

GEWINDEFORMEN

THREAD FORMING

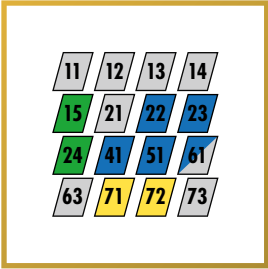


AUF ANFRAGE

Spezialanfertigungen mit angepassten Polygonformen für spezifische Bearbeitungsfälle.

ON REQUEST

Special executions with adapted polygon lobes for specific applications.

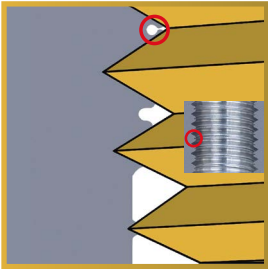


Anwendungsbereich

Für sämtliche kaltverformbaren Werkstoffe mit einer Bruchdehnung von mindestens 10 % und einer Zugfestigkeit von bis zu 1'150 N/mm², z.B. Stähle, rostfreie Stähle, Reintitan, Aluminium, Kupfer, langspannendes Messing, usw.

Range of application

All materials with a minimum of 10 % elongation and a tensile strength of up to 1'150 N/mm², e.g. steels, stainless steels, pure titanium, aluminium, copper, long chipping brass, etc.



Formprozess

Die Zahnspitzen und -flanken des Gewindeformers dringen in den verformbaren Werkstoff ein und verdrängen das Material in die Freiräume des Werkzeugprofils. Dadurch entsteht das Gewindeprofil mit der typischen Furche in der Spitze.

Forming process

The polished points and flats of the thread former's teeth pierce the ductile material and force the material into the space in the tool profile. This creates the thread profile with its typical groove in the crest.



Vorteile

- Höhere Prozesssicherheit, da keine Späne entstehen.
- Ein einziges Werkzeug für Durchgangs- und Sacklöcher.
- Ideal für tiefe Gewinde.
- Gewinde mit höherer Ausreissfestigkeit bei statischer und dynamischer Belastung.

Advantages

- Higher process security due to the lack of shavings.
- Only one tool for both, through and blind holes.
- Optimal for deep threads.
- Thread with higher resistance of stripping by static and dynamic load.



Einsatzeinschränkung

Das Gewindeformen in dünnwandige Werkstücke ist aus physikalischer Sicht mit der notwendigen Sorgfalt anzuwenden.

Application restriction

For physical reasons, thread forming in thin-walled workpieces should be carried out with due care.

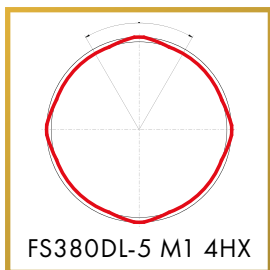


Ausreichend Schmieren

Beim Verformen von Werkstoffen entstehen erhebliche Reibkräfte. Deshalb muss das Werkzeug stets durch einen Schmierfilm geschützt werden. Ein Riss des Schmierfilms verursacht schnell Kaltverschweißungen, die zum Werkzeugbruch führen können.

Adequate lubrication

The thread forming process generates considerable friction. Therefore the tool must be protected by a film of lubricant. If the supply of lubricant is interrupted, then cold welding will quickly occur, resulting in tool failure.

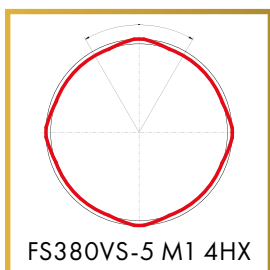


Gewindeformer FS-DL

Universalgewindeformer mit 4 Druckstollen für kleine Gewinde im Abmessungsbereich $\varnothing \geq 1 - < 3$ mm in alle kaltverformbaren Werkstoffe. Mit "DLC"-Verschleisschutzschicht mit ausserordentlichen Gleit- und Schmiereigenschaften. Für rostfreie Stähle, Reinkupfer, usw.

Thread former FS-DL

Universal thread former with 4 forming lobes for small thread sizes $\varnothing \geq 1 - < 3$ mm, in all cold forming materials. With "DLC" wear-protective coating with excellent lubrication and sliding properties. For stainless steels, pure copper, etc.



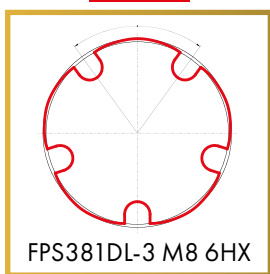
Gewindeformer FS-VS

Universalgewindeformer mit 4 Druckstollen für kleine Gewinde im Abmessungsbereich $\varnothing \geq 1 - < 3$ mm in alle kaltverformbaren Werkstoffe. Mit DC-"VS"-Gleit- und Verschleisschutzschicht.

Thread former FS-VS

Universal thread former with 4 forming lobes for small thread sizes $\varnothing \geq 1 - < 3$ mm, in all cold forming materials. With DC "VS" tool wear protective coating with high sliding properties.

NEW

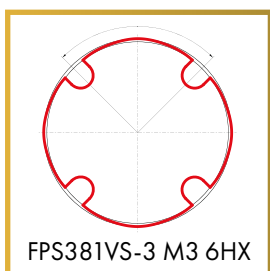


Gewindeformer FPS-DL

Für $\varnothing \geq 3$ mm, mit breiten Druckstollen, die bei abrasiven Werkstoffen ein progressives Fließen verursachen. Mit "DLC"-Verschleisschutzschicht für besseres Gleiten und höhere Standzeiten in langspannendem Messing und Aluminium.

Thread former FPS-DL

For $\varnothing \geq 3$ mm, with large forming lobes designed for a progressive flow of abrasive materials. With "DLC" wear-protective coating for better gliding and high tool life in long chipping brass and aluminium.

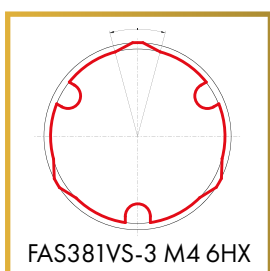


Gewindeformer FPS-VS

Für $\varnothing \geq 3$ mm, mit breiten Druckstollen, für ein progressives Fließen von Werkstoffen mit geringer Bruchdehnung. Mit DC-"VS"-Verschleisschutzschicht mit thermischer und chemischer Beständigkeit bei hohen Temperaturen. Für Baustähle, Kohlenstoffstähle, legierte Stähle, usw.

Thread former FPS-VS

For $\varnothing \geq 3$ mm, with large forming lobes designed for a progressive flow of materials with low elongation coefficient. With DC "VS" wear-protective coating with thermal and chemical properties. For structural steels, carbon steels, alloy steels, etc.



Gewindeformer FAS-VS

Für $\varnothing \geq 3$ mm, mit spitzen Druckstollen, für ein schnelles Fließen von zähen Werkstoffen mit hoher Bruchdehnung. Mit DC-"VS"- Verschleisschutzschicht mit ausserordentlichen Gleit- und Schmiereigenschaften. Für rostfreie Stähle, Reinkupfer, usw.

Thread former FAS-VS

For $\varnothing \geq 3$ mm, with pointed forming lobes designed for a fast flow of tough materials with high elongation coefficient. With DC "VS" wear-protective coating with excellent lubrication and sliding properties. For stainless steels, pure copper, etc.



Schmiernuten ab Ø 3 mm

Dank dieser Nuten wird der Schmierstoff besser zur Werkzeugoberfläche geführt, die mit dem Werkstoff in direktem Kontakt ist.

Lubrication grooves from Ø 3 mm

Lubricant will be guided to the surface of the tool which is directly in contact with the material.



Ohne Schmiernuten

Besonders geeignet für die Bearbeitung von weichen Werkstoffen und für Durchgangslöcher in dünne Bleche.

Without lubrication grooves

Especially recommended for forming soft materials and for through holes in thin parts (e.g. for sheet metal working).

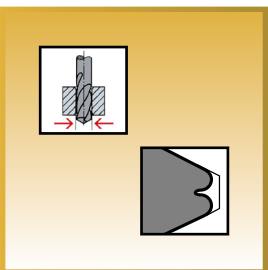


Mit Innenkühlung

Speziell empfohlen für tiefere Gewinde und für die Horizontalbearbeitung.

With internal coolant supply

Highly recommended for deeper threads and for horizontal working.

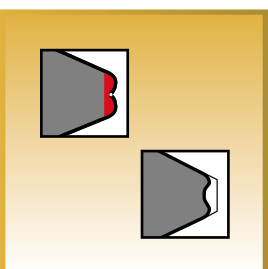


Korrektes Gewindeprofil

Für das Verformen ist eine genaue, saubere Vorbohrung erforderlich, damit ein normgerechtes Gewinde entsteht. Bei Werkstoffen mit sehr hoher Bruchdehnung oder bei Gewindetiefen von $> 2 \times D$ empfehlen wir, den Vorbohrungs-Ø um 0.02 bis 0.05 mm zu vergrößern.

Correct thread profile

Accurate core hole is required in order to form a thread according to the norm. For materials with a very high elongation coefficient and threading depth $> 2 \times D$, we recommend increasing the core hole Ø by 0.02 to 0.05 mm.



Unkorrektes Gewindeprofil

Profil zu gross zufolge eines zu kleinen Vorbohrungsdurchmessers; verursacht ein zu hohes Drehmoment.

Profil ungenügend - Folge eines zu grossen Vorbohrungsdurchmessers.

Incorrect thread profile

Too big profile due to the too small core hole diameter. The required torque is higher.

Incomplete profile caused by the core hole diameter being too big.

KODIERUNG — CODIFICATION

DC-Gewindeformer

DC Thread formers

Beispiel - Example



Standard Polygonform < Ø 3 mm	Standard polygon form < Ø 3 mm	FS							
Passive Polygonform ≥ Ø 3 mm	Passive polygon form ≥ Ø 3 mm	FPS							
Aktive Polygonform ≥ Ø 3 mm	Active polygon form ≥ Ø 3 mm	FAS							
Spezialausführung	Special execution		3						
Langer DIN-Schaft verstärkt	DIN long - reinforced shank			3					
Langer DIN-Schaft durchfallend	DIN long - reduced shank			4					
Extra-langer DIN-Schaft verstärkt	DIN extra-long - reinforced shank			5					
Extra-langer DIN-Schaft durchfallend	DIN extra-long - reduced shank			6					
Gewindeformer	Thread former				8				
Ohne Schmiernuten	Without lubrication grooves					0			
Mit Schmiernuten	With lubrication grooves					1			
Innenkühlung mit seitlichem Austritt	Internal coolant with radial outflow					4			
Verschleisschutzschicht	VS wear-protective coating, general						VS		
DLC-Beschichtung	DLC-coating						DL		
2 - 3 Gewindegänge	2 - 3 chamfered threads							-3	
1.5 - 2 Gewindegänge	1.5 - 2 chamfered threads							-5	

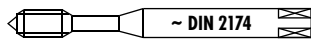
PIKTOGRAMME — PICTOGRAPHS



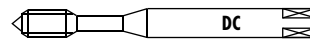
Für Werkstoffgruppen gemäss (DC)-Anwendungstabelle
For material groups as per (DC) application chart

12	
1.0037	Si37-2 (S235JR)
1.0050	St50-2 (E295)
1.0060	St60-2 (E335)
1.5919	15CrNi6
1.7131	16MnCr5

22	
1.4301	X5CrNi18-10
1.4406	X2CrNiMoN17-12-2
1.4435	X2CrNiMo18-14-3
1.4541	X6CrNiTi18-10
1.4571	X6CrNiMoTi17-12-2



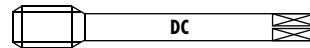
Verstärkter Schaft gemäss ~ DIN 2174
Reinforced shank as per ~ DIN 2174



Verstärkter Schaft gemäss DC-Werksnorm
Reinforced shank as per DC standards



Durchfallender Schaft gemäss ~ DIN 2174
Reduced shank as per ~ DIN 2174



Durchfallender Schaft gemäss DC-Werksnorm
Reduced shank as per DC standards



Extra-lang
Extra-long



HSSE-PM
HSSE-PM



Gewindeformer
Thread former



Gewindeformer mit Schmiernuten
Thread former with lubrication grooves



Innenkühlung mit stirnseitigem Schmiermittelaustritt, auf Anfrage
Internal coolant with frontal outflow, on request



Innenkühlung mit seitlichem Schmiermittelaustritt, neu 45°
Umstellung auf neue Ausführung im Gange
Internal coolant with radial outflow, new 45°
Change to new version in progress



Kernlochdurchmesser
Core hole diameter



Linksgewinde auf Anfrage
Left-hand thread on request



2 - 3 Gewindegänge, Form C
2 - 3 chamfered threads, form C



1.5 - 2 Gewindegänge, Form E
1.5 - 2 chamfered threads, form E



Toleranzklasse ISO 2 6HX
Tolerance class ISO 2 6HX



Toleranzklasse ISO 3 6GX
Tolerance class ISO 3 6GX



Durchgangs- und Sacklöcher < 1 x D
Through / blind holes < 1 x D



Durchgangs- und Sacklöcher < 1.5 x D
Through / blind holes < 1.5 x D



Durchgangs- und Sacklöcher < 2.5 x D
Through / blind holes < 2.5 x D



Durchgangs- und Sacklöcher > 2.5 x D
Through / blind holes > 2.5 x D



Durchgangs- und Sacklöcher < 3 x D
Through / blind holes < 3 x D



DLC-Beschichtung
DLC-coating



DC-"VS"-Verschleisschutzschicht für den allgemeinen Einsatz
DC "VS" wear-protective coating for general use



Für synchrones Gewindeschneiden
For Rigid Tapping



Für klassisches Gewindeschneiden
For Classic Tapping



Lagerartikel
Stock item

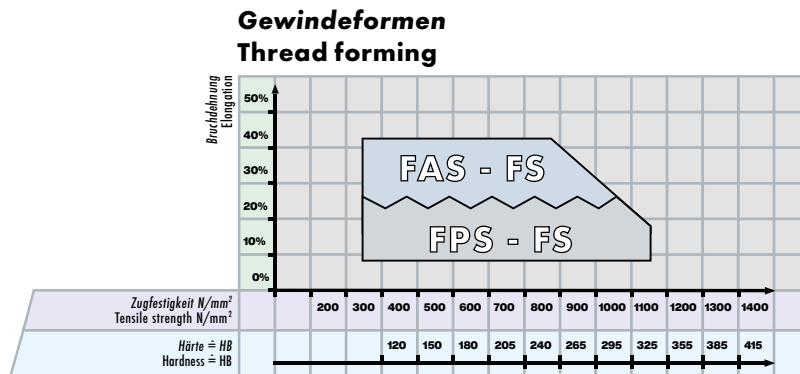


Kurzfristig lieferbar
Available at short notice



Ab Lager lieferbar solange Vorrat
Available from stock, while stock lasts

ANWENDUNGSTABELLE — APPLICATION CHART



DC -Anwendungsgruppen

DC Material classification

Werkstoff-Gruppen Material groups	Werkstoffbezeichnung Material designation	Härte Hardness (HB)	Festigkeit Tensile strength Rm (N/mm²)	Dehnung Elongation A (%)
10 Stahl Steels	11 Automatenstahl Free-cutting steels	< 200	< 700	< 10
	12 Baustahl, Einsatzstahl Structural, cementation steels	< 200	< 700	< 30
	13 Kohlenstoffstahl Carbon steels	< 300	< 1000	< 20
	14 Stahl legiert < 850 N/mm² Alloy steels < 850 N/mm²	< 250	< 850	< 30
	15 Stahl legiert / vergütet > 850 - < 1150 N/mm² Alloy steels hard. / temp. > 850 - < 1150 N/mm²	> 250	> 850	< 30
	16 Hochfester Stahl ≤ 44 HRC High tensile alloy steels ≤ 44 HRC	> 250	> 850	< 12
	17 Stahl vergütet > 44 - ≤ 54 HRC Alloy steels tempered > 44 - ≤ 54 HRC	> 410	> 1400	< 2
	18 Stahl gehärtet > 54 - ≤ 63 HRC Alloy steels hardened > 54 - ≤ 63 HRC	> 560	> 1980	< 2
20 Rostfreier Stahl Stainless steels	21 Rostfreier Stahl, geschwefelt Free machining stainless steels	< 250	< 850	< 25
	22 Austenitisch Austenitic stainless steels	< 250	< 850	> 20
	23 Ferritisch, martensitisch < 850 N/mm² Ferritic and martensitic < 850 N/mm²	< 250	< 850	> 20
	24 Ferritisch, martensitisch > 850 - < 1150 N/mm² Ferritic and martensitic > 850 - < 1150 N/mm²	> 250	> 850	> 15
30 Guss Cast iron	31 Grauguss Cast iron	< 250	< 850	< 10
	32 Kugelgraphitguss, Temperguss Spheroidal graphite + malleable cast iron	< 250	< 850	> 10
40 Titan Titanium	41 Reintitan Pure titanium	< 250	< 850	> 20
	42 Titanlegierung Titanium alloys	> 250	> 850	< 20
50 Nickel Nickel	51 Nickellegierung 1 ≤ 850 N/mm² Nickel alloys 1 ≤ 850 N/mm²	< 250	< 850	> 25
	52 Nickellegierung 2 > 850 - ≤ 1150 N/mm² Nickel alloys 2 > 850 - ≤ 1150 N/mm²	> 250	> 850	< 25
	53 Nickellegierung 3 > 1150 - ≤ 1600 N/mm² Nickel alloys 3 > 1150 - ≤ 1600 N/mm²	> 340	> 1150	< 20
60 Kupfer Copper	61 Reinkupfer (Elektrolytkupfer) Pure copper (electrolytic copper)	< 120	< 400	> 12
	62 Messing, Bronze, Rotguss (kurzspanend) Short chip brass, phosphor bronze, gun metal	< 200	< 700	< 12
	63 Messing (langspanend) Long chip brass	< 200	< 700	> 12
	64 Messing bleifrei Lead free brass	< 220	< 700	> 15
70 Aluminium Magnesium Aluminium Magnesium	71 Al unlegiert Al unalloyed	< 100	< 350	> 15
	72 Al legiert Si < 1.5 % Al alloyed Si < 1.5 %	< 150	< 500	> 15
	73 Al legiert Si > 1.5 % - < 10 % Al alloyed Si > 1.5 % - < 10 %	< 120	< 400	< 15
	74 Al legiert Si > 10 %, Mg-Legierungen Al alloyed Si > 10 %, Mg-alloys	< 120	< 400	< 10
80 Kunststoff Plastic compounds	81 Thermoplaste Thermoplastics	-	-	-
	82 Duroplaste Duroplastics	-	-	-
	83 Faserverstärkte Kunststoffe Glass fibre reinforced plastics	-	-	-
90 Edelmetalle Precious metals	91 Gelbgold Yellow gold	-	-	-
	92 Rotgold Red gold	-	-	-
	93 Weissgold White gold	-	-	-
	94 Silber Silver	-	-	-

Optimal mit Schneidöl
Optimal with cutting oil

Geeignet mit Schneidöl
Suitable with cutting oil

Optimal mit Emulsion
Optimal with emulsion

Geeignet mit Emulsion
Suitable with emulsion

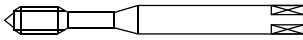
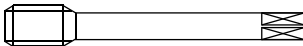
GEWINDEFORMEN — THREAD FORMING



Ab Seite:
From page:

M
MF
UNC
UNF
G

FS		FPS					FAS		
254	255	256	256	256	256	258	259	259	260
					262			262	
263					263			263	
264					264			264	
					265			265	
									
FPS.80VS	FPS.80DL	FPS.80DL	FPS.81DL	FPS.80VS	FPS.81VS	FPS.84VS	FAS.80VS	FAS.81VS	FAS.84VS
									
 				 	 	 			
 				 	 	 			
 				 	 	 			
 				 	 	 			
									
 	 						 	 	 
 	 						 	 	 
	 						 	 	 
									
									
								 	 
	 							 	 
	 	 	 						
	 	 	 						
	 	 	 						
	 	 	 						
	 	 	 						

					FS		FPS	
Merkmale Characteristics					 VS	 DLC	 	 
					 E 1.5 x P	 C 2.5 x P	 DLC	 VS
					 	 	 	 
							NEW	
Lochart Hole type								
					FS380VS-5 FS380VS-3	FS380DL-5 FS380DL-3	FPS380DL-3 FPS381DL-3	FPS380VS-3 FPS381VS-3
M	6HX	ISO DIN 13	DIN lang DIN long	~DIN 2174	254	255	256	256
M	6GX	ISO DIN 13	DIN lang DIN long	~DIN 2174	254	255		256
M	6HX	ISO DIN 13	Extra-lang Extra-long	DC				
MF	6HX	ISO DIN 13	DIN lang DIN long	~DIN 2174				262
UNC	2BX	ASME B1.1	DIN lang DIN long	~DIN 2184-1	263			263
UNF	2BX	ASME B1.1	DIN lang DIN long	~DIN 2184-1	264			264
								FPS481VS-3
M	6HX	ISO DIN 13	DIN lang DIN long	~DIN 2174				257
M	6GX	ISO DIN 13	DIN lang DIN long	~DIN 2174				
M	6HX	ISO DIN 13	Extra-lang Extra-long	DC				
MF	6HX	ISO DIN 13	DIN lang DIN long	~DIN 2174				262
UNC	2BX	ASME B1.1	DIN lang DIN long	~DIN 2184-1				
UNF	2BX	ASME B1.1	DIN lang DIN long	~DIN 2184-1				
G (BSP)		DIN EN ISO 228	DIN lang DIN long	~DIN 2189				265

FPS			FAS			
						
VS			VS	VS		
						
						
FPS384VS-3	FPS581VS-3	FPS584VS-3	FAS380VS-3 FAS381VS-3	FAS384VS-3	FAS581VS-3	FAS584VS-3
258			259	260		
			259			
	257	258			261	261
			262			
			263			
			264			
FPS484VS-3	FPS681VS-3	FPS684VS-3	FAS481VS-3	FAS484VS-3	FAS681VS-3	FAS684VS-3
258			259	260		
			259			
	257	258			261	261
			262			
			265			

FS FORMING

FS380VS-5



VS

11 12 13 14
21

FS380VS-3



VS

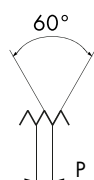
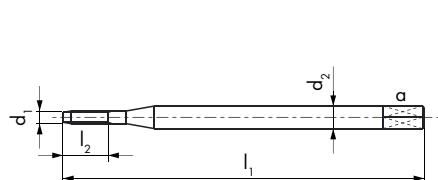
11 12 13 14
21

FS380VS-5

FS380VS-3

FS380VS-3

FS380VS-3



6HX

6HX

6HX

6GX

Ø d ₁ M	P mm	l ₁ mm	l ₂ mm	d ₂ mm	a mm	4HX Tol. 6HX
1	0.25	40	3	2.5		0.88 +0.02
1.2	0.25	40	3.6	2.5		1.08 +0.02
1.4	0.3	40	4.2	2.5		1.25 +0.02
1.6	0.35	40	4.8	2.5		1.45 +0.02
1.7	0.35	40	5.1	2.5		1.55 +0.02
1.8	0.35	40	5.4	2.5		1.65 +0.02
2	0.4	45	8	2.8	2.1	1.8 +0.02
2.5	0.45	50	10	2.8	2.1	2.3 +0.02
2.6	0.45	50	10	2.8	2.1	2.4 +0.02

ID	ID	ID	ID	6H + mm
● 157171	● 173452			
● 157172	● 173455			
● 157173	● 173458			
● 157174	● 169779			
	● 169782			
● 157175	● 169785			
		● 157176	● 157180	0.019
		● 157178	● 157181	0.020
		● 157179		

≤M1.5

4HX

FS FORMING

FS380DL-5



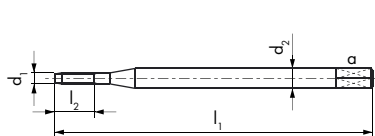
DLC



FS380DL-3



DLC



FS380DL-5

FS380DL-3

FS380DL-3

FS380DL-3



6HX

6HX

6HX

6GX

$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	d_2 mm	a mm	4HX Tol. 6HX	ID	ID	ID	ID	6H + mm
1	0.25	40	3	2.5		0.88 +0.02	● 172839	● 173461			
1.2	0.25	40	3.6	2.5		1.08 +0.02	● 172840	● 173464			
1.4	0.3	40	4.2	2.5		1.25 +0.02	● 172841	● 173467			
1.6	0.35	40	4.8	2.5		1.45 +0.02	● 170585	● 170916			
1.7	0.35	40	5.1	2.5		1.55 +0.02		● 172843			
1.8	0.35	40	5.4	2.5		1.65 +0.02	● 172842	● 172844			
2	0.4	45	8	2.8	2.1	1.8 +0.02			● 158814	● 172849	0.019
2.5	0.45	50	10	2.8	2.1	2.3 +0.02			● 172845	● 173246	0.020
2.6	0.45	50	10	2.8	2.1	2.4 +0.02			● 172846		

≤M1.5

4HX

FPS FORMING

FPS380DL-3



DLC

63 64 71 72
73 91 92 94

FPS381DL-3



DLC

63 64 71 72
73 91 92 94

FPS380VS-3



VS

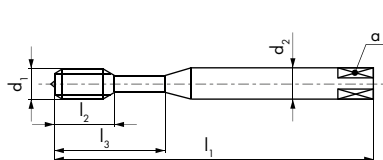
11 12 13 14

FPS381VS-3



VS

11 12 13 14
15



FPS380DL-3

FPS381DL-3

FPS380VS-3

FPS381VS-3



6HX

6HX

6HX

6HX

Ø d ₁ M	P mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
3.5	0.6	56	13	20	4	3	3.25 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05

ID

ID

ID

ID

● 170553	● 182038	● 166614	● 166616
● 175347	● 182623	● 166620	● 166622
● 170554	● 182039	● 166627	● 166629
● 182619	● 178343	● 166635	● 166637
● 182620	● 171112	● 166644	● 166646
● 182621	● 179144	● 166654	● 166656
● 182622	● 171113	● 166664	● 166666

6GX

6GX

Ø d ₁ M	P mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
3.5	0.6	56	13	20	4	3	3.25 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05

ID

6H
+ mm

ID

6H
+ mm

● 166697	0.020	● 166617	0.020
● 166687	0.021	● 166623	0.021
● 166688	0.022	● 166630	0.022
● 166689	0.024	● 166638	0.024
● 166686	0.026	● 166647	0.026
● 166740	0.028	● 166657	0.028
● 166739	0.032	● 166667	0.032

FPS FORMING

FPS481VS-3



VS

11 12 13 14
15

FPS581VS-3



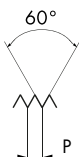
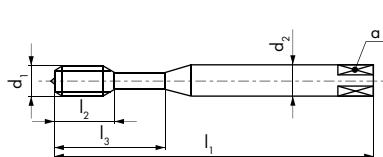
EL VS

11 12 13 14
15

FPS681VS-3



EL VS

11 12 13 14
15

FPS481VS-3

FPS581VS-3

FPS681VS-3



6HX

6HX

6HX

$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	d_2 mm	a mm	6HX Tol.
12	1.75	110	24	9	7	11.2 +0.05
14	2	110	28	11	9	13.1 +0.05
16	2	110	30	12	9	15.1 +0.05
20	2.5	140	36	16	12	18.85 +0.05

ID

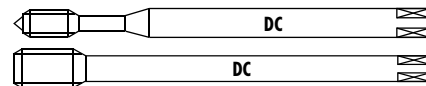
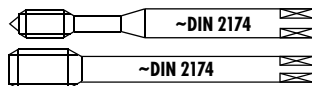
- 166673
- 166678
- 166683
- 168713

$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	l_3 mm	d_2 mm	a mm	6HX Tol.
3	0.5	100	12	18	3.5	2.7	2.8 +0.03
4	0.7	125	14	21	4.5	3.4	3.7 +0.03
5	0.8	140	15	25	6	4.9	4.65 +0.03
6	1	160	17	30	6	4.9	5.55 +0.05
8	1.25	180	20	35	8	6.2	7.4 +0.05
10	1.5	200	22	39	10	8	9.3 +0.05
12	1.75	224	24		9	7	11.2 +0.05

ID

ID

- 172824
- 172826
- 172828
- 172830
- 172832
- 172834
- 172836



FPS FORMING

FPS384VS-3



11 12 13 14
15

FPS484VS-3



11 12 13 14
15

FPS584VS-3

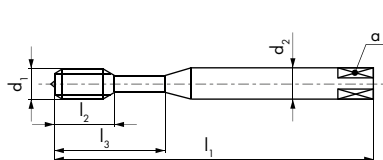


11 12 13 14
15

FPS684VS-3



11 12 13 14
15



FPS384VS-3

FPS484VS-3

FPS584VS-3

FPS684VS-3



6HX

6HX

6HX

6HX

$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	l_3 mm	d_2 mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05
12	1.75	110	24		9	7	11.2 +0.05
14	2	110	28		11	9	13.1 +0.05
16	2	110	30		12	9	15.1 +0.05

ID

ID

- 166737
- 166738
- 166640
- 166650
- 166660
- 166670

- 166675
- 166680
- 166685

$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	l_3 mm	d_2 mm	a mm	6HX Tol.
3	0.5	100	12	18	3.5	2.7	2.8 +0.03
4	0.7	125	14	21	4.5	3.4	3.7 +0.03
5	0.8	140	15	25	6	4.9	4.65 +0.03
6	1	160	17	30	6	4.9	5.55 +0.05
8	1.25	180	20	35	8	6.2	7.4 +0.05
10	1.5	200	22	39	10	8	9.3 +0.05
12	1.75	224	24		9	7	11.2 +0.05

ID

ID

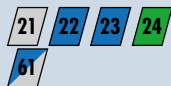
- 172763
- 172766
- 172769
- 172772
- 172775
- 172778
- 172781

FAS FORMING

FAS380VS-3



VS



FAS381VS-3



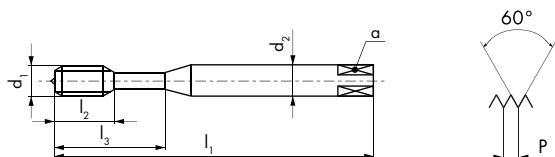
VS



FAS481VS-3



VS



FAS380VS-3



6HX

FAS381VS-3



6HX

FAS481VS-3



6HX

Ø d ₁ M	P mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
3.5	0.6	56	13	20	4	3	3.25 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05
12	1.75	110	24		9	7	11.2 +0.05
14	2	110	28		11	9	13.1 +0.05
16	2	110	30		12	9	15.1 +0.05
20	2.5	140	36		16	12	18.85 +0.05

ID

- 170603
- 170605
- 170607
- 170609
- 170611
- 170616
- 170618

ID

- 166612
- 166618
- 166624
- 166632
- 166641
- 166651
- 166661

ID

- 166671
- 166676
- 166681
- 168711

6GX

6GX

Ø d ₁ M	P mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
3.5	0.6	56	13	20	4	3	3.25 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05
12	1.75	110	24		9	7	11.2 +0.05
14	2	110	28		11	9	13.1 +0.05
16	2	110	30		12	9	15.1 +0.05

ID

6H

+ mm

- 166703 0.020
- 166704 0.021
- 166705 0.022
- 166706 0.024
- 166707 0.026
- 166708 0.028
- 166709 0.032

ID

6H

+ mm

- 166710 0.034
- ★ 166711 0.038
- 166712 0.038

FAS FORMING

FAS384VS-3

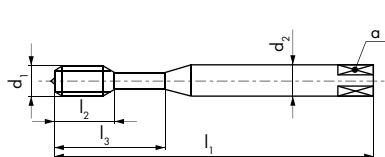


FAS484VS-3



FAS384VS-3

FAS484VS-3



$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	l_3 mm	d_2 mm	a mm	6HX Tol.
3	0.5	56	12	18	3.5	2.7	2.8 +0.03
4	0.7	63	14	21	4.5	3.4	3.7 +0.03
5	0.8	70	15	25	6	4.9	4.65 +0.03
6	1	80	17	30	6	4.9	5.55 +0.05
8	1.25	90	20	35	8	6.2	7.4 +0.05
10	1.5	100	22	39	10	8	9.3 +0.05
12	1.75	110	24		9	7	11.2 +0.05
14	2	110	28		11	9	13.1 +0.05
16	2	110	30		12	9	15.1 +0.05

ID

ID

● 166741

● 166742

● 166690

● 166691

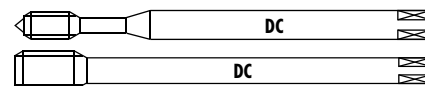
● 166692

● 166693

● 166694

● 166695

● 166696



FAS FORMING

FAS581VS-3



EL

VS



FAS681VS-3



EL

VS

FAS584VS-3



EL

VS

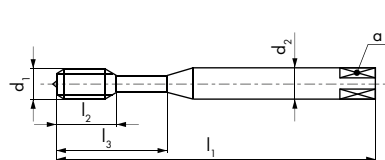


FAS684VS-3



EL

VS



FAS581VS-3

FAS681VS-3

FAS584VS-3

FAS684VS-3



$\emptyset d_1$ M	P mm	l_1 mm	l_2 mm	l_3 mm	d_2 mm	a mm	6HX Tol.
3	0.5	100	12	18	3.5	2.7	2.8 +0.03
4	0.7	125	14	21	4.5	3.4	3.7 +0.03
5	0.8	140	15	25	6	4.9	4.65 +0.03
6	1	160	17	30	6	4.9	5.55 +0.05
8	1.25	180	20	35	8	6.2	7.4 +0.05
10	1.5	200	22	39	10	8	9.3 +0.05
12	1.75	224	24		9	7	11.2 +0.05

ID

ID

ID

ID

● 172784

● 172805

● 172787

● 172808

● 172790

● 172811

● 172793

● 172814

● 172796

● 172817

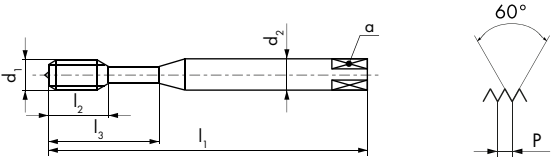
● 172799

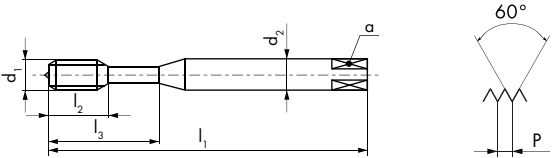
● 172820

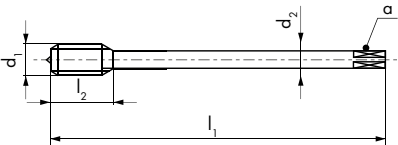
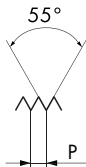
● 172802

● 172822

FPS FAS FORMING								FPS381VS-3	FPS481VS-3	FAS381VS-3	FAS481VS-3
FPS381VS-3 FPS481VS-3 FAS381VS-3 FAS481VS-3											
Ø d ₁ MF	P mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	6HX Tol.	ID	ID	ID	ID
4	0.5	63	14	21	4.5	3.4	3.8 +0.03	● 166631		● 166625	
5	0.5	70	15	25	6	4.9	4.8 +0.03	● 166639		● 166633	
6	0.5	80	17	30	6	4.9	5.8 +0.03	● 166699		● 166698	
6	0.75	80	17	30	6	4.9	5.65 +0.03	● 166649		● 166642	
8	0.75	90	20	35	8	6.2	7.65 +0.03	● 166702		● 166700	
8	1	90	20	35	8	6.2	7.55 +0.05	● 166659		● 166652	
10	1	100	22	39	10	8	9.55 +0.05	● 166669		● 166662	
12	1	100	19		9	7	11.55 +0.05		● 166674		● 166672
14	1.5	100	24		11	9	13.3 +0.05		● 166679		● 166677
16	1.5	100	26		12	9	15.3 +0.05		● 166684		● 166682

FS FPS FORMING FAS										FS380VS-3		FPS381VS-3	FAS381VS-3
FS380VS-3 VS 11 12 13 14 21													
FPS381VS-3 VS 11 12 13 14 15													
FAS381VS-3 VS 21 22 23 24 41 51 61													
													
2BX										2BX		2BX	2BX
Ø" d ₁ UNC	P TPI	d ₁ mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm	2BX Tol.		ID		ID	ID
2	56	2.18	45	9		2.8	2.1	1.95 +0.02	● 157285				
4	40	2.84	56	12	18	3.5	2.7	2.55 +0.03			● 170063	● 170065	
6	32	3.5	56	13	20	4	3	3.15 +0.03			● 166713	● 166725	
8	32	4.16	63	14	21	4.5	3.4	3.8 +0.03			● 166714	● 166726	
10	24	4.82	70	15	25	6	4.9	4.35 +0.05			● 166715	● 166727	
1/4	20	6.35	80	17	30	7	5.5	5.75 +0.05			● 166716	● 166728	

FS FPS FORMING FAS										FS380VS-5		FPS381VS-3	FAS381VS-3
FS380VS-5  VS 11 12 13 14 21													
FPS381VS-3  VS 11 12 13 14 15													
FAS381VS-3  VS 21 22 23 24 41 51 61													
													
													
Ø" d ₁ UNF	P TPI	d mm	l ₁ mm	l ₂ mm	l ₃ mm	d ₂ mm	a mm		Tol.	ID		ID	ID
0	80	1.52	40	4.6		2.5		1.37	+0.02	● 161498			
10	32	4.82	70	15	25	6	4.9	4.45	+0.03		● 166718	● 166730	
1/4	28	6.35	80	17	30	7	5.5	5.95	+0.05		● 166719	● 166731	
5/16	24	7.93	90	20	35	8	6.2	7.45	+0.05		● 166720	● 166732	

FPS FAS FORMING									FPS481VS-3		FAS481VS-3	
FPS481VS-3  VS 11 12 13 14 15												
FAS481VS-3  VS 21 22 23 24 41 51 61												
 												
												
Ø" d₁ G	P	d ₁	l ₁	l ₂	d ₂	a		Tol.	ID			
1/8	28	9.72	90	22	7	5.5	9.25	+0.05	● 166721			
1/4	19	13.15	100	20	11	9	12.5	+0.05	● 166722			
3/8	19	16.66	100	20	12	9	16	+0.05	● 166723			
1/2	14	20.95	125	22	16	12	20	+0.05	● 166724			
									● 166733			
									● 166734			
									● 166735			
									● 166736			