

Reliable and fast vacuum handling

Five steps to the optimum suction gripper:

Step 1: Calculating the weight of the workpiece

m = L x B x H x ρ

Example:  
m = 20 cm x 10 cm x 0,2 cm x 7,85 g/cm³  
= 314 g  
= 0,314 kg

m= weight (kg), L = length (cm), W = width (cm), H = height (cm), ρ = density (g/cm³)

Step 2: Selecting the suction gripper

Different vacuum gripper shapes are recommended depending on the surface finish of the workpiece:

**Standard suction cups**

For flat and slightly undulating and domed surfaces, such as sheet metal or cardboard.

**Extra deep suction cups**

For round and domed workpieces.

**Bellows suction cup with 1.5 convolutions**

For bevelled surfaces, depending on suction cup diameter between 5° and 30°. For domed, round, large surface and pliable workpieces.

**Bellows suction cup with 3.5 convolutions**

For delicate workpieces such as glass bottles or light bulbs. Inexpensive height compensator.

**Oval suction cup**

For slim, oblong workpieces such as profiles, pipes.



Step 4: Determination of suction cup diameter and shape

Breakaway and retention force FA dependent on suction cup diameter and shape.

| Suction cup round  | F <sub>A</sub> at ~0.7 bar |            |                         |                         |                          | Suction cup oval      | F <sub>A</sub> at ~0.7 bar |
|--------------------|----------------------------|------------|-------------------------|-------------------------|--------------------------|-----------------------|----------------------------|
| Suction cup-Ø [mm] | Standard                   | Extra deep | 1.5 convolution bellows | 3.5 convolution bellows | Suction cup, bell-shaped | Suction cup size [mm] | oval                       |
| 2                  | 0.10 N                     |            |                         |                         |                          | 4 x 10                | 2.0 N                      |
| 4                  | 0.46 N                     |            |                         |                         |                          | 4 x 20                | 3.4 N                      |
| 6                  | 1.10 N                     |            |                         |                         |                          | 6 x 10                | 2.9 N                      |
| 8                  | 2.30 N                     |            |                         |                         |                          | 6 x 20                | 5.9 N                      |
| 10                 | 3.90 N                     |            | 4.7 N                   | 3.9 N                   |                          | 8 x 20                | 8.0 N                      |
| 15                 | 8.50 N                     | 9.8 N      |                         |                         |                          | 8 x 30                | 10.9 N                     |
| 20                 | 16.30 N                    | 17.0 N     | 12.9 N                  | 8.2 N                   |                          | 10 x 30               | 15.2 N                     |
| 30                 | 40.80 N                    | 37.2 N     | 26.2 N                  | 20.8 N                  | 36 N                     | 15 x 45               | 32.0 N                     |
| 40                 | 69.60 N                    | 67.6 N     | 52.3 N                  | 42.4 N                  | 64 N                     | 20 x 60               | 62.8 N                     |
| 50                 | 105.80 N                   | 103.6 N    | 72.6 N                  | 63.4 N                  | 97 N                     | 25 x 75               | 92.5 N                     |
| 60                 | 166.10 N                   | 162.5 N    |                         |                         | 134 N                    | 30 x 90               | 134.4 N                    |
| 80                 | 309.70 N                   | 275.0 N    | 213.6 N                 |                         | 245 N                    |                       |                            |
| 100                | 503.60 N                   | 440.8 N    |                         |                         | 375 N                    |                       |                            |
| 150                | 900.00 N                   |            |                         |                         |                          |                       |                            |
| 200                | 1610.00 N                  |            |                         |                         |                          |                       |                            |

FESTO

2000 options,  
1 principle,  
zero selection  
problems

The ideal "pneumatic hand" with over 2,000 gripper type variants, sizes and materials.

Step 5: Observing of environmental conditions

| Material                                   | Nitrile rubber | Polyurethane  | Vulkollan®          | Silicone      | Fluor rubber   | Nitrile rubber (anti-static) |
|--|----------------|---------------|---------------------|---------------|----------------|------------------------------|
| Characteristic operating temperatures      | -10 ... +70    | -20 ... +60   | -10 ... +80         | -30 ... +180  | -10 ... +200   | -10 ... +70                  |
| 200  |                |               |                     |               |                |                              |
| 150  |                |               |                     |               |                |                              |
| 100  |                |               |                     |               |                |                              |
| 50   |                |               |                     |               |                |                              |
| 0  |                |               |                     |               |                |                              |
| -50  |                |               |                     |               |                |                              |
| Material characteristics                   |                |               |                     |               |                |                              |
| Material Code                              | N              | U             | T                   | S             | F              | NA                           |
| Colour                                     | Black          | Blue          | Red-brown           | Transparent   | Grey           | Black with white dot         |
| Wear resistance                            | ••             | •••           | •••                 | •             | ••             | ••                           |
| Abrasion resistance                        | ••             | •••           | •••                 | •             | ••             | ••                           |
| Shore hardness A                           | 50 ±5          | 60 ±5         | 72 ±5               | 50 ±5         | 60 ±5          | 50 ±5                        |
| Typical application areas                  |                |               |                     |               |                |                              |
| Conventional application                   |                | Rough surface | Automobile industry | Food industry | Glass industry | Electronics industry         |
| Very demanding conditions                  | •              | •             | •                   | •             | •              | •                            |
| Food                                       | –              | –             | –                   | •             | –              | –                            |
| Oily workpieces                            | •              | •             | •••                 | –             | •              | •                            |
| High ambient temperatures –                | –              | –             | •                   | •             | –              | –                            |
| Low ambient temperatures –                 | •              | •             | •                   | –             | –              | –                            |
| Smooth surfaces (glass)                    | •              | •             | •                   | –             | •              | –                            |
| Rough surfaces (wood, stone)               | –              | •             | ••                  | –             | –              | –                            |
| Anti-static                                | –              | –             | –                   | –             | –              | •                            |
| Fragile surfaces                           | –              | •             | –                   | •             | –              | –                            |
| Resistance                                 |                |               |                     |               |                |                              |
| Atmospheric conditions                     | •              | ••            | ••                  | •••           | •••            | ••                           |
| Tensile strength                           | ••             | •••           | •••                 | •             | ••             | ••                           |
| Permanent deformation                      | ••             | •             | ••                  | ••            | •••            | ••                           |
| Hydraulic oil, mineral                     | •••            | •••           | •••                 | –             | •••            | –                            |
| Hydraulic oil, synthetic ester             | •              | –             | –                   | –             | •              | –                            |
| Non-polar solvents (e.g. petroleum spirit) | •••            | ••            | ••                  | –             | •••            | –                            |
| Polar solvents (e.g. acetone)              | –              | –             | –                   | –             | –              | –                            |
| Ethyl alcohol                              | •••            | –             | –                   | •••           | ••             | –                            |
| Isopropanol                                | ••             | –             | –                   | •••           | •••            | –                            |
| Water                                      | •••            | –             | –                   | ••            | ••             | –                            |
| Acids (10%)                                | –              | –             | –                   | •             | •••            | –                            |
| Alkaline solutions (10%)                   | ••             | •             | •                   | •••           | ••             | –                            |

••• Highly suitable    •• very suitable    • suitable    – unsuitable    © Vulkollan® is a registered trademark of Bayer

Modular vacuum suction gripper range from Festo

Vacuum range selection software from Festo

Suction cup holder ESH-...

Straight

ESH-HA-...

Straight with stroke length compensator

ESH-HC-...

Straight with stroke length compensator, long

ESH-HCL-...

Angular

ESH-HB-...

Angular, with stroke length compensator

ESH-HD-...

Angular, with stroke length compensator, long

ESH-HDL-...

Straight, with screw-in thread

ESH-HF-...

Adaption

ESH-HE-...

Angle compensator (optional)

Angle compensator ESWA-...

Filter (optional)

Filter (not for oval suction cups) ESF-...

Suction cups

Illustrations of one example each from the product range

Suction cup, standard, without attachment parts ESV-...-...S...

Suction cup, standard, with attachment parts ESS-...-...S...

Suction cup, extra deep without attachment parts ESS-...-GT...

Suction cup, extra-deep with attachment parts ESV-...-E...

Suction cup, extra-deep with attachment parts ESS-...-E...

Suction cup, 1.5 convolution bellows, without attachment parts ESV-...-B...

Suction cup, 1.5 convolution bellows, with attachment parts ESS-...-B...

Suction cup, 3.5 convolution bellows, without attachment parts ESV-...-C...

Suction cup, 1.5 convolution bellows, with attachment parts ESS-...-C...

Suction cup, oval, with attachment parts ESS-...-O...