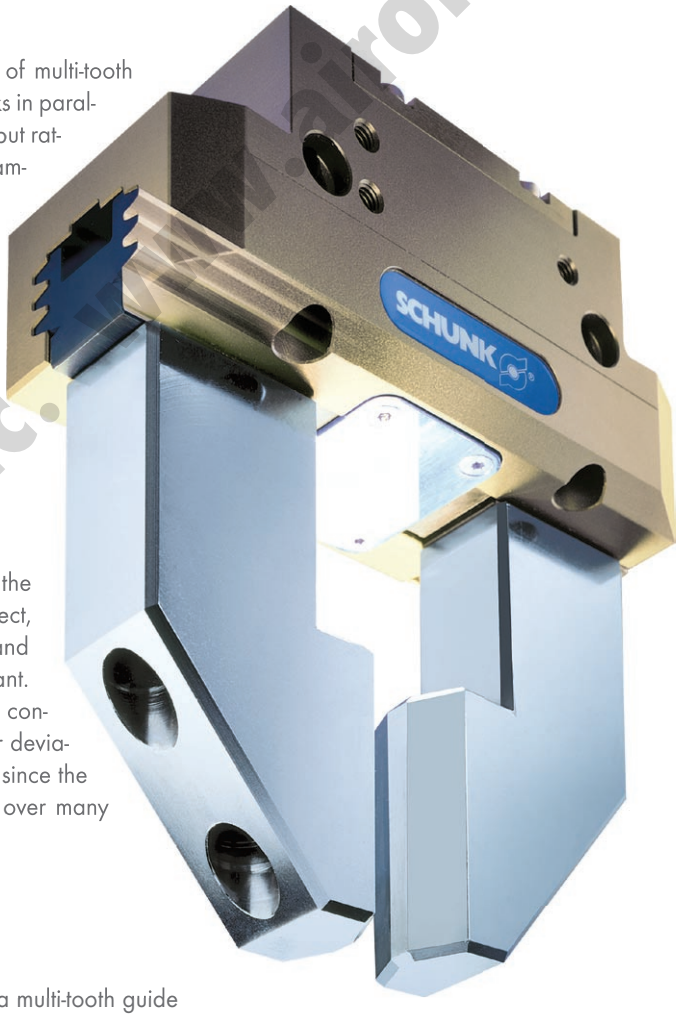
SCHUNK

Knowledge BASE

09 – Multi-Tooth Guidance

Patented and Very Impressive -

The SCHUNK Multi-Tooth Guidance



Distribution of the load on many shoulders – that is the principle of multi-tooth guidance, developed and patented by SCHUNK. The guidance tasks in parallel and centric grippers are no longer performed by a classic T-slot, but rather by several prismatic guides in a parallel configuration. Such teamwork has many advantages, because forces and moments are then distributed over several guiding surfaces. The guides therefore have a higher load capacity, which makes itpossible to use longer gripper fingers for the same size gripper without overloading the guides. Since the base jaws also fit into the housing with an accuracy of 0.01 mm, wear and play in the guidance is minimized. The bottom line is that SCHUNK customers benefit from high-precision and durable components.

No chance for the drawer effect

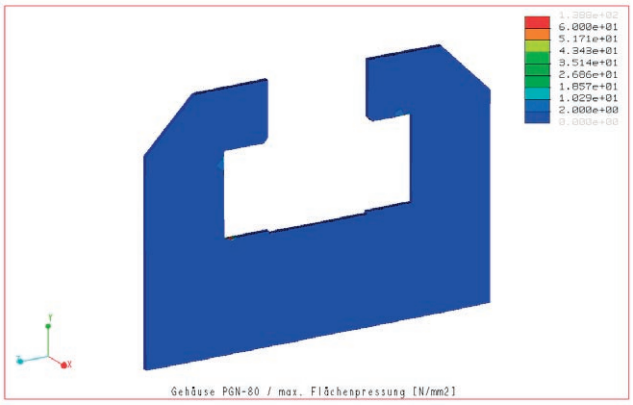
With the parallel configuration of several narrow prismatic guides, the SCHUNK engineers have greatly reduced the so-called drawer effect, which occurs when a conventional flat guided drawer is pulled out, and the guide length L decreases while the guide height H remains constant. The angular deviations between the drawer and the guide increase continuously and the smaller the ratio of L to H, the greater the angular deviations and the point loads. The multi-tooth guide solves this problem, since the use of several parallel guides distributes the forces and moments over many guide surfaces, thus reducing the contact pressure.

Greater forces and moments

While the first impression already demonstrates the advantages of a multi-tooth guide as compared with a flat guide, the effect is clearly confirmed by a simulation with the FEA program. In a simulation of a horizontal force that is applied from right to left at a distance of 100 mm from the top edge of the gripper, the advantages of the multi-tooth guide become apparent especially in the analysis of the displacements. The long force flow on the right flank of the T-slot guides produces an elongated expansion area, which flexes the entire right area of the guide to the right, while the left flank of the guide is flexed to the left. This is shown on the top end of the left flank by an extreme displacement. Quite otherwise with the multi-tooth guide, where the rapid distribution of the tensions and the short distance to the base of the guide considerably reduce the flexing of the guide. This not only increases the rigidity, stability and load capacity of the guide, but also reduces wear and increases durability.

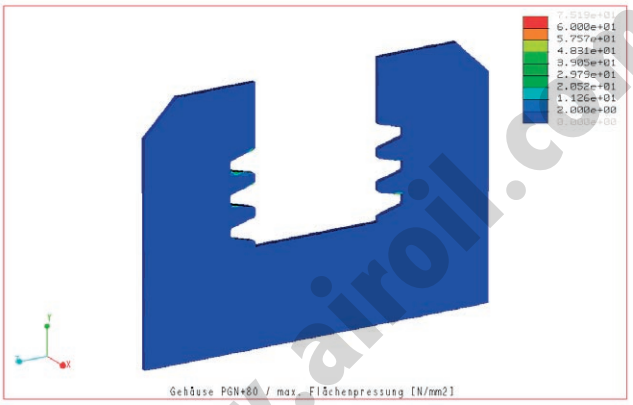
Comparison of the stress distribution

The conventional T-slot guide



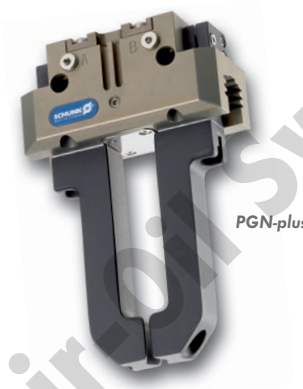
The moment created by the force causes very high local stress in the lower left corner of the guide, and this stress is increased by the notch effect. On the right side of the guide, the moment is absorbed by the upper flank in the area of the corner. The stress here is especially high, since the force flow is deflected strongly, causing it to diminish. In its continuation it then expands the entire right flank, which causes increased displacement and flexing of the guide.

Advantage of the multi-tooth guide



The transmitted moment affects the left guide flank primarily due to stress on the upper and middle tooth. The stress is distributed quickly, and the force flow is guided directly into the lower, solid part of the guide. On the right side of the guide the force resulting from the moment is absorbed directly in the bottom tooth, distributed and likewise transmitted quickly into the lower area of the cross section, where it is distributed over a large area.

Free choice: numerous components with multi-tooth guides



PGN-plus

PNZ-plus

PGN-plus and PZN-plus

The multi-tooth guide is available for numerous SCHUNK components, the flagship being the pneumatic parallel gripper of the PGN-plus series and its three-fingered counterparts the PZN-plus series. The PGN-plus high-performance grippers are available in sizes 40 to 380 with gripping forces from 140 to 21800 N and finger strokes from 2.5 mm to 45 mm for masses from 0.17 to 39.5 kg. This enables a wide variety of handling tasks, from small components to motor blocks! The 3-finger centric grippers of the PZN-plus series are likewise suitable for universal applications. They are available from sizes 40 to 300 with strokes from 2 mm to 35 mm per finger and gripping forces from 260 N to 37500 N, which is sufficient for workpiece weights from 1.3 kg to 190 kg. In addition: The PGN-plus and PZN-plus gripper series are available in sizes 64 to 100 also with spindle interfaces, such as HSK-A, Capto C6 or KM 63.

This enables fully automatic loading of machining centers without the use of a robot, and the grippers can be exchanged directly from the tool magazine, thus reducing manufacturing down-times and loading times enormously! The grippers are driven either with compressed air supplied from the machine spindle or with the cooling lubricant of the internal high-pressure cooler.

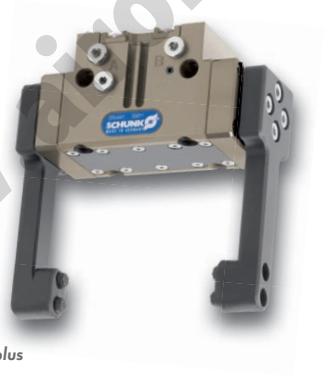
Center bore for flexibility: PGB grippers

When an opening is needed in the gripper for installing a camera, for the feeding of material or for gripping extra long workpieces, these are tasks for the PGB grippers with their continuous center bore. With four sizes from 64 to 125, this series is suitable for a wide range of tasks. The diameter of the center bore is 10 mm to 24 mm, depending on the model, and the strokes range from 4 mm to 10 mm per jaw, with maximum gripping forces between 110 N and 640 N. As in the PGN-plus grippers, the drive consists of an oval piston, which transmits its force via a wedge hook mechanism – and here again the multi-tooth guide ensures reliable movements with no play for millions of cycles!

PGB

Sealed gripper with multi-tooth guide – DPG-plus and DPZ-plus

Applications in wet areas require high-performance sealed gripping modules, which do not allow any materials to enter the inside of the gripper. SCHUNK has solved this problem by combining multi-tooth guides and O-rings for high absorption of load moments and a one hundred percent seal. The sealed grippers of the DPG-plus and DPZ-plus series feature IP 67 sealing for the highest seal in their class, with moments between 30 Nm and 160 Nm, depending on the direction of load and size of the unit. The high sealing class and performance are made possible by combining a multi-tooth guide with a round sealing surface of the base jaws toward the outside. The applications for this gripper are accordingly diverse, ranging from machine loading to use in painting or powder coating systems – wherevery high power is needed in combination with a tight seal. The series is available in sizes 40 to 200 mm with a stroke of 3 mm to 25 mm per finger; the pneumatic drive is actuated by an oval piston, which produces a significantly higher driving force than a round piston with the same volume.



DPG-plus

Servo-electric parallel and centric grippers EGN and EZN

Do you need something as rugged and reliable as the PGN-plus and PZN-plus, but electrically driven? If this is what you want, then you will be satisfied with the EGN electric parallel grippers and the EZN electric centric grippers. They are equipped with the multi-tooth guide, and also feature all the advantages of mechatronics. Due to the integration of a brushless servo motor and a resolver for position analysis, these grippers can be operated flexibly in power or position mode. This makes it possible to regulate the gripping force, position or speed, which opens up entirely new possibilities for interesting applications, such as for gripping of sensitive components or sorting of parts, due to the new capability of checking dimensions during the gripping process. The EGN 100, for example, features a stroke of up to 10 mm per finger and a maximum gripping force of 620 N, while the centric gripper EZN 100 even has a gripping force of 900 N with the same stroke.

EGN

Secure gripping in palletizing in magazine: 4-finger centric gripper PZV

Most gripping tasks can be performed with 2- or 3-finger grippers. For palletizing of cylindrical workpieces, however, the 4-finger centric gripper PZV is the ideal tool, because its gripper fingers can grip precisely into the spaces between the tightly packed cylindrical workpieces. The four fingers make the PZV very flexible, as well. It can be used as a parallel gripper for example, and can grip as a parallel gripper, for example,

PZV

it can grip concentric workpieces with two different pairs of attachment fingers easily and without changing the fingers. This results in optimized set-up times without interruption of ongoing processes. The design principle with the multi-tooth guide and a powerful pneumatic piston provides for maximum moments and high gripping forces. The PZV is available in the four sizes 64, 100, 160 and 200 and features gripping forces of 580 to 7100 N with gripping strokes of 4 to 16 mm – ideal for a large range of workpieces, due to the extremely robust multi-tooth guidance!

Stationary clamping system TANDEM KSP plus:

TANDEM KSP plus

SCHUNK has equipped not only grippers with the multi-tooth guide, but also the stationary clamping system TANDEM KSP plus – another example of how high strength can be combined with maximum precision. The clamping system is available in sizes 100, 160 and 250, with clamping forces of 18000 N to 60000 N. Due to the multi-tooth guide, these forces cause minimum jaw lifting, so that clamping repeat accuracy of 0.01 to 0.03 mm is possible. The jaw strokes range from 2 mm to 5 mm and the units weigh between 3.5 kg and 32 kg.

Additional Product Information on SCHUNK Automation Components

You can find detailed information on SCHUNK components in the SCHUNK catalog programme. A free catalog can be requested by calling **800.772.4865** or by visiting the SCHUNK website at **www.schunk.com**.
The catalog pages for each SCHUNK product are also available for download at **www.schunk.com**.

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