Cabling

Twisting methods

Cabling (also known as twisting) is the process where cores are wrapped around one another, enabling the cable to be flexed more easily without failure. Without this rotation the core(s) on the inside of the bend would be placed under compression and the core(s) on the outside of the bend would be placed under tension, causing deformation of the cable, damage to the other cores in the centre of the cable and also breakages within the connectors.

Many different types of components can be cabled together, however unlike hand-built constructions it is essential that the diameter of the central layer is large enough to support further layers. For example: An 8 core cable with cores of equal size can be made as a single core in the centre with 7 cores around it if hand-built. Mathematically however it is only possible to place up to 6 cores around the centre if all cores are of equal size and machined cables must follow this mathematical model.

Other than a single core in the centre, the length of the cores can be up to 10% longer than the cable they are make up since they rotate around one another. The maximum conductor resistance Habia Cable specifies for cores within a multi-core cable will nominally be 5% higher than that specified in the single core datasheets to account for this extra length.

Direction

Most cables will be manufactured with alternating left-hand (S) and right-hand (Z) layers. This is done to make the cable evenly balanced which prevents it from twisting up into a coil under dynamic use. Each core will also often have back-twist applied to further prevent this twisting process and to ensure that the cable is as 'dead' as possible.

It is most common to have the final layer as a left-hand layer, an example of which is a typical 19 core cable that would have:

- Centre: 1x core laid straight.
- 1st layer: 6x cores around centre with a right-hand lay.
- 2nd layer: 12x cores around 1st layer with left-hand lay.

Torsion

The exception to the rule of alternating layers is where the application will require torsion to be applied to the cable (such as coiled/spiral cables). In this instance it is advantageous to have all the elements cabled in a single direction as this will help the cable to return to its original form each time, even when extended and retracted frequently.

Lay-lengths

Expressed in mm or inches, The lay-length is the distance a core rotates around the cable from it's starting position in a layer, around the cable and back to its original position. A short lay length will have a more springy and flexible feel to it while a long lay-length results in a stiffer cable. Longer lay-lengths can be produced significantly quicker and use less material which provides benefits in both manufacturing time and cost, so there are good reasons for using a long lay-length if flexibility is not critical to the cable design. Habia Cable nominally use between 8x and 16x the cabled diameter, so for flexible cables a lay-length close to 8x the cabled diameter will be used, whilst normal use cables will be closer to 16x the cabled diameter.

Twists per inch

Lay length is often specified as a given number of twists per inch. This relates to the number of times a core should travel from its starting position at 12 o'clock, around the cable and back again over a given distance. A cable requirement of 3 twists per inch would therefore require the same core to rotate around the cable and return to the 12 o'clock position 3 times over the distance of 1 inch (25.4mm) giving a lay length of approximately 8mm.

Flat cables

Up to 8 components (depending on size) can be laid side by side for inclusion in a flat cable design. Flat cables provide a significant benefit with regard to bend radius if the cable is being flexed in a single direction, as the cable can be made with a noticeably smaller overall dimension and yet still contain several elements. Flat cables are not appropriate for applications which require movement in multiple directions.