

# THE MOST IMPORTANT ON THE SUBJECT OF VACUUM CLAMPING TECHNOLOGY

## WHAT IS A VACUUM?

A vacuum is the state in a space which is free of matter. In practice, we already call it a vacuum when the air pressure in a space is less than that of the atmosphere.

## UNITS OF MEASUREMENT USED

The most common units are the pascal and the bar.

- > 100 Pa = 1 hPa
- > 1 hPa = 1 mbar
- > 1 mbar = 0.001 bar

## VACUUM CLAMPING SYSTEMS

Vacuum clamping systems are used above all in the wood, plastics and non-ferrous metals industries for quick, simple machining; they are compatible with CNC machine tools. Here vacuum technology is used in connection with special handling systems, for example in order to fix an aluminium plate and machine it from all sides. This increases productivity and cost-effectiveness: the fixing does not cause any damage to the workpiece, and no laborious, time-consuming aligning of the workpiece is required. The latest clamping systems allow attachments of various sizes and shapes to be exchanged in a very short time, thus facilitating flexible handling of a wide range of workpiece shapes.

## WHAT DOES VACUUM CLAMPING MEAN?

In vacuum clamping, an underpressure is generated under the workpiece being clamped, i.e. a pressure differential is created which presses the workpiece against the clamping plate. Thus the workpiece is not, as one might think, actually „sucked,“ but is rather pressed against the vacuum table. The sliding force of the workpiece depends on its surface structure, the pressure differential and the area on which the vacuum acts. The larger this area is, the better the holding forces.

## WHY DOES A VACUUM GENERATE A HOLDING FORCE?

All surfaces of an object are subjected to an even pressure of approx. 1 bar by the surrounding atmosphere. The integrated Venturi nozzle or an external vacuum pump then removes some of the air from under the workpiece being held, thus removing part of the pressure load on that surface. What remains is a one-sided pressure on the top surface of the workpiece, whose size depends on the degree of the vacuum. Generally it is 0.7 - 0.8 bar. This means, for example, that a vacuum of 200mbar (absolute pressure) is generated. The pressure differential acting on the workpiece is therefore 800mbar (approx. 0.8 kp/cm). The size of the clamping force is then only dependent on the clamping area.

## CALCULATION FORMULAE:

- > Force = Pressure x Area
- >  $F \text{ (N)} = \text{bar} \times A \text{ (m}^2\text{)} \times 10^5$
- > 1 bar = 10 N / cm<sup>2</sup>



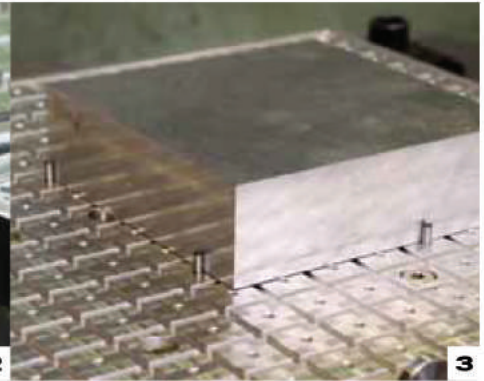
# THE BENEFITS OF AMF VACUUM CLAMPING TECHNOLOGY



> The AMF vacuum clamping plate can be operated using compressed air and the integrated Venturi nozzle, or with an external vacuum pump.



> The height-adjustable eccentric stops absorb the sliding forces, and can be adjusted individually to the workpiece height.



> Easy positioning of workpieces by fastening with stop pins. These also absorb the sliding forces.



> Irregularities in the workpiece surface are compensated for by the sealing cord. The workpiece contour can be represented optimally using the grid pattern on the plate.



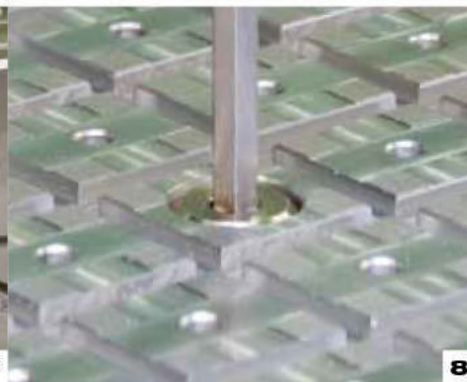
> Lateral grooves allow the vacuum clamping plate to be fastened to a baseplate or onto the machine table using AMF clamps No. 6325.



> Fixtures can be positioned on the vacuum clamping plate with a precision of  $\pm 0.01$  mm using one locating pin and one diamond pin each.



> The sound absorber is integrated into the vacuum clamping plate. We offer two different versions of the sound absorber (No. 7800VSDI and 7800VSD), depending on the specific application.



> Depending on the size of the clamping plate, workpieces can be clamped using more than one suction point. This can also be used to clamp multiple workpieces – even different ones.



> For efficient changing of the vacuum clamping plate, it can be used in combination with the AMF „Zero-Point“ clamping system. This minimises setup times and increases machine runtime.

## No. 7800

### Vacuum clamping plate

Included in scope of supply:

- Baseplate made of aluminium
- Integrated Venturi nozzle
- Sound absorber, supplied
- Vacuum meter
- Shut-off valve
- 6 eccentric stops
- 2 m pneumatic hose
- Plug-in nipple for compressed air connection
- 10 m sealing cord  $\varnothing$  4 mm

Order no.	Operating pressure [bar]	max. vacuum [%]	Number of suction points	L	B	H $\pm$ 0,1	R	Weight [Kg]
375105	3-8	93	1	150	150	40	25	1,0
374470	3-8	93	3	200	300	40	25	6,0
374488	3-8	93	9	300	400	40	25	12,0
374496	3-8	93	9	400	400	40	25	16,0
374504	3-8	93	9	400	600	40	25	24,0
375717	3-8	93	1	150	150	40	12,5	1,0
375733	3-8	93	3	200	300	40	12,5	6,0
375758	3-8	93	9	300	400	40	12,5	12,0
375774	3-8	93	9	400	400	40	12,5	16,0
375790	3-8	93	9	400	600	40	12,5	24,0

### Design:

The vacuum plate has grooves and suction points on its upper side. By inserting the sealing cord, one or more fields can be defined for the desired workpiece size. All suction points are interconnected. Easy positioning via holes for stop pins or lateral, height-adjustable eccentric stops.

Lateral grooves or fastening holes allow the vacuum clamping plate to be fastened to a baseplate (e.g. machine table).

Fixture plates can additionally be fixed using a sword or locating pin. It is also no problem to integrate the vacuum clamping plate into the AMF „Zero-Point“ clamping system (see the AMF catalogue „Zero-Point Systems“).

### Application:

The workpieces being machined are clamped through generation of a vacuum by means of the integrated Venturi nozzle technology (included in scope of supply) or with an external vacuum pump. By means of individual grid allocation it is also possible to clamp and machine multiple, different workpieces at the same time.

Typical applications are milling and grinding operations.

The vacuum clamping plate is ready to use right away – all of the necessary components are included in the scope of supply.

### Advantage:

- The AMF vacuum clamping plate can be operated using compressed air and the integrated Venturi nozzle, or with an external vacuum pump.

- Cost savings through use of the Venturi nozzle

- Low compressed air consumption, thus low operating costs

Example: 1 m<sup>3</sup> of compressed air costs 0.0078 €. At an average consumption of 40 l/min, this corresponds to 0.0187 €/h.

- Multiple suction points, thus flexible grid allocation and clamping of multiple parts possible

- Vacuum plates can be combined with each other

- High holding forces

- Universal use

- High coefficient of friction allows secure clamping of unmachined workpiece surfaces

- Sealing cords compensate for small irregularities in the workpiece surface

- Distortion-free, vibration-free five-sided machining

### Note:

Operate only with dried, filtered, non-lubricated compressed air!

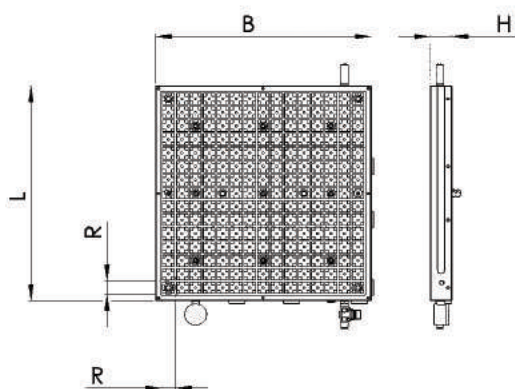
Max. suction volume against atmosphere: 21.8 l/min.

Operating pressure for max. suction volume flow: 3.5 bar.

Please observe installation manual 7800.

### On request:

Special dimensions



### Recommendations



No. 7800AMG,  
page 10



No. 7800APA,  
page 11



No. 7800VP,  
page 13



## No. 7800AMG

### Adapter mat, rubber

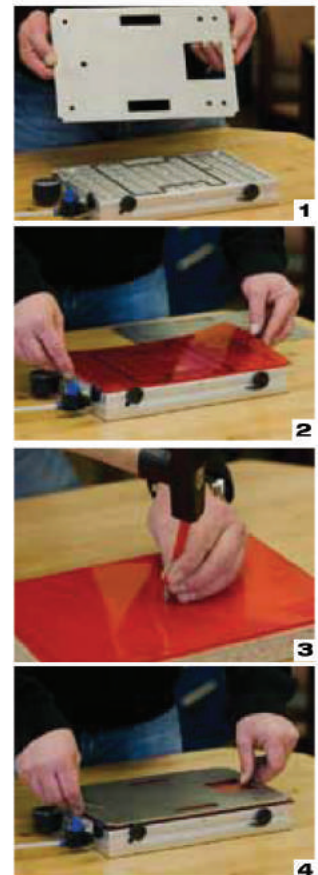
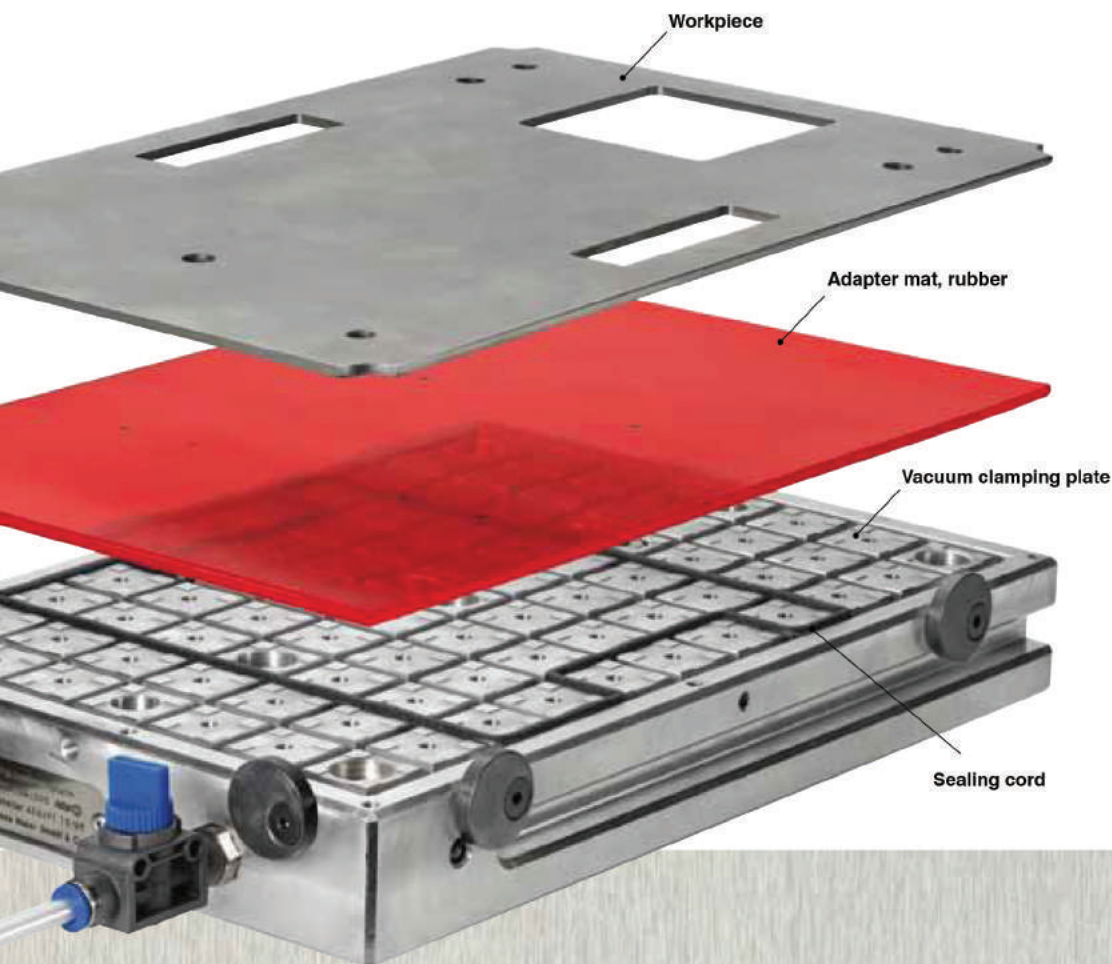
Order no.	Dimension [mm]	Material thickness $\pm 0.2$ [mm]	Weight [g]
375485	150x150	4	110
375014	300x200	4	275
375022	300x400	4	550
375030	400x400	4	780
375048	400x600	4	1100

#### Application:

1. The sealing cord is placed in the grid of the vacuum clamping plate. It goes up to the end of the area to be worked on in the workpiece.
2. The adapter mat is placed onto the vacuum clamping plate.
3. Holes are made in the adapter mat within the marked clamping surface over a wood plate with a 3-5 mm diameter hole punch. The location of the holes must be in the area of the grid cuts of the vacuum clamping plate.
4. The workpiece to be worked on is placed on it and fixed using the adjustable eccentric stops.

#### Advantage:

- The good coefficient of friction offers especially good resistance against the displacement forces that arise during processing.
- The adapter mat can be cut into up to 2 mm deep without problem.
- If the same contours are used, the adapter mat can be reused almost any number of times, since it does not undergo wear.



**No. 7800APA**

**Adapter plate, aluminium**

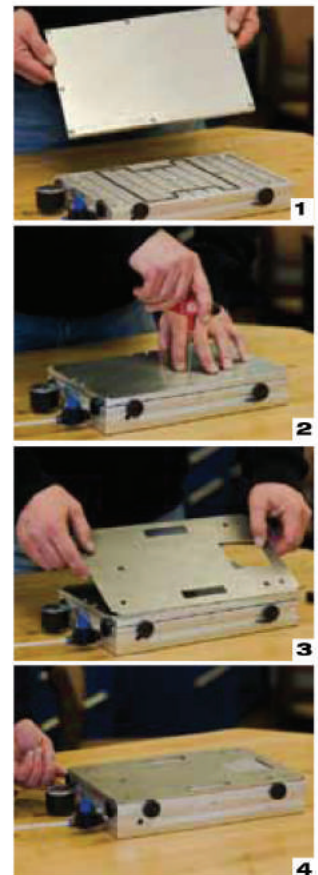
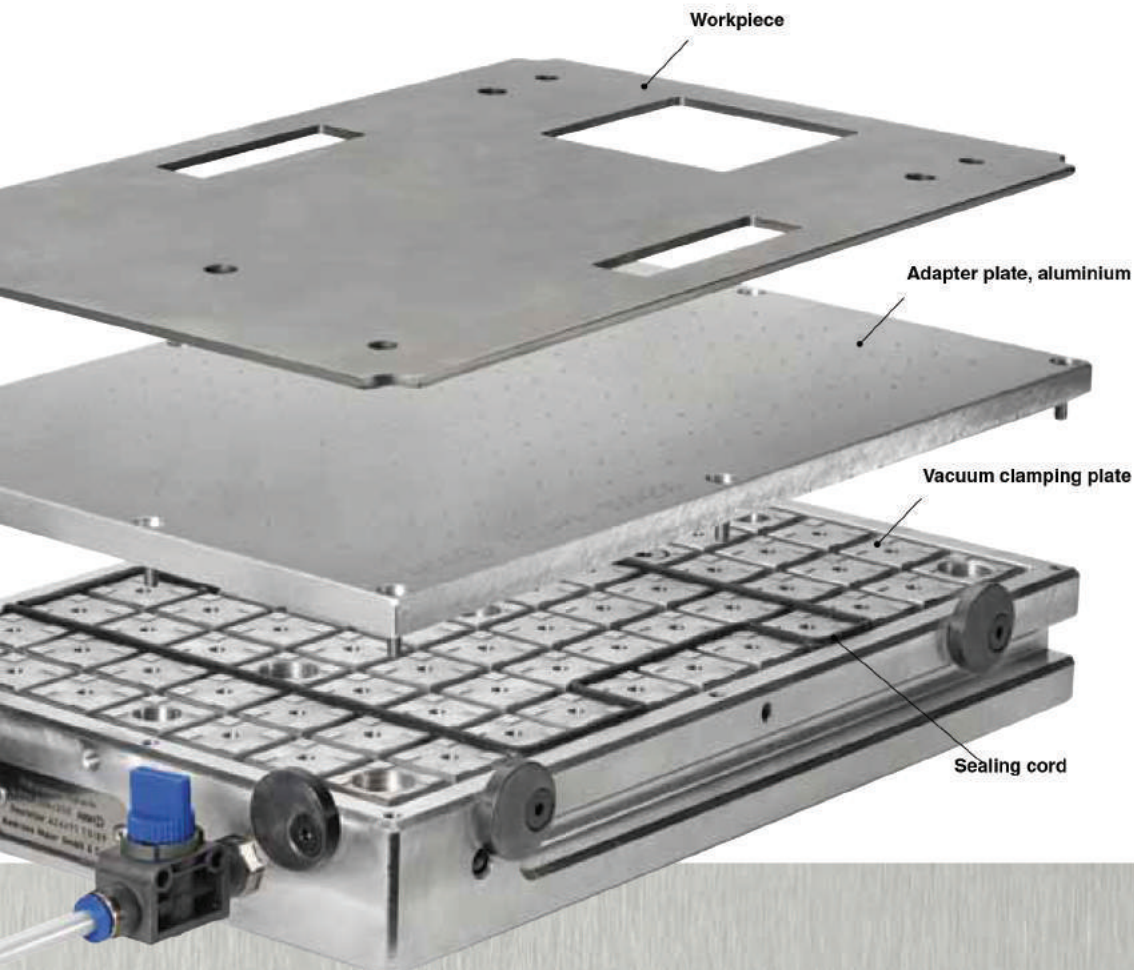
Order no.	Dimension [mm]	Material thickness $\pm 0.1$ [mm]	Weight [Kg]
375097	150x150	10	0,6
374876	300x200	10	1,6
374892	300x400	10	3,3
374900	400x400	10	4,4
374918	400x600	10	6,6

**Application:**

1. The sealing cord is placed in the grid of the vacuum clamping plate. It goes up to the end of the area to be worked on in the workpiece.
2. The adapter plate is screwed to the vacuum clamping plate.
3. The workpiece to be worked on is placed on it.
4. The workpiece is fixed using the adjustable eccentric stops.

**Advantage:**

- The adapter plate can be overcut by up to 2 mm (elimination of cuts).
- Preferred uses are for processing thin sheet metal, foils, boards and even paper.



## No. 7810AB

### Surface-mounted block

The following are supplied as standard:

- Surface-mounted block from aluminium, grid 12.5 x 12.5 mm
- 3 eccentric stops with fixing screws
- 1 m sealing cord Ø 2.0 mm



Order no.	max. vacuum [%]	Number of suction points	L	B	H	Weight [g]
375626	93	1	78	78	40	600

### Design:

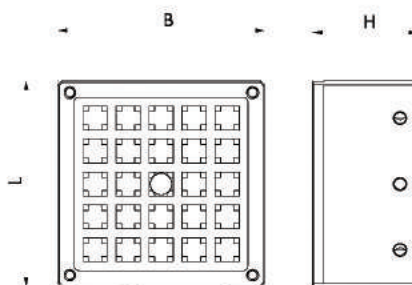
The surface-mounted block has grooves and a suction point on its upper side. The grid spacing is 12.5 mm. The field size is individually defined by inserting the sealing cord. The surface-mounted block is placed directly over a suction point on the vacuum clamping plate no. 7800. The underside is equipped with a sealing cord Ø 2.0 mm.

### Application:

The use of surface-mounted blocks allows openings for finishing. Workpieces can be through-bored without the vacuum clamping plate or the component itself being damaged.

### Note:

Please order sealing cord Ø 4.0 mm separately (OrderNo. 374512).



## No. 7810APA

### Adapter plate, aluminium

Suitable for surface-mounted block no. 7810AB.



Order no.	Dimension [mm]	Material thickness ±0.1 [mm]	Weight [g]
375634	78 x 78	10	200

### Advantage:

- The adapter plate can be milled down to 2 mm (millings on both sides).
- Preferred applications are the finishing of thin sheets, foils, PCBs and even paper.

## No. 7810AMG

### Adapter mat, rubber

Suitable for surface-mounted block no. 7810AB.



Order no.	Dimension [mm]	Material thickness ±0.2 [mm]	Weight [g]
375642	78 x 78	4	60

### Advantage:

- The good coefficient of friction offers particularly favourable resistance to the resulting displacement forces during finishing.
- Milling down to 2 mm deep in the adaptermat is no problem.
- If the same contours are always applied, the adapter mat can be reused any number of times, since they do not suffer any wear.

## No. 7800VP

### Rotary vane vacuum pump

Included in scope of supply:

- suction-side fine-mesh filter
- oil mist separator
- reversing valve for coarse or fine vacuum operation
- anti-vibration buffer
- initial oil fill
- without gas ballast



Order no.	Vacuum [%]	Suction performance [m³/h]	Lubrication	Motor rating [V/Hz]	Noise level [dB (A)]	Code class	Continuous operation [%]	Weight [Kg]
374991	99	15	15	230/50	59	54	100	19

#### Application:

If compressed air is present where the vacuum clamping plate is used, we recommend using the AMF rotary vane vacuum pump. It ensures reliable continuous operation of the clamping plates used. Due to its small design, the pump can be attached directly to your machine.

#### On request:

Other sizes and suction performances are available on request.

## No. 7800VPF

### Liquid separator

Included in scope of supply:

- Water separator
- Vacuum filter
- Fastening unit
- Ball valve
- Coupling plug 1/2" external thread - 15 mm
- Plastic tube Ø 15 x 12 mm, length 2 m
- Coupler socket
- Double nipple



Order no.	Size	Connection	Flow [m³/h]	Weight [g]
374975	D100x250	3/4"	15	1610

#### Application:

The liquid separator effectively removes condensate (water) from the vacuum clamping system and so protects it from contamination.

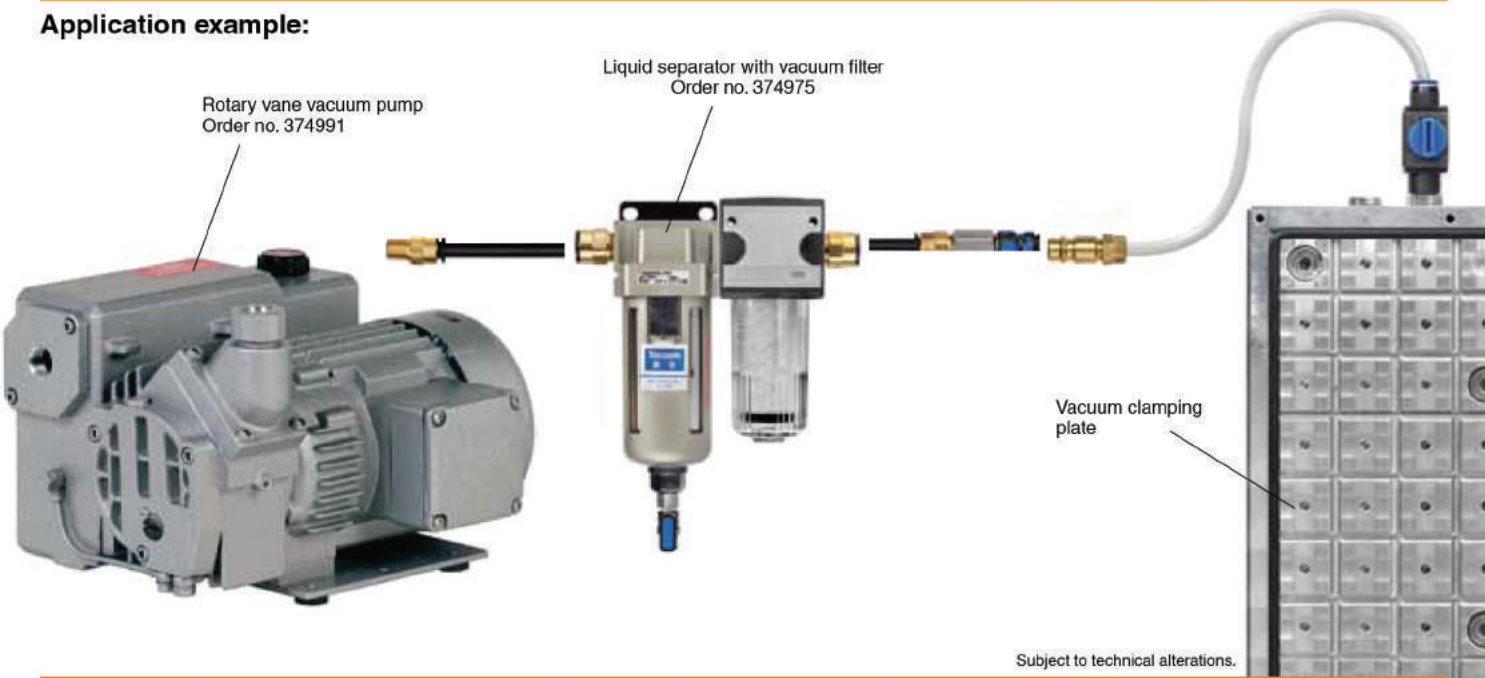
#### Advantage:

- Removal of 99% of the contained liquid
- maintenance-free
- system's operation and maintenance costs are minimised
- easy to install (before the vacuum pump)

#### Note:

The set is supplied in the assembled state.

### Application example:





## No. 7800VPE

### Vacuum pump, external



Order no.	max. vacuum [%]	Max. suction volume flow [l/min.]	min. operating pressure [bar]	Vacuum connection Outside dia. [mm]	Pneum. connection Outside dia. [mm]	Weight [g]
376434	93	21,8	3,5	6	6	47

#### Design:

- Silencer open
- Ball valve
- Plug connection for hose

#### Application:

A small plastic ejector that is used to clamp suction-tight workpieces. For use in systems with external (decentralised) vacuum generation.

#### Advantage:

Very small design, universal use and economical.

## No. 7800D

### Sealing cord

Shore hardness: 8-13°.



Order no.	Groove width [mm]	dia. [mm]	Length [m]	Weight [g]
374512	4	4,0 ±0,45	10	320

#### Application:

The sealing cord is inserted in the groove to delimit the clamping surface.

#### Advantage:

Multiple workpieces can be clamped, even with different sizes.

## No. 7800V

### Vacuum meter



Order no.	Indicators area [bar]	dia. [mm]	Connection below	Weight [g]
374694	-1 ... 0	40	G1/8	73

## No. 7800VDS

### Vacuum pressure sensor with accessories

Electrical connection:

Cable with connector according to EN 60947-5-2, round design M 8x1, 4-pin, Cable length 0.3 m.

Scope of supply consists of:

- Pressure sensor
- Vacuum hose, outer Ø 4 mm, length 30 cm
- Plug connection G1/8-4



Order no.	Indicators area [bar]	Ambient temp. [°C]	Weight [g]
374520	-1 ... 0	0-50	80

#### Application:

The threshold values (variable: 2 x relative pressure) are set on the pressure sensor using teaching. If the vacuum pressure drops, the machine is switched off.

#### Advantage:

The vacuum pressure sensor serves to monitor the applied air pressure. If the pressure drops, the machine is switched off. This contributes decisively to process reliability.

### No. 7800VD

#### Sealing ring

for vacuum meter



Order no.	Connection	Weight [g]
374561	G1/8	0,5

#### Application:

Sealing ring is used in installation of the vacuum meter.

### No. 7800E

#### Eccentric stop, dia. 30 mm

Steel, blued.

Complete with flat-head screw.



Order no.	dia. [mm]	Weight [g]
374538	30	26

#### Advantage:

Individual adjustment to the workpiece height. The sliding forces are absorbed by the stop.

### No. 7800VSD

#### Sound absorber

Housing and absorber insert of PE.



Order no.	Connection	Ambient temp. [°C]	Weight [g]
374579	G1/8	-10 - 60	5

#### Application:

Can be screwed directly into the in vacuum clamping plate.

#### Note:

Check sound absorber regularly for fouling.

### No. 908-G1/8

#### Screw plug

with rubber seal



Order no.	Connection	Weight [g]
374553	G1/8	7

### No. 7800VAF

#### Suction filter

Housing of brass, filter insert of tin bronze.



Order no.	Connection	Weight [g]
374884	G1/8	2

#### Application:

The suction filter is screwed into the vacuum clamping plate.

#### Note:

Check suction filter regularly for fouling.

### No. 7800AV

#### Ball-Valve

manually operated.



Order no.	Connection	Hose dia. [mm]	Weight [g]
374587	G1/8	6	40

#### Application:

The hand valve is screwed into the plate directly. With O-ring seal.

### No. 7800VNS

#### Plug-in nipple for quick coupling

with cap nut DN7.2. Brass.



Order no.	Hose dia., outer [mm]	Weight [g]
374595	6	17

#### Advantage:

Easy connection with the pneumatic hose of the vacuum clamping plate.

### No. 7800ZS

#### ISO 8734-4x12-A cylinder pin

Steel.



Order no.	Packaging unit [pc]	Weight [g]
374603	10	15

#### Application:

Easy positioning of workpieces by fastening in the holes provided in the vacuum clamping plate.

#### Advantage:

The sliding forces are absorbed by the stop.

### No. 2800W-06

#### Pneumatic hose



Order no.	Hose dia. [mm]	Length [m]	Weight [g]
374611	6	10	300

### No. 7800VAB

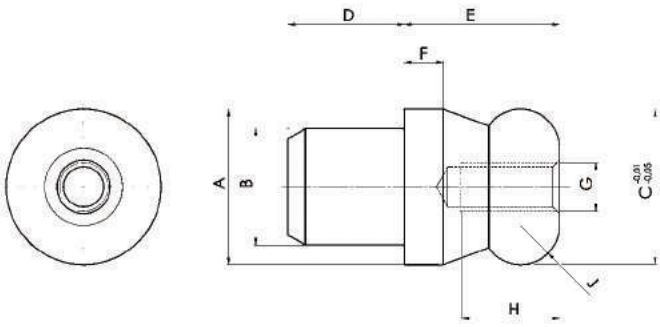
#### Locating pin

Steel.

Order no.	A	B	C	D	E	F	G	H	J	Weight [g]
374629	16	12	16	12	16	4	M5	10	R4	30

#### Advantage:

Quick, precise alignment of the fixtures being clamped.



### No. 7800VSB

#### Diamond pin

Steel.

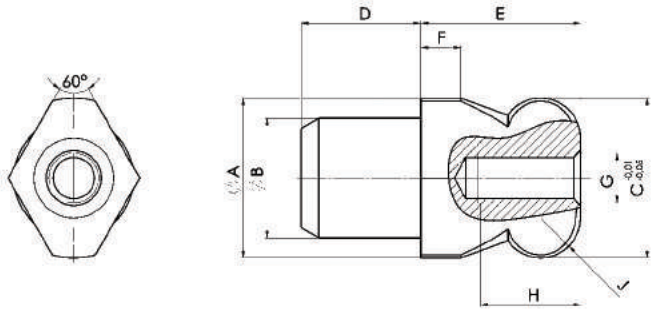
Order no.	A	B	C	D	E	F	G	H	J	K	Weight [g]
374637	16	12	16	12	16	4	M5	10	R4	4,3	23

#### Application:

The sword pin is used for tolerance compensation ( $\pm 0.01$ ).

#### Advantage:

Quick, precise alignment of the fixtures being clamped.

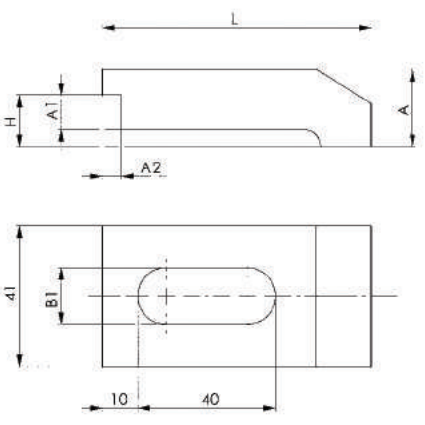


### No. 6325

#### Clamps for machine vices

Tempering steel, blued, packaged in pairs.

Order no.	B1	L	for clamping screw metric	for clamping screw inch	for jaw width	A	A1x A2	H	Weight [g]
74682	16,5	78	M12, 14, 16	1/2, 5/8	100	22,5	10x5,5	15	685



## No. 6370ZN-20

### Clamping nipple for clamping modules K20

Hardened, for hydraulic and pneumatic clamping modules size K20.



Order no.	Size	dia. DN	dia. D1	dia. D2	H	H1	M	T	Weight [g]
303149	K20	32,0	25	12	28	23	-	5	110
303156	K20	32,0	25	12	28	23	-	5	110
303164	K20	31,8	25	12	28	23	-	5	110

#### Design:

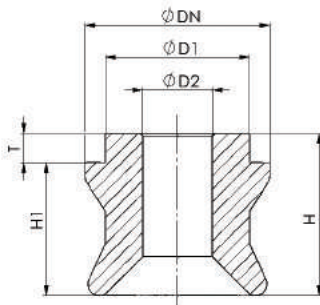
Order no. 303149: Zero point nipple

Order no. 303156: Slit nipple

Order no. 303164: Undersized nipple

#### Note:

The slit nipple has an additional auxiliary bore, which can be optionally used for simple installation.



## No. 6370ZNS-001

### Engagement nipple screw

Strength class 10.9.

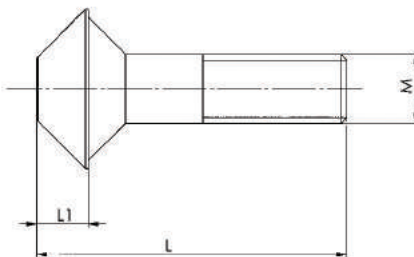
Suitable for clamping nipple, article no. 6370ZN.



Order no.	Size	M	L	L1	Weight [g]
303222	K20	M12	54	9,0	70

#### On request:

Engagement nipple screws in various lengths and materials (e.g. high-grade stainless steel).

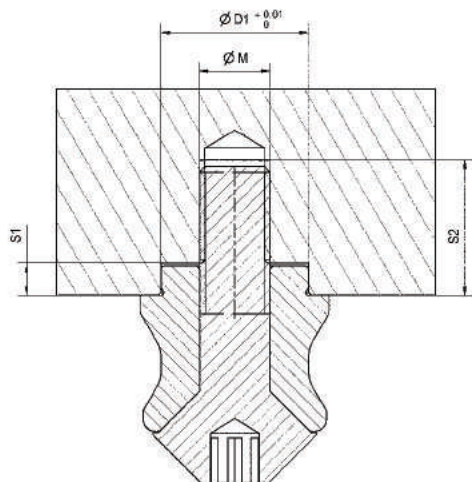


### Dimensions for machining nipple mountings

Size	ØD1	ØM	S1	S2
K20	25	M12	5,5	23

#### Figure:

Shown with clamping nipple and engagement nipple screw.



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