

#### 7.4.2 Avoidance of a build-up of electrostatic charge for Group I or Group II

Equipment is intended to be designed so that under normal conditions of use, danger of ignition due to electrostatic charges on external surfaces of enclosures is avoided. This shall be satisfied by employing one or more of the following techniques:

NOTE 1 It is often practical to employ different mitigation techniques on different parts of the equipment.

- a) by selection of the material so that surface resistance shall meet at least one of the criteria given below when measured in accordance with 26.13:
  - $\leq 1 \text{ G}\Omega$  measured at  $(50 \pm 5) \%$  relative humidity;
  - $\leq 100 \text{ G}\Omega$  measured at  $(30 \pm 5) \%$  relative humidity.
- b) by limitation of the surface area of non-metallic parts of enclosures as shown in Table 7.

The surface area is defined as follows:

- for sheet materials, the area shall be the exposed (chargeable) area;
- for curved objects, the area shall be the projection of the object giving the maximum area;
- for individual non-metallic parts, the area shall be evaluated independently if they are separated by conductive earthed frames.

The permitted values of the surface area can be increased by a factor of four if this surface area of non-metallic material is surrounded by and in contact with a conductive earthed surface.

The permitted values of the surface area can be increased by a factor of two if this surface area is, at the longest opposite sides, in contact with a conductive earthed surface.

Alternatively, for long parts with non-metallic surfaces, such as tubes, bars, or ropes, the surface area need not be considered, but the diameters or widths shall not exceed the values shown in Table 8. Cables for connection of external circuits are not considered to fall under this requirement. See 16.7.

- c) by limitation of the thickness of a non-metallic layer bonded to conductive or dissipative surfaces, which is connected to earth with a connection resistance of less than  $1 \text{ G}\Omega$ . For the purposes of this standard, dissipative surfaces are those complying with the requirements of 7.4.2 a). The thickness of the non-metallic layer shall not exceed the values shown in Table 9 or the breakdown voltage shall be  $\leq 4 \text{ kV DC}$  (measured across the thickness of the insulating material according to the method described in IEC 60243-1 with the additional requirements of IEC 60243-2 for DC testing);

NOTE 2 A painted enclosure complying with 7.4.2 c) and Table 9 only will not comply with 7.4.3 c).

- d) by provision of a conductive or dissipative coating. Non-metallic surfaces may be covered with a bonded durable conductive or dissipative coating. The resistance between coating and either the point of bond (in the case of equipment for fixed installations) or the farthest point of potential contact with the enclosure (in the case of portable equipment) shall not exceed 1 GΩ. The resistance shall be measured in accordance with 26.13 but using a 100 mm<sup>2</sup> electrode at the worst case position of the surface and either the bond or the farthest point of potential contact. The equipment shall be marked “X” in accordance with item e) of 29.3 and the documentation shall provide guidance on the use of the bonding connection (for fixed equipment) and provide information to enable the user to decide on the durability of the coating material with respect to the environmental conditions;

NOTE 3 The environmental conditions that have an effect on the coating material may include influences from small particles in an air stream, solvent vapours, and the like.

- e) for fixed installations where the installation is intended to minimize the risk from electrostatic discharge, by marking the equipment “X” in accordance with item e) of 29.3. The instructions shall provide guidance for the user to minimize the risk from electrostatic discharge. Where practicable, the equipment shall also be marked with the electrostatic charge warning given in item g) of 29.13.

NOTE 4 Examples of possible guidance for the Specific Conditions of Use include:

- Control of environmental humidity to minimize the generation of static electricity.
  - Protection from direct airflow causing a charge transfer.
  - Touch with an insulating object.
  - Means to continuously drain off electrostatic charges
- f) for portable, mains powered, equipment, where the non-metallic materials are protected from charging or discharging by the provision of an earth-connected conductive or dissipative guard, the equipment shall be marked “X” in accordance with item e) of 29.3. The instructions shall provide guidance for the user to minimize the risk from electrostatic discharge. Where practicable, the equipment shall also be marked with the electrostatic charge warning given in item g) of 29.13.
- g) by testing that the maximal transferred charge measured according to 26.17 is within the threshold limits of Table 10.

NOTE 5 In many industrial applications, including coal mining, it is highly likely that warning labels may become illegible through the deposition of dusts. If this is the case, it is possible that the act of cleaning the label can cause a static discharge.

NOTE 6 A minimum insulation resistance for electrical insulating materials is normally specified to avoid problems arising from touching exposed non-metallic parts that are in contact with live parts.

**Table 7 – Limitation of surface areas**

Maximum surface area mm <sup>2</sup>				
Group I equipment	Group II equipment			
	Equipment Protection Level	Group IIA	Group IIB	Group IIC
10 000	EPL Ga	5 000	2 500	400
	EPL Gb	10 000	10 000	2 000
	EPL Gc	10 000	10 000	2 000

**Table 8 – Maximum diameter or width**

Maximum diameter or width mm				
Group I equipment	Group II equipment			
	Equipment Protection Level	Group IIA	Group IIB	Group IIC
30	EPL Ga	3	3	1
	EPL Gb	30	30	20
	EPL Gc	30	30	20

**Table 9 – Limitation of thickness of non-metallic layer**

Maximum thickness mm				
Group I equipment	Group II equipment			
	Equipment Protection Level	Group IIA	Group IIB	Group IIC
2	EPL Ga	2	2	0,2
	EPL Gb	2	2	0,2
	EPL Gc	2	2	0,2

NOTE 7 These thickness limitations do not apply to non-metallic layers that have a surface resistance of less than 1 GΩ or 100 GΩ, as applicable. See 7.4.2 a).

NOTE 8 One of the main reasons for the thickness limitation is that the maximum thickness of the non-metallic layer is intended to bind the static charge at the surface. By this means the static charge is not able to build incendive discharges.

**Table 10 – Maximum acceptable transferred charge**

Maximum acceptable transferred charge nC				
Group I equipment	Group II equipment			
	Equipment Protection Level	Group IIA	Group IIB	Group IIC
60	EPL Ga	60	25	10
	EPL Gb	60	25	10
	EPL Gc	60	25	10

NOTE The limits ensure that incendive discharges do not occur.