# DANNY WEINER

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## 1.0 | INTRODUCTION

Standard nylon cable ties are flexible, multi-use fastening tools that are broadly available for both commercial and personal use. Typical scenarios range from cable management to law enforcement-utilized handcuffs, all based on unidirectional, sturdy tightening. While cable ties/zip ties/tie-wraps come in many names and forms, this documentation will exclusively pertain to Commercial Electric™ 8”/20.32 cm Cable Ties, product code CHS 221. A photograph of these ties appears in Figure 1.0.1:

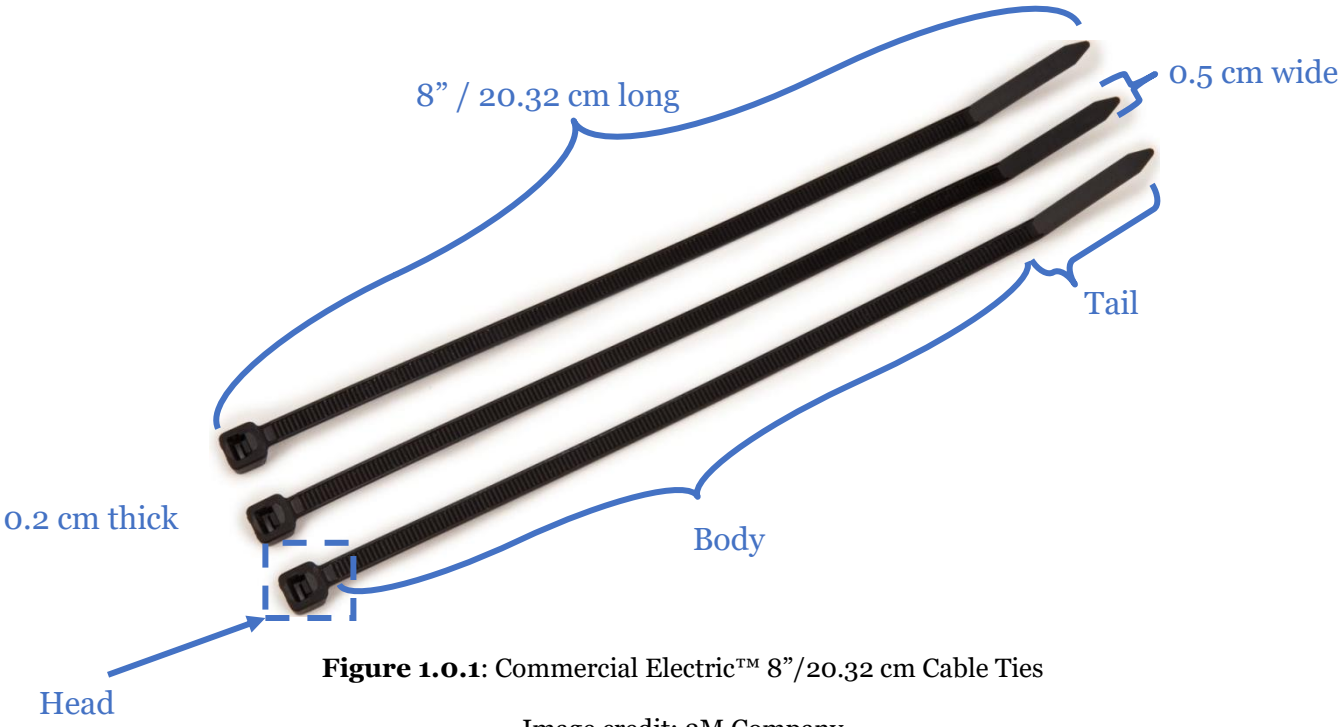


**Figure 1.0.1**: Commercial Electric™ 8”/20.32 cm Cable Ties

Image credit: 3M Company

It is worth noting that these cable ties have two states: *passive* and *engaged*, which can also be thought of as *unlocked* and *locked*, or *opened* and *closed*. Figure 1.0.2 shows an engaged cable tie, contrasting with the passive cable ties in Figure 1.0.1. In conjunction with that, this documentation will refer to the

standard cable tie in three parts, as labeled in both Figures 1.0.1 and 1.0.2: body, tail, and head. In terms of manufacturing and usage, however, the three parts are cast as one.

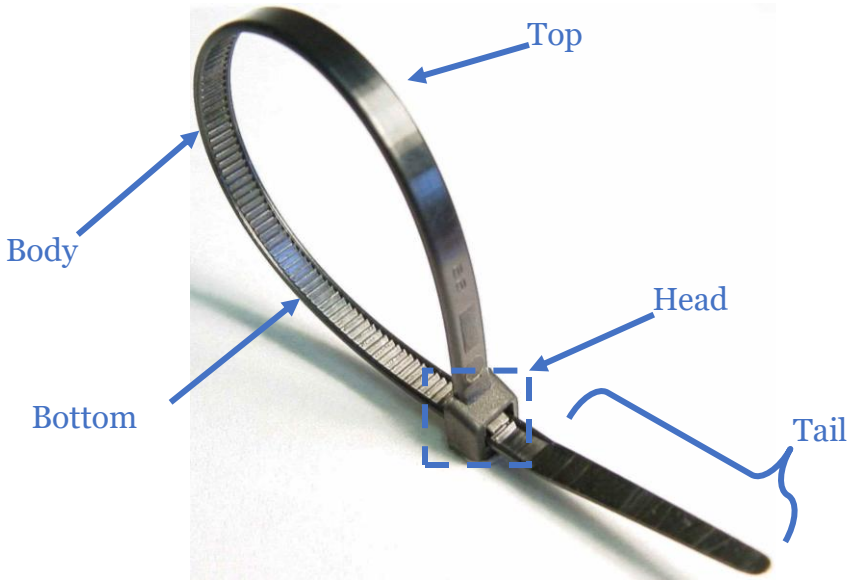


**Figure 1.0.2**: "Engaged" cable tie

Image credit: *cabletiefan.co.uk*

## 2.1 | Body

The body is, intuitively, the bulk of the cable tie, consuming 16.83 cm of the 20.32 cm total length. The high length-to-width ratio of the body means this piece is especially pliable, and that flexibility is what drives the looping capability one can see in Figure 1.0.2's engaged state.

On one side, the side towards which the head protrudes (henceforth deemed the "top"), the body has a smooth, glossy finish, for both aesthetic and scratch-resistance purposes; conversely, the relative bottom (seen in Figure 1.0.1) has a multitude of right-angled ridges, whose perpendicular sides face uniformly towards the head and away from the

tail. This cascade of roughly 160 right triangular prisms, spaced 0.8 mm apart, is visible in Figure 1.0.2 and analogous to a gear rack. Accordingly, the body is one half of the trademark ratchet mechanic of the common cable tie; the head of the Commercial Electric™ Cable Tie will be discussed in further detail, but it is important to understand that these sets of ridges delineate the various diameters and degrees of tightness available with this tie.

## 2.2 | Tail

The tail is the terminal 2.86 cm of the tie, when measuring away from the head. It is 0.1 cm thick and 0.4 cm wide, making it slim enough to easily thread through the opening of the head (dimensions given in §2.3). Ease of use encapsulates the tail's entire purpose and design philosophy; namely, the angle of the subsection and the top's raised edges provide a more ergonomic grip point for a gloved or ungloved hand. Indeed, the tail is a non-critical component of a Commercial Electric™ Cable Tie, as it is the body and head that comprise the ratchet mechanic.

## 2.3 | Head

The final partitioned piece of a standard Commercial Electric™ Cable Tie, the head, is the linchpin of the entire device. The noticeable difference in material thickness indicates that this part is designed to be stronger in order to hold the engaged loop together. Moreover, the thickness allows for the aforesaid opening within the head, as pictured in Figure 2.3.1, which serves as a receptacle for the tail-guided body to enter and engage in unidirectional interlocking.

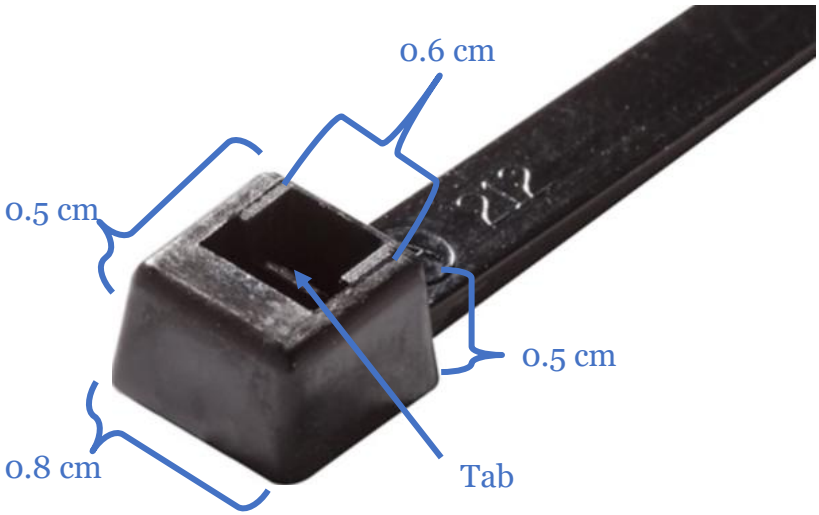


**Figure 2.3.1**: Head of a Commercial Electric™ 8”/20.32 cm Cable Tie

Image credit: *AdvancedCableTies.com*


**Figure 2.3.2**: Auxiliary head views: tab can be seen from both top and bottom perspectives

Image credit: *cablestiesandmore.com*

Figure 2.3.2 shows a clearer view of the tab (or pawl) centered in the head’s opening, mounted on the side conjoined with the body. The tab is not flush with either the top or bottom face of the head, allowing it to bend in one direction (towards the body) and return to its initial position. There are three divots in the pawl, cutting in from the flat, head side and towards the body. These divots mirror the design of the body’s orthogonal ridges: they maintain the same dimensions but with reversed direction. Therefore, the

ridges on the tail will fit neatly in these grooves as they pass over. As the tail is pulled through the head, and the body behind it, the tab is depressed by continuous motion and only springs back into place once its teeth and those of the body interlock. Furthermore, reverse motion will be prevented by this tab, based on the singular way in which it can bend, though the user is free to pull the body through as far as they desire or require.

## 3.0 | Usage

As first suggested in Figure 1.1, Commercial Electric™ Cable Ties have two states: passive and engaged; because of the ratchet design, the only tenable state change is passive to engaged. The user, following the arc of the tail for proper bend direction, merely inserts the tail into the head and pulls until the desired diameter is achieved.


**Figure 3.0.1**: An engaged and truncated cable tie surrounds a bundle of wires.

Image credit: Bisco Industries®

Traditionally, the user has little need to preset ties to a specific diameter, and instead selects the target diameter to be a hairbreadth thicker than the outer dimension of the object(s) being fastened, simply by pulling the body (guided by the tail piece) through the head as far as physically possible. Of course, some users may prefer to leave the tie slightly looser than necessary to provide a buffer for additional items to be passed through and/or to prevent cutting into the fastened item(s). For aesthetic or spatial concerns, the user may choose to slice off the excess body/tail length, leaving the sealed head as the new endpoint of the engaged cable tie.

### 3.1 | Applications

Commercial Electric™ Cable Ties have two characteristics that expand the number of applications dramatically:

1) Intended for both indoor and outdoor use;
2) Head design enables individual ties to hook together to form an elongated chain, bundle, or tree.

Common applications include, but are not limited to, the following:

- Bundling loose cables;
- Law enforcement handcuffs;
- Childproofing cabinets by fastening knobs;
- Organization of tools or other loose items;
- Zipper pulls;
- Reinforcing a splint or sling
- Securing packages for shipping/storage.

### 3.2 | Usage Warnings

On the other hand, Commercial Electric™ Cable Ties have two main points of caution:

1) Ties should be kept out of reach of children;
2) By design, loosening is difficult or impossible, and attempts to do so will damage the integrity of the tie.

## 4.0 | Manufacture

This product is made in China and distributed by Home Depot U.S.A., Inc. Any extant plastic manufacturing facility should have adequate injection-molding capability to mass-produce this product. By the time the manufacturing process is completed, Commercial Electric™ 8”/20.32 cm Cable Ties will host the following specifications:

- Military-grade;
- 8”/20.32 cm in total length;
- UV resistant;
- Nylon material;
- Loop tensile strength: 334 N (75lbf);
- Minimum bundle diameter: 0.118”/3mm;
- Maximum bundle diameter: 1.969”/50mm;
- Minimum operating temperature: -4 ºF/-20 ºC;
- Maximum operating temperature: 185 ºF / 85 ºC;
- Minimum installation temperature: 32 ºF / 0 ºC.

## 5.0 | Conclusion

Home Depot U.S.A., Inc.'s distribution of this product makes Commercial Electric™ 8"/20.32 cm Cable Ties widely available at low cost; Homedepot.com lists a 100-pack for $6.97, though various sizes and quantities are available and can typically be purchased for under $0.10 per tie. However, inexpensiveness should not suggest subpar quality, as cable ties most often exhibit failure only in the face of destructive modification. The aforementioned myriad of functions, combined with this low overhead and high reliability, results in a nearly ubiquitous commodity.