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industry



# BROACHING.



**Made in Switzerland**  
since 1969

## PCM WILLEN SA

For over 40 years, PCM Willen SA is one of the world's leading manufacturers of special tool holders for automatic lathes.

All our products are developed and manufactured in Switzerland and bear the label «Swiss Made», which is synonymous with precision, quality and reliability.

Our company is located in the middle of French-speaking part of Switzerland at the edge of Lake Geneva near Montreux.

Our international dealer network ensures continued after sales support. We offer training courses, which we tailor to individual customer requirements.

PCM stays for innovation and progress. Our superbly qualified engineering staff ensures finest quality of manufacturing solutions and keeps our customers ahead of the competition.

In close cooperation with machine builders and end users, we stay on the way to satisfied customers. We will keep this track in the future.

The best quality toolholders can only provide optimum performance if they are maintained or repaired with first class replacement parts. PCM experts emphasize professional after sale support for all PCM equipment.



## BROACHING

Since broaching operation can be performed on a part that is rotating, turned parts requiring a broached hole can be completed in the original setup on a screw machine or CNC turning machine.

This eliminates the need for secondary operation. The rotary broaching can also be applied on CNC machining centre or transfer machine.

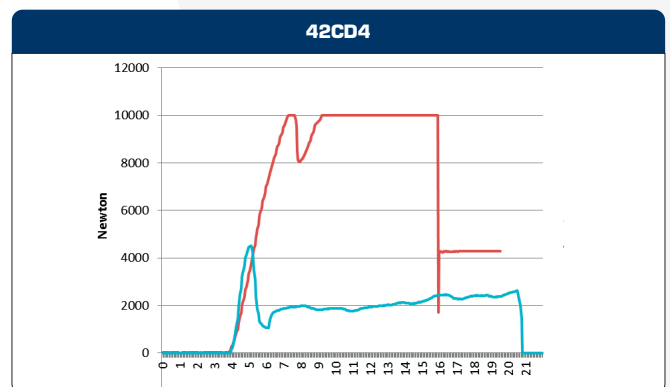
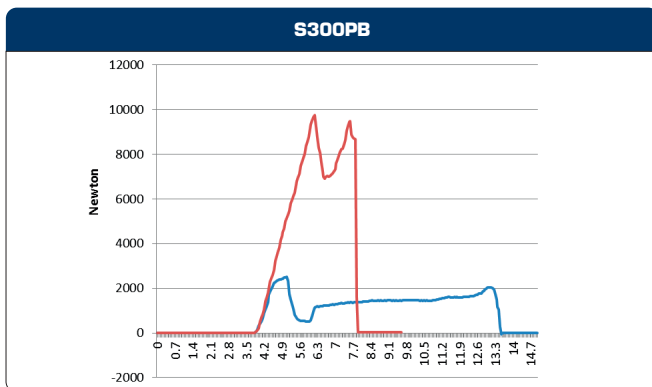
The only difference being that the broach holder is rotated in the machine spindle and the part is stationary instead of the reverse condition on a turning machine.

In order to produce parts successfully there are some basic rules that must be followed. Broaching rotation speed

The centreline of the cutting tool is offset at 1° from the centreline of the work piece.

This causes the broach to shear its way into the part with a scalloping effect as it is advanced into the work piece and makes it to cut only on its leading edge, not its full end surface.

This eases the load of the cut and creates a shearing, rotational cutting action reducing the thrust force up to 80%.



— With System PCM  
— Without System PCM

## E

## MANUAL

### Centering the broach

Nothing is more important than having the cutter centered as close as possible to the center of the workpiece. Improper center setting will cause uneven hole configurations, oversize holes and spiralling. For an easy setting use our gages 6189-280 or 6199-550.

### Drilling the hole

In general, we recommend drilling the hole 1% larger than the largest of the areas measured mass. Wherein material having a lower strength, the bore can be reduced. The drilling depth for blind hole 6-point must be 1.3 to 1.4 times to have the depth of the profile.

### Broach pre-guidance

A chamfer, slightly bigger than the largest dimensions of the broach, is essential for easy starting of the broach. When exact concentricity is required, drill a pre-bore equivalent to the broach dimensions across corners. This keeps the broach concentric when broaching operation starts.

### Broaching rotation speed

Rotational speed has almost no effect on cutting speed and tool life. However, at high speed, cutting edges of the broach tend to mill the material when starting causing tool wear. Therefore, start broaching operation at a slow rotation of 300 RPM and a feed of 0.1 mm/RPM until the broach is touching the material, then increase speed up to 2000 RPM and the feed to the result of your calculation (see next paragraph).

Spiralling can be reduced by reversing the spindle rotation half way into the part. For a faster worktime increase the speed but never the feed!

### Feed rate

The feed choice mainly depends on material characteristics. To found the feed that will be used, you can make this calculation:  $0.002 \times (\text{outer dimension of broach})$

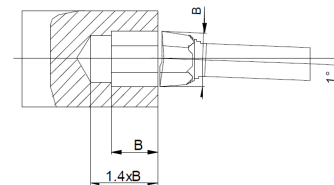
**Expl.:** Broach of 6mm hex  
 $0.002 \times 6\text{mm} = 0.012 \text{ mm/rpm}$

### Coolant

Usual coolant or cutting oil

### Broachsharpening

External or internal broaches can be re-sharpened on the front face only with a cutting angle from 4 to 8°.



## PRE-DRILLING FOR TORX

TORX [mm]	Bore-Ø [mm]	Tolerance 0.00 [mm]
T5	1	0.05
T6	1.4	0.05
T7	1.55	0.07
T8	1.9	0.1
T10	2.2	0.1
T15	2.6	0.1
T20	2.9	0.1
T25	3.5	0.1
T27	3.75	0.1
T30	4	0.1
T40	5	0.15
T45	5.8	0.2
T50	6.7	0.2
T55	8.2	0.2
T60	9.2	0.2

## ADJUSTMENT OF BROACHES FOR EXACT CENTERING

Broaching toolholders PCM 6180, 6190, 26200 and 26300 series are delivered adjusted within 0,015 for standard tools with exact length.  
When tools with different length are used, it is essential to re-adjust exact centering.

Experience has often proved turret bores are not in perfect alignment with the machine spindle after a certain working time. When misalignment is over 0.05, it is really necessary to re-adjust the turret positioning to avoid difficulties especially on small sizes.

When the machines are geometrically correct, PCM broaching toolholders pre-adjusted for standart tools length, can be mounted directly without setting. For broaches of different lengths, centering adjustment is necessary.

### Pre-setting for exact centering

The pre-setting holder (1) with bore H6, turn the toolholder (2) with spindle (3) together, provided with the gauge (4) in same length „L“ as the broach, to obtain a max. eccentricity of 0.02 on the right position of the gauge, checked with the clock (5).

4 radial screws assist this operation. Check again after clamping of the 4 front screws.

Comment: the slow revolution of the complete toolholder will show the small oscillation of the broach.

### Centering adjustment directly on the machine

Adjustment on the machine offers the advantage to correct the mis-alignment between machine spindle and turret bore. But the main inconvenience of this way is that the adjustment is only valid for one hole of the turret on the machine.

The diameter (1) is provided with the gauge (2) of equalent length « L » as the broach and stand. Fix the magnetic support with the clock on the chuck face.

Place the point at the right length on the gauge. Turn the machine spindle.

Adjust the concentricity to max. 0,02 using 4 radial screws, then clamp the 4 front screws. Check again after clamping.

If necessary, move the diameter in various positions and check again. The proper concentricity of the gauge and turning diameter should not exceed 0,012.

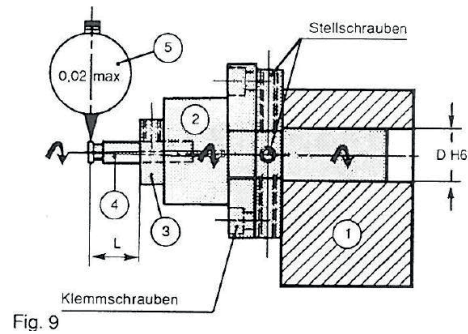


Fig. 9

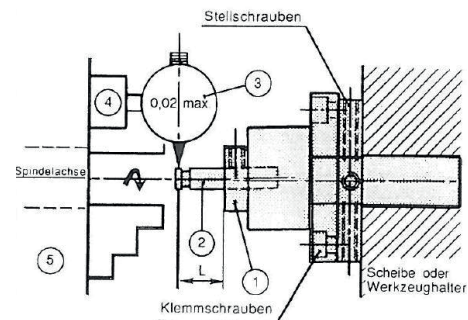


Fig. 10

## BROACHING TOOL HOLDER SELECTOR

	PCM broaching tool holder types				
	2150	2100	26200	26100	26300
Inner rotary broaching operation PCM broaching holder capacity					
Max. pushing force in daN	50	400	1000-1200	1200	4000
Type of broach	2151	2110	2110	6150	6150

Material	Max. hardness in HB =300	Tool life	Max. broaching dimensions in mm				
			Max 2	1-8	2-12	2-17	4-22
Cutting off steel 700 N/mm <sup>2</sup>	< 205	good	"	1-8	2-12	2-17	4-22
Drawn steel 700 N/mm <sup>2</sup>	< 205	good	"	1-8	2-12	2-17	4-22
Drawn steel 45/60 850 N/mm <sup>2</sup>	< 250	reduced	"	1-6	2-12	2-17	4-22
Non alloyed steel, annealed	< 140	very good	"	1-8	2-12	2-17	4-22
Alloyed steel, annealed < 800 N/mm <sup>2</sup>	< 240	acceptable	"	1-6	2-12	2-17	4-22
Alloyed steel >1000 N/mm <sup>2</sup>	> 310	bad	-	-	-	-	-
Alloyed steel, annealed before heat tr. < 750 N	< 230	good	"	1-6	2-12	2-17	4-22
Nitriding alloyed steel, annealed	< 250	acceptable	"	1-6	2-12	2-17	4-22
Nitriding treated alloyed steel	> 310	bad	-	-	-	-	-
Cutting off alloyed steel (ETG100)	< 300	reduced & non regular	"	1-6	2-12	2-17	4-22
Bearing steel	< 220	good	"	1-6	2-12	2-17	4-22
Tool steel unhardened	< 250	acceptable	"	1-6	2-12	2-17	4-22
Tool steel unhardened	< 220	good	"	1-6	2-12	2-17	4-22
Austenitic stainless steel AISI 304/ 316L	< 215	good	"	1-6	2-12	2-17	4-22
Ferritic stainless steel AISI 431	< 295	reduced & non regular	"	1-6	2-12	2-17	4-22
Ferritic stainless steel AISI 420	< 245	reduced & non regular	"	1-6	2-12	2-17	4-22
Cutting off stainless steel AISI 303/430F	< 230	good	"	1-6	2-12	2-17	4-22
Brass		very good	3	1-12	2-17	2-19	5-22
Light material, aluminium		very good	3	1-14	2-17	2-19	5-22
non alloyed titanium 30	< 170	good	Max2	1-6	2-12	2-17	4-22
non alloyed titanium 40/55/0.2 PD	< 200	acceptable	"	1-6	2-12	2-17	4-22
non alloyed titanium 70	< 275	reduced	"	1-6	2-12	2-17	4-22
Alloyed titanium	> 310	bad	-	-	-	-	-
Synthetic material		very good	6	2-17	3-17	3-22	10-22

03.05.2016

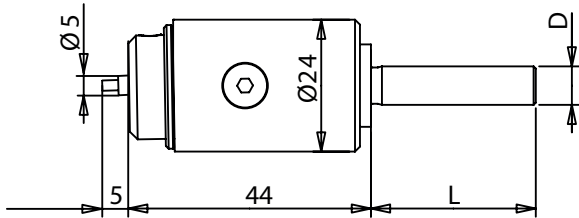
# **BROACHING TOOL HOLDERS**

<b>Tool Holders for Ø5 broaches</b>	<b>8</b>
<b>Tool Holders for Ø8 broaches</b>	<b>9</b>
<b>Tool Holders for Ø12 broaches</b>	<b>12</b>
<b>Accessories</b>	<b>14</b>
<b>Standards broaches Ø5</b>	<b>15</b>
<b>Standards broaches Ø8</b>	<b>16</b>
<b>Standards broaches Ø12</b>	<b>17</b>
<b>Torx broaches</b>	<b>18</b>



*Other dimensions and forms on request*

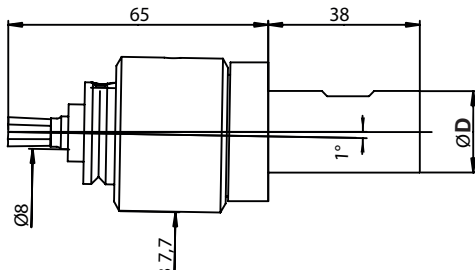
## 2150



<b>Broache Ø</b>		5
<b>daN max.</b>		50
<b>ØD</b>	<b>L</b>	<b>Article N°</b>
7	30	2150-070
8	30	2150-080
10	38	2150-100
12	38	2150-120
13	38	2150-130
14	38	2150-140
15	38	2150-150
16	38	2150-160
19.05	38	2150-190
20	38	2150-200

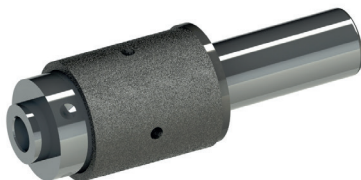
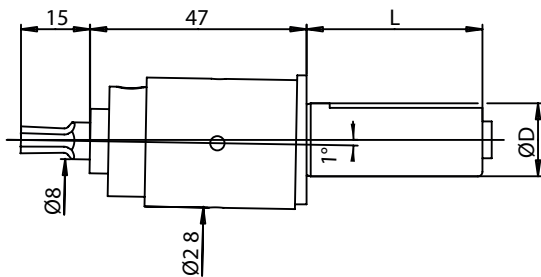


## 2100



Broache Ø		8
daN max.		400
ØD	L	Article N°
15.87	38	2100-58
16	38	2100-16
19.05	38	2102
20	38	2101
22	75	2100-22-75
25	50	2103
25.4	50	2104

## 2160

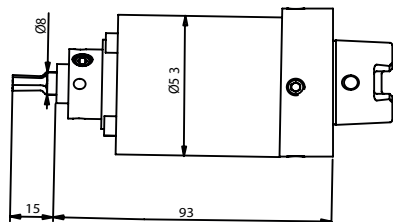


Broache Ø		8
daN max.		1'000
ØD	L	Article N°
8	38	2160-080-038
10	38	2160-100-038
12	38	2160-120-038
16	38	2160-160-038
19.05	100	2160-190-100
20	100	2160-200-100
22	100	2160-220-100
23	100	2160-230-100
25	120	2160-250-120
25.4	120	2160-254-120

### Notes

L from 100 mm to 120 mm can be cut

## 6165



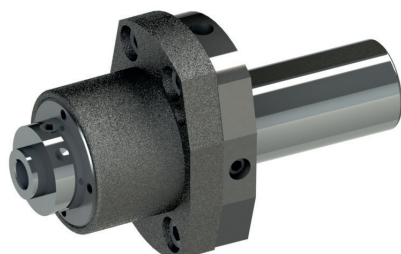
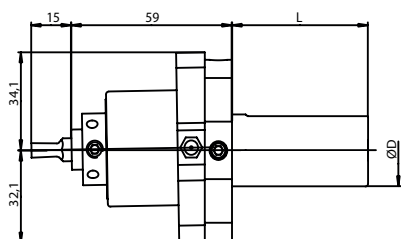
<b>Broache Ø</b>	8	
<b>daN max.</b>	1'200	
<b>ØD</b>	<b>L</b>	<b>Article N°</b>
16	45	6165-08-160
19.05	45	6165-08-190
20	45	6165-08-200
25	45	6165-08-250
25.4	45	6165-08-254
32	45	6165-08-320
40	45	6165-08-400

### Notes

Adjustable tool holder



## 6180



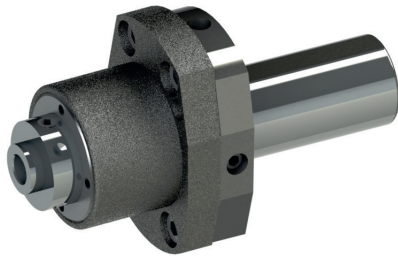
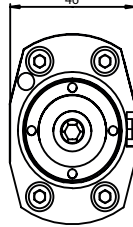
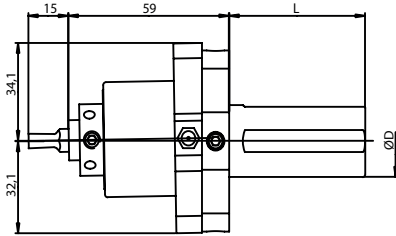
<b>Broache Ø</b>	8	
<b>daN max.</b>	1'200	
<b>ØD</b>	<b>L</b>	<b>Article N°</b>
15.87	40	6180-158
16	40	6180-160
19.05	40	6180-190
20	40	6180-200
25	50	6180-250
25.4	50	6180-254
30	60	6180-300
31.75	60	6180-317
32	60	6180-320

### Notes

Adjustable tool holder without flat on the shank



## 6181

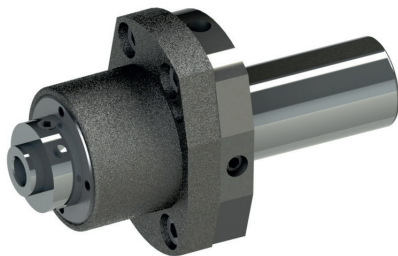
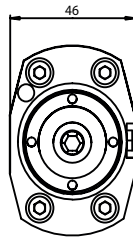
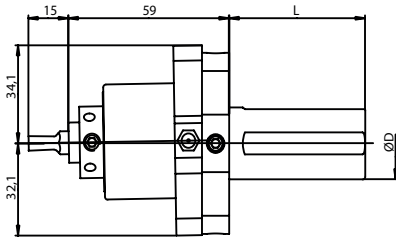


<b>Broache Ø</b>	8	
<b>daN max.</b>	1'200	
<b>ØD</b>	<b>L</b>	<b>Article N°</b>
15.87	40	6181-158
16	40	6181-160
19.05	40	6181-190
20	40	6181-200
25	50	6181-250
25.4	50	6181-254
30	60	6181-300
31.75	60	6181-317
32	60	6181-320

### Notes

Adjustable tool holder with 2 flats on the shank

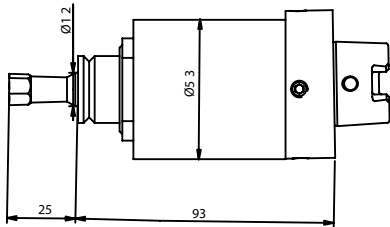
## 26200



<b>Broache Ø</b>	8	
<b>daN max.</b>	1'200	
<b>VDI</b>	<b>L</b>	<b>Article N°</b>
16	32	26200-16
20	40	26201

### Notes

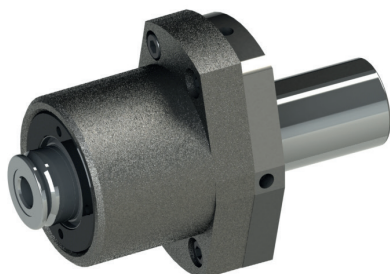
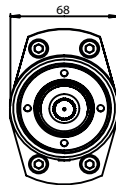
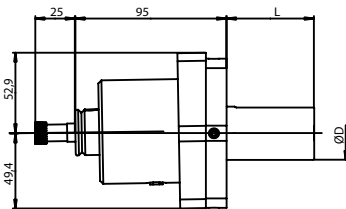
Adjustable tool holder

**6162**

<b>Broache <math>\varnothing</math></b>	12	
<b>daN max.</b>	1'200	
<b><math>\varnothing D</math></b>	<b>L</b>	<b>Article N°</b>
16	45	6162-12-160
19.05	45	6162-12-190
20	45	6162-12-200
25	45	6162-12-250
25.4	45	6162-12-254
32	45	6162-12-320
40	45	6162-12-400

**Notes**

Adjustable tool holder

**6190**

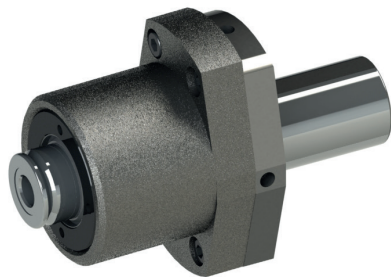
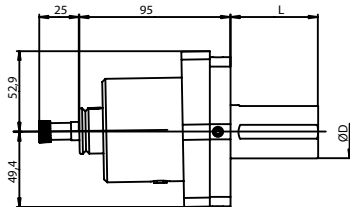
<b>Broache <math>\varnothing</math></b>	12	
<b>daN max.</b>	4'000	
<b><math>\varnothing D</math></b>	<b>L</b>	<b>Article N°</b>
20	55	6190-200
25	55	6190-250
25.4	55	6190-254
30	55	6190-300
31.75	55	6190-317
32	55	6190-320

**Notes**

Adjustable tool holder without flat on the shank



## 6191



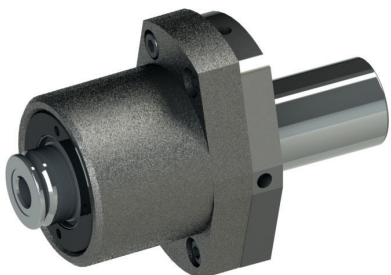
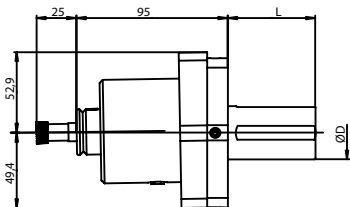
Broache $\varnothing$		12
daN max.		4'000
$\varnothing D$	L	Article N°
19.05	55	6191-190
20	55	6191-200
25	55	6191-250
25.4	55	6191-254
30	55	6191-300
31.75	55	6191-317
32	55	6191-320
35	55	6191-350
40	55	6191-400
50	68	6191-500

### Notes

Adjustable tool holder with 2 flats on the shank



## 26300



Broache $\varnothing$		12
daN max.		4'000
VDI	L	Article N°
30	55	26303
40	63	26304

### Notes

Adjustable tool holder



## ACCESSORIES



Article	Description
<b>6189-280</b>	Setting gauge for exact centering of Ø8 broach (explanation p.5 of the catalog)



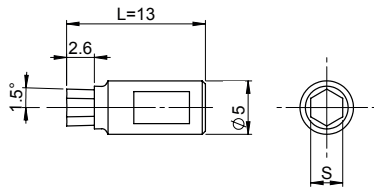
Article	Description
<b>6199-550</b>	Setting gauge for exact centering of Ø12 broach (explanation p.5 of the catalog)

## ACCESSOIRES



Article	Description
<b>852-190-17</b>	Rotation lock key of the broach Ø8

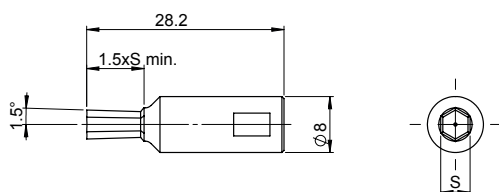
## 2151



S mm	Hex mm	Article N°
1.538 ±0.007	1.5 D9	2151-01.50H
2.038 ±0.007	2 D9	2151-02.00H
2.553 ±0.007	2.5 D10	2151-02.50H
3.071 ±0.009	3 E11	2151-03.00H
3.586 ±0.009	3.5 E11	2151-03.50H
4.086 ±0.009	4 E11	2151-04.00H

Other dimensions on request

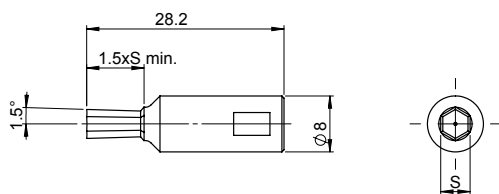
## 2110

HSS steel with coating.

S mm	mm	Article N° HSS	Article N° Carbide
1.538 ±0.007	1.5 D9	2110-1.5H	<b>2110-1.5C</b>
2.038 ±0.007	2 D9	2112H	<b>2112C</b>
2.553 ±0.007	2.5 D10	2112-5H	<b>2112-5C</b>
3.071 ±0.009	3 E11	2113H	<b>2113C</b>
4.086 ±0.009	4 E11	2114H	<b>2114C</b>
5.086 ±0.009	5 E11	2115H	<b>2115C</b>
6.084 ±0.011	6 E11	2116H	<b>2116C</b>
7.104 ±0.011	7 E11	2117H	-
8.104 ±0.011	8 E11	2118H	-
9.104 ±0.011	9 E11	2119H	-
10.102 ±0.013	10 E11	2110-10H	-
11.129 ±0.013	11 E11	2110-11H	-
12.129 ±0.013	12 E11	2110-12H	-
13.129 ±0.013	13 E11	2110-13H	-
14.129 ±0.013	14 E11	2110-14H	-

## 2110

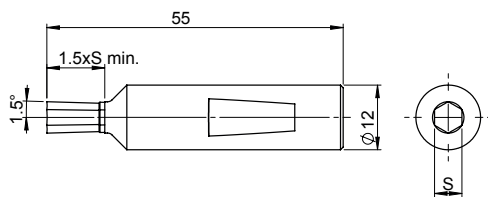
HSS steel with coating.

S mm	inch	Article N° HSS	Article N° Carbide
1.625 ±0.007	1/16" D9	2110-159H	<b>2110-159C</b>
2.022 ±0.007	5/64" D9	2110-198H	<b>2110-198C</b>
2.434 ±0.007	3/32" D10	2110-238H	<b>2110-238C</b>
2.851 ±0.007	7/64" E11	2110-278H	<b>2110-278C</b>
3.261 ±0.009	1/8" E11	2110-317H	<b>2110-317C</b>
4.054 ±0.009	5/32" E11	2110-397H	<b>2110-397C</b>
4.848 ±0.009	3/16" E11	2110-476H	<b>2110-476C</b>
5.642 ±0.009	7/32" E11	2110-556H	<b>2110-556C</b>
6.454 ±0.011	1/4" E11	2110-635H	<b>2110-635C</b>
8.041 ±0.011	5/16" E11	2110-794H	-
9.629 ±0.011	3/8" E11	2110-952H	-



## 6150

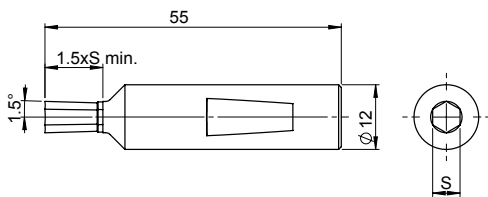
18.214 ±0.016	18 D12	6150-18H
19.259 ±0.016	19 D12	6150-19H



HSS steel with coating.

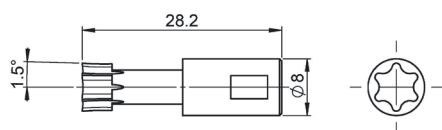
S mm	Hex mm	Article N°
3.071 ±0.009	3 E11	6150-03H
4.086 ±0.009	4 E11	6150-04H
5.086 ±0.009	5 E11	6150-05H
6.084 ±0.011	6 E11	6150-06H
7.104 ±0.011	7 E11	6150-07H
8.104 ±0.011	8 E11	6150-08H
9.104 ±0.011	9 E11	6150-09H
10.102 ±0.013	10 E11	6150-10H
11.129 ±0.013	11 E11	6150-11H
12.129 ±0.013	12 E11	6150-12H
13.129 ±0.013	13 E11	6150-13H
14.129 ±0.013	14 E11	6150-14H
15.217 ±0.013	15 E11	6150-15H
16.217 ±0.013	16 D12	6150-16H
17.217 ±0.013	17 D12	6150-17H

## 6150

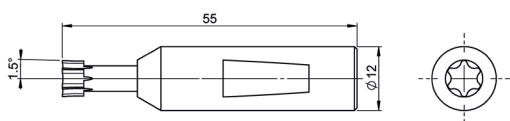


HSS steel with coating.

S mm	Hex Inch	Article N°
3.261 ±0.009	1/8" E11	6150-317H
4.054 ±0.009	5/32" E11	6150-397H
4.848 ±0.009	3/16" E11	6150-476H
5.642 ±0.009	7/32" E11	6150-556H
6.454 ±0.011	1/4" E11	6150-635H
8.041 ±0.011	5/16" E11	6150-794H
9.629 ±0.011	3/8" E11	6150-952H
12.829 ±0.013	1/2" E11	6150-127H
14.504 ±0.013	9/16" D12	6150-142H
16.092 ±0.013	5/8" D12	6150-158H

**2122**

Torx (ISO 10664)	Article N°
6	2122-T06
7	2122-T07
8	2122-T08
9	2122-T09
10	2122-T10
15	2122-T15
20	2122-T20
25	2122-T25
30	2122-T30
40	2122-T40
45	2122-T45
50	2122-T50
55	2122-T55

**6173**

Torx (ISO 10664)	Article N°
6	6173-T06
7	6173-T07
8	6173-T08
9	6173-T09
10	6173-T10
20	6173-T20
25	6173-T25
30	6173-T30
40	6173-T40
45	6173-T45
50	6173-T50
55	6173-T55
60	6173-T60



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