# Pneumatic Grippers

## Parallel and Angular Grippers

*Catalog 1900-2/US*

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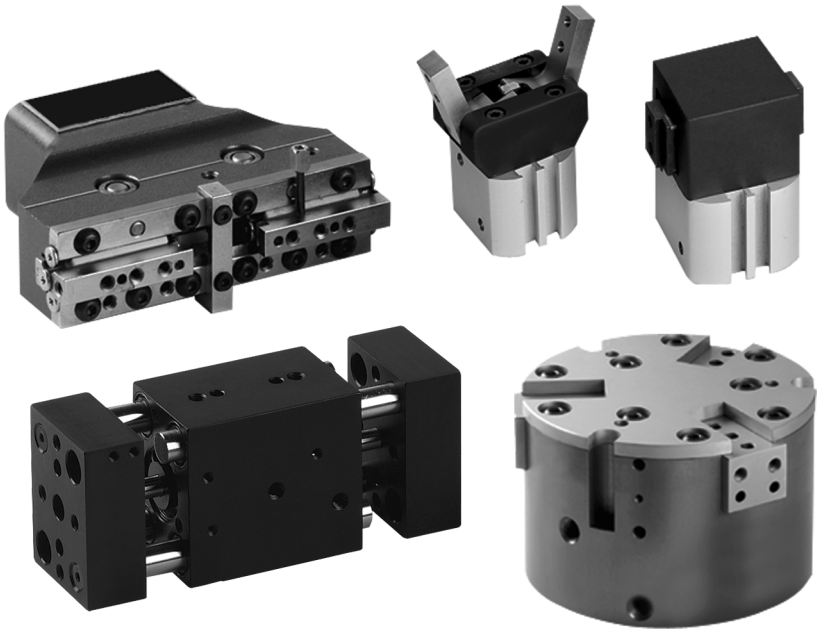
**Parker Hannifin Corporation**
Automation Actuator Division
Wadsworth, Ohio USA

# Introducing Parker's Expanded Line of Pneumatic Grippers



## Parallel Grippers

- Miniature
- Automation
- Low Profile
- Precision
- Long Stroke
- Heavy Duty
- Three-Jaw

## Angular Grippers

- Miniature (30° and 180°)
- Automation (30° and 180°)
- High Force (30°)
- Precision (30° and 180°)
- Locking (12°)



**Parker Hannifin Corporation**
Actuator Division
Wadsworth, Ohio USA

## Parallel Grippers

| | | Model Number | Stroke (in) | | | | | | | | | Total Grip Force (lbs) | | | | | | | | | Metric Design | Ball Bearing Construction | Clean Room | Spring Open | Spring Closed | Sensors | | Non-Syncronous | Page Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0-0.24 | 0.25-0.49 | 0.50-.074 | 0.75-0.99 | 1.00-1.49 | 1.50-1.99 | 2.00-3.99 | 4.00-4.99 | 5.00+ | 0-4 | 5-9 | 10-24 | 25-49 | 50-99 | 100-249 | 250-499 | 500-999 | 1000+ | | | | | | Reed/Hall Effect | Proximity | | |
| Miniature |  | GPR-1A | | ● | | | | | | | | ● | | | | | | | | | ● | ● | | | | | ● | | 4 |
| | | GPR-3A | | | ● | | | | | | | | ● | | | | | | | | ● | ● | | | | | ● | | 5 |
| | | GPR-10A | | | | ● | | | | | | | | ● | | | | | | | ● | ● | | | | | ● | | 6 |
| |  | GPCR-10C | ● | | | | | | | | | ● | | | | | | | | | ● | ● | O | O | | ● | | | 10 |
| | | GPCR-16C | | ● | | | | | | | | | ● | | | | | | | | ● | ● | O | O | | ● | | | 11 |
| | | GPCR-20C | | ● | | | | | | | | | | ● | | | | | | | ● | ● | O | O | | ● | | | 12 |
| | | GPCR-25C | | | ● | | | | | | | | | ● | | | | | | | ● | ● | O | O | | ● | | | 13 |
| |  | P5G-HPM-1 | ● | | | | | | | | | | ● | | | | | | | | O | | O | | | | | | 16 |
| | | P5G-HPM-2 | ● | | | | | | | | | | ● | | | | | | | | O | | O | | | | | | 17 |
| | | P5G-HPM-3 | | ● | | | | | | | | | ● | | | | | | | | O | | O | | | | | | 18 |
| Automation |  | P5G-HP-5 | ● | | | | | | | | | | | ● | | | | | | | O | | | | | | | | 22 |
| | | P5G-HP-10 | | ● | | | | | | | | | | | ● | | | | | | O | | | | | | | | 23 |
| | | P5G-HP-11 | | ● | | | | | | | | | | | ● | | | | | | O | | | | | | ● | | 24 |
| | | P5G-HP-11-D | ● | | | | | | | | | | | | | ● | | | | | O | | | | | | ● | | 25 |
| | | P5G-HP-12 | | ● | | | | | | | | | | | | ● | | | | | O | | | | | | ● | | 26 |
| | | P5G-HP-12-D | ● | | | | | | | | | | | | ● | | | | | | O | | | | | | ● | | 27 |
| | | P5G-HP-15 | | | ● | | | | | | | | | | | ● | | | | | O | | | | | | ● | | 28 |
| | | P5G-HP-15-D | | ● | | | | | | | | | | | | ● | | | | | O | | | | | | ● | | 29 |
| | | P5G-HP-17 | | | | ● | | | | | | | | | | | ● | | | | O | | | | | | ● | | 30 |
| | | P5G-HP-17-D | | | | | ● | | | | | | | | | | ● | | | | O | | | | | | ● | | 31 |
| | | P5G-HP-18 | | | | | ● | | | | | | | | | | | ● | | | O | | | | | | ● | | 32 |
| | | P5G-HP-18-D | | | | | | ● | | | | | | | | | | ● | | | O | | | | | | ● | | 33 |
| | | P5G-HP-19 | | | | | | | ● | | | | | | | | | | ● | | O | | | | | | ● | | 34 |
| | | P5G-HP-19-D | | | | | | ● | | | | | | | | | | | ● | | O | | | | | | ● | | 35 |
| |  | GPT10 | | | ● | | | | | | | | | | ● | | | | | | | | | | | ● | ● | | 40 |
| | | GPT15 | | | ● | | | | | | | | | | | ● | | | | | | | | | | ● | ● | | 41 |
| |  | P5G-AP3 | ● | | | | | | | | | | | | ● | | | | | | ● | ● | | O | O | ● | ● | | 46 |
| | | P5G-AP4 | | ● | | | | | | | | | | | | ● | | | | | ● | ● | | O | O | ● | ● | | 47 |
| | | P5G-AP5 | | ● | | | | | | | | | | | | ● | | | | | ● | ● | | O | O | ● | ● | | 48 |
| | | P5G-AP6 | | ● | | | | | | | | | | | | | ● | | | | ● | ● | | O | O | ● | ● | | 49 |
| Low Profile |  | GPEL-8 | | | ● | | | | | | | ● | | | | | | | | | ● | ● | | | | ● | | ● | 58 |
| | | GPEL-12 | | | | ● | | | | | | | ● | | | | | | | | ● | ● | | | | ● | | ● | 59 |
| |  | GPDL-8 | | | ● | | | | | | | ● | | | | | | | | | ● | ● | | | | ● | | | 62 |
| | | GPDL-12 | | | | ● | | | | | | | | ● | | | | | | | ● | ● | | | | ● | | | 63 |
| | | GPDL-14 (S) | | | | | ● | | | | | | | ● | | | | | | | ● | ● | | | | ● | | | 64 |
| | | GPDL-14 (L) | | | | | | | ● | | | | | ● | | | | | | | ● | ● | | | | ● | | | 64 |
| | | GPDL-18 (S) | | | | | | ● | | | | | | | ● | | | | | | ● | ● | | | | ● | | | 65 |
| | | GPDL-18 (L) | | | | | | | ● | | | | | | ● | | | | | | ● | ● | | | | ● | | | 65 |
| |  | P5G-HPL-1 | | ● | | | | | | | | | | ● | | | | | | | O | ● | O | | | ● | | O | 70 |
| | | P5G-HPL-2 | | | ● | | | | | | | | | ● | | | | | | | O | ● | O | | | ● | | O | 71 |
| | | P5G-HPL-3 | | | | ● | | | | | | | | | ● | | | | | | O | ● | O | | | ● | | O | 72 |
| | | P5G-HPL-4 | | | | ● | | | | | | | | | ● | | | | | | O | ● | O | | | ● | | O | 73 |
| Precision |  | P5G-RH1 | ● | | | | | | | | | | | | ● | | | | | | ● | | | | O | ● | ● | | 78 |
| | | P5G-RH2 | ● | | | | | | | | | | | | | ● | | | | | ● | | | | O | ● | ● | | 79 |
| | | P5G-RH3 | | ● | | | | | | | | | | | | | ● | | | | ● | | | | O | ● | ● | | 80 |
| | | P5G-RH4 | | | ● | | | | | | | | | | | | | ● | | | ● | | | | O | ● | ● | | 81 |
| | | P5G-RH5 | | | ● | | | | | | | | | | | | | | ● | | ● | | | | O | ● | ● | | 82 |
| |  | P5G-HP-50P | | | ● | | | | | | | | | ● | | | | | | | O | ● | | | | | ● | O | 86 |
| | | P5G-HP-100P | | | | ● | | | | | | | | | ● | | | | | | O | ● | | | | | ● | O | 87 |
| | | P5G-HP-25P | | | | | ● | | | | | | | | | ● | | | | | O | ● | | | | | ● | O | 88 |
| | | P5G-HP-35P | | | | | ● | | | | | | | | | | ● | | | | O | ● | | | | | ● | O | 89 |
| | | P5G-HP-40P | | | | | | | ● | | | | | | | | ● | | | | O | ● | | | | | ● | O | 90 |
| | | P5G-HP-43P | | | | | | | ● | | | | | | | | | ● | | | O | ● | | | | | ● | O | 91 |
| High Force/Long Stroke |  | GPK-12 | | | | ● | | | | | | | ● | | | | | | | | ● | ● | | | | ● | | O | 96 |
| | | GPK-16 | | | | | ● | | | | | | | ● | | | | | | | ● | ● | | | | ● | | O | 97 |
| | | GPK-20 | | | | | | ● | | | | | | ● | | | | | | | ● | ● | | | | ● | | O | 98 |
| | | GPK-25 | | | | | | | ● | | | | | | ● | | | | | | ● | ● | | | | ● | | O | 99 |
| |  | P5G-HPW-250 | | | | ● | | | | | | | | | ● | | | | | | O | | | | | | ● | O | 102 |
| | | P5G-HPW-375-1 | | | | | ● | | | | | | | | | ● | | | | | O | | | | | | ● | O | 103 |
| | | P5G-HPW-375-2 | | | | | | | ● | | | | | | | ● | | | | | O | | | | | | ● | O | 104 |
| | | P5G-HPW-500-1 | | | | | | ● | | | | | | | | | ● | | | | O | | | | | | ● | O | 105 |
| | | P5G-HPW-500-2 | | | | | | | ● | | | | | | | | ● | | | | O | | | | | | ● | O | 106 |
| | | P5G-HPW-625-1 | | | | | | | ● | | | | | | | | ● | | | | O | | | | | | ● | O | 107 |
| | | P5G-HPW-625-2 | | | | | | | ● | | | | | | | | ● | | | | O | | | | | | ● | O | 108 |
| | | P5G-HPW-750 | | | | | | | | ● | | | | | | | | ● | | | O | | | | | | ● | O | 109 |
| |  | P5G-HPB-24 | | | | | | | | ● | | | | | | | | ● | | | | ● | | | | | ● | | 114 |
| | | P5G-HPB-26 | | | | | | | | | ● | | | | | | | ● | | | | ● | | | | | ● | | 115 |

● = standard, O = optional



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## Three Jaw Grippers

| | | Model Number | Stroke (in) | | | | | | | | Total Grip Force (lbs) | | | | | | | | Metric Design | Ball Bearing Construction | Clean Room | Spring Open | Spring Closed | Sensors | | Non-Syncronous | Page Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0-0.24 | 0.25-0.49 | 0.50-.074 | 0.75-0.99 | 1.00-1.49 | 1.50-1.99 | 2.00-3.99 | 4.00-4.99 | 5.00+ | 0-4 | 5-9 | 10-24 | 25-49 | 50-99 | 100-249 | 250-499 | 500-999 | 1000+ | | | | | Reed/Hall Effect | Proximity | | |
| Three Jaw |  | P5G-HPC-315 | | ● | | | | | | | | | | | | | ● | | | | O | | ● | | | ● | | | 120 |
| | | P5G-HPC-320 | | ● | | | | | | | | | | | | | | ● | | | O | | ● | | | ● | | | 121 |
| | | P5G-HPC-331 | | | ● | | | | | | | | | | | | | | ● | | O | | ● | | | ● | | | 122 |
| | | P5G-HPC-344 | | | | ● | | | | | | | | | | | | | ● | | O | | ● | | | ● | | | 123 |
| | | P5G-HPC-356 | | | | | ● | | | | | | | | | | | | | ● | O | | ● | | | ● | | | 124 |
| | | P5G-HPC-368 | | | | | ● | | | | | | | | | | | | | ● | O | | ● | | | ● | | | 125 |

## Angular Grippers

| | | Model Number | 30 Degree | 180 Degree | Total Grip Force | | | | | | | Metric Design | Ball Bearing Construction | Clean Room/ Dust Cover | Spring Open | Spring Closed | Sensors | | Page Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0-4 | 5-9 | 10-24 | 25-49 | 50-99 | 100-249 | 250-499 | | | | | | Reed/Hall Effect | Proximity | |
| 30° Angular |  | GVC-8 | ● | | ● | | | | | | | ● | | | O | | ● | | 132 |
| | | GVC-10 | ● | | ● | | | | | | | ● | | | O | | ● | | 133 |
| | | GVC-16 | ● | | | ● | | | | | | ● | | | O | | ● | | 134 |
| | | GVC-20 | ● | | | | ● | | | | | ● | | | O | | ● | | 135 |
| | | GVC-25 | ● | | | | | | ● | | | ● | | | O | | ● | | 136 |
| |  | GAA101 | ● | | | | ● | | | | | | | | | | ● | ● | 140 |
| | | GAA151 | ● | | | | | | ● | | | | | | | | ● | ● | 141 |
| |  | P5G-HA-5 | ● | | | | ● | | | | | O | | | | | ● | | 146 |
| | | P5G-HA-6 | ● | | | | | ● | | | | O | | | | | ● | | 147 |
| | | P5G-HA-7 | ● | | | | | | | ● | | O | | | | | ● | | 148 |
| | | P5G-HA-8 | ● | | | | | | | ● | | O | | | | | ● | | 149 |
| | | P5G-HA-10 | ● | | | | ● | | | | | O | | | | | ● | | 150 |
| |  | P5G-AA3 | ● | | | | ● | | | | | ● | | | | O | ● | ● | 154 |
| | | P5G-AA4 | ● | | | | | | ● | | | ● | | | | O | ● | ● | 155 |
| | | P5G-AA5 | ● | | | | | | ● | | | ● | | | | O | ● | ● | 156 |
| | | P5G-AA6 | ● | | | | | | | ● | | ● | | | | O | ● | ● | 157 |
| |  | P5G-RK1 | ● | | | | ● | | | | | ● | | O | | | ● | ● | 162 |
| | | P5G-RK2 | ● | | | | | ● | | | | ● | | O | | | ● | ● | 163 |
| | | P5G-RK3 | ● | | | | | | | ● | | ● | | O | | | ● | ● | 164 |
| | | P5G-RK4 | ● | | | | | | | ● | | ● | | O | | | ● | ● | 165 |
| | | P5G-RK5 | ● | | | | | | | | ● | ● | | O | | | ● | ● | 166 |
| |  | 3H2 | ● | | | | | | | ● | | O | | ● | O | | | ● | 174 |
| 12° |  | P5G-HA15 | 12 | | | | | | ● | | | O | | | | | | ● | 170 |
| | | P5G-HA25 | 12 | | | | | | | | ● | O | | | | | | ● | 171 |
| 180° Wide Angular |  | GVH-12 | | ● | ● | | | | | | | ● | | | | | ● | | 178 |
| | | GVH-16 | | ● | ● | | | | | | | ● | | | | | ● | | 179 |
| | | GVH-20 | | ● | ● | | | | | | | ● | | | | | ● | | 180 |
| | | GVH-25 | | ● | | ● | | | | | | ● | | | | | ● | | 181 |
| |  | GAW101 | | ● | | | ● | | | | | | | | | | ● | ● | 184 |
| | | GAW151 | | ● | | | | | ● | | | | | | | | ● | ● | 185 |
| |  | P5G-AW3 | | ● | | | ● | | | | | ● | | | | O | ● | ● | 190 |
| | | P5G-AW4 | | ● | | | | ● | | | | ● | | | | O | ● | ● | 191 |
| | | P5G-AW5 | | ● | | | | ● | | | | ● | | | | O | ● | ● | 192 |
| | | P5G-AW6 | | ● | | | | ● | | | | ● | | | | O | ● | ● | 193 |
| |  | P5G-RB1 | | ● | | | ● | | | | | ● | | O | | | ● | ● | 200 |
| | | P5G-RB2 | | ● | | | | ● | | | | ● | | O | | | ● | ● | 201 |
| | | P5G-RB3 | | ● | | | | | ● | | | ● | | O | | | ● | ● | 202 |

● = standard, O = optional



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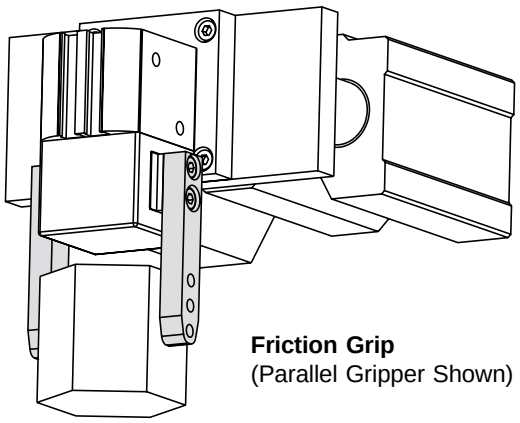
## Force Requirements

When determining gripper force requirements, the gripper fingers must be able to control the workpiece under worst-case conditions. The specific workpiece needs to maintain a steady, constant position within the grasp of the fingers, and at the same time, care must be taken to ensure the workpiece will not deform.

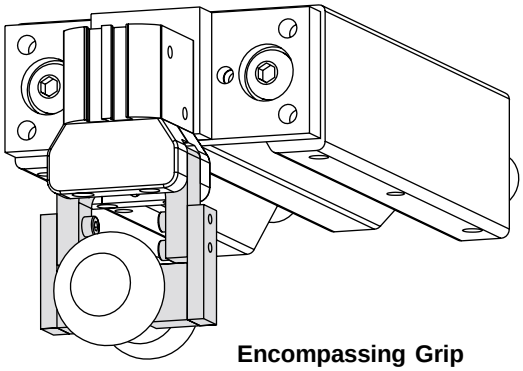
There are two types of grips that determine the force required from a gripper: (1) friction grip and (2) encompassing grip.

**Friction grip** depends on the frictional force of the gripper to maintain the position of the workpiece. Generally, this corresponds to tight tolerances and increased positional accuracy. Typical coefficient of friction for a friction grip is 0.2 to 0.4. This will vary depending on specific applications. A typical friction grip requires as much as four times the force to perform the same function as an encompassing grip.



**Friction Grip**
(Parallel Gripper Shown)

**Encompassing grip** uses the fingers to cradle the workpiece. This provides for more stability and safety because the fingers must be forced open to move the workpiece.



**Encompassing Grip**
(Angular Gripper Shown)

## Grip Forces

Forces are additive when figuring out the total gripper holding force. The weight of the workpiece governs the required holding force. Forces can be broken down into:

- Weight – weight of part and tooling
- Acceleration – starting and stopping forces

Both forces are additive.

A factor of safety should always be included and can vary depending on specific application. In general, the following factor of safety is suggested:

| | |
|---|---|
| Friction grip | 4 |
| Encompassing grip | 1.25 |

Example 1 uses gravitational force (G = 32.26 ft/s$^2$) to solve for gripper holding force.

***Example 1:***

A workpiece weighing 20 pounds is subject to an acceleration of .5G (16.1 ft/s$^2$). The grip force needed is

**Weight of Workpiece + Acceleration Force = Grip Force**

20 lbf + (20 lbf x .5) = 30 lbf

From the example, solve for grip force.

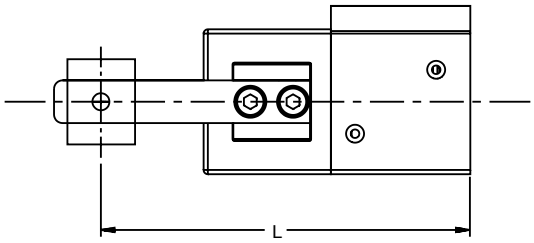
Friction grip = 4 x 30 lbf = 120 lbf

Encompassing grip = 1.25 x 30 lbf = 37.5 lbf

Use load charts for individual gripper models to determine the correct gripper size.

## Torque

The forces acting on the center of gravity of the workpiece at a distance (L) from the bottom of the gripper creates a moment arm.




The sum of the force components acting on the center of gravity can be broken down into:

- Force created by static load
- Force created from acceleration

Both forces are additive so that:

**Sum of Force Components x Distance (L) = Total Torque**

When solving for torque, be aware that forces will change depending on the orientation of the workpiece. To minimize torque, the workpiece should be gripped as close to the top of the gripper as possible.



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## System Design

The two main considerations are (1) throughput and productivity design and (2) reliability design. By overlapping each criteria, a design may concentrate on both production and reliability. Also, in multiple steps or functions, both design concentrations can be utililzed to achieve a desired result. Each function in the system is unique and must be analyzed according to a specific design criteria.

### Throughput and Productivity Criteria

1) Minimize dead space between gripper fingers and workpiece. This is the clearance between a fully open/closed gripper and the workpiece. Use encompassing gripper fingers and minimal jaw travel.
2) Minimize weight of gripper to decrease acceleration forces.
3) Clamp workpiece securely. Use an encompassing grip to increase machine speeds.
4) Avoid time consuming tool changes. Use one gripper for various workpieces.
5) Use one gripper to perform multiple functions.

### Reliability Criteria

1) Clamp workpiece securely. Minimize the possiblity of a dropped or misaligned workpiece.
2) Use encompassing type grip. Ensure precision and accuracy.
3) Regulate clamping force. Protect against deforming the workpiece.
4) Minimize finger length. The longer the tooling, the more the finger will deflect and lose grip force.
5) Provide sufficient deadspace to ensure clearance between the part and the fingers. Minimize the chance of the fingers crashing into a misaligned part.
6) Gripper fingers should properly align the workpiece on critical operations.
7) Surface materials of both gripper and workpiece should clamp at low friction to ensure precise and accurate placement of the workpiece.
8) Do not use parts in an assembled workpiece to maintain proper part alignment in the gripper – any tolerance in the assembled workpiece can affect the alignment.
9) Use a gripper dedicated to one function to perform multiple functions – minimizes the chance of being mishandled since the workpiece never leaves the gripper.
10) Utilize cushions or shock absorbers to create smooth acceleration or deceleration.

## Conversion Chart

**Metric to English**
(Multiply ___ by_____ to obtain)

| | | |
|---|---|---|
| **Length** | | |
| mm | 0.0394 | in |
| **Area** | | |
| $mm^2$ | 0.0016 | $in^2$ |
| $cm^2$ | 0.155 | $in^2$ |
| **Volume** | | |
| $mm^3$ | $6.10x10^{-5}$ | $in^3$ |
| $cm^3$ (cc) | 0.061 | $in^3$ |
| L | 0.0353 | $ft^3$ |
| **Weight** | | |
| g | 0.0353 | oz. |
| kg | 2.204 | lb. |
| **Force** | | |
| kgf | 2.204 | lbf |
| N | 0.224 | lbf |
| **Torque** | | |
| Nm | 0.737 | ft-lb |
| **Pressure** | | |
| kPa | 0.145 | psi |
| bar | 14.50 | psi |
| **Energy** | | |
| Nm | 0.737 | ft-lb |
| **Power** | | |
| W | 0.737 | ft-lb/s |
| kW | 1.341 | hp |

**Temperature**
°F = (1.8 x °C) + 32

**Flow rate**
l/min x 0.035 = SCFM

**Key**
mm = millimeter
cm = centimeter
cc = cubic centimeter
L = liter
g = gram
kg = kilogram
kgf = kilogram force
N = Newton
Nm = Newton meter
in = inch
ft = foot
oz = ounce
lb = pound
lbf = pound force
ft-lb = foot pound

## Using Catalog Data

### Load Data

The graph curves have been determined mathematically. Forces may deviate in practical applications from predetermined values. For maximum gripping force, keep finger tooling as short as possible. Maximum load that grippers can handle will vary depending on part size, texture, shape of finger tooling, speed, acceleration and air pressure.

### Dimensional Data

Unless otherwise noted, all dimensions are in inches (mm). All tolerances are as shown below:

| Imperial (in) | Metric (mm) |
|---|---|
| 0.0 = ±0.01 | [0] = [± 0.25] |
| 0.00 = ±0.005 | [0.0] = [± 0.13] |
| 0.000 = ±0.0005 | [0.00] = [± 0.013] |



**Parker Hannifin Corporation**
Actuator Division
Wadsworth, Ohio USA

## Contact Information:

**Name:** _____ **Phone Number:** _____

**Company:** _____ **Fax Number:** _____

**E-Mail:** _____

Please tell us about your application and we will respond promptly with recommendations. Please provide the following application details and ***fax to (330) 334-3335***.

**Weight of workpiece:** _____

**Workpiece hardness:** _____

**Workpiece temperature:** _____

**Workpiece shape:** _____

**Number of orientations per cycle:** _____

**Type of actuator:** _____

**Maximum acceleration:** _____

**Cycles per minute:** _____

**Distance Travel per Step:** _____

**Type of Fingers: Friction** _____ **Encompassing** _____

**Workpiece positioning tolerance:** _____

**Supply air pressure:** _____

**Control method:** _____

**Electrical supply:** _____

**Operating conditions:** _____

**Type of position sensor:** _____

**Number of sensors:** _____

**Flow controls*:** _____

*Flow controls are recommended on all grippers.

**Sketch of applications**



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