

# Vacuum Compatible Screws

Socket Head Cap Screws



Hex Head Screws



Socket Button Head Screws



Flat Head Screws



Socket Set Screws



Accessories

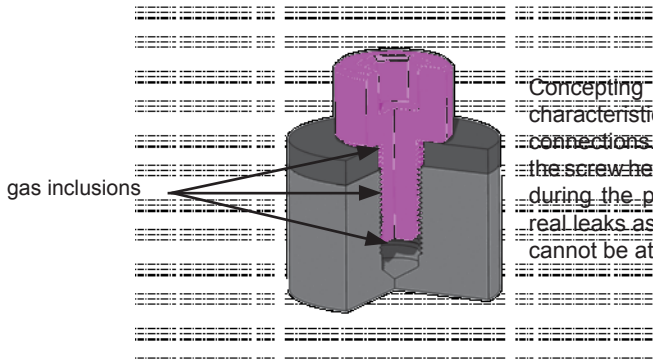


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## Introduction

In vacuum technology; you basically have to differentiate two fields of application of fastening elements e.g. like screws. The chapter Vacuum Compatible Screws contains connecting components applicable in a vacuum environment. Connecting components used in atmosphere for instance for flange assemblies can be found in chapter 3 Standard Components of this catalog.



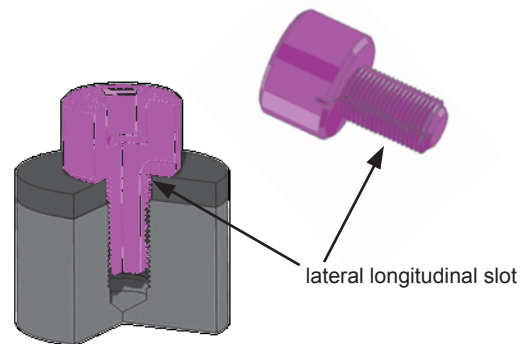
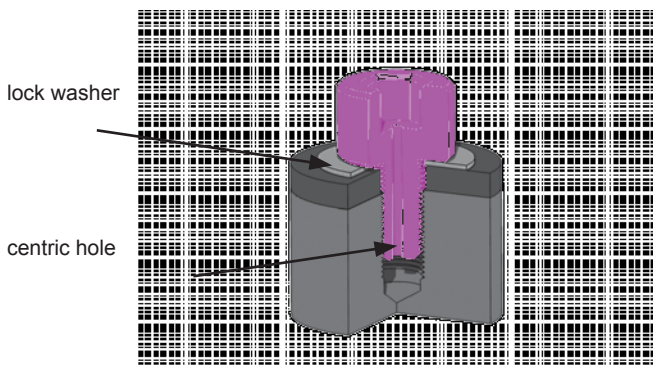
Concepting a vacuum equipment stage you have to consider the special characteristics of vacuum technology, when using often indispensable screw connections. Hollow spaces in threaded blind holes, between threads and under the screw heads are traps for gas inside the vacuum chamber, which are outgassing during the pump down. These so called virtual leaks simulate the existence of real leaks as extended pump down times occur and the desired ultimate pressure cannot be attained.

Rigorous requirements to the cleanliness of vacuum components forbid to lubricate bolted joints. Lubricants are mostly made from longchain organic polymers. The outgassing of these substances can contaminate the whole vacuum chamber. Many processes cannot be run under such circumstances. Even with a well-defined tightening torque on screws, non-greased threads will cause undefined pretension forces. Stainless steel screws cleaned for use in vacuum are totally oil-free, which will increase the danger of galling dramatically. In consequence you will have long down times of your vacuum system in case of modification or maintenance.

## Vented Screws for Use in High and Ultrahigh Vacuum Conditions

The appearance of gas traps in a vacuum installation can be prevented by a vacuum suitable design of the used construction parts. In most cases this fact leads to an increased production effort, which is reflected in the costs of the construction parts. A reasonable alternative are vented fasteners.

We offer screws with centric vent holes by default. Washers with vent grooves or lock washers ensure the venting of the cavity under the screw head. Alternatively screws with a lateral longitudinal slot can be offered. This allows the venting of the cavity under the screw head without using a grooved washer.



When tightening screws with centric vent holes, the maximal recommended tightening torques stated in the table below should be used considering the reduced profile of these screws. Screws with venting slot can be tightened with the full permissible torque  $M_{NB}$ . We recommend to order these screws with electropolished surface due to the edges arising at the thread.

Size	M2	M2,5	M3	M4	M5	M6	M8	M10	M12	M14	M16
$M_{NB}$ [Nm]	0.2	0.45	1.0	1.7	3.4	5.9	14.5	30.0	50.0	79.0	121.0
$M_B$ [Nm]	0.16	0.4	0.9	1.5	3.0	5.3	13.5	28.8	48.5	77.4	118.0
$\varnothing$ [mm]	0.7	0.7	0.9	1.1	1.4	1.6	1.8	1.8	1.8	1.8	1.8

supposed frictional coefficient of 0.1

$M_{NB}$ : maximum tightening torque for non-vented screws respectively for screws with laterally milled slot

$M_B$ : maximum tightening torque for hole vented screws

$\varnothing$ : diameter of the vent hole

## Surface Modified Screws

To avoid galling of an unlubricated stainless steel connection it is recommended to use special processed fasteners in vacuum environment. We offer vented and non-vented screws in various surface modifications.

Electropolished fasteners feature a reduced surface roughness. Burrs formed during the machining of the thread are reliably removed by the polishing process and the effective surface will be drastically reduced. Thereby, surface desorption and propensity for galling are obviously decreased.

Silver and gold coatings have the purpose to reduce the friction value between the threads. Thus, reproducible preload forces can be reached by using a well-defined torque. The commonly applied platings of the screws prevent galling. The layer of noble metals increases the chemical resistance even in a harsh environment so that the corrosion of the connecting elements is prevented as well.

Fasteners coated with tungsten sulfide  $WS_2$  or molybdenum sulfide  $MoS_2$  are predestinated for the use in a vacuum environment under high temperatures. The thermal stability in vacuum is at more than 1000 °C (1832 °F) for each. Both compounds are established as wear-reducing solid lubricants in mechanical engineering and construction for many years. They guarantee a vacuum compliant thread lubrication even for repeated use (see the info box below).

Nickel plated fasteners reach excellent corrosion protection due to the superior chemical resistance of nickel. This coating reliably prevents from galling of the stainless steel threads while reducing the friction value at the same time.

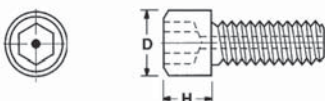
### Screw materials:

All connecting elements provided from us for use in vacuum environment are made of stainless steel A2 strength class 70 by default. They are UHV compatible cleaned and packed in a class 100 (ISO 4) cleanroom environment. Furthermore, cleanroom compatible double packaging is available on request. In addition to our catalog assortment we can meet many more requirements for standard parts, whether they are vented or non-vented, plated or not plated. Please request an individual quote.

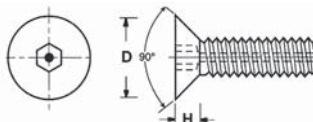
Differing materials such as stainless steel A4, titanium, aluminum et cetera can be likewise requested. We gladly advise you about the suitability of the different materials for your individual application. We can also provide customized connecting elements with or without coating. Please do not hesitate to contact us.

**Screw forms:** (specified dimensions: see following table)

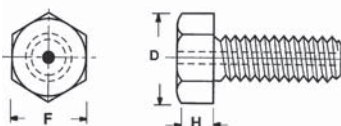
VFC-Socket head cap screw  
ISO 4762/DIN 912



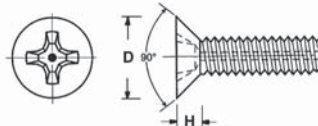
VFFA-Socket drive flat head screw  
ISO 10642 (DIN 7991)



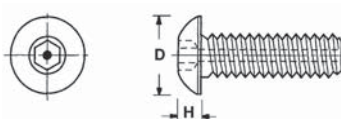
VFH-Hex head screw  
ISO 4017/DIN 933



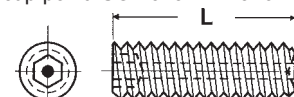
VFF-Phillips drive flat head screw  
ISO 7046 (DIN 965)



VFBU-Socket drive button head screw  
ISO 7380



VFT-Socket drive set screw with  
cup point ISO 4029/DIN 916



### Addition:

N	non-vented
SV	slot vented
EP	electropolished
A	silver plated
AU	gold plated
C	$MoS_2$ coated
W	$WS_2$ coated
K	nickel plated

### Info box

#### Screw materials:

The standard material of our screws is stainless steel A2, the "classic" AISI 304. For especially corrosive medias or in case of needing a lower magnetizability, the stainless steel A4 (AISI 316) can be used. Titanium and aluminum can be applied, where fasteners should be non-magnetizable. Thereby, the reduced strength of aluminum has to be considered.

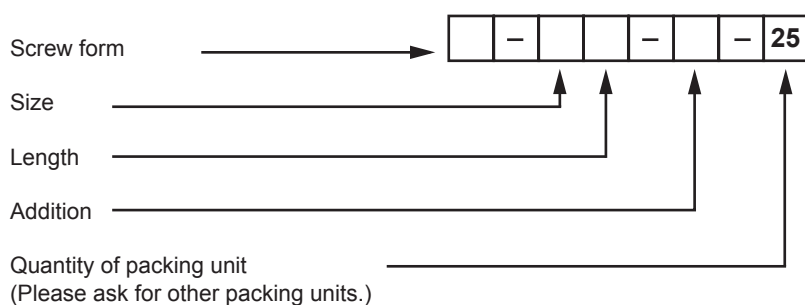
#### Multiple use of screws:

The repeated use of screws can lead to malfunction independent of their coating. Coatings on screws can generate particles after multiple application. That is why we generally suggest to replace the fasteners after a one time usage. If you have questions about the multiple use of fasteners, we like to provide our advice.

Size	Socket head cap screws		Socket drive button head screws		Hex head screws			Socket drive flat head screws		Phillips drive flat head screws	
	VFC		VFBU		VFH			VFFA		VFF	
	D	H	D	H	D	H	F	D	H	D	H
<b>M2</b>	3.8	2.0	-	-	-	-	-	4.0	1.2	3.8	1.2
<b>M2,5</b>	4.5	2.5	-	-	-	-	-	5.0	1.5	4.7	1.5
<b>M3</b>	5.5	3.0	5.7	1.7	6.0	2.0	5.5	6.0	1.7	5.6	1.7
<b>M4</b>	7.0	4.0	7.6	2.2	7.7	2.8	7.0	8.0	2.3	7.5	2.2
<b>M5</b>	8.5	5.0	9.5	2.8	8.8	3.5	8.0	10.0	2.8	9.2	2.5
<b>M6</b>	10.0	6.0	10.5	3.3	11.1	4.0	10.0	12.0	3.3	11.0	3.0
<b>M8</b>	13.0	8.0	14.0	4.4	14.4	5.5	13.0	16.0	4.4	14.5	4.0
<b>M10</b>	16.0	10.0	17.5	5.5	18.9	6.4	17.0	20.0	5.5	18.0	5.0
<b>M12</b>	18.0	12.0	-	-	21.1	7.5	19.0	24.0	6.5	22.0	6.0

## Ordering Information Fasteners

Please use the following product key to order vacuum compatible screws:



### Example:

#### VFC-620-25

Socket head cap screw  
ISO 4762/DIN 912  
Size: M6 x 20 mm  
center vented  
packing unit of 25 pieces

#### VFC-845-SVEP-25

Socket head cap screw  
ISO 4762/DIN 912  
Size: M8 x 45 mm  
slot vented, electropolished  
packing unit of 25 pieces

#### VFFA-204-EP-25

Socket drive flat head screw  
ISO 10642 (DIN 7991)  
Size: M2 x 4 mm  
center vented, electropolished  
packing unit of 25 pieces

#### VFT-308-25

Socket drive set screw with cup point  
ISO 4029/DIN 916  
Size: M3 x 8 mm  
center vented  
packing unit of 25 pieces

#### VFH-835-NAU-25

Hex head screws  
ISO 4017/DIN 933  
Size: M8 x 35 mm  
non-vented, gold plated  
packing unit of 25 pieces

#### VFBU-2.505-W-25

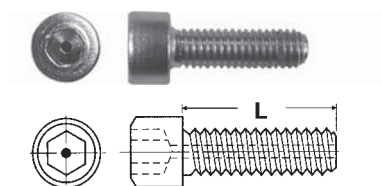
Socket drive button head screws  
ISO 7380  
Size: M 2.5 x 5 mm  
center vented, WS<sub>2</sub> coated  
packing unit of 25 pieces

Screws of our stock assortment can also be ordered in our onlineshop [www.vacom-shop.com](http://www.vacom-shop.com).

# Standard Assortments of Vacuum Compatible Screws

## Socket Head Cap Screws

VFC : ISO 4762/DIN 912 with hexagon socket, center vented, UHV and cleanroom compatible cleaned

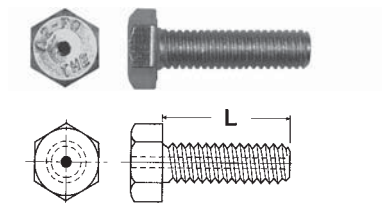


Length	M 2	M 2.5	M 3	M 4	M 5	M 6	M 8	M 10	M 12
4	■	■	■	■					
5	●●	■	■	■					
6	■	■	●●	●●	■				
8	■	■	●●	●●	■	■			
10	●●	■	●●	●●	●●	●●	■		
12	■	■	●●	●●	●●	●●	■		
16	■	■	■	●●	●●	●●	●●	■	
20			■	■	●●	●●	●●	■	■
25			■	■	■	●●	●●	■	■
30			■	■	■	●●	●●	■	■
35				■	■	●●	■	■	■
40				■	■	■	■	■	■
45				■	■	■	■	■	■
50					■	■	■	■	■
60							■	■	■

- Stock assortment, packing unit of 25 pieces
- Standard assortment

## Hex Head Screws

VFH : ISO 4017/DIN 933 without shank, center vented, UHV and cleanroom compatible cleaned



Length	M 3	M 4	M 5	M 6	M 8
5	■				
6	■	■			
8	■	■	■	■	
10	■	■	■	■	■
12	■	■	■	■	■
16	■	■	■	■	■
20		■	■	●●	●●
25		■	■	■	■
30		■	■	■	■
35		■	■	●●	■
40					●●

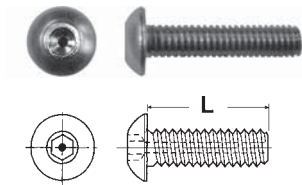
- Stock assortment, packing unit of 25 pieces
- Standard assortment

Please use product key page 11-5 for request and orders.  
Please ask for sizes differing from standard assortment.

# Standard Assortments of Vacuum Compatible Screws

## Socket Button Head Screws

VFBU : ISO 7380 with hexagon socket, center vented, UHV and cleanroom compatible cleaned

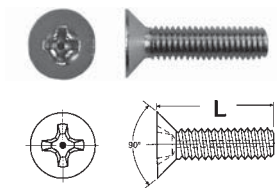


Length	M 2	M 2.5	M 3	M 4	M 5	M 6
4	■	■				
5	■	■	■			
6	■	■	■	■		
8	■	■	■	■	■	
10	■	■	■	■	■	■
12			■	■	■	■
16			■	■	■	■
20				■	■	■
25				■	■	■
30					■	■

■ Standard assortment

## Flat Head Screws

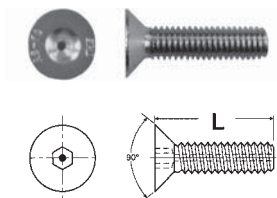
VFF : ISO 7046 (DIN 965) Phillips drive, center vented, UHV and cleanroom compatible cleaned



Length	M 2	M 2.5	M 3	M 4	M 5	M 6
4	■	■				
5	■	■	■			
6	■	■	■	■		
8	■	■	■	■	■	
10	■	■	■	■	■	■
12			■	■	■	■
14			■	■	■	■
16			■	■	■	■
20				■	■	■
25				■	■	■

■ Standard assortment

VFFA : ISO 10642 (DIN 7991) socket drive, center vented, UHV and cleanroom compatible cleaned



Length	M 2	M 2.5	M 3	M 4	M 5	M 6
4	■	■				
5	■	■	■			
6	■	■	■	■		
8	■	■	■	■	■	
10	■	■	■	■	■	■
12			■	■	■	■
14				■	■	■
16			■	■	■	■
20				■	■	■
25				■	■	■

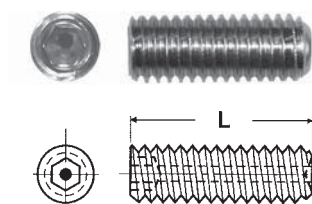
■ Standard assortment

Please use product key page 11-5 for request and orders.  
Please ask for sizes differing from standard assortment.

# Standard Assortments of Vacuum Compatible Screws

## Set Screws

VFT : ISO 4029/DIN 916 socket drive, center vented, UHV and cleanroom compatible cleaned



Length	M 2	M 2.5	M 3	M 4	M 5	M 6
4	■	■				
5	■	■	■			
6	■	■	■	■		
8	■	■	■	■	■	
10	■	■	■	■	■	■
12			■	■	■	■
16			■	■	■	■
20				■	■	■
25				■	■	■
30					■	■

■ Standard assortment

Please use product key page 11-5 for request and orders.  
Please ask for sizes differing from standard assortment.

## Accessoires

As a standard, we provide accessories for screw connections within a vacuum installation such as flat washers with or without vent slots. Washers according to DIN 127 can be applied as a reasonably priced alternative. Hex nuts complete the range of accessories. All mentioned articles consist of stainless steel A2 as standard, are cleaned for the use in UHV environment and packed in a cleanroom class 100. In addition, these connecting elements can be provided in other materials and in various surface modifications on request.

VFFWV : ISO 7089 (DIN 125 A) Flat washer with vented slot, cleaned for UHV application

VFFW : ISO 7089 (DIN 125 A) Flat washer without vented slot, cleaned for UHV application

VFLW : DIN 127 B Lock washers, cleaned for UHV application

VFN : ISO 4032 (DIN 934) Hex nuts, cleaned for UHV application

8



Size	VFFWV	VFFW	VFLW	VFN
M 2	VFFWV-02 ●●●	VFFW-02 ●●●●	VFLW-02 ●●●●	VFN-204 ●●●●
M 2.5	VFFWV-02.5 ■	VFFW-02.5 ■	VFLW-02.5 ■	VFN-2.5045 ■
M 3	VFFWV-03 ●●●	VFFW-03 ●●●●	VFLW-03 ●●●●	VFN-305 ●●●●
M 4	VFFWV-04 ●●●	VFFW-04 ●●●●	VFLW-04 ●●●●	VFN-407 ●●●●
M 5	VFFWV-05 ●●●	VFFW-05 ●●●●	VFLW-05 ●●●●	VFN-508 ●●●●
M 6	VFFWV-06 ●●	VFFW-06 ●●●●	VFLW-06 ●●●●	VFN-610 ●●●●
M 8	VFFWV-08 ●●	VFFW-08 ●●●●	VFLW-08 ●●●●	VFN-8125 ●●●
M 10	VFFWV-10 ■	VFFW-10 ■	VFLW-10 ■	VFN-1015 ■
M 12	VFFWV-12 ■	VFFW-12 ■	VFLW-12 ■	VFN-12175 ■

●●●● Stock assortment, packing unit of 100 pieces  
 ●●● Stock assortment, packing unit of 50 pieces  
 ●● Stock assortment, packing unit of 25 pieces  
 ■ Standard assortment