

# Cable Management Ecosystem

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## Overview

Cable management is an important part of the design process in terms of functionality, aesthetics and safety. A design with proper cable management offers a professional look and ease of maintenance for its users.

## Cable measurements table

Cable type	Part number	Cable outside diameter (mm)	Connector outside diameter (mm)	Weight per meter (g/m)	Minimum bend radius (mm)
M12 end-stop cable	CE-CA-018-XXXX	5.0	14.6	46	25
MM1 Stepper motor cable	CE-CA-020-XXXX	6.9	22.2	47	25
MM2 Stepper motor cable	CE-CA-020-XXXX	15	26	300	75
MachineMotion1 control device cable	CE-CA-022-5000	6.2	14.6	56	45
MachineMotion2 control device cable	CE-CA-022-5001	7.0	14.5	63	39
Safety device cable	CE-CA-028-XXXX	5.1	15.0	44	25
6 mm pneumatic tubing	CA-TB-006-XXXX	6.0	10.8	33	40
Pneumatic actuator position cable	CE-SN-008-0001	2.6	15.0 x 15.0 (square)	12	10

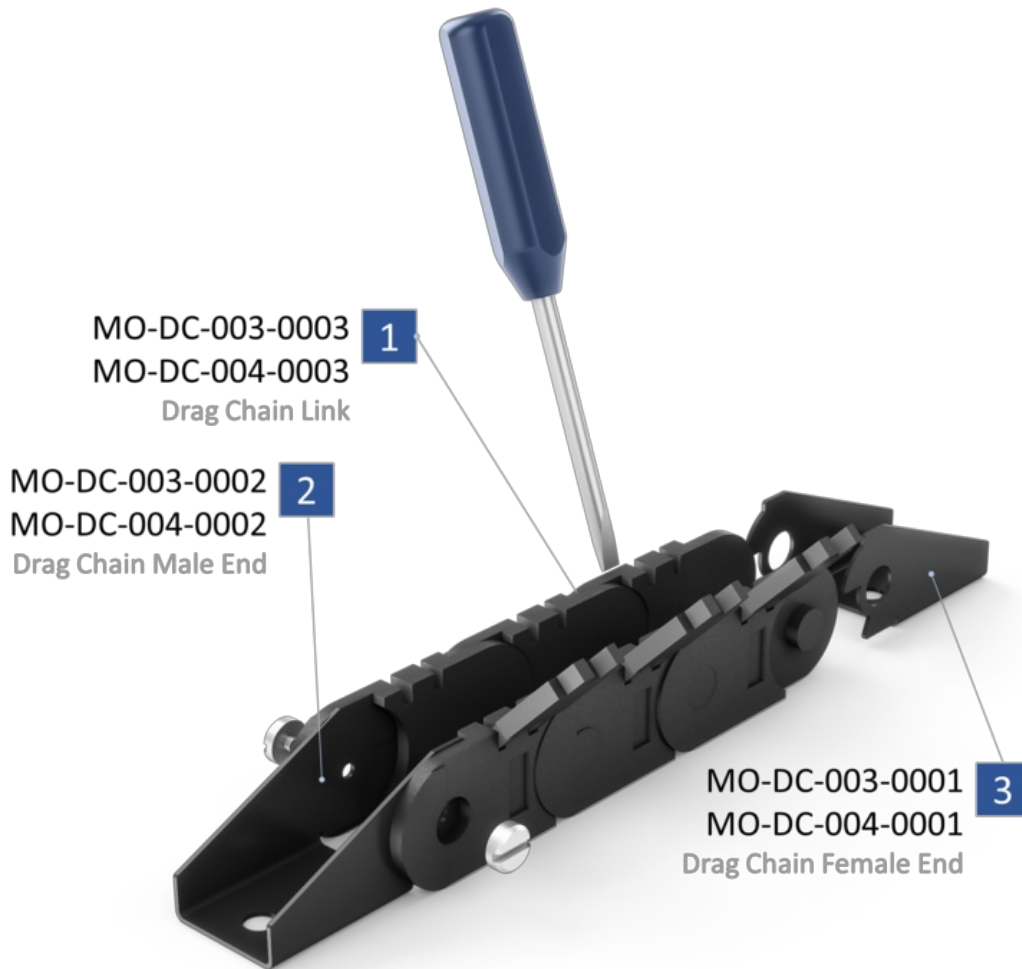
Note: If possible, position cable connectors outside of cable raceways or drag chains. This helps keep cable bundles small and makes maintenance easier.

# Drag Chain

Drag chains ([MO-DC-XXX-XXXX](#)), also known as cable carriers, and cable tracks carry electrical cables and pneumatic hoses to the moving side of an actuator. Each chain is composed of repeating links into which the cables are inserted. Cable carrier ends must be attached to a framing component.

## Installing the drag chain

You will need a flat blade screwdriver and Vention T-handle. Drag chain ends come in two types, male and female. Male ends have two screws, whereas female ends have two holes into which the drag chain fits.



*Drag chain assembly.*

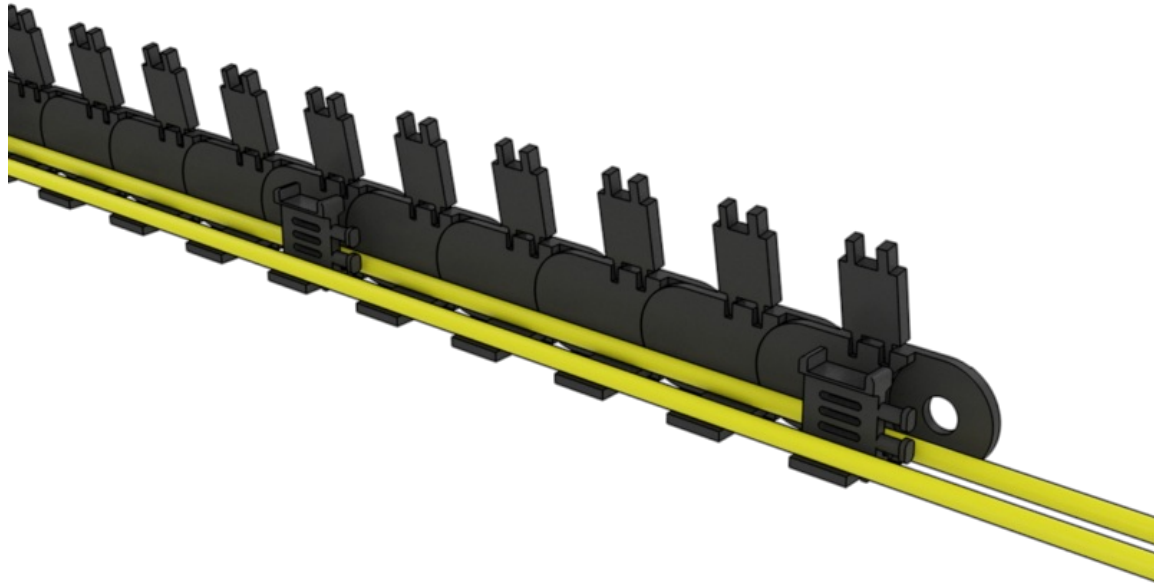
To separate or assemble links in a drag chain:

1. Using a small flat blade screwdriver, open the three crossbar links on either side of the break point.
2. Insert screwdriver between the links and lever them apart.
3. Re-attach links by squeezing the ends of the male link (see description below) and pushing the male and female ends together.
4. To install the male end, remove the two screws with a flat head screwdriver then reinstall them with the drag chain link in place.
5. To install the female end, open the last three crossbar links and squeeze the drag chain link. Bend the female drag chain end slightly to install onto the drag chain link.

△ **Important:** Always remove screws before assembling male drag chain ends. Failure to do so may result in bending and damaging the brackets.

To insert cables into the drag chain, open the crossbars on each link with a screwdriver. Snap them closed with a push.

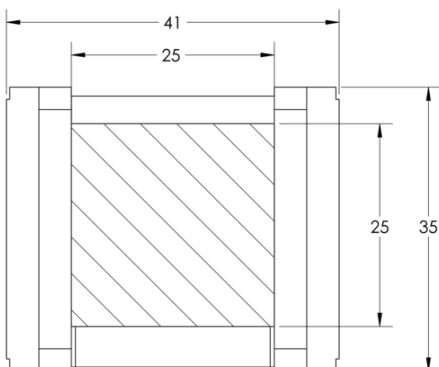
Drag chain strain relief brackets are included with each drag chain end. Insert the brackets between the crossbars of every fifth link, and attach cables to them with zip ties.

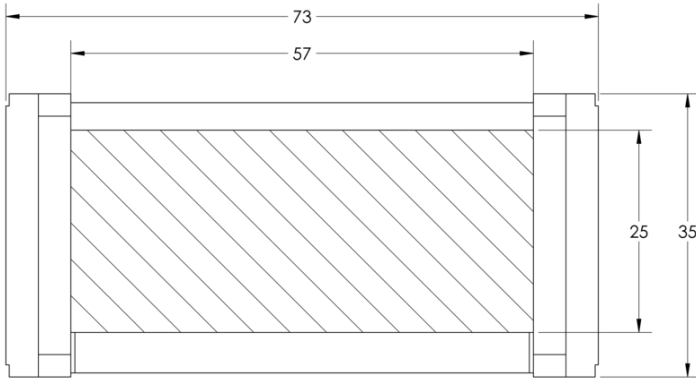


*Drag chain section view with strain relief brackets.*

## Designing with drag chains

Vention offers two sizes of drag chain (shown below). The right size for you depends on your cable bundle size.





⚠ **Important:** Always include 10% extra space around each cable and 20% around pneumatic hoses, to allow the them to move freely when the drag chain is bent.

It is most cost-effective to place the fixed side of the drag chain in the center of travel, because this minimizes the number of chain links. In this case, the required length is:

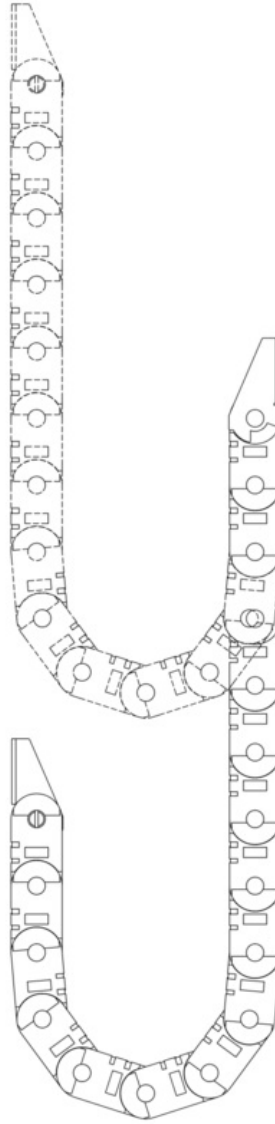
$$\text{drag chain length} = \frac{\text{required travel}}{2} + 330$$

$$\text{required links} = \frac{\text{drag chain length}}{46}$$

The max unsupported length depends on the drag chain's fill weight. Determine your fill weight with reference to the cable measurements table. Max unsupported length is therefore:

$$\text{max unsupported length} = 2 - \frac{2}{3} * \text{weight per meter}$$

Where length is in meters, weight is in kg. When mounting drag chains vertically, we recommend simply hanging the chain. That way you won't need any extra supports, so you'll save costs and hassle.

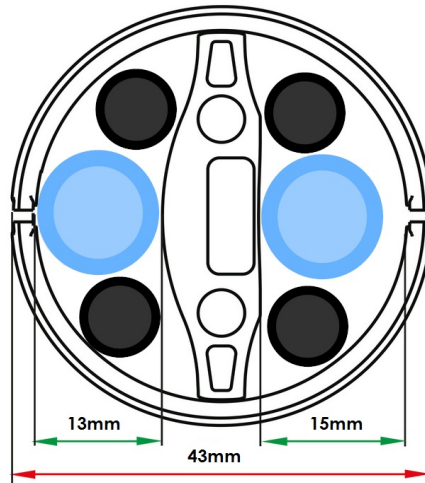


*Hanging drag chain example.*

## Cobot dresskit

### Installing the cobot dresskit

When installing the cobot dresskit, the first step is always to insert the tubes and cables needed. This kit has two zones that can take components of up to 13mm and the other goes up to 15mm (see picture below).



***Dresskit Chain Dimensions***

Once all the components are fitted in the dresskit, the next step is to mount it on the robot.

1. Install the mounting bracket with strain relief on the wrist of the robot with the provided velcro strip. Make sure the strain relief is pointing out of the wrist and that the velcro is fully tightened and meets about halfway around the arm. Do not cut the velcro yet.
2. Install all four mounting brackets without strain relief on top of the forearm and upper arm of the robot at the start and end. Again, make sure that the velcro is fully tightened and meets about halfway around the arm. Do not cut the velcro yet.
3. Clamp the last link of the dress kit chain in the mounting bracket with the strain relief.
4. While leaving some slack in the chain, clamp the dresskit chain to the next mounting bracket.
5. At slow speed, while keeping a hand on an estop, run the robot to confirm that there is enough slack in the dresskit to allow for all the needed motions.
6. Adjust the mounting bracket and the loose in the dresskit accordingly.
7. Clamp the dresskit in the next mounting bracket, while keeping the dresskit straight.
8. Repeat steps 4 to 7 for the upper arm and base of the robot.
9. Test all motion at full speed and adjust accordingly.
10. Once certain the dresskit is not constraining the robot and does not get stuck during motion, the excess velcro can be cut on every mounting brackets.
11. If the dresskit is too long, shorten it by grabbing it with two hands and twisting it. Make sure to not shorten it too much, since this will reduce the resistance to torsion if the removed linked are reinstalled.



***Cobot Dresskit Installed***

## Cable Tray

## Installing the cable tray

The cable tray can be mounted with plates to clamp it to an extrusion on its side or its top. The following images shows some examples of how it can be done.



*Cable Tray Mounted on a Workstation*

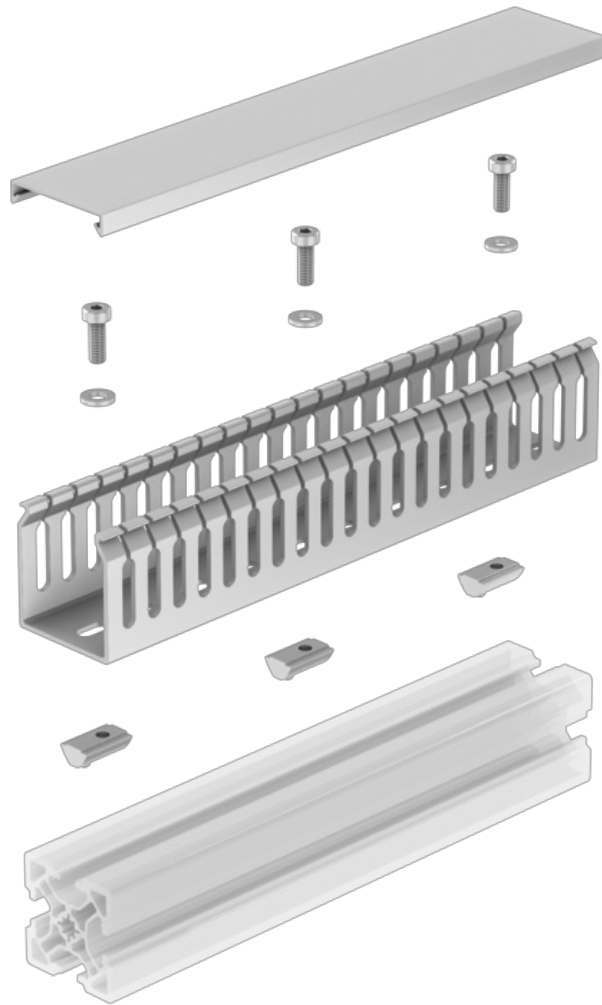


*Cable Tray Mounted on a Fence*

## Wiring duct

### Installing the wiring duct

Installing a wiring duct is quick and only requires a 4 mm hex key.



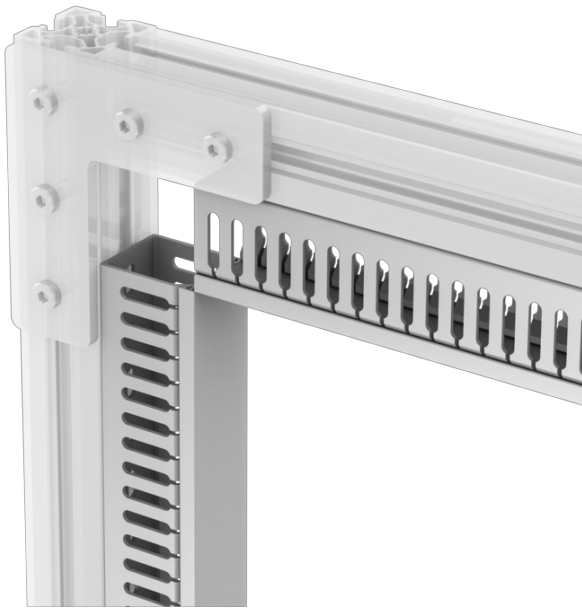
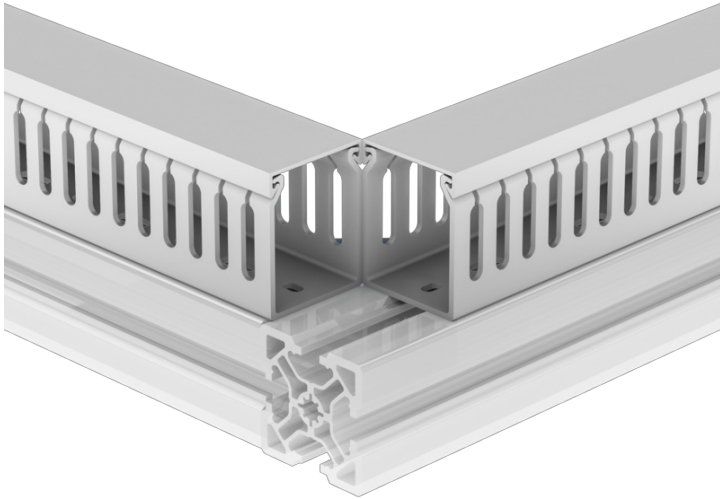
***Wiring duct assembly.***

1. Remove the wiring duct cover to access the mounting holes.
2. Place a washer ([HW-WS-005-0002](#)) between the wiring duct base and the screw ([HW-FN-005-0016](#)). Using a 4 mm hex key, tighten the screws to secure the wiring duct.
3. Place the cables inside the wiring duct and snap the cover in place.

**Note:** To avoid deforming/damaging the raceway, install the fasteners 200 mm apart (that is, every four slots), and do not over-tighten. In general, they should only be tightened by an extra quarter turn once resistance is felt.

If the walls of the raceway tilt inwards due to over-tightening, remove the cover and use your hands to gently spread apart the walls, in order to create an outward force that helps secure the cover.





## Adjusting the raceway length and modifying the teeth

The raceway can be cut to custom lengths with a duct cutter or hacksaw. Cut the wiring duct U-channel and cover separately, to avoid slipping and uneven cuts. Once cut, you may want to deburr the edges with a box cutter.

You can remove the wiring duct teeth to allow larger cables to exit at various distances from its ends. To do so, a duct or box cutter can be used. To use the box cutter method, score the base of the teeth and bend the teeth away from the score line until they snap off.

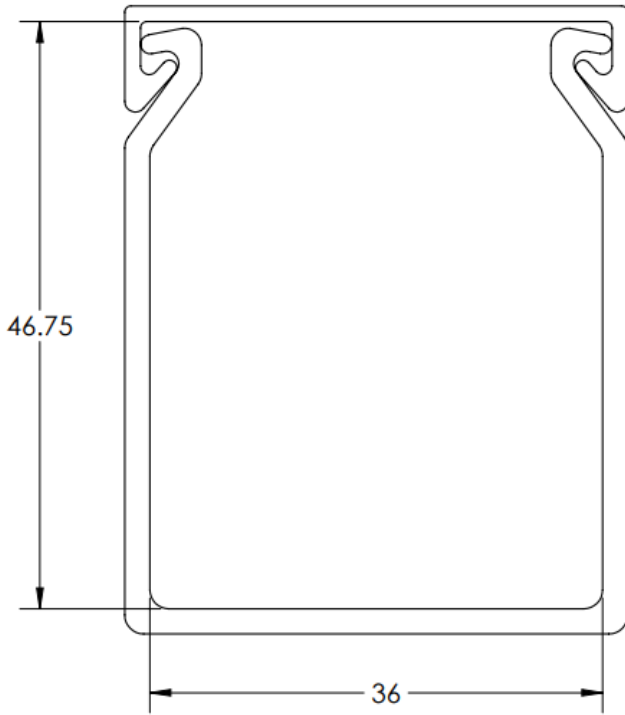
## Wire fill

The recommended raceway wire fill percentage is 50%. This takes the material's thickness into account, as well as the air space between cables.

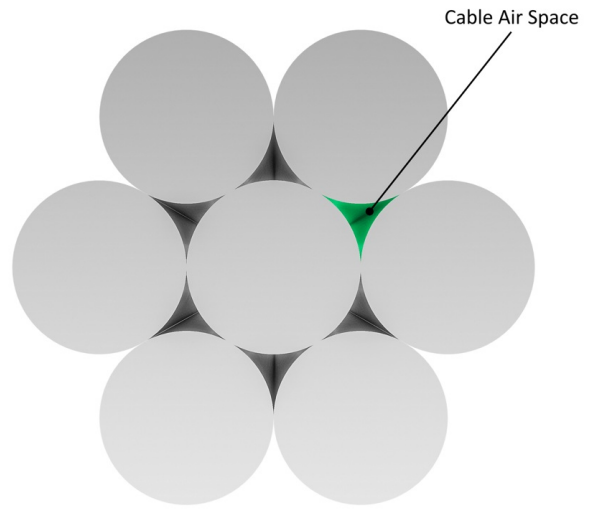
$$50\% \text{ Wire Fill} = \frac{1042}{D^2}$$

The above equation calculates the number of cables, at a given diameter D, that can fit in a 40 x 50 mm raceway. The variable D must be expressed in mm.

**Note:** Air space varies with the cable diameter (for instance, larger cables have more air space between them).



*Raceway profile.*

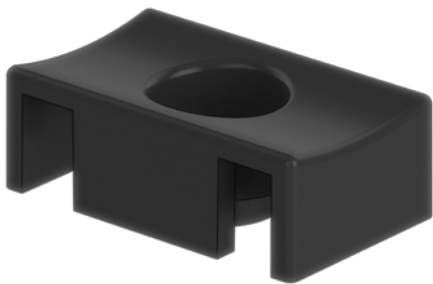


*Air space allotment between cables.*

## Accessories

Cable ties are a quick way to organize cables. Add screw-in cable tie mounts (HW-TW-001-0001) at every point where the cables must be supported.

5 mm x 250 mm Cable Ties (HW-TW-002-0001).



*Screw-In Cable Tie Mount*



*5 mm x 250 mm Cable Ties*