60364-7-702** Swimming pools and other basins
- **IEC 60364-7-705** For agricultural and horticultural premises

The



Figure 3 - Equipotential bonding of heating pipes

difference to the main equipotential bonding is the fact that the cross sections of the conductors can be chosen to be smaller (*Table 1*), and also this supplementary equipotential bonding can be limited to a particular location.

**Reference:** *Lightning Protection Guide* – [www.dehn.de](http://www.dehn.de)

Source :

<http://electrical-engineering-portal.com/equipotential-bonding-for-metal-installations>