GBX/CP2

4PVD Service & Supply

Enforced, continuous 3-fold Rotation

Gearbox

Top Plates

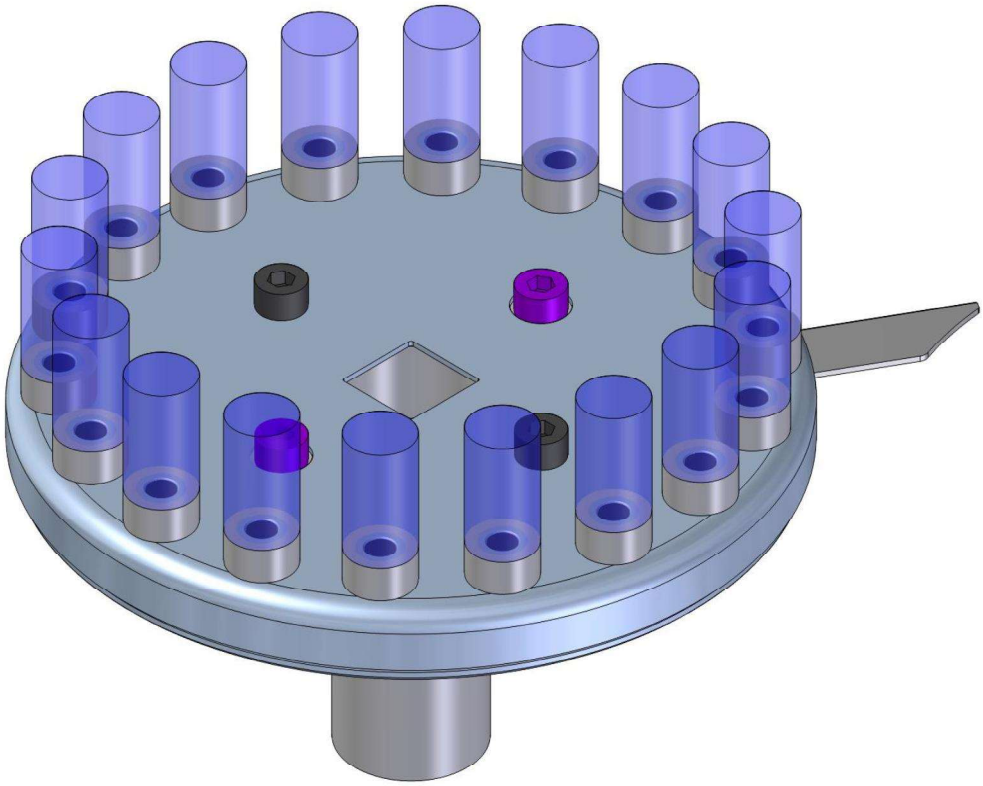
Spacer Tubes

www.webshop.4pvd.de

GBX + CP2 gearboxes with forced rotation

The substrates are loaded on GBX and CP2 similar as on COLT plates. Otherwise the rotation of a COLT plate is initiated through a kicker finger, substrates on gearboxes are driven by a forced rotation mechanism. Because of that forced rotation the constancy and reliability of the third axle is nearly 100%. GBX and CP2 are compatible with COLT plates, which means both can be stacked together on the same tower.

All GBX and CP2 are provided with an overload clutch. The clutch disconnects the gearbox if it is e.g. blocked by whatever reason. In the usage of many gearboxes, you safe the whole charge, by only losing the parts of the defect gearbox.



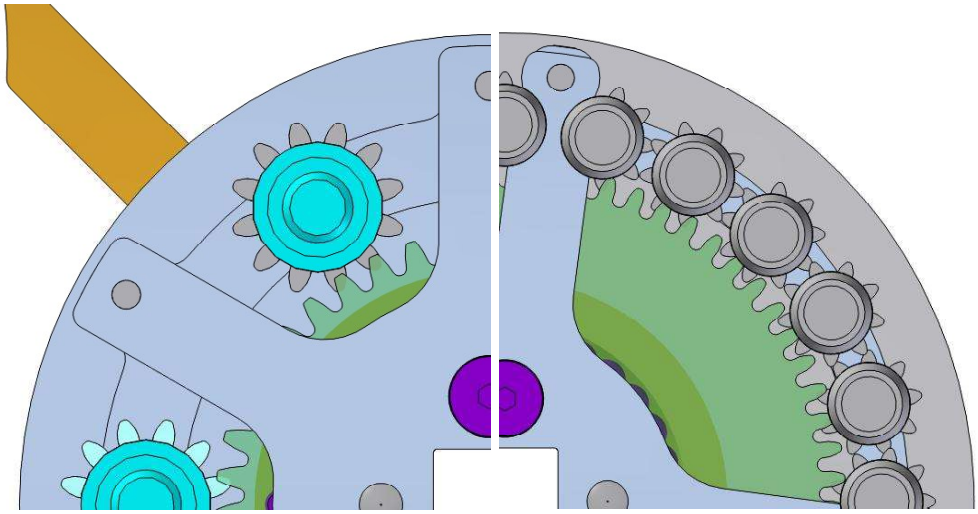
In use the safety handle is pressed against the kicker tree and translates the forced rotation to the gearbox. If the gearbox is blocked for whatever reason, the handle retracts under the gearbox and shows a rotation error. In use the safety handle is pressed against the kicker tree and translates the forced rotation to the gearbox. If the gearbox is blocked for whatever reason, the handle retracts under the gearbox and shows a rotation error. There is no need of kicker fingers anymore, so it is possible to relocate the tree to the inside. Most standard gearboxes can easily be modified for the other direction of rotation.

With GBX and CP2 gearboxes, the actual gearbox is usually encapsulated with a cover. This can easily be dismantled and given away for sandblasting or decoating. With the cover removed, the gearboxes can be easily serviced.

Depending on the weight and geometry of the substrates, there are various options, some of which can be combined with one another. But there are also geometrical limits beyond which we cannot implement gearboxes.

Fast vs. Slow rotation of the substrate

The smaller the substrates, the greater the transmission ratio between the sun gear and the substrate axes. A normal (fast / GBX) Ø130mm gearbox with 24 turning positions translates into about 8: 1. If the planets rotate at 15 min-1, the substrates rotate at approx. 120 min-1. This requires a lot of power, causes abrasion and light substrates can fall out of the receptacles.

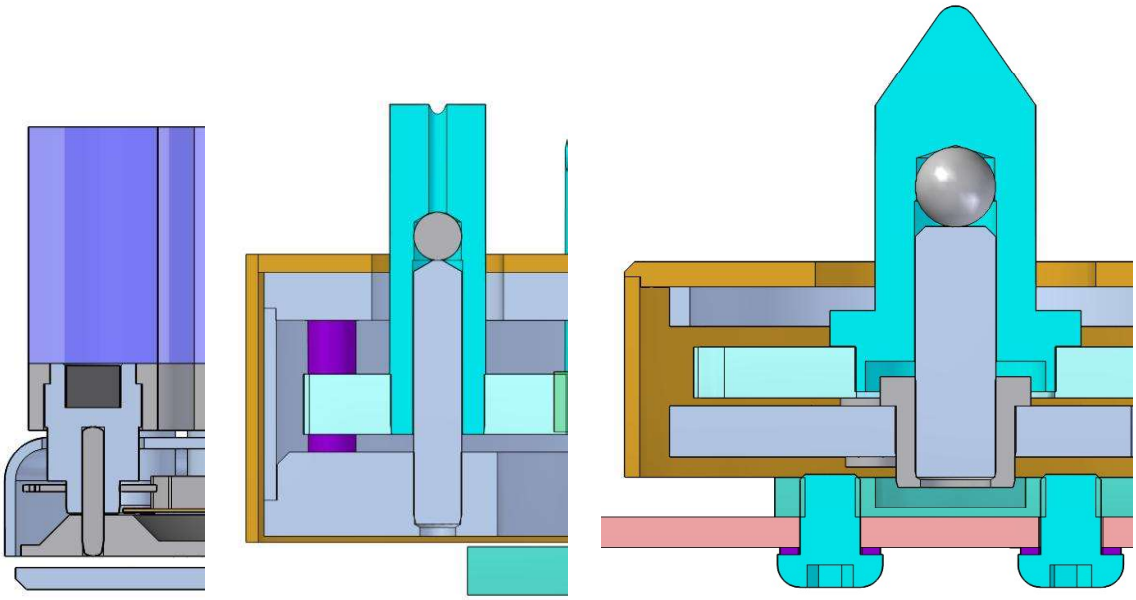


In a reduced-speed (slow) CP2 gearbox, the rotational speed of the planets is first reduced by a factor of 10 before the transmission of the sun gear takes effect. For example, an Ø130mm CP2 gearbox generates a total gear ratio of approx. 0.65: 1, which means that light substrates wobble less and the gearboxes can withstand higher rotation speed of the planets.

The reduction gear limits the dimensions of the CP2 gearbox somewhat. The smallest currently available outer diameter is Ø125mm and the largest planet shaft that fits through is the V15 (square 15 x 15mm) or the SW19 (hexagon with 19mm wrench size). Small (<Ø150mm) CP2 gearboxes are only available in the light version.

Light vs. heavy design

Most gearboxes are available in a light and a heavy weight version. The light version is for light substrates (<100g). The advantage of the light line is the lower space requirement and the low weight. Heavy weight gearboxes carry substrates up to 1000g or in heavy duty (HD) versions even up to 5kg. They are about twice as high as the light version and are accordingly heavier. In the case of heavy gearboxes, the casing is usually made of thicker material and is therefore more resistant to frequent sandblasting. Gearboxes in heavy and HD versions can be designed for substrate storage on both sides.

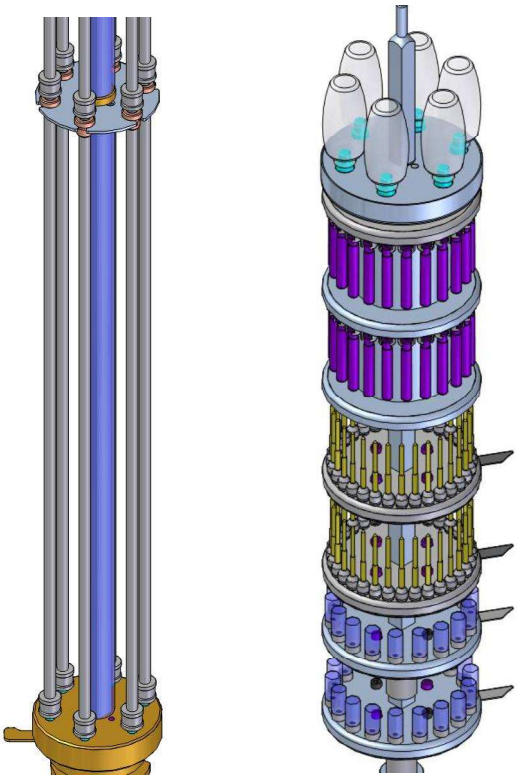


Design light (le.) heavy (mi.) and HD (ri.)

Heavy and HD gearboxes can be designed for substrate storage on both sides.

One- vs. both sided substrate bearing

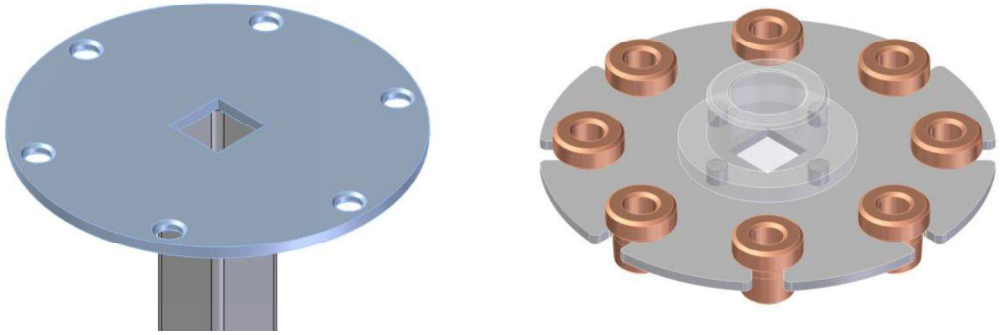
Substrates that have a sufficiently large center hole can often be stacked (skewered) on top of one another. Thus, only one gear level is required and the substrate is stack on a rod. Non-stackable substrates require a gear per level.



Skewer guided charge, one gear level (left)
Gearbox guided charge, one gearbox on every level (right)

Gearboxes for substrate storage on both sides also require a counter bearing consisting of a central tube with the upper bearing disk (for the second storage) and a set of substrate rods. In the case of very high coating systems, several rods can be stacked on top of one another so that the individual rods do not become too unmanageable.

The tower with rods has only one overload clutch per gearbox (per tower). Especially with heavy substrates (on rods) and if the tower is built in several levels, we recommend pluggable bearing bushes to make the assembly easier.

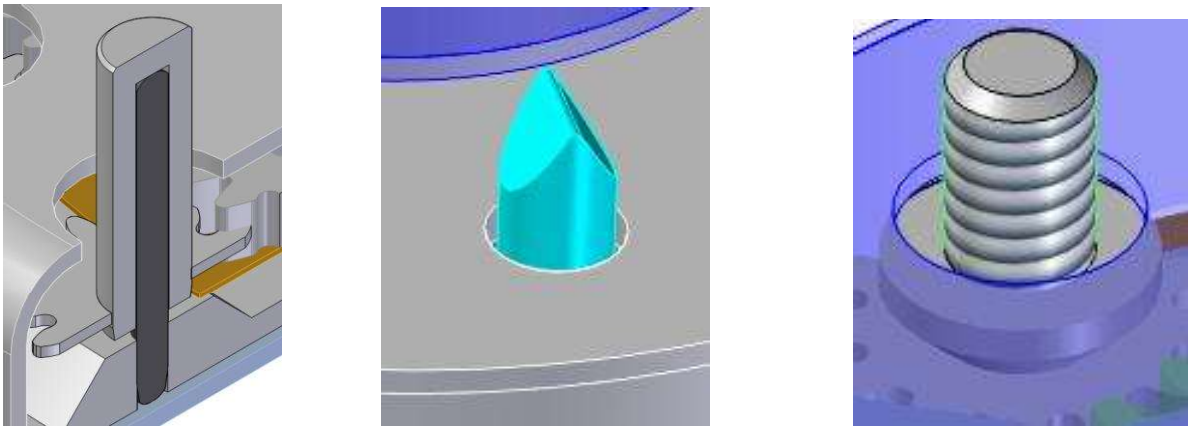


Counter bearings basic (le.) and with bearing bushes (ri.)

Gearboxes with counter bearings usually have a securing system at the end of the rod. They are shaped as a screwdriver blade. The rod can be placed on it at any angle, whereupon it slides into the correct position. In addition, the rod has sufficient mobility to be placed at a tilted angle. Gear units without a counter bearing can have a wide variety of receptacles depending on the application.

Shape of the substrate holder

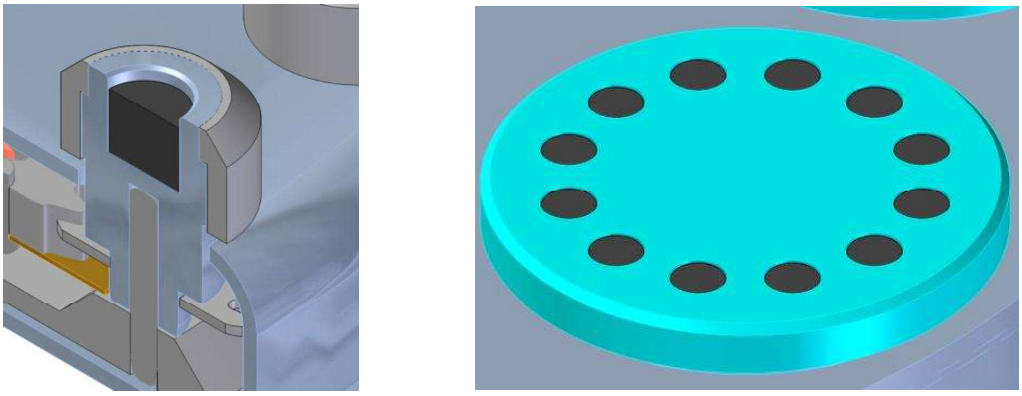
The simplest and most space-saving mount is a round pin. The bearing pin overlaps with the pin which requires a very small overall height. The attached substrate holder masks the pin and protects it from layer deposition.



Spigot shaped Pin (le.) Wedge (m.) und Thread (ri.)

The pin has a residual risk (even though a very small one) that the substrate holder could twist or get stuck on it. This can be eliminated the variants of the screwdriver blade shape or thread shape. However, both variants make the substrate holder and the gearbox more expensive and possibly the loading and unloading process more complex.

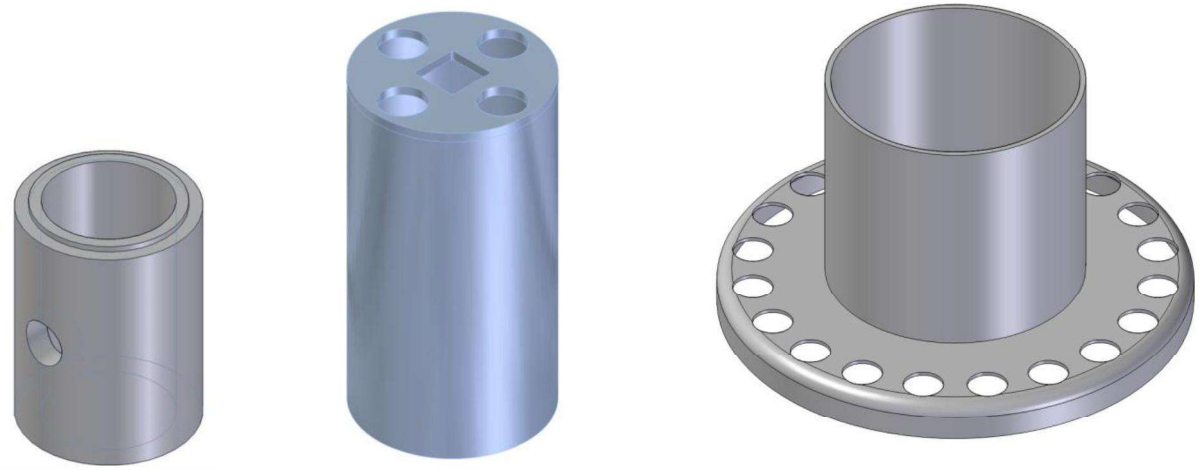
In addition to the form-fit, there are also force-fit recordings such as with magnets. Smaller parts are held with a single magnet, heavier parts on a yoke with multiple magnets.



Single magnet holder (le.) and with a yoke plate (ri.)

Since magnets cannot be decoated, magnetic holder should never be used without a cover. For both versions we offer cover rings, either with or without centering, which protect the magnet and the holder. Centering's cover a small part of the substrate circumference, but make loading easier and more secure.

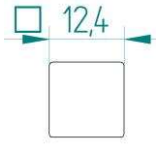
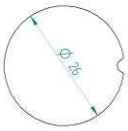
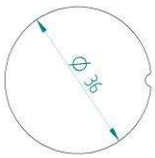
Finally, there are also variants with spacers which keeps the space between the gears if stacked on top of each other. Depending on the process, it can make sense to fill the interior space between the substrates as much as possible or to insert as less additional space as possible. For this we offer slim or filling spacers.



Slim (le.) filling (m.) and welded (ri.) spacers

For series productions with always the same loads, the spacer sleeves can also be permanently welded to one half of the cover. This results in one part less when loading or sandblasting.

The previous products, gearboxes, counter bearings and spacers can be supplied with a cutout (center hole) for most planet shafts. 4pvd offers central cutouts for many common system types, so that GBX and CP2 gearboxes fit on your PVD system without modification.

Bez.	Geometry	Description
V12		Square-cut for square rods 12mm
V15		Square-cut for square rods 15mm
V20		Square-cut for square rods 20mm (not for CP2 < 160mm)
SW19		Cutout for hexagonal rods 19mm
RF20		Round-cut with flat for 20mm rods
RN15		Round-cut with nose for 15mm rods
RN25		Round-cut with nose for 25mm rods (not for CP2 < 160mm)
RN36		Round-cut with nose for 35mm rods (not for GBX / CP2 < 200mm)

The gearbox and counter bearing should have the same central mount. If there are no planet shafts yet, we recommend the V15 up to 1.2m in length and the SW19 for above.

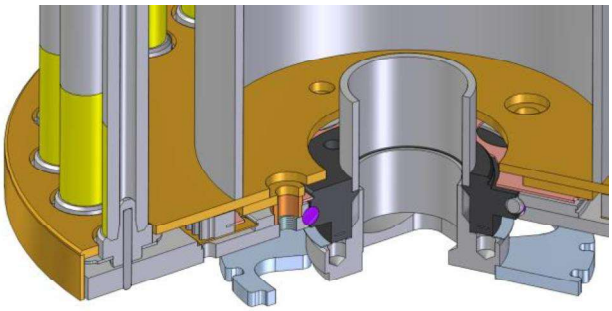
Special models

GBX / CP2 special programs are adapted to special applications. You can find out the available sizes on request:

Inside propulsion

Gearbox is driven form the inside and there is no handle:

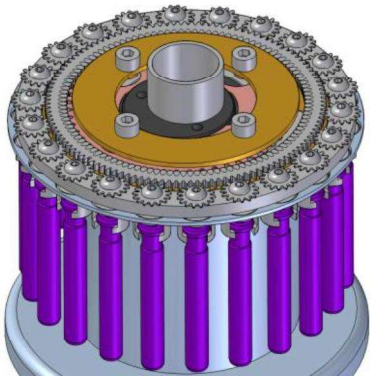
- For hanging substrates
- For set-through substrates
- No handles
- Requires an adaptor for your machine



Hanging substrates

For dust-free end faces:

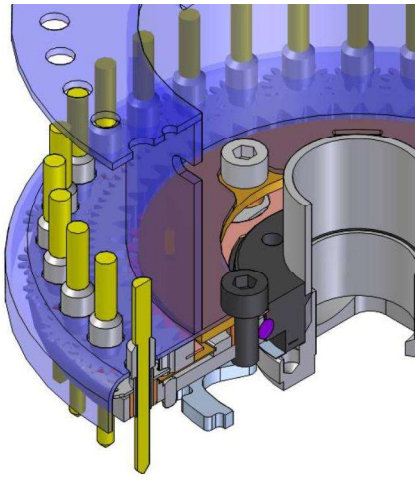
- For hanging substrates
- For substrates with a bigger end diameter
- No handles
- Requires an adaptor for your machine



Set-through substrates

To coat both sides simultaneously:

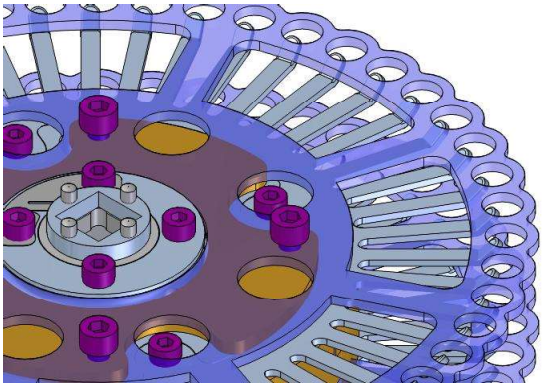
- For set-through substrates
- For substrates with a bigger end diameter
- No handles
- Requires an adaptor for your machine



Ball gearboxes

All around coating for balls:

- Slow and steady roll over of the balls
- High batch capacity/density
- High deposition rate
- Requires an adaptor for your machine

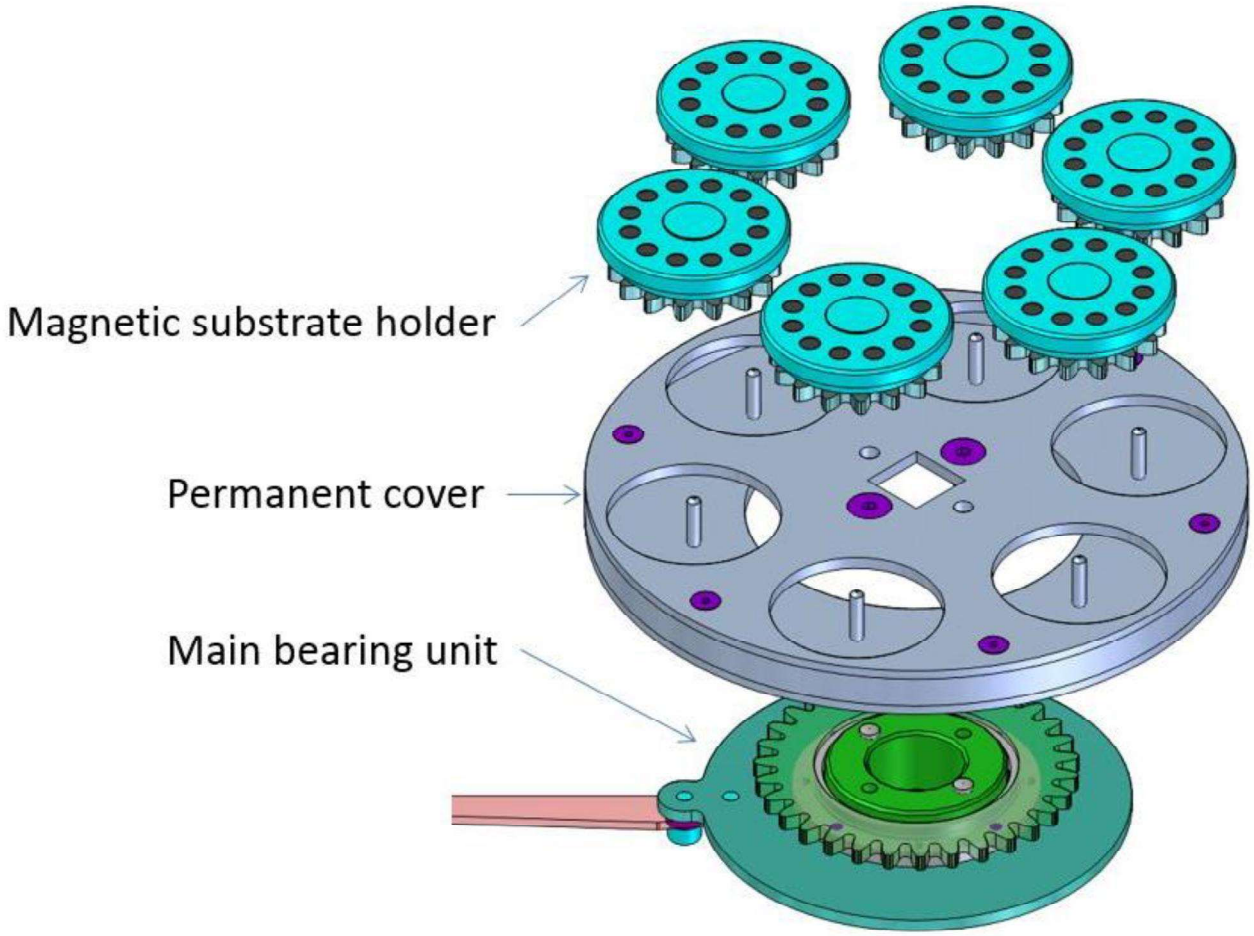


Removable or permanent cover

The mechanics of most gearboxes are protected by a two-part, removable cover. For decoating and maintenance, the cover is removed and a lower shield unscrewed. With additional covering parts, maintenance can be advanced very quickly and if the covering parts are deformed by sandblasting, they can be replaced cheaply.

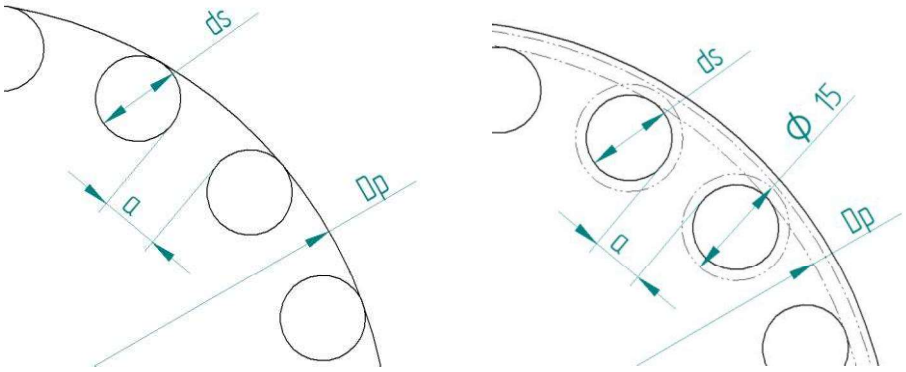
However, the additional covering increases the weight a little and requires a little space. In result the maximum load cannot be achieved. It can make sense to work without a removable cover. The fixed covering occurs more frequently in large gearboxes or those with few substrate mountings.

The shape of the substrate holder should also be taken into account here. A large magnetic plate is able to cover a large vent in the gearbox, so large that the magnetic holder with the gear can simply be pulled off upwards. If you loosen the two screws of the main bearing, the fixed covering unit can be removed.



Measurements

The same basic rules essentially apply to all gearbox variants. The outside diameter of the gearbox and the substrate diameter plus the required distance between the substrates, results to the theoretical max. possible partition (left):



for ds > 18 for ds < 18

$T = (Dp-ds) * \pi / (ds + a)$ $T = (Dp-18) * \pi / (ds + a)$

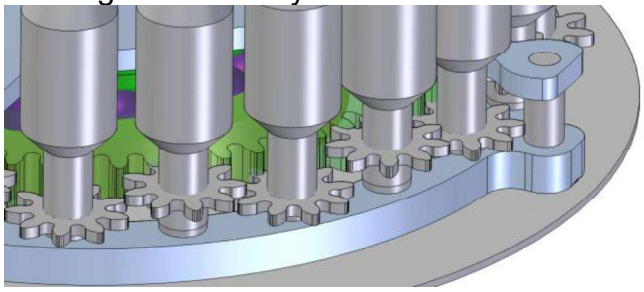
Formulas for (approximate) maximum division (1)[1]

It must be taken into account that the pinions under the substrates have a minimum diameter for technical reasons. Pinions with a diameter of less than 15mm either have a small amount or too less teeth to be driven reliably. This means that the value ds, which must be subtracted from Dp, must be at least 18 (15mm for the pinion plus 3mm for the covering and the distance to it, shown in the picture on the right).

The minimum distance ‘a’ depends on the PVD process, but also on the length of the substrates and whether a counter bearing is used. Long substrates can touch each other more easily at the free end due to a slight incline (which can never be completely avoided because of the fits). A counter bearing largely prevents this.

A greater distance must also be maintained for magnetic holder without centering. The outer diameter of the coverings must also be taken into account here, because the coverings may not come too close to one another.

There is also an absolute maximum division for each gearbox diameter. This results from the fact that the smallest possible gears would then touch the axis of the neighbors. With gear Ø130mm this partition is 36. With higher partitions, the pinions need to run in two planes. Therefore, these gears can only have an even number of substrate holders.



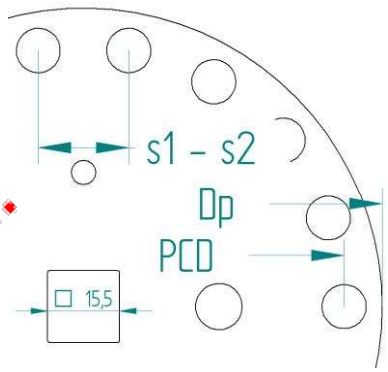
[1] The exact formula requires the trigonometric function arcsin. The error of the simplified formula is negliglble for divisions >6.

Examples

The large number of dimensions combined with the various options results in several thousand possible transmissions. Only a few possible examples are shown below.

CP2 slowly rotating gearboxes Dp = Ø 128mm

Dimension	S1 - s2	Ø PCD	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product number
128 x 18	19,4	112	390	325	293	228	4155516[illegible]
128 x 20	17,2	110	402	335	302	235	4155[illegible]513
128 x 22	15,6	110	414	345	311	242	4[illegible]553565
128 x 24	14,3	110	426	355	320	249	415551017
128 x 28	12,2	109	450	375	338	263	4155[illegible]
128 x 32	10,9	112	474	395	[illegible]	277	4[illegible]50908
128 x 36	9,7	112	498	415	374	291	4[illegible]553567



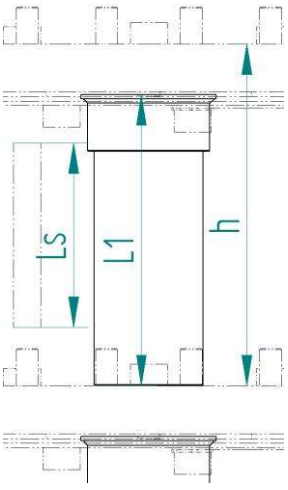
Fits with square rod V15, also available for planet shafts RF20 and SW19

With rotating pins Ø 5mm. For operation there is a need of sleeves (as shown below)

Spacer Sleeves

The vertical distance between two gears is maintained with spacer sleeves. With different spacer sleeves, a gear can be optimized for products of different lengths. The table gives the length of the spacer sleeves (L1) the maximal possible length of the substrates (Ls) and the overall height of a gearbox in the tower (h).

Length L1	max. Ls	h [mm]	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product-number
35,8	11	48	16,50	13,50	11,50	10,50	415551539
41,1	16	53	17,00	14,00	12,00	11,00	415553132
46,1	21	58	17,50	14,50	12,50	11,50	415553165
51,4	28	65	18,00	15,00	13,00	12,00	415552995
55,4	30	64	18,00	15,00	13,00	12,00	415553376
60,0	35	72	18,50	15,50	13,50	12,50	415552858
63,4	38	75	18,50	15,50	13,50	12,50	415552874
67,0	42	79	19,00	16,00	14,00	13,00	415550592
75,8	51	88	19,50	16,50	14,50	13,50	415551018

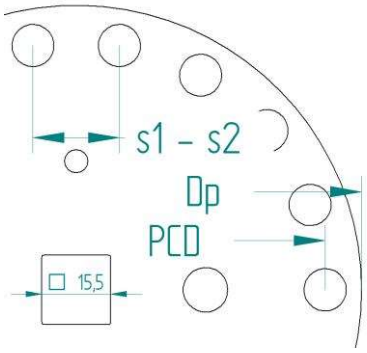


In addition to the spacer sleeves, filling tubes can be used which inhibits the ignition of a plasma in between the substrates and the central rod.

The gearboxes mentioned above are also available with magnetic holders. Since the magnet needs approx. 5mm height, this must be subtracted from the maximum substrate length. CP2 gear units are usually not combined with a counter bearing.

GBX Gearboxes, light weight design < Ø 130mm

Dimension	S1 - s2	Ø PCD	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product-number
125 x 08	34,4	90	800	440	420	280	415551749[1]
125 x 10	29,0	94	800	440	420	280	415553063[2]
128 x 16	20,0	108	800	420	390	290	415551034[3]
130 x 05	56,0	95	800	430	400	300	415550813[3]
130 x 06	47,5	95	800	440	410	300	415550812[1]
130 x 08	36,4	95	800	440	410	300	415551077[1]

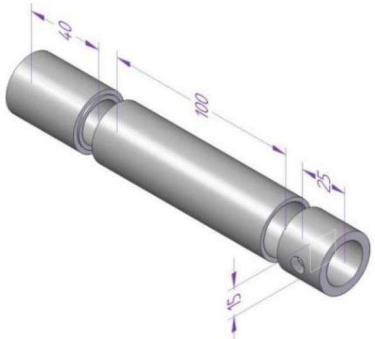


Fits with square rod V15, also available for planet shafts V12, RN15, RF20 and SW19

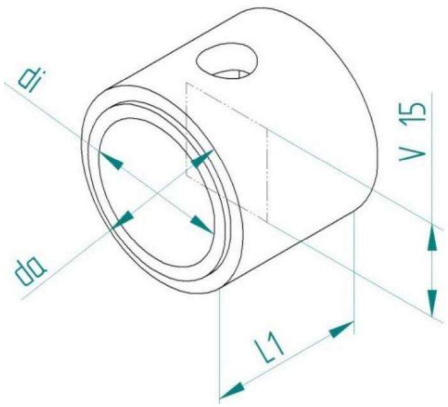
Holder 1=Thread pin, 2= magnets, 3= pin. For sticking up you need spacer sleeves (as shown below)

Spacer Sleeves

For adjustment of the vertical distance between gearbox levels.



Combination of Colt spacer sleeves for V15

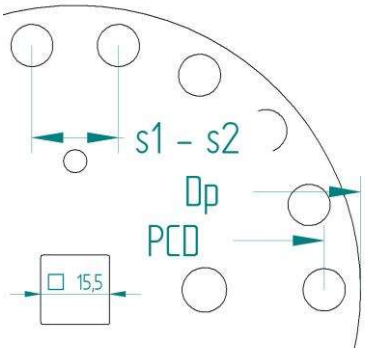


There are thin-walled sleeves (sections of pipe with a wall thickness of approx. 2mm) and thick-walled (turned parts with a wall thickness of approx. 4mm with a centering attachment). The pipe sections are cheaper to bridge large distances. The centering attachment allows the turned parts to be combined with the pipe sections.

Dimension OD x L1 x wall	da	Di	For central rod	L1	€ @ 5	€ @ 10	€ @ 20	€ @ 50	Product number
21 x 020 x 2	21,3	17,3	VK12, RN15	20,0	5,30	4,80	4,40	4,10	415550340
21 x 030 x 2	21,3	17,3	VK12, RN15	30,0	5,30	4,80	4,40	4,10	415550341
21 x 040 x 2	21,3	17,3	VK12, RN15	40,0	5,30	4,80	4,40	4,10	415550342
21 x 070 x 2	21,3	17,3	VK12, RN15	70,0	5,30	5,00	4,40	4,10	415550343
30 x 025 x 4	**30,0**	**21,5**	**VK15**, RF20	**25,0**	**5,10**	**4,50**	**4,20**	**3,90**	**398761904**
30 x 040 x 4	**30,0**	**21,5**	**VK15**, RF20	**40,0**	**5,80**	**5,20**	**4,80**	**4,40**	**398761855**
30 x 100 x 4	**30,0**	**26,0**	**VK15**, RF20	**100**	**4,40**	**3,90**	**3,60**	**3,30**	**398761915**

GBX Gearboxes, middle weight design < Ø 130mm

Dimen-sion	S1 - s2	Ø PCD	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product-number
120 x 06	47,5	95	348	280	261	203	415551749[1]
125 x 04	56,0	79	477	397	358	278	415551172[2]
128 x 05	50,0	84	456	380	342	266	415551170[2]
127 x 06	42,2	84	436	363	327	255	413990929[2]
128 x 12	26,0	101	472	393	354	276	415551169[2]
129 x 14	22,7	102	458	381	343	267	415552124[2]
129 x 16	19,5	100	479	399	360	280	415552154[2]
130 x 24	13,4	103	486	405	365	284	412831835[1]



Fits for square rods V15, also available for planet shafts V12, RN15, RF20 and SW19

Holder: 1= Sleeve and V20, 2= Magnets. For sticking up you need spacer sleeves (as shown below)

The gearboxes mentioned above are also available with magnetic holders. Since the magnet needs approx. 5mm height, this must be subtracted from the maximum substrate length. Medium sized gearboxes are usually not combined with a counter bearing.

Spacer sleeves Ø54mm

Spacer sleeves for medium and heavy gears are slightly larger in diameter to give the gears more stability when loading. The gearbox should not tip over when components are attached on one side. Therefore, these spacer sleeves are also independent of the shape of the planet shaft.

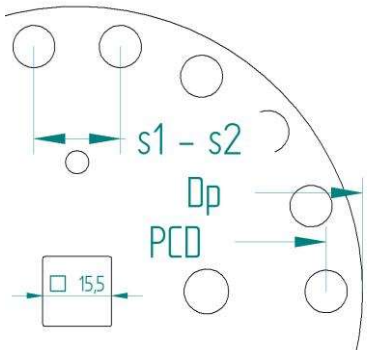
Size OD x L1 x wall	da	Di	For central rods	L1	€ @ 5	€ @ 10	€ @ 20	€ @ 50	Product number
54 x 029 x 2	54	50	all	29,0	13,00	11,50	11,00	10,00	415551358
54 x 040 x 2	54	50	all	40,0	13,00	11,50	11,00	10,00	398271336
54 x 061 x 2	54	50	all	61,0	13,00	11,50	11,00	10,00	415552398
54 x 080 x 2	54	50	all	80,0	16,00	14,00	13,00	11,00	415550861
54 x 090 x 2	54	50	all	90,0	16,00	14,00	13,00	11,00	415552327
54 x 100 x 2	54	50	all	100,0	16,00	14,00	13,00	11,00	415550369
54 x 126 x 4	54	50	all	126,0	18,00	16,50	15,00	13,00	415552068
54 x 156 x 4	54	50	all	156,0	18,00	16,50	15,00	13,00	415552067
54 x 202 x 2	54	50	alle	202,0	18,00	16,50	15,00	13,00	415552066

Intermediate sizes are available if requested.

The spacer sleeves from above center on the gear itself and are therefore suitable for all planet shafts. The following heavy-duty gearboxes also use the above Ø54mm spacer tubes.

GBX Gearboxes, heavy design < Ø130

Dimen-sion	S1 - s2	Ø PCD	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product number
125 x 04	58,0	82	396	330	297	231	415550764[1]
129 x 05	48,0	82	402	335	302	235	405111737[1]
125 x 06	41,0	82	408	340	306	238	415550765[1]
130 x 08	38,0	100	420	350	315	245	404291908[1]
129 x 10	31,5	102	396	330	297	231	415550801[2]
129 x 12	26,5	102	408	340	306	238	415550807[2]
130 x 14	22,7	102	456	380	342	266	404921202[1]



Fits for square rods V15, also available for planet shafts V12, RN15, RF20 and SW19

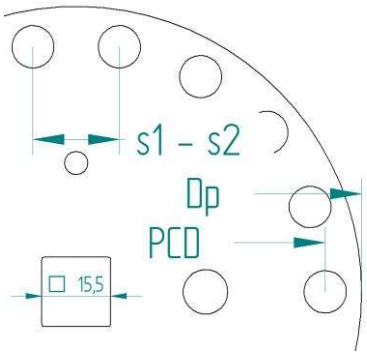
Holders 1= wedge, 2= wedge and V20. For stucking up you need spacer sleeves (as shown below)

The gearboxes mentioned above are also available with magnetic holders. Since the magnet needs approx. 5mm height, this must be subtracted from the maximum substrate length. Heavy gearboxes can be operated with counter bearings.

The PCD and the number of bore holes as well as the mount for the planet shaft of the counter bearing must match with the gearbox below. The outer diameter of the counter bearings is usually somewhat smaller than that of the gearbox. The table below shows only a small selection.

Counter bearing for heavy design gearboxes < Ø130

Dimen-sion	height h	Bore hole	Ø PCD	€ @ 1	€ @ 5	€ @ 10	€ @ 50	Product number
125 x 04	300	8,3	82	200	114	100	84	415550766
129 x 05	230	8,6	82	200	114	100	84	415551122[2]
125 x 06	300	8,3	82	200	114	100	84	415550770
130 x 08	23	9,0	100	235	135	117	100	404291926[1]
129 x 10	759	16	102	210	120	105	89	415552411[3]
129 x 12	759	16	102	210	120	105	89	415550810[3]
130 x 14	23	9	102	250	142	125	106	404921206[1]



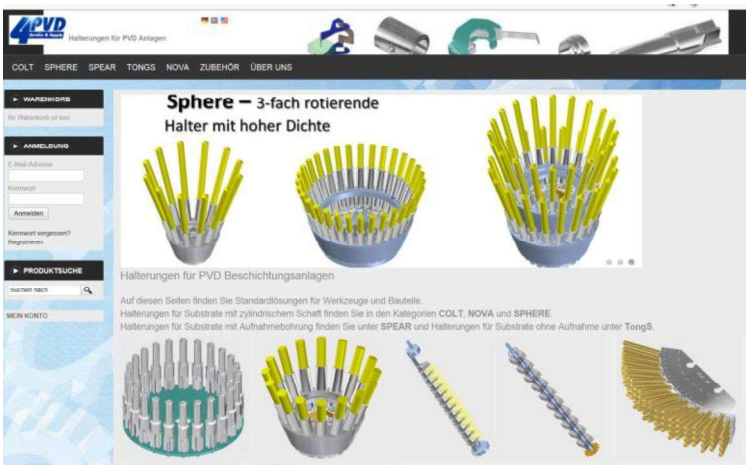
Fits for square rods V15, also available for planet shafts V12, RN15, RF20 and SW19

Construction 1= with bushings, 2= V20, 3= V20 for bushings

Rods for gearboxes, heavy design

Rods are usually adapted to the customer's components. As a rule, the gap between the rod and the component must not be greater than 1mm. Square or hexagonal rods facilitate outgassing and cleaning. If you want to stack rods on top of each other in several levels, they must also have the "wedge" shape at the top.

Easy product finding in our **4pvd Online Shop**



On the main page our products are sorted according to our product lines Colt, Sphere, Spear, TongS, Nova and accessory.

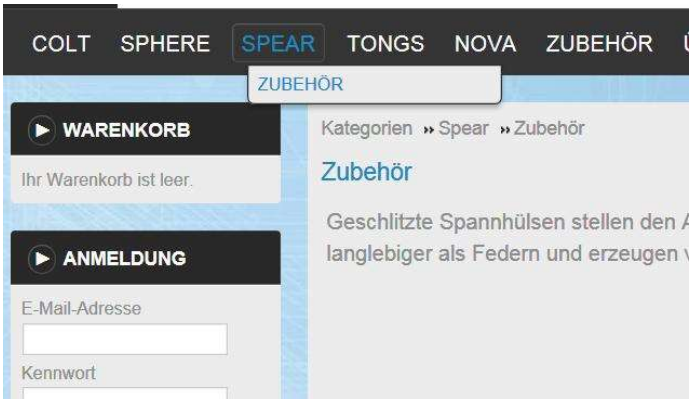
In the center some examples will appear in intervals.

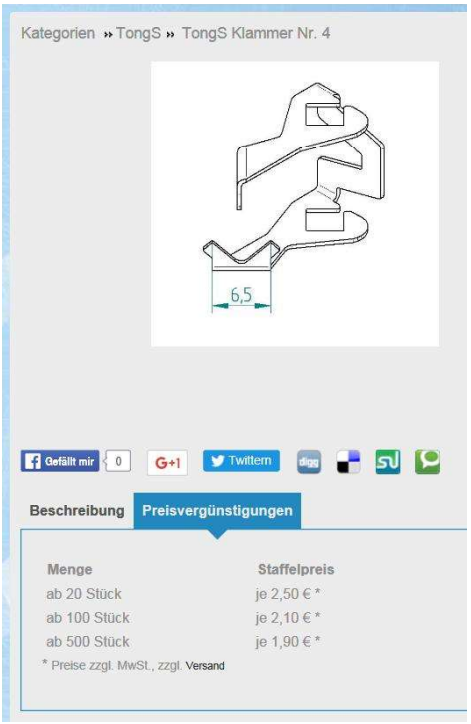
You can browse through the shop with or without log-in.

Behind the main categories other menus are available.

You may also search for key words or item numbers.

A log in account is only necessary for ordering. If you are already a 4pvd customer, please let us fill your account data.





For each item you can find dimensions, prices and discounts as well as stock availability.

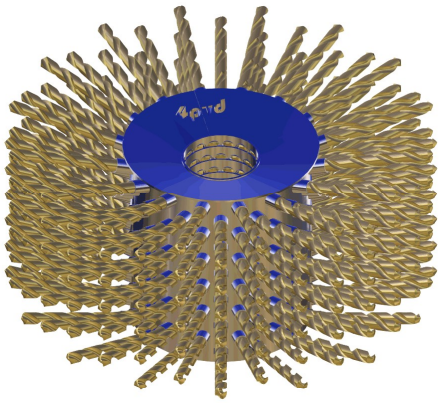
Corresponding accessory is listed at the bottom part of the item window.

Get into the shop via the link for our website www.4pvd.de or directly via: www.webshop.4pvd.de

The pages and descriptions may be displayed in English and German language.

Earlier orders can be recalled and products can be place on the memory board until the next visit.

Other 4pvd Fixture systems



Nova fixtures position the products radial, so the tips face to the evaporators and get the highest coating thickness. Nova is most useful for products with short length of operation as end mills, micro drills, punches, etc.

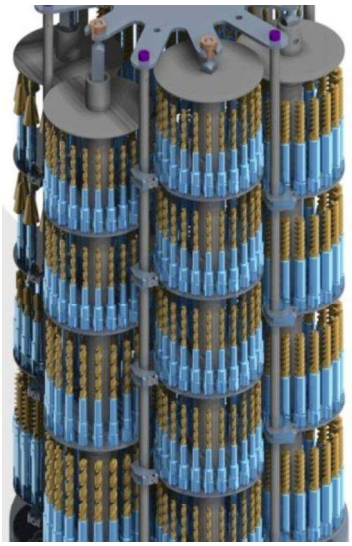
If rotation along the products axle is not necessary, nova provides huge capacity for your furnace.

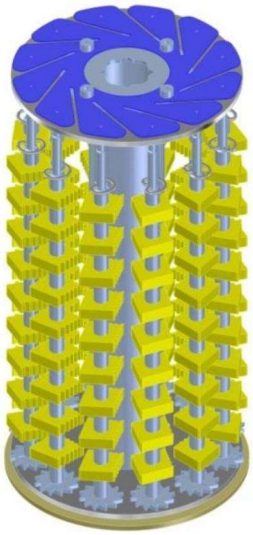
Nova is available for up to three rotation axles, with encoding and optional with integrated clinch.

Holders of the **COLT** series resemble the mostly used system of the manufacturer in the point of the arrangement of sleeves. Through a rotation with the maximum of the triple an even coat is applied at the perimeter of your products, a must-have for drills, cutter, taps and reamers.

It is available with up to four rotation axes, with a one - sided or overhung extension, with encoding and with integrated actuator.

Find out more at:
http://www.4pvd.de/html/colt.html





Spear fixtures hold a large quantity of small substrates as indexable inserts in a very compact space. If the substrates have holes the Spear holder is a very simple rod with gear for the third rotation axle at the bottom end.

For substrates without hole, Spear fixtures will be adapted individually on the substrate geometry and hold them with form fit. This form fit is one of the main differences to the TongS fixture series which take negative shaped substrates.

The standard Spear and Tongs fixture sizes fit to plates with a bearing on the lower and the upper end. They may rotate around two or three axles on the substrate table. A spring protects the rods against unwanted displacement. Please check also:
http://www.4pvd.de/html/wendeplatten.html

Weitere 4pvd Produkte

Other 4pvd Products

Table Systems

Substrate tables for 2-fold rotation with up to 18 planets, optionally on different PCD (e. g. for occasionally coating of bigger parts)

Flat design for maximum utilization of your coating zone. Modular concept for fast maintenance. Low weight, low torque.

Double shield set for better heat insulation available.

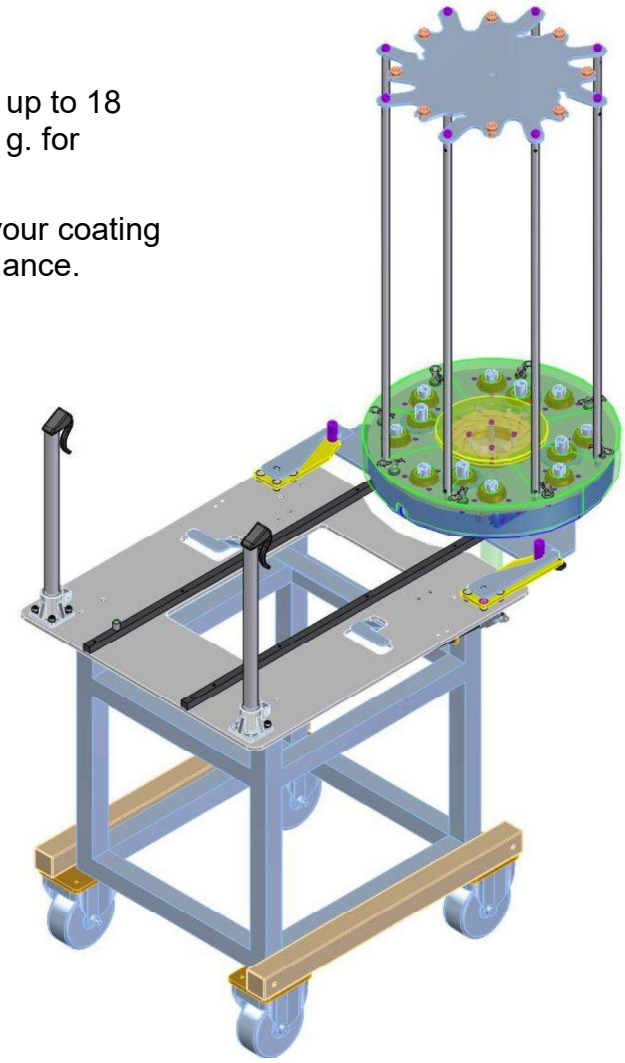
Exchangeable liners on floating potential.

Prepared with kicker rods and upper bearing plate for operation of third rotation axis.

Installation kits with rails and clutch system for easy roll-in and roll-out.

Batching cart with clutch system and brakes as well as parking stations for preloading.

Accessory as planet adaptors
High load platforms and
all fixtures from our supply.

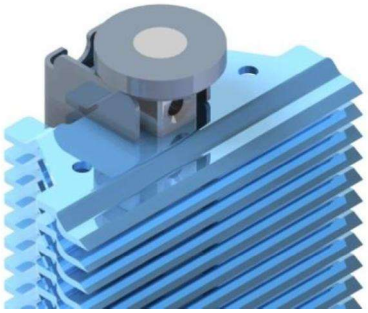


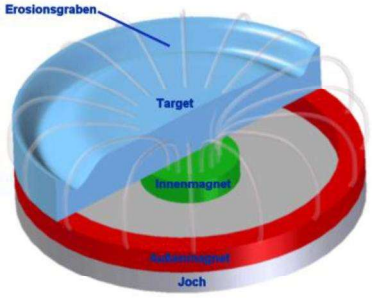
Custom Design Fixtures

Did not find your product here or anything fitting for your application?

We will be happy to help you with your challenge.

Be the No. 1 in terms of quality, economics and speed. Use 4pvd know how and fixture systems.





Consulting, Training and Design Work

4pvd assists you during development, marketing and distribution of your coated products as well as the related material flow and logistics.

With our experience you can place your products quickly, exactly and at reasonable cost. 4pvd will check your chances before you invest lots of money.