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Technical Bulletin 22: Anti-static or Insulative Synthetic Slings?

Requests for both synthetic slings that can be used as an insulator and synthetic slings that are non-sparking are not uncommon. It is important to note that these requirements are inherently different, and therefore no sling can meet both at once. A sling that does not conduct electricity well will tend to store energy, which discharges in the form of static electricity. A sling that does not build up as much stored energy achieves this by transferring it to other materials, and hence being more conductive. Customers who are interested in controlling the potential of sparking are often referring to "anti-static" materials.

What is static electricity?

Static electricity refers to electric charges that build up in or on the surface of a material. These charges arise because of an imbalance of electrons generated typically by contact and separation of materials (triboelectric charging)[1]. Static can build up whenever materials are in contact and at least one of those materials has a high resistance to electricity (insulator). The blocks in Figure 1 show this charge imbalance upon separation.

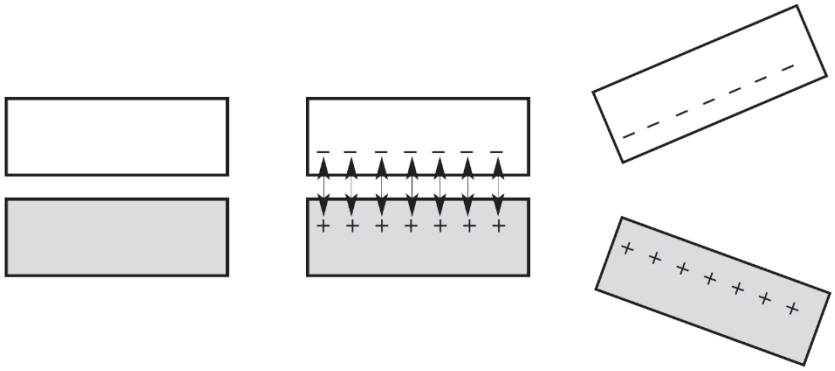

Figure 1. Charge imbalance by triboelectric charging[2]. Other forms of static charging include induction charging and heat and pressure-induced charging.

This charge can sometimes build up faster than it can be dissipated and will remain, ready to dissipate and return to equilibrium. When a suitable material comes close or into contact with this charged surface or body, the charged material can discharge directly or through an air gap. This electrostatic discharge can create a spark or even arc in certain cases. Sparking can appear to occur spontaneously if a surface has enough stored charge. Sparks can jump more than 1 centimeter per every 10 kilovolts, and it is not uncommon for surfaces to store thousands of kilovolts of charge[3]. Figure 2 shows some common actions and the static generated.

Examples of Static Generation

Typical Voltage Levels

Means of Generation	10-25% RH	65-90% RH
Walking across carpet	35,000V	1,500V
Walking across vinyl tile	12,000V	250V
Worker at bench	6,000V	100V
Poly bag picked up from bench	20,000V	1,200V
Chair with urethane foam	18,000V	1,500V

Figure 2. Examples of typical voltage levels at varying relative humidity (RH). (Reprinted from Table 2)[1].

What is an anti-static material?

Materials are often categorized as conductors or insulators to represent their resistance to electron flow[1]. Very high resistance would be characteristic of an almost perfect insulator, and very low resistance would be characteristic of an almost perfect conductor[4]. But materials are not simply one, or the other, but rather on a continuum between the two extremes[4] (Figure 3). Static dissipative (or "anti-static") materials typically lie in between the two and allow electron flow at a rate controlled by its resistance[1]. This allows them to dissipate stored charge to ground or other conductive objects over time.

It is not possible to be both insulative and anti-static at once in the colloquial sense. Anti-static materials MUST allow electric flow to be considered dissipative and will therefore not be as insulating as a material with a much higher resistance. Technically, conductive materials are also anti-static (it just dissipates *very* quickly!). Insulative material, which is much slower to transfer electrons, is more prone to building up static and will hold more of it for longer.

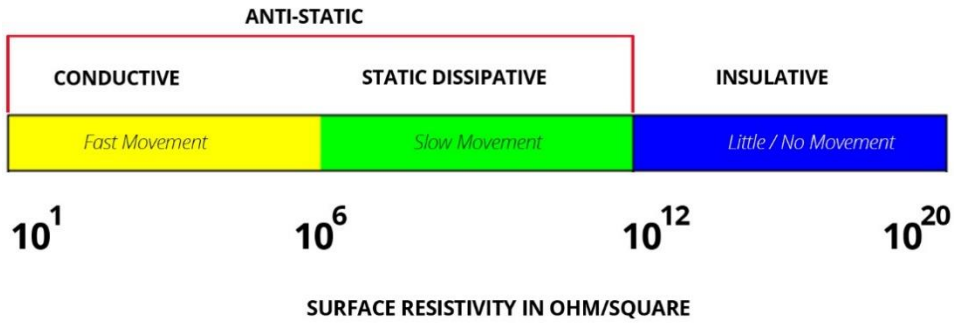

Figure 3. Resistivity Continuum.[5] Anti-static materials vary in dissipation speed.

So, are my slings conductive or insulative?

Twin-Path® roundslings with Covermax® are made from a collection of materials with the jacket material having a surface resistivity on the order of 10^9-10^{10} ohm/sq at 72 degrees Fahrenheit and ~50% RH (see Figure 3). This places our high performance synthetic roundslings in the static dissipative region. This means that the material in the jackets will conduct electricity, but not to the degree that traditional conductors would. This resistivity also means that the roundsling jackets will dissipate built up static charge and have some anti-static properties.

<u>In the Field</u>

There are a few reasons why recommendations that are not generalized can be tricky:

- Surface and volume resistivity will vary greatly with temperature and humidity. The table in Figure 2 shows a few examples of how dramatic this can be.
- Anti-static performance will depend highly on the condition of the material at any given time. All measurements are made on clean material in controlled conditions. Slings that are contaminated with any foreign substance (dust, dirt, oils, retained liquid) will see their conductivity/resistivity will reflect that. It is very possible to have a sling surface be highly conductive or highly insulative based on what materials that sling has been in contact with.
- Anti-static requirements may vary. Some consider a surface resistivity of 10^6-10^9 ohm/sq or less to be anti-static[2]. The customer may have standards, policies or guidelines that they wish to adhere to. It is important to ensure that the working conditions are well understood so that the customer can make an informed decision on their application needs.

References

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[3] AlphaLab (2018) Common static problems and remedies: a series of brief articles. Available at:

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