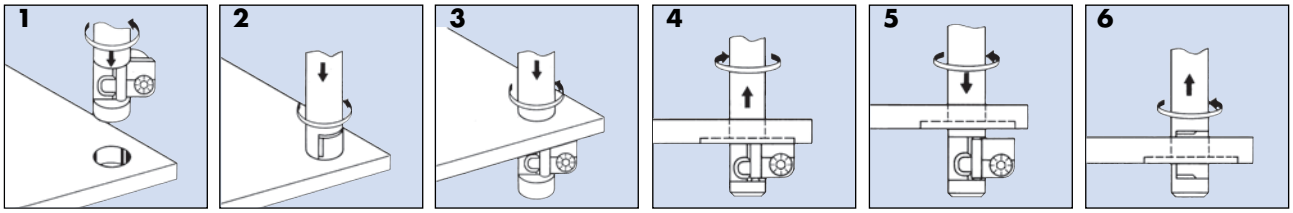
Automatic Back Spotfacer

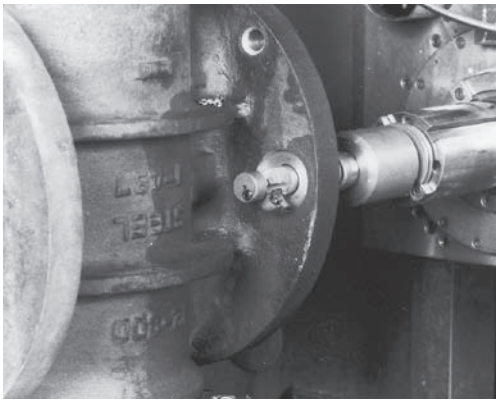
SPOTFACING · CHAMFERING
COUNTERBORING · DEBURRING

METRIC TOOLS

www.erixtool.com

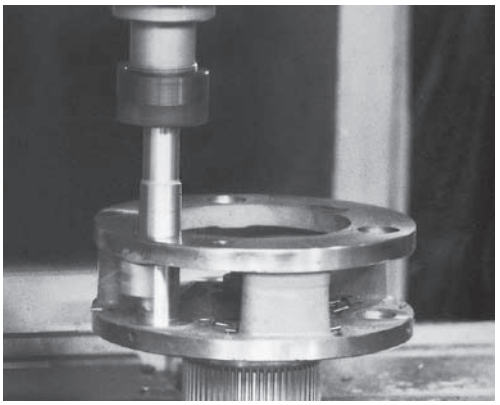
HOW THE ERIX TOOL OPERATES



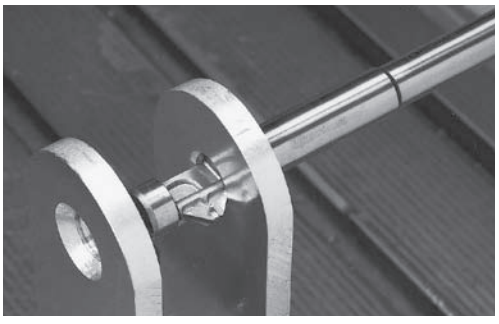


Back spotfacing large valve body.

Spindle with coolant through (CT).



Front and back spotfacing.

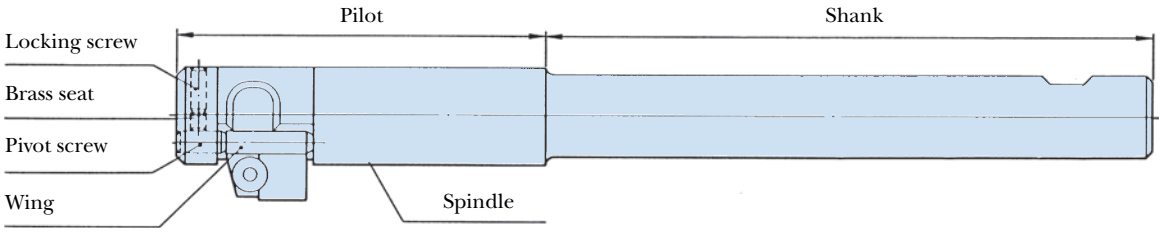


Front and Back chamfering.

TECHNICAL DESCRIPTION

Patented Design. Reliable Performance. The Erix tool is an automatic back spotfacing or back chamfering tool consisting of a spindle and a cutter, called a wing, which folds into the spindle recess when the tool enters the hole in the workpiece. Excellent performance is ensured because there is only one moving part.

Save time and money. Working time saved when compared with conventional methods is normally between 60% and 70%, in some cases more than 90%.



SPINDLE.

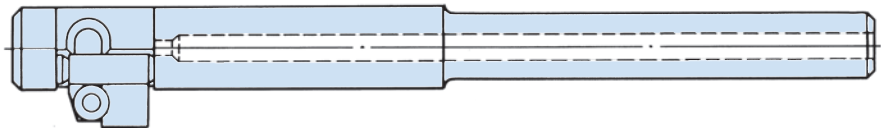
The pilot part of the spindle guides the spotfacer into the hole and takes up the cutting forces. The pilot diameter is less than the nominal hole diameter.

The difference in diameter is as follows:

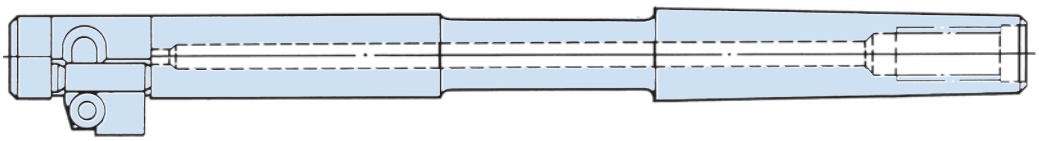
Hole dia.	*Difference*
4.5 – 9.0 mm	0.05 mm
10.0 – 13.0 mm	0.10 mm
14.0 – 24.0 mm	0.20 mm
25.0 – 30.0 mm	0.30 mm
above 30 mm	0.30 mm

Spindles above size 30 mm have a pilot diameter which is 1 mm less than the hole diameter. These spindles are provided with wear strips, which guide the spotfacer into the hole. Spindles size 4,5–9 mm have cylindrical shanks only. Larger spindles have either cylindrical or Morse Taper shanks.

COOLANT THROUGH



All spindles with cylindrical shanks, for hole size 10 mm and above, have coolant through.



All spindles with Morse Taper shanks (DIN 228A), for hole size 10 mm and above, can be drilled for coolant through. Morse Taper spindles with coolant through are coded with a suffix (CT) e.g. 27-14-MK2 (CT).

WING

During operation the wing must be free to swing. Therefore, when assembling a wing, **the pivot screw should be released about 30 degrees,** before tightening the locking screw.

Smaller wings are made of HSS with integral cutting edge. Larger size wings have square inserts type ISO SPUN or rectangular inserts type ISO/R242.

The inserts are clamped to the wings by means of Secodex **lefthand** threaded screws.

FEED AND SPEED

When operating in different material

Workpiece Material		Hardness HB	Number and Letter Code	
			Wings HSS	Wings Carbide
1. Steel	1,1 Magnetic soft steel	≤ 120	35 E	70 E
	1,2 Structural steel	≤ 200	30 D	60 D
	1,3 Plain Carbon steel	≤ 250	25 D	50 D
	1,4 Alloy steel	≤ 250	20 C	40 C
	1,5 Alloy, tempered steel	> 250; ≤ 350	15 B	30 B
	1,6 Alloy, tempered steel	> 350	10 A	20 A
2. Stainless steel Stahl	2,1 Free machining, steel	≤ 250	15 E	40 E
	2,2 Austenitic	≤ 250	10 D	30 D
	2,3 Ferritic, Martensitic	≤ 300	5 C	20 C
3. Cast Iron	3,1 Lamellar graphite	≤ 150	30 E	40 E
	3,2 Lamellar graphite	> 150; ≤ 300	20 E	30 E
	3,3 Malleable Cast Iron	≤ 200	15 D	20 D
	3,4 Malleable Cast Iron	> 200; ≤ 300	10 D	10 D
4. Titanium	4,1 Titanium unalloyed	≤ 200	15 C	40 C
	4,2 Titanium alloyed	≤ 270	10 B	20 B
	4,3 Titanium alloyed	> 270; ≤ 350	5 B	10 B
5. Nickel	5,1 Nickel, unalloyed	≤ 150	10 B	40 B
	5,2 Nickel, alloyed	≤ 270	6 B	20 B
	5,3 Nickel, alloyed	> 270; ≤ 350	5 A	10 A
6. Copper	6,1 Copper	≤ 100	50 C	70 C
	6,2 B-Brass, Bronze	≤ 200	45 D	80 D
	6,3 α-Brass	≤ 200	40 D	80 D
	6,4 High Strength Bronze	≤ 470	20 E	40 E
7. Aluminium Magnesium	7,1 Al, Mg unalloyed	≤ 100	60 F	80 F
	7,2 Al alloyed, Si < 0,5%	≤ 150	50 F	70 F
	7,3 Al alloyed, 0,5% > Si < 10%	≤ 120	40 E	60 E
	7,4 Al alloyed, Si > 10%	≤ 120	30 E	40 E
8. Synthetic material	8,1 Thermoplastics	- -	60 D	80 D
	8,2 Thermosetting plastics	- -	40 B	60 B
	8,3 Reinforced plastic materials	- -	30 A	40 A

How to use the tables

1. Enter the table to the left with the correct workpiece material and the relevant wing type (HSS or Carbide) and obtain Number and Letter Code.

Example: Suppose workpiece material is Plain Carbon steel to be cut with a wing fitted with a carbide insert. You will find the Code: 50D.

2. With this code you go to the two tables below, using also the Spotfacing or Chamfering diameter *(Please note! Not hole diameter)*.
   To the left, using Letter Code, you will find Feed in mm/REV, and to the right, using Number Code, you find Speed in RPM.

Example: Suppose you are going to operate our tool 90-25/45-CS20. With a Spotfacing diameter of 45 mm and the above Code 50D you will find:

Feed: 0,14 mm / REV

Speed: 338 RPM

This would give a feed rate of: 338 x 0,14 = 47 mm/min.

Spot-facing/ Cham-fering diameter in mm	Feed in mm / REV						Speed in REV / min												
	Letter Code						Speed m/min												
	A	B	C	D	E	F	5	10	15	20	25	30	35	40	45	50	60	70	80
8	0,01	0,015	0,02	0,03	0,04	0,05	200	400	600	800	950	1200	1400	1600	1800	1900	2400	2800	3200
11	0,015	0,02	0,025	0,035	0,05	0,06	145	290	435	580	725	870	1015	1160	1300	1450	1740	2030	2320
14	0,02	0,025	0,03	0,04	0,06	0,07	115	230	340	455	570	680	795	910	1020	1140	1360	1590	1820
18	0,025	0,03	0,035	0,05	0,07	0,08	88	177	265	352	442	530	618	704	796	884	1060	1236	1408
21	0,03	0,035	0,04	0,06	0,08	0,10	76	152	228	304	380	456	534	608	687	760	912	1068	1216
25	0,035	0,04	0,05	0,08	0,10	0,12	64	128	192	256	320	382	446	512	573	640	764	892	1024
30	0,04	0,05	0,06	0,09	0,12	0,14	53	106	159	212	265	318	371	424	477	530	636	742	850
35	0,045	0,055	0,07	0,11	0,14	0,16	46	92	138	184	227	276	320	368	410	454	552	640	728
40	0,05	0,06	0,08	0,12	0,16	0,18	40	80	120	160	190	240	280	320	360	380	480	560	640
45	0,055	0,07	0,10	0,14	0,18	0,21	36	71	107	142	169	213	249	284	320	338	427	498	569
50	0,06	0,08	0,12	0,16	0,20	0,24	32	64	96	128	160	192	224	256	288	320	384	448	510
60	0,065	0,09	0,13	0,18	0,22	0,27	27	54	81	108	135	162	189	216	243	270	324	378	425
70	0,07	0,10	0,14	0,22	0,25	0,33	23	46	69	92	115	138	160	184	207	230	276	320	364
80	0,075	0,11	0,16	0,24	0,28	0,37	20	40	60	80	95	120	140	160	180	190	240	280	320
>80	0,08	0,12	0,18	0,25	0,30	0,40	15	20	50	65	80	95	110	125	145	160	190	220	250

DIRECTIONS FOR USE of ERIX Spot Facers

BEFORE USING THE TOOL MAKE THE FOLLOWING CHECKS:

TOOL

– Check that the wing is free to swing. To prevent tightening of the wing caused by heat expansion, the **pivot screw** should have been **released about 30 degrees.**

– Spot Facers above size 30 mm have wings provided with a guide tang to keep the wing in a working position even at low speeds and in horizontal position. It is of **utmost importance** to check that the **entire length** of wing **including the guide tang** will **have space** enough within the workpiece to swing free before cutting operation starts. If this is not the case damage to wing and spindle will be caused.

– Check insert quality. **Use ISO K20 for cast iron** and **ISO P40 for steel.** ERIX Spot Facers are normally fitted with insert of grade ISO K20. When changing inserts note that the **clamping screw is lefthand threaded.**

TOOL HOLDER

Thoroughly fasten tool or tool holder with tool into the machine spindle.

WORKPIECE

Since the hole acts as a guiding surface for the Spot Facer, **a few drops of thin oil** in the hole **should be used.** When machining in steel coolant should be used.

OPERATION

Choose machine spindle **speed according** to **table.**

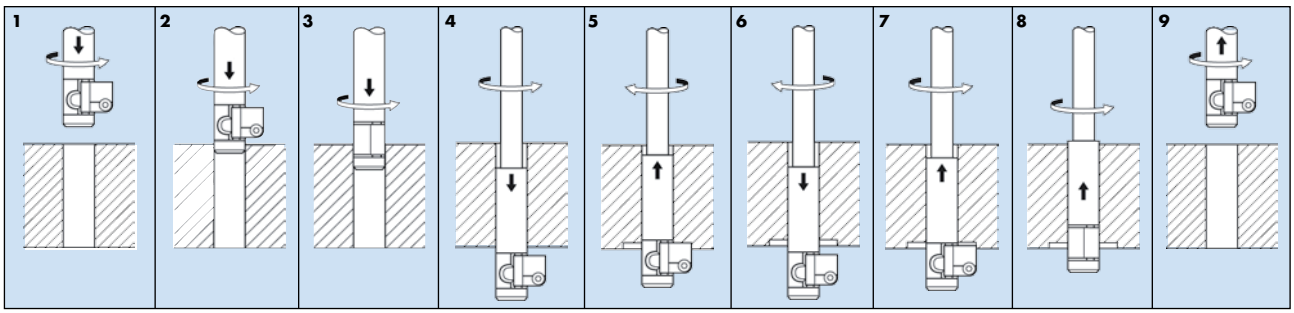
Start the machine spindle **counter-clockwise** (looking away from machine headstock) and **feed** the Spot Facer **rapidly up to the hole.** Since the wing must make contact with the workpiece in order to properly close, the **feedrate should be reduced** to **maximum 0,2 mm/rev. when entering** the hole. The wing will remain folded in, while passing through the hole and will swing out again by centrifugal force after having passed through. **Make sure that the entire length of the wing including the guide tang swings free of workpiece before reversing** to **clockwise rotation.** Then **apply feed according** to **table.**

IMPORTANT! The wing closes through contact with the workpiece, not through the centrifugal force.

After spot-facing, rapid traverse the wing away from the spotfaced surface. **If the wing has a guide tang the traverse must also clear the guide tang.**

Now reverse the spindle rotation and **back feed rapidly** until wing (or guide tang) is **near the spot faced surface.** Then the **feedrate should be reduced** again to **maximum 0,2 mm/rev.** until the wing is completely closed. The tool may then be withdrawn from the hole in rapid traverse.

IMPORTANT! When cutting in a fillet (interrupted cut), with a horizontal spindle 30 mm or less, speed should be increased up to 2 times figures given in table. Feed to be reduced by 20-30%.



A FEW HINTS FOR SMOOTH OPERATION

1. Small wings of type HSS might be magnetized during the operation. Demagnetize them if necessary.

2. Use coolant. For cast iron use a few drops of thin, non-sticky oil.

3. Tolerance on spotfacing diameter is approximately:

Hole dia.	*Tolerance*
4,5 - 9 mm	± 0,1 mm
10 - 30 mm	± 0,2 mm
31 – 69 mm	± 0,3 mm

4. To improve the surface finish on the spotfaced surface, reduce the speed and feed at the end of the operation and let the tool dwell for a few seconds.

5. To avoid marks in the finished hole, proceed as follows: drill the hole undersize, back spot face, ream the hole to finished size.

6. Always check that the support for workpiece is strong enough to avoid any form of vibration.

7. Use ”coolant through” whenever possible. It has several advantages: chips break, chips are removed, keeps spindle and wing cool, prevents workpiece surface from hardening. If ”coolant through” is not available we then recommend that plenty of coolant be applied as close to the cutting operation as possible.

8. Ensure that screws are correctly tightened:
a) the pivot-screw, after having been slightly tightened, should be released about 30 degrees and then secured by the locking screw and its brass seat.
b) the Secodex clamping screw in the wing is *lefthand* threaded. When tightening this screw the insert will be secured firmly into the pocket made specially for this purpose in the wing. Furthermore the Secodex-screw has the form of an umbrella with a rim acting like a spring pressing hard and holding the insert. So don’t forget to tighten this screw!
c) remaining screws. Check that they are tightened.

9. Keep the cutting edge sharp, (except when operating in hard aluminium). Regrind cutting edge or change insert frequently.

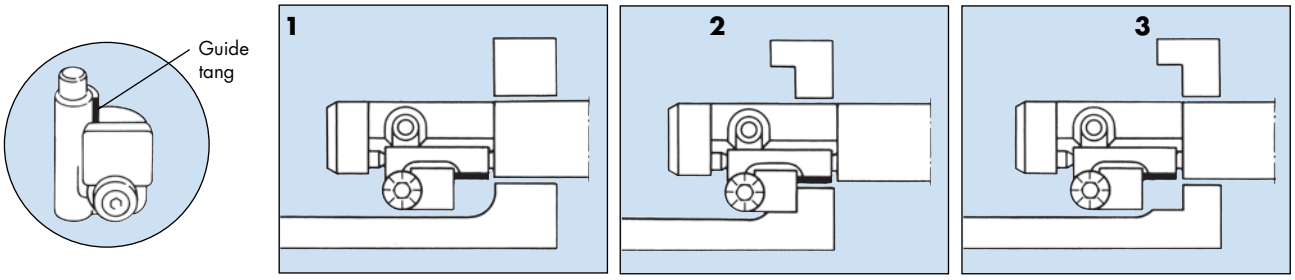
10. Ensure that there is space enough for the wing to swing out freely before, during or after the cutting operation.

11. The Erix tool is not designed to cut in a radial direction. If you try to use the tool as a reamer, the wing and/or spindle will break.

12. Ensure that the hole in the workpiece has a *+tolerance* (i.e. is larger than the nominal diameter), as for instance H 11.
A drill that produces a *-tolerance* (smaller than nominal) should not be used.

WINGS WITH GUIDE TANG

Large spotfacing tools run at low speed. When operating in a *horizontal* position the centrifugal force acting on the wing is insufficient to hold the wing in correct working position. Therefore, spotfacing tools above 30 mm diameter have wings provided with a *guide tang*.

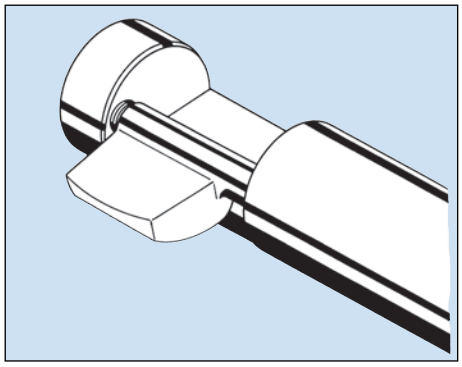


1. When cutting in a fillet the guide tang must enter the hole before the tip of insert cuts the fillet.
2. When the guide tang enters the hole it will keep the wing in its working position.
3. After spotfacing, the spindle must be retracted until the guide tang is free from the hole before the spindle can be reversed.

IMPORTANT!

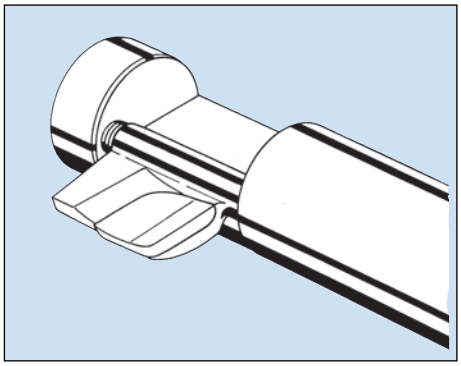
When cutting in a fillet *(interrupted cut)* with a horizontal spindle *increase speed* up to 2 times figures given in table and *reduce feed* by 20–30% (spindles 4,5–30 mm diameter only).

When operating the tools for hole size above 30 mm see instructions above.



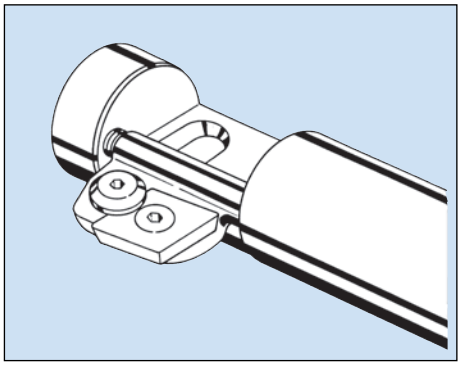
WINGS TYPE HSS ES

When operating conditions are too severe for the ordinary HSS wing the use of the EXTRA STRONG HSS wing is recommended. Such a wing is coded with the suffix ES; e.g. 37-037 ES.



WINGS TYPE HSS BI

Spotfacing wings size 020 and 030, normally made of HSS, can be supplied with BRAZED INSERTS grade K20 (or grade P40 for steel).
Such a wing is coded with the suffix BI; e.g. 37-037 BI.



WINGS WITH CENTERLOCK INSERTS

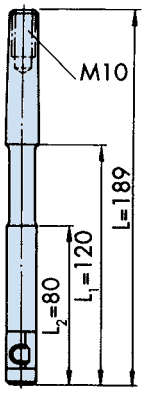
Heavy cutting loads in tough material such as stainless or high alloy steel make stringent demands on the clamping system. To comply with such demands, wings of size 060 or larger, which are normally fitted with square SPUN inserts, can be supplied with centerlocked inserts type SPMA. These wings are coded 38- instead of 37-; e.g. 38-120-2070.

SPECIAL HINTS FOR OPERATION IN SOME DIFFICULT MATERIALS

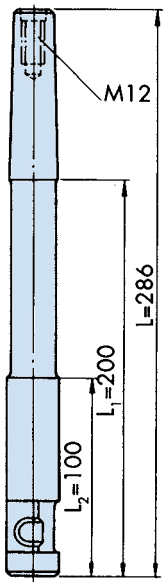
WORKPIECE MATERIAL	RECOMMENDATIONS
Steel: It can be a little difficult with soft steel to choose the best speed and feed. If speed is too high, vibrations might occur; if too low, material might build up on the cutting edge.	*Deviate from recommended figures up and down to find best result.*
If there is a weld within the area to be spot faced and especially if there is also an interrupted cut, you might experience difficulties due to local high-hardness spots.	*HSS-wings should - if possible - have brazed inserts, quality P40, (type BI). Larger wings can either have inserts with a centerlock screw (type 38-) (See page 7) or on special request be fitted with brazed inserts (quality P40).*
Stainless steel: Operating in stainless steel can cause problems similar to those described above.	*Follow above recommendations. If they are not sufficient, ask us for chip breakers to be ground at the cutting edge of the wing or the insert. To further relieve the stress on the wing it can under certain circumstances be advisable to make the spotface in two diameter-steps.*
Cast iron: The surface is often very hard and sometimes you will find grains of sand included in the surface. The cutting edge will quickly become blunt, which can cause the wing to break.	*When using HSS-wings try type BI with brazed inserts quality K20 or, when they are not available, type ES (See page 7). For larger wings use inserts quality K20.*
Titanium: Titanium is a very special material. When you have got experience, however, you should not expect difficulties.	*Insert quality P40 is generally recommended. For smaller wings use brazed inserts P40, where available. Otherwise wings type ES. Larger wings should have ordinary inserts P40. If necessary ask for special wings with brazed inserts.*
Aluminium: Soft aluminium will give long chips.	*If necessary arrange chip breaker. (See under stainless steel above).*
Hard aluminium will give short chips.	*Ask us to supply wings or inserts with a chipping angle reduced from 7,5 degrees (which is our standard) to 0 degrees. It can also be useful to hone the cutting edge to obtain a small (approx 0,1 mm) negative chipping angle.*

MORSE TAPER SHANKS

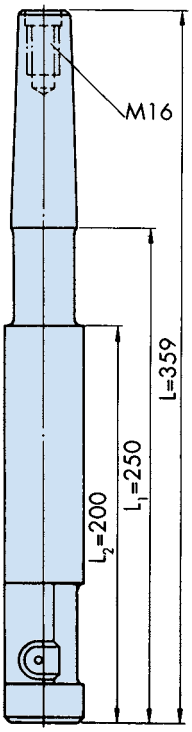
MK2
Hole size ø 10 – ø 15,5



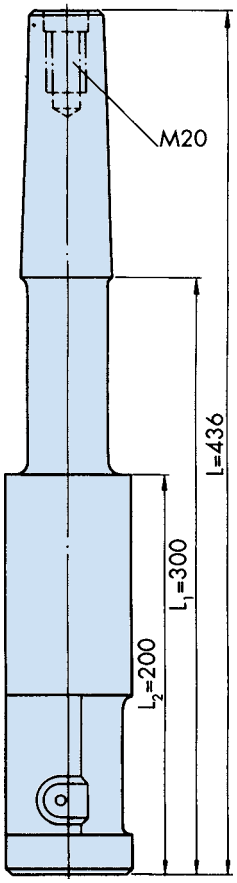
MK3
Hole size ø 16 – ø 30



MK4
Hole size ø 31 – ø 43

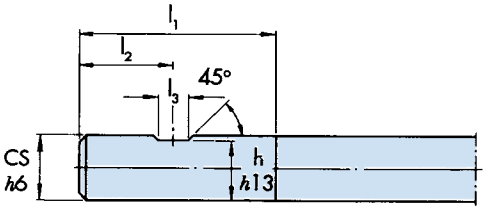


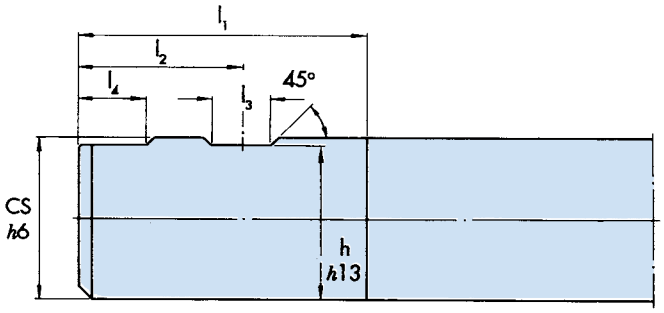
MK5
Hole size ø 44 – ø 69



All spindles from hole size ø 10 mm and above can be supplied with Morse Taper shank manufactured according to DIN 228A, instead of with cylindrical shank. The part number is for example 27-25-MK3.

WELDON





All spindles from hole size ø 10 and above with cylindrical shanks are arranged for Weldon fastening according to DIN 1835B.

Shank CS	l_1	l_2	l_3	l_4	h
10	40	20	7	–	8,4
12	45	22,5	8	–	10,4
16	48	24	10	–	14,2
20	50	25	11	–	18,2
25	56	32	12	15	23,0
32	60	36	14	17	30,0
40	70	40	14	17	38,0
50	80	45	18	21	47,8

PART NUMBERING SYSTEM

Complete tool is coded 90–25/45–CS20
Prefix 90– = back spotfacing 90°
25 = hole diameter in mm
45 = facing diameter in mm
CS= cylindrical shank
20 = shank diameter in mm

Other prefixes:
45–= chamfering 45°
60–= chamfering 60°
30–= chamfering 30°
902–= front and back spotfacing
452–= front and back chamfering 45°
29–= special tool

Spindle is coded 27–25–CS20
Prefix 27– = spindle, standard or semistandard
25 = hole diameter in mm
CS = cylindrical shank
20 = shank diameter in mm

Other prefix:
29– = special spindle

Important! To front- and Backspotface with Spindle above 30 mm. Please see page 22 and 23.

Wing is coded 37–111 (standard) or 37–110–1450 (semistandard)
Prefix 37– = wing for back spotfacing 90°

Other prefixes:
34– = back chamfering
35– = front and back chamfering
36– = front and back spotfacing
38– = back spotfacing 90° with centerlock screw
39– = special wing

Wings with Centerlock Inserts

Type	Inserts - Type (K 20 or P40*)
38-061	SPMA 080312
38-062	SPMA 090308
38-063	SPMA 090308
38-091	SPMA 120308
38-101	SPMA 090308
38-102	SPMA 090308
38-111	SPMA 120308
38-121	SPMA 150408
38-131	SPMA 150408
38-132	SPMA 190412
38-141	SPMA 150408
38-142	SPMA 190412

Other types – Please request!

* K20 delivered as standard.

SEMISTANDARD AND SPECIAL TOOLS

In addition to the tools listed in this Catalogue we manufacture semistandard and special spindles and wings for …

1. Hole sizes up to 200 mm in diameter.

2. Holes with diameters between those listed at intervals of 0,1 mm (0,05 mm for hole size ø 4,5 – ø 9 mm).

3. Back spotfacing and Front/Back spotfacing at intervals of 0,1 mm in facing diameter.

4. Chamfering angles other than 45°, 60° and 30°. Minimum angle is 15°.

5. Special shanks.

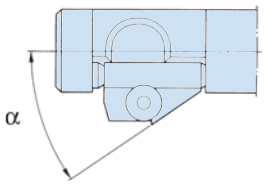
When requesting a quotation for a non-standard tool, please supply the following information …

a) Hole diameter to the nearest 0,1 mm (or 0,05 mm for hole size ø 4,5 – ø 9 mm).

b) Facing diameter to the nearest 0,1 mm.

c) Operation – back spotfacing/chamfering or front and back spotfacing/chamfering.

d) Chamfering angle α.

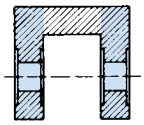


e) Type of shank.

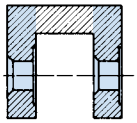
f) Grade of carbide insert i.e. K20 for cast iron or P40 for steel.

For very special or unusual applications please send a dimensioned sketch of the workpiece.

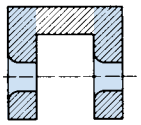
Possibilities for Erix Tool



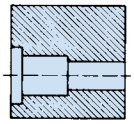
Front spot facing and back spot facing



Front spot facing and back chamfering



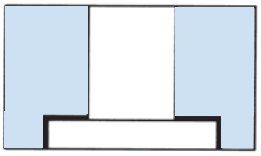
Back chamfering with radius

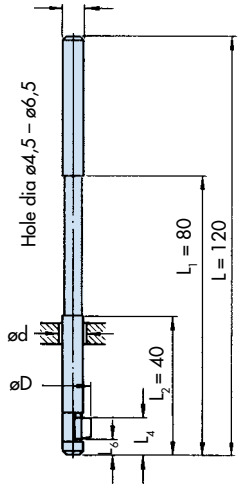


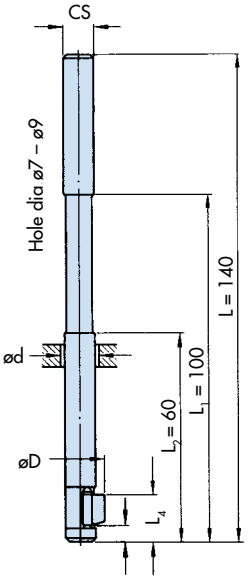
Front spot facing with dual diameters

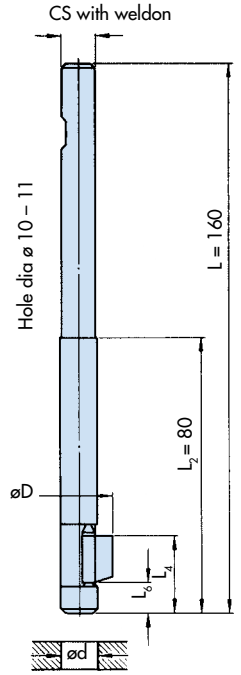
BACK SPOTFACING

HOLE SIZE ø 4,5 – ø 11 mm



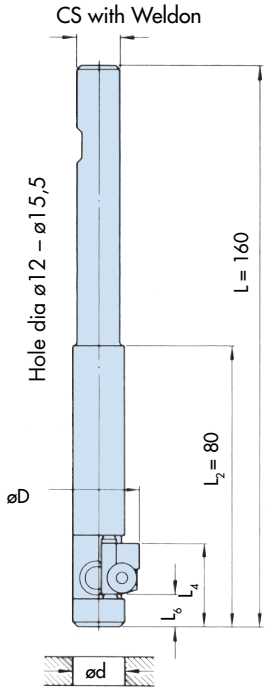






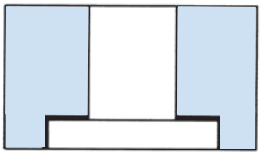
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_4	L_6
4,5	8	**90– 4,5 / 8 –CS6**	27-4,5-CS6	37-011	HSS	11	5
	8,3	**90– 4,5 / 8,3 –CS6**		-010-0315			
5,5	9	**90– 5,5 / 9 –CS6**	27-5,5-CS6	37-011	HSS	11	5
	10	**90– 5,5 /10 –CS6**		-012			
	10,5	**90– 5,5 /10,5 –CS6**		-013			
	11	**90– 5,5 /11 –CS6**		-014			
	11,3	**90– 5,5 /11,3 –CS6**		-010-0415			
6,5	9,5	**90– 6,5 /9,5 –CS6**	27-6,5-CS6	37-011	HSS	11	5
	10,5	**90– 6,5 /10,5 –CS6**		-012			
	11	**90– 6,5 /11 –CS6**		-013			
	11,5	**90– 6,5 /11,5 –CS6**		-014			
	13	**90– 6,5 /13 –CS6**		-015			
	13,3	**90– 6,5 /13,3 –CS6**		-010-0490			
7	11,8	**90– 7 /11,8 –CS8**	27-7-CS8	37-021	HSS	15	5
	13,8	**90– 7 /13,8 –CS8**		-022			
	14,4	**90– 7 /14,4 –CS8**		-023			
8,4	13	**90– 8,4 /13 –CS8**	27-8,4-CS8	37-021	HSS	15	5
	15	**90– 8,4 /15 –CS8**		-022			
	15,6	**90– 8,4 /15,6 –CS8**		-023			
	17	**90– 8,4 /17 –CS8**		-024			
	18	**90– 8,4 /18 –CS8**		-020-0650			
	18,2	**90– 8,4 /18,2 –CS8**		-020-0660			
9	13,4	**90– 9 /13,4 –CS8**	27-9-CS8	37-021	HSS	15	5
	15	**90– 9 /15 –CS8**		-020-0480			
	15,4	**90– 9 /15,4 –CS8**		-022			
	16	**90– 9 /16 –CS8**		-023			
	17,4	**90– 9 /17,4 –CS8**		-024			
	18	**90– 9 /18 –CS8**		-025			
	19,6	**90– 9 /19,6 –CS8**		-020-0710			
10	15,5	**90– 10 /15,5 –CS10**	27-10-CS10	37-031	HSS	24	10
	17	**90– 10 /17 –CS10**		-032			
	17,5	**90– 10 /17,5 –CS10**		-033			
	18	**90– 10 /18 –CS10**		-034			
	19	**90– 10 /19 –CS10**		-035			
	19,6	**90– 10 /19,6 –CS10**		-030-0730			
10,5	16	**90– 10,5 /16 –CS10**	27-10,5-CS10	37-031	HSS	24	10
	17,5	**90– 10,5 /17,5 –CS10**		-032			
	18	**90– 10,5 /18 –CS10**		-033			
	18,5	**90– 10,5 /18,5 –CS10**		-034			
	19,5	**90– 10,5 /19,5 –CS10**		-035			
	20	**90– 10,5 /20 –CS10**		-036			
	20,5	**90– 10,5 /20,5 –CS10**		-037			
	21,1	**90– 10,5 /21,1 –CS10**		-030-0780			
11	16,5	**90– 11 /16,5 –CS10**	27-11-CS10	37-031	HSS	24	10
	18	**90– 11 /18 –CS10**		-032			
	18,5	**90– 11 /18,5 –CS10**		-033			
	19	**90– 11 /19 –CS10**		-034			
	20	**90– 11 /20 –CS10**		-035			
	20,5	**90– 11 /20,5 –CS10**		-036			
	21	**90– 11 /21 –CS10**		-037			
	22,6	**90– 11 /22,6 –CS10**		-030-0830			

HOLE SIZE ø 12 – ø 15,5 mm



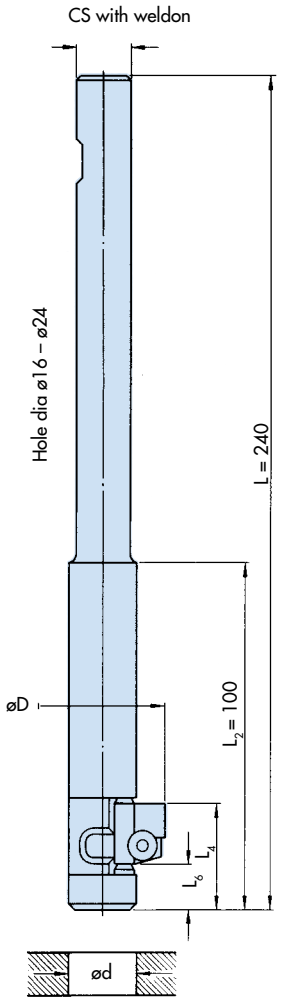
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_4	L_6
12	17,5	**90– 12 /17,5 –CS10**	27-12-CS10	37-031	HSS	24	10
	19	**90– 12 /19 –CS10**		-032			
	19,5	**90– 12 /19,5 –CS10**		-033			
	20	**90– 12 /20 –CS10**		-034			
	21	**90– 12 /21 –CS10**		-035			
	21,5	**90– 12 /21,5 –CS10**		-036			
	22	**90– 12 /22 –CS10**		-037			
	24	**90– 12 /24 –CS10**		-042	080208	25	9
	25,6	**90– 12 /25,6 –CS10**		-040-0930			
13	17,5	**90– 13 /17,5 –CS10**	27-13-CS10	37-031	HSS	24	10
	19	**90– 13 /19 –CS10**		-032			
	19,5	**90– 13 /19,5 –CS10**		-033			
	20	**90– 13 /20 –CS10**		-034			
	21	**90– 13 /21 –CS10**		-035			
	21,5	**90– 13 /21,5 –CS10**		-036			
	22	**90– 13 /22 –CS10**		-037			
	24	**90– 13 /24 –CS10**		-042	080208	25	9
	26	**90– 13 /26 –CS10**		-044			
	26,6	**90– 13 /26,6 –CS10**		-040-0980			
13,5	18	**90– 13,5 /18 –CS12**	27-13,5-CS12	37-031	HSS	24	10
	19,5	**90– 13,5 /19,5 –CS12**		-032			
	20	**90– 13,5 /20 –CS12**		-033			
	20,5	**90– 13,5 /20,5 –CS12**		-034			
	21,5	**90– 13,5 /21,5 –CS12**		-035			
	22	**90– 13,5 /22 –CS12**		-036			
	22,5	**90– 13,5 /22,5 –CS12**		-037			
	24	**90– 13,5 /24 –CS12**		-041	080208	25	9
	26	**90– 13,5 /26 –CS12**		-043			
	28,1	**90– 13,5 /28,1 –CS12**		-050-1030	C-0820	23	9
14	18,5	**90– 14 /18,5 –CS12**	27-14-CS12	37-031	HSS	24	10
	20	**90– 14 /20 –CS12**		-032			
	20,5	**90– 14 /20,5 –CS12**		-033			
	21	**90– 14 /21 –CS12**		-034			
	22	**90– 14 /22 –CS12**		-035			
	22,5	**90– 14 /22,5 –CS12**		-036			
	23	**90– 14 /23 –CS12**		-037			
	25	**90– 14 /25 –CS12**		-042	080208	25	9
	27	**90– 14 /27 –CS12**		-044			
	29,6	**90– 14 /29,6 –CS12**		-050-1080	C-0820	23	9
15	19,5	**90– 15 /19,5 –CS12**	27-15-CS12	37-031	HSS	24	10
	21	**90– 15 /21 –CS12**		-032			
	21,5	**90– 15 /21,5 –CS12**		-033			
	22	**90– 15 /22 –CS12**		-034			
	23	**90– 15 /23 –CS12**		-035			
	23,5	**90– 15 /23,5 –CS12**		-036			
	24	**90– 15 /24 –CS12**		-037			
	26	**90– 15 /26 –CS12**		-042	080208	25	9
	30	**90– 15 /30 –CS12**		-052	C-0820	23	9
	32,6	**90– 15 /32,6 –CS12**		-050-1180	C-1000		
15,5	20	**90– 15,5 /20 –C12**	27-15,5-CS12	37-031	HSS	24	10
	21,5	**90– 15,5 /21,5 –CS12**		-032			
	22	**90– 15,5 /22 –CS12**		-033			
	22,5	**90– 15,5 /22,5 –CS12**		-034			
	23,5	**90– 15,5 /23,5 –CS12**		-035			
	24	**90– 15,5 /24 –CS12**		-036			
	24,5	**90– 15,5 /24,5 –CS12**		-037			
	26	**90– 15,5 /26 –CS12**		-041	080208	25	9
	30	**90– 15,5 /30 –CS12**		-051	C-0820	23	9
	34,1	**90– 15,5 /34,1 –CS12**		-050-1230	C-1000		

BACK SPOTFACING

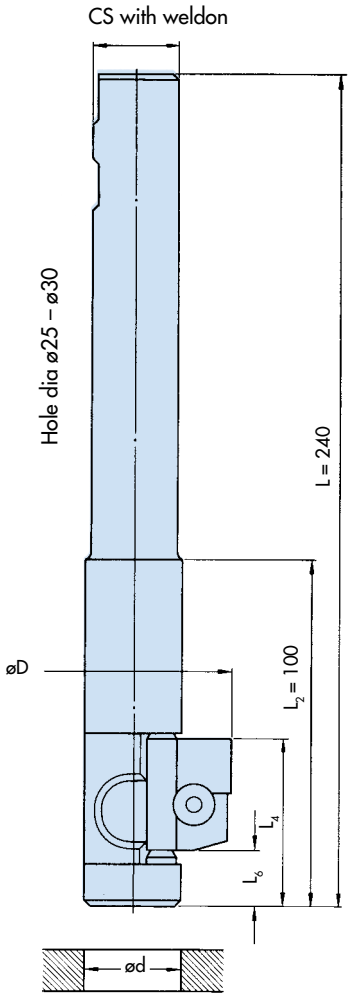


HOLE SIZE ø 16 – ø 24 mm

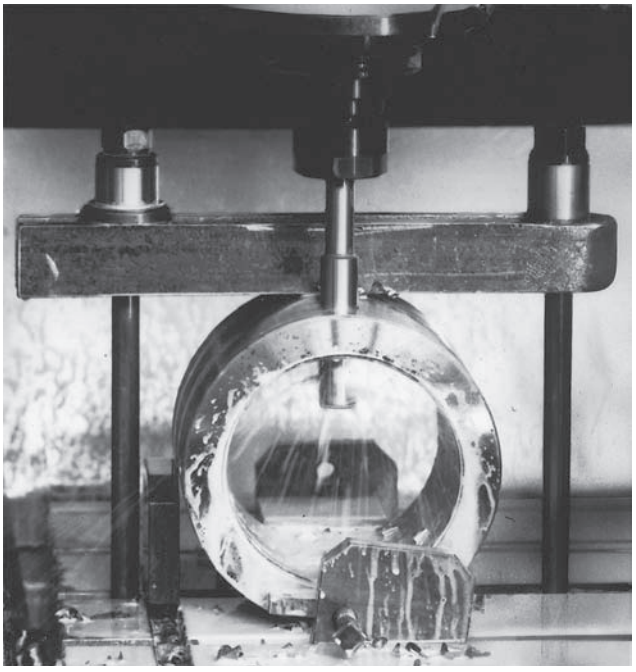
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_4	L_6
16	24	**90– 16 / 24 –CS12**	27-16-CS12	37-060-0750	Brazed	28	11
	26	**90– 16 / 26 –CS12**		-061	080208		
	30	**90– 16 / 30 –CS12**		-062	090308	30	
	33	**90– 16 / 33 –CS12**		-063			
	33,6	**90– 16 / 33,6 –CS12**		-070-1230	K-1050	28	
17	27	**90– 17 / 27 –CS16**	27-17-CS16	37-061	080208	28	11
	31	**90– 17 / 31 –CS16**		-062	090308	30	
	34	**90– 17 / 34 –CS16**		-063			
	36,6	**90– 17 / 36.6 –CS16**		-070-1330	K-1150	28	
17,5	26	**90– 17.5 / 26 –CS16**	27-17,5-CS16	37-060-0775	Brazed	28	11
	27,5	**90– 17.5 / 27,5 –CS16**		-061	080208		
	30	**90– 17.5 / 30 –CS16**		-060-0975			
	31,5	**90– 17.5 / 31.5 –CS16**		-062	090308	30	
	33	**90– 17.5 / 33 –CS16**		-060-1125			
	34,5	**90– 17.5 / 34,5 –CS16**		-063			
	38,1	**90– 17.5 / 38,1 –CS16**		-070-1380	K-1150	28	
18	28	**90– 18 / 28 –CS16**	27-18-CS16	37-061	080208	28	11
	32	**90– 18 / 32 –CS16**		-062	090308	30	
	35	**90– 18 / 35 –CS16**		-063			
	39,6	**90– 18 / 39,6 –CS16**		-070-1430	K-1250	28	
19	28	**90– 19 / 28 –CS16**	27-19-CS16	37-061	080208	28	11
	32	**90– 19 / 32 –CS16**		-062	090308	30	
	35	**90– 19 / 35 –CS16**		-063			
	40,6	**90– 19 / 40,6 –CS16**		-080-1480	K-1250	28	
20	29	**90– 20 / 29 –CS16**	27-20-CS16	37-061	080208	28	11
	30	**90– 20 / 30 –CS16**		-060-0900			
	33	**90– 20 / 33 –CS16**		-062	090308	30	
	36	**90– 20 / 36 –CS16**		-063			
	43,6	**90– 20 / 43,6 –CS16**		-080-1580	K-1350	28	
21	30	**90– 21 / 30 –CS20**	27-21-CS20	37-061	080208	28	11
	34	**90– 21 / 34 –CS20**		-062	090308	30	
	37	**90– 21 / 37 –CS20**		-063			
	46,6	**90– 21 / 46,6 –CS20**		-080-1680	K-1450	28	
22	30	**90– 22 / 30 –CS20**	27-22-CS20	37-061	080208	30	13
	33	**90– 22 / 33 –CS20**		-060-1000			
	34	**90– 22 / 34 –CS20**		-062	090308	32	
	36	**90– 22 / 36 –CS20**		-060-1150			
	37	**90– 22 / 37 –CS20**		-063			
	40	**90– 22 / 40 –CS20**		-090-1350	120308	33	11
	41	**90– 22 / 41 –CS20**		-091			
	47,6	**90– 22 / 47,6 –CS20**		-090-1730	K-1450	30	
23	31	**90– 23 / 31 –CS20**	27-23-CS20	37-061	080208	30	13
	35	**90– 23 / 35 –CS20**		-062	090308	32	
	38	**90– 23 / 38 –CS20**		-063			
	42	**90– 23 / 42 –CS20**		-091	120308	33	11
	50,6	**90– 23 / 50,6 –CS20**		-090-1830	K-1550	30	
24	32	**90– 24 / 32 –CS20**	27-24-CS20	37-061	080208	30	13
	36	**90– 24 / 36 –CS20**		-062	090308	32	
	39	**90– 24 / 39 –CS20**		-063			
	40	**90– 24 / 40 –CS20**		-090-1250			11
	43	**90– 24 / 43 –CS20**		-091	120308	33	
	53,6	**90– 24 / 53,6 –CS20**		-090-1930	K-1650	30	



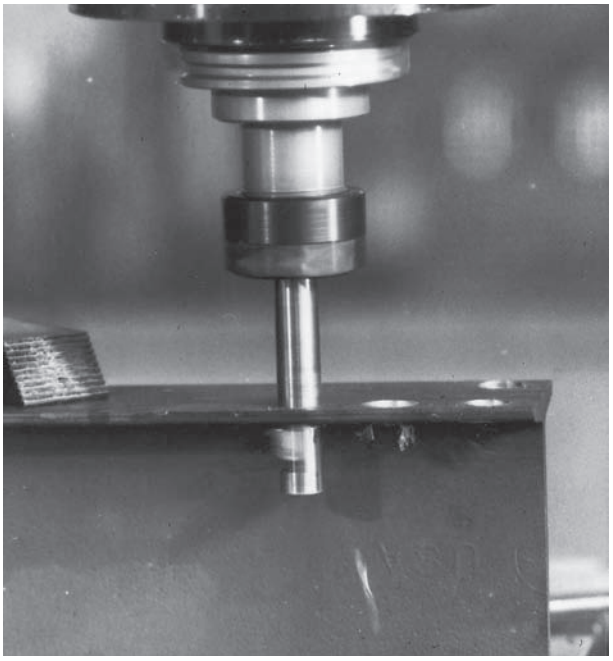
HOLE SIZE ø 25 – ø 30 mm



Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_4	L_6
25	33	**90– 25 /33 –CS20**	27-25-CS20	37-101	090308	46	15
	40	**90– 25 /40 –CS20**		-102			
	45	**90– 25 /45 –CS20**		-111	120308	44	
	50	**90– 25 /50 –CS20**		-121	150412	46	
	50,4	**90– 25 /50,4 –CS20**		-120-1870			
26	34	**90– 26 /34 –CS25**	27-26-CS25	37-101	090308	46	15
	40	**90– 26 /40 –CS25**		-100-1300			
	41	**90– 26 /41 –CS25**		-102			
	43	**90– 26 /43 –CS25**		-110-1450	120308	44	
	46	**90– 26 /46 –CS25**		-111			
	51	**90– 26 /51 –CS25**		-121	150412	46	
	53,4	**90– 26 /53,4 –CS25**		-120-1970			
27	35	**90– 27 /35 –CS25**	27-27-CS25	37-101	090308	46	15
	42	**90– 27 /42 –CS25**		-102			
	47	**90– 27 /47 –CS25**		-111	120308	44	
	52	**90– 27 /52 –CS25**		-121	150412	46	
	56,4	**90– 27 /56,4 –CS25**		-120-2070	190408	48	
28	36	**90– 28 /36 –CS25**	27-28-CS25	37-101	090308	46	15
	43	**90– 28 /43 –CS25**		-102			
	48	**90– 28 /48 –CS25**		-111	120308	44	
	53	**90– 28 /53 –CS25**		-121	150412	46	
	59,4	**90– 28 /59,4 –CS25**		-120-2170	190408	48	
29	37	**90– 29 /37 –CS25**	27-29-CS25	37-101	090308	46	15
	44	**90– 29 /44 –CS25**		-102			
	49	**90– 29 /49 –CS25**		-111	120308	44	
	54	**90– 29 /54 –CS25**		-121	150412	46	
	62,4	**90– 29 /62,4 –CS25**		-120-2270	190408	48	
30	38	**90– 30 /38 –CS25**	27-30-CS25	37-101	090308	46	15
	43	**90– 30 /43 –CS25**		-100-1250			
	45	**90– 30 /45 –CS25**		-102			
	46	**90– 30 /46 –CS25**		-100-1400			
	50	**90– 30 /50 –CS25**		-111	120308	44	
	53	**90– 30 /53 –CS25**		-110-1750			
	55	**90– 30 /55 –CS25**		-121	150412	46	
	65,4	**90– 30 /65,4 –CS25**		-120-2370	190408	48	



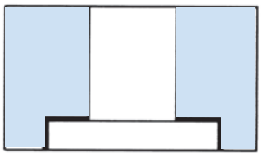
Back spotfacing with coolant through the spindle.



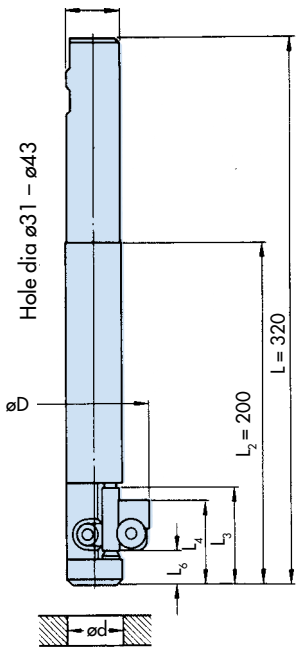
Back spotfacing with filleted corners.

BACK SPOTFACING

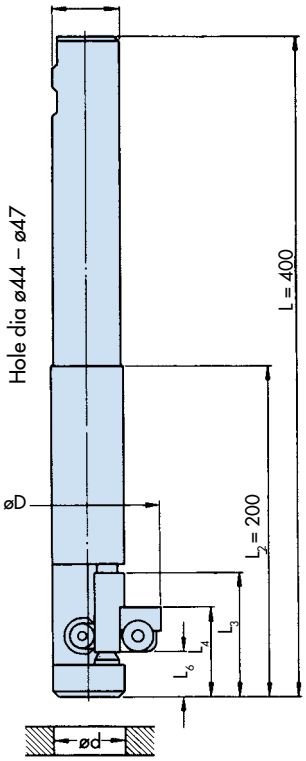
HOLE SIZE ø 31 – ø 47 mm



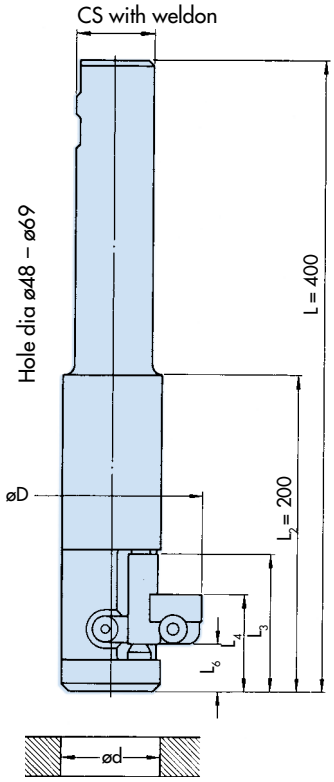
CS with weldon



CS with weldon



Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
31	54	**90– 31 /54 –CS32**	27-31-CS32	37-131	150412	58	47	21
	60	**90– 31 /60 –CS32**		-132	190408		50	
	62	**90– 31 /62 –CS32**		-130-2300				
32	55	**90– 32 /55 –CS32**	27-32-CS32	37-131	150412	58	47	21
	61	**90– 32 /61 –CS32**		-132	190408		50	
	65	**90– 32 /65 –CS32**		-130-2400				
33	48	**90– 33 /48 –CS32**	27-33-CS32	37-130-1500	090308	58	41	21
	53	**90– 33 /53 –CS32**		-130-1750	120308		44	
	56	**90– 33 /56 –CS32**		-131	150412		47	
	61	**90– 33 /61 –CS32**		-130-2150	190408		50	
	62	**90– 33 /62 –CS32**		-132				
	68	**90– 33 /68 –CS32**		-130-2500				
34	57	**90– 34 /57 –CS32**	27-34-CS32	37-131	150412	58	47	21
	63	**90– 34 /63 –CS32**		-132	190408		50	
	71	**90– 34 /71 –CS32**		-130-2600	EC 20		44	
35	58	**90– 35 /58 –CS32**	27-35-CS32	37-131	150412	58	47	21
	64	**90– 35 /64 –CS32**		-132	190408		50	
	74	**90– 35 /74 –CS32**		-130-2700	EC 20		44	
36	53	**90– 36 /53 –CS32**	27-36-CS32	37-140-1750	120308	68	51	28
	57	**90– 36 /57 –CS32**		-140-1950				
	63	**90– 36 /63 –CS32**		-141	150412		54	
	69	**90– 36 /69 –CS32**		-142	190408		57	
	71	**90– 36 /71 –CS32**		-140-2650	EC 20		51	
37	64	**90– 37 /64 –CS32**	27-37-CS32	37-141	150412	68	54	28
	70	**90– 37 /70 –CS32**		-142	190408		57	
	74	**90– 37 /74 –CS32**		-140-2750	EC 20		51	
38	65	**90– 38 /65 –CS32**	27-38-CS32	37-141	150412	68	54	28
	71	**90– 38 /71 –CS32**		-142	190408		57	
	77	**90– 38 /77 –CS32**		-140-2850	EC 25		53	
39	57	**90– 39 /57 –CS32**	27-39-CS32	37-140-1800	120308	68	51	28
	61	**90– 39 /61 –CS32**		-140-2000	120308		51	
	66	**90– 39 /66 –CS32**		-141	150412		54	
	71	**90– 39 /71 –CS32**		-140-2500	190408		57	
	72	**90– 39 /72 –CS32**		-142				
	80	**90– 39 /80 –CS32**		-140-2950	EC 25		53	
40	67	**90– 40 /67 –CS32**	27-40-CS32	37-141	150412	68	54	28
	73	**90– 40 /73 –CS32**		-142	190408		57	
	83	**90– 40 /83 –CS32**		-140-3050	EC 25		53	
41	68	**90– 41 /68 –CS32**	27-41-CS32	37-141	150412	68	54	28
	74	**90– 41 /74 –CS32**		-142	190408		57	
	86	**90– 41 /86 –CS32**		-140-3150	EC 25		53	
42	69	**90– 42 /69 –CS32**	27-42-CS32	37-141	150412	68	54	28
	75	**90– 42 /75 –CS32**		-142	190408		57	
	89	**90– 42 /89 –CS32**		-140-3250	EC 25		53	
43	70	**90– 43 /70 –CS32**	27-43-CS32	37-141	150412	68	54	28
	76	**90– 43 /76 –CS32**		-142	190408		57	
	92	**90– 43 /92 –CS32**		-140-3350	EC 25		53	
44	86	**90– 44 /86 –CS40**	27-44-CS40	37-151	EC 25	78	59	30
	87	**90– 44 /87 –CS40**		-150-3250				
45	66	**90– 45 /66 –CS40**	27-45-CS40	37-150-2150	150412	78	59	30
	71	**90– 45 /71 –CS40**		-150-2400				
	82	**90– 45 /82 –CS40**		-150-2950	EC 25			
	87	**90– 45 /87 –CS40**		-151				
	90	**90– 45 /90 –CS40**		-150-3350				
46	88	**90– 46 /88 –CS40**	27-46-CS40	37-151	EC 25	78	59	30
	93	**90– 46 /93 –CS40**		-150-3450				
47	89	**90– 47 /89 –CS40**	27-47-CS40	37-151	EC 25	78	59	30
	96	**90– 47 /96 –CS40**		-150-3550				

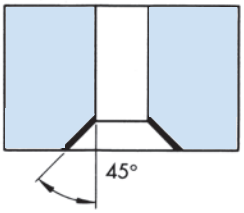


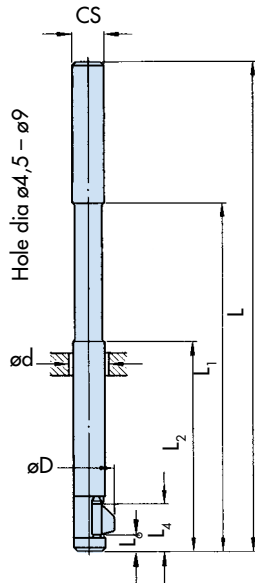
HOLE SIZE ø 48 – ø 69 mm

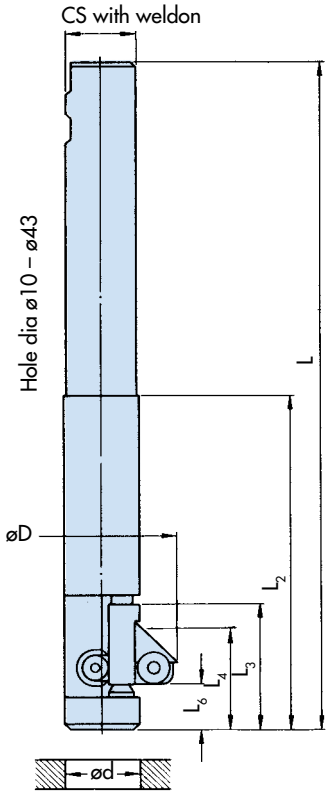
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
48	90	**90– 48 /90 –CS40**	27-48-CS40	37-151	EC25	78	59	30
	99	**90– 48 /99 –CS40**		-150-3650	EC32		63	
49	91	**90– 49 /91 –CS40**	27-49-CS40	37-151	EC25	78	59	30
	102	**90– 49 /102 –CS40**		-150-3750	EC32		63	
50	92	**90– 50 /92 –CS40**	27-50-CS40	37-151	EC25	78	59	30
	105	**90– 50 /105 –CS40**		-150-3850	EC32		63	
51	93	**90– 51 /93 –CS40**	27-51-CS40	37-151	EC25	78	59	30
	108	**90– 51 /108 –CS40**		-150-3950	EC32		63	
52	76	**90– 52 /76 –CS40**	27-52-CS40	37-150-2300	150412	78	59	30
	78	**90– 52 /78 –CS40**		-150-2400				
	94	**90– 52 /94 –CS40**		-151	EC25			
	98	**90– 52 /98 –CS40**		-150-3400				
	111	**90– 52 /111 –CS40**		-150-4050	EC32		63	
53	95	**90– 53 /95 –CS40**	27-53-CS40	37-151	EC25	78	59	30
	114	**90– 53 /114 –CS40**		-150-4150	EC32		63	
54	94	**90– 54 /94 –CS50**	27-54-CS50	37-161	EC25	88	59	30
	108	**90– 54 /108 –CS50**		-162	EC32		63	
	109	**90– 54 /109 –CS50**		-160-4050				
55	95	**90– 55 /95 –CS50**	27-55-CS50	37-161	EC25	88	59	30
	109	**90– 55 /109 –CS50**		-162	EC32		63	
	112	**90– 55 /112 –CS50**		-160-4150				
56	96	**90– 56 /96 –CS50**	27-56-CS50	37-161	EC25	88	59	30
	110	**90– 56 /110 –CS50**		-162	EC32		63	
	115	**90– 56 /115 –CS50**		-160-4250				
57	97	**90– 57 /97 –CS50**	27-57-CS50	37-161	EC25	88	59	30
	111	**90– 57 /111 –CS50**		-162	EC32		63	
	118	**90– 57 /118 –CS50**		-160-4350				
58	98	**90– 58 /98 –CS50**	27-58-CS50	37-161	EC25	88	59	30
	112	**90– 58 /112 –CS50**		-162	EC32		63	
	121	**90– 58 /121 –CS50**		-160-4450				
59	99	**90– 59 /99 –CS50**	27-59-CS50	37-161	EC25	88	59	30
	113	**90– 59 /113 –CS50**		-162	EC32		63	
	124	**90– 59 /124 –CS50**		-160-4550	EC40		65	
60	100	**90– 60 /100 –CS50**	27-60-CS50	37-161	EC25	88	59	30
	114	**90– 60 /114 –CS50**		-162	EC32		63	
	127	**90– 60 /127 –CS50**		-160-4650	EC40		65	
61	101	**90– 61 /101 –CS50**	27-61-CS50	37-161	EC25	88	59	30
	115	**90– 61 /115 –CS50**		-162	EC32		63	
	130	**90– 61 /130 –CS50**		-160-4750	EC40		65	
62	102	**90– 62 /102 –CS50**	27-62-CS50	37-161	EC25	88	59	30
	116	**90– 62 /116 –CS50**		-162	EC32		63	
	133	**90– 62 /133 –CS50**		-160-4850	EC40		65	
63	103	**90– 63 /103 –CS50**	27-63-CS50	37-161	EC25	88	59	30
	117	**90– 63 /117 –CS50**		-162	EC32		63	
	136	**90– 63 /136 –CS50**		-160-4950	EC40		65	
64	104	**90– 64 /104 –CS50**	27-64-CS50	37-161	EC25	88	59	30
	118	**90– 64 /118 –CS50**		-162	EC32		63	
	139	**90– 64 /139 –CS50**		-160-5050	EC40		65	
65	105	**90– 65 /105 –CS50**	27-65-CS50	37-161	EC25	88	59	30
	119	**90– 65 /119 –CS50**		-162	EC32		63	
	142	**90– 65 /142 –CS50**		-160-5150	EC40		65	
66	106	**90– 66 /106 –CS50**	27-66-CS50	37-161	EC25	88	59	30
	120	**90– 66 /120 –CS50**		-162	EC32		63	
	145	**90– 66 /145 –CS50**		-160-5250	EC40		65	
67	107	**90– 67 /107 –CS50**	27-67-CS50	37-161	EC25	88	59	30
	121	**90– 67 /121 –CS50**		-162	EC32		63	
	146	**90– 67 /146 –CS50**		-160-5250	EC40		65	
68	108	**90– 68 /108 –CS50**	27-68-CS50	37-161	EC25	88	59	30
	122	**90– 68 /122 –CS50**		-162	EC32		63	
	147	**90– 68 /147 –CS50**		-160-5250	EC40		65	
69	109	**90– 69 /109 –CS50**	27-69-CS50	37-161	EC25	88	59	30
	123	**90– 69 /123 –CS50**		-162	EC32		63	
	148	**90– 69 /148 –CS50**		-160-5250	EC40		65	

BACK CHAMFERING 45°

HOLE SIZE ø 4,5 – ø 43 mm



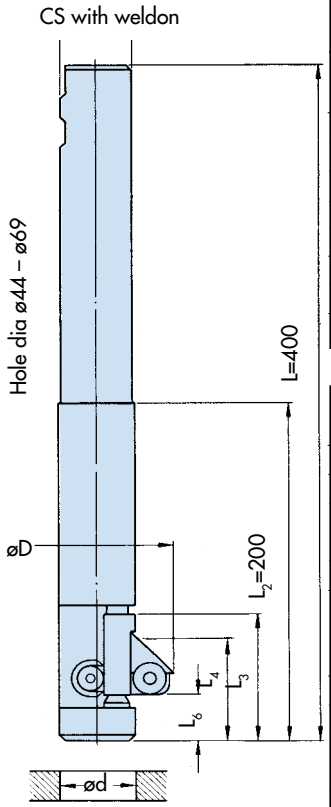




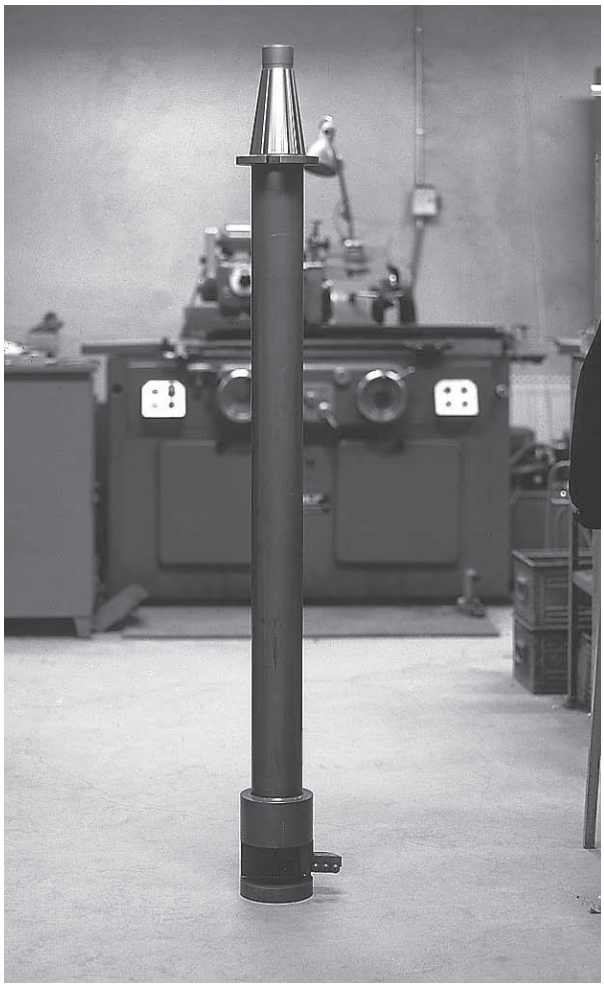
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
4,5	8	**45– 4,5 /8 –CS6**	27-4,5-CS6	34-011	HSS		11	5
5,5	9	**45– 5,5 /9 –CS6**	-5,5					
6,5	9,5	**45– 6,5 /9,5 –CS6**	-6,5					
7	14,4	**45– 7 /14,4 –CS8**	27-7-CS8	34-023	HSS		15	5
8,4	15,6	**45– 8,4 /15,6 –CS8**	-8,4					
9	16	**45– 9 /16 –CS8**	-9					
10	19	**45– 10 /19 –CS10**	27-10-CS10	34-035	HSS		24	10
10,5	19,5	**45– 10,5 /19,5 –CS10**	-10,5					
11	20	**45– 11 /20 –CS10**	-11					
12	21	**45– 12 /21 –CS10**	-12					
13	21	**45– 13 /21 –CS10**	-13					
13,5	21,5	**45– 13,5 /21,5 –CS12**	27-13,5-CS12					
14	22	**45– 14 /22 –CS12**	-14					
15	23	**45– 15 /23 –CS12**	-15					
15,5	23,5	**45– 15,5 /23,5 –CS12**	-15,5					
16	33	**45– 16 /33 –CS12**	27-16-CS12	34-063	090308X45		30	11
17	34	**45– 17 /34 –CS16**	27-17-CS16					
17,5	34,5	**45– 17,5 /34,5 –CS16**	-17,5					
18	35	**45– 18 /35 –CS16**	-18					
19	35	**45– 19 /35 –CS16**	-19					
20	36	**45– 20 /36 –CS16**	-20					
21	37	**45– 21 /37 –CS20**	27-21-CS20					
22	37	**45– 22 /37 –CS20**	-22				32	13
23	38	**45– 23 /38 –CS20**	-23					
24	39	**45– 24 /39 –CS20**	-24					
25	50	**45– 25 /50 –CS20**	-25	34-121	150412X45		46	15
26	51	**45– 26 /51 –CS25**	27-26-CS25					
27	52	**45– 27 /52 –CS25**	-27					
28	53	**45– 28 /53 –CS25**	-28					
29	54	**45– 29 /54 –CS25**	-29					
30	55	**45– 30 /55 –CS25**	-30					
31	60	**45– 31 /60 –CS32**	27-31-CS32	34-132	190408X45	58	50	21
32	61	**45– 32 /61 –CS32**	-32					
33	62	**45– 33 /62 –CS32**	-33					
34	63	**45– 34 /63 –CS32**	-34					
35	64	**45– 35 /64 –CS32**	-35					
36	69	**45– 36 /69 –CS32**	27-36-CS32	34-142	190408X45	68	57	28
37	70	**45– 37 /70 –CS32**	-37					
38	71	**45– 38 /71 –CS32**	-38					
39	72	**45– 39 /72 –CS32**	-39					
40	73	**45– 40 /73 –CS32**	-40					
41	74	**45– 41 /74 –CS32**	-41					
42	75	**45– 42 /75 –CS32**	-42					
43	76	**45– 43 /76 –CS32**	-43					

Hole dia	L	L_1	L_2
4,5 -6,5	120	80	40
7 - 9	140	100	60
10 -15,5	160	–	80
16 -30	240	–	100
31 -43	320	–	200

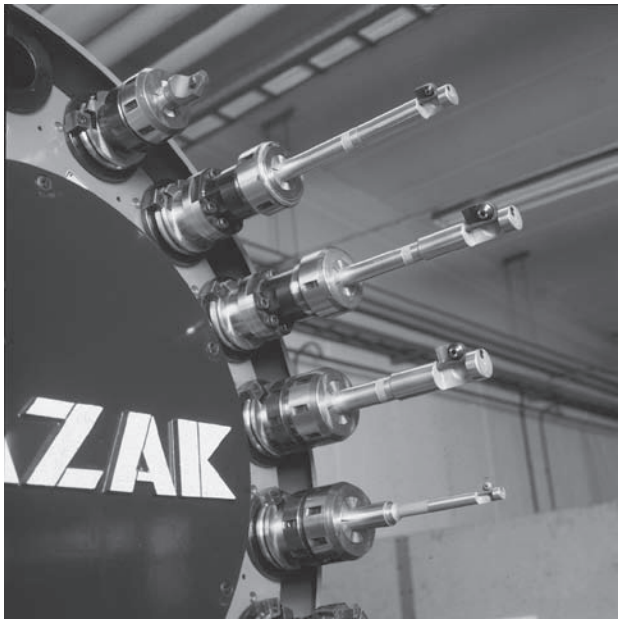
HOLE SIZE ø 44 – ø 69 mm



Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
44	79	**45– 44 /79 –CS40**	27-44-CS40	34-150	190408X45	78	63	30
45	80	**45– 45 /80 –CS40**	-45					
46	81	**45– 46 /81 –CS40**	-46					
47	82	**45– 47 /82–CS40**	-47					
48	83	**45– 48 /83 –CS40**	-48					
49	84	**45– 49 /84 –CS40**	-49					
50	85	**45– 50 /85 –CS40**	-50					
51	86	**45– 51 /86 –CS40**	-51					
52	87	**45– 52 /87 –CS40**	-52					
53	88	**45– 53 /88 –CS40**	-53					
54	89	**45– 54 /89 –CS50**	27-54-CS50	34-160	190408X45	88	63	30
55	90	**45– 55 /90 –CS50**	-55					
56	91	**45– 56 /91 –CS50**	-56					
57	92	**45– 57 /92 –CS50**	-57					
58	93	**45– 58 /93 –CS50**	-58					
59	94	**45– 59 /94 –CS50**	-59					
60	95	**45– 60 /95 –CS50**	-60					
61	96	**45– 61 /96 –CS50**	-61					
62	97	**45– 62 /97 –CS50**	-62					
63	98	**45– 63 /98 –CS50**	-63					
64	99	**45– 64 /99 –CS50**	-64					
65	100	**45– 65 /100 –CS50**	-65					
66	101	**45– 66 /101 –CS50**	-66					
67	102	**45– 67 /102 –CS50**	-67					
68	103	**45– 68 /103 –CS50**	-68					
69	104	**45– 69 /104 –CS50**	-69					



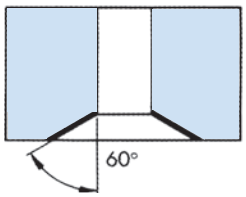
Special tool to operate in a diesel engine block.

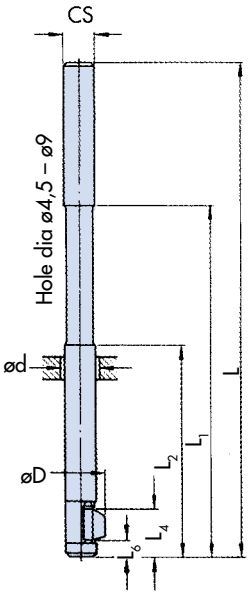


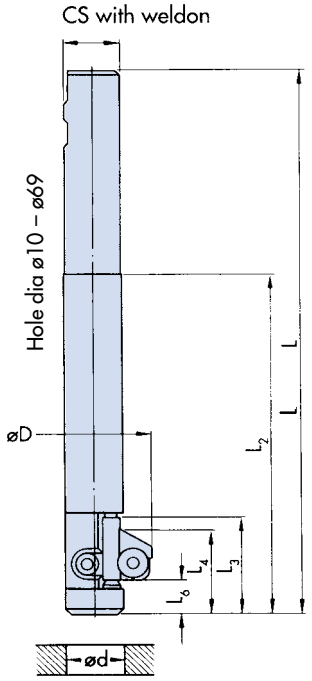
Erix tools in a NC-Machine.

BACK CHAMFERING 60°

HOLE SIZE ø 4,5 – ø 69





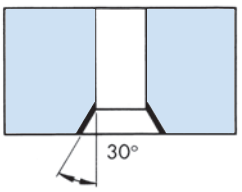


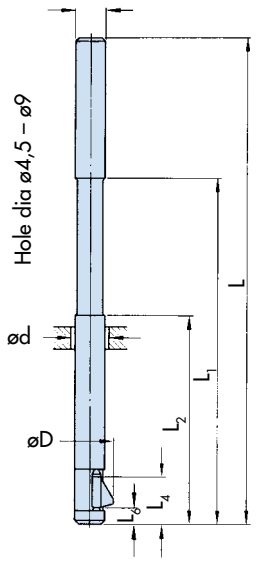
Hole dia	L	L_1	L_2
4,5 -6,5	120	80	40
7 - 9	140	100	60
10 -15,5	160		80
16 -30	240		100
31 -43	320		200
44 -69	400		200

Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
4,5	8	**60– 4,5 /8 –CS6**	27-4,5-CS6					
5,5	9	**60– 5,5 /9 –CS6**	-5,5	34-011-60	HSS		11	5
6,5	9,5	**60– 6,5 /9,5 –CS6**	-6,5					
7	14,4	**60– 7 /14,4 –CS8**	27-7-CS8					
8,4	15,6	**60– 8,4 /15,6 –CS8**	-8,4	34-023-60	HSS		15	5
9	16	**60– 9 /16 –CS8**	-9					
10	19	**60– 10 /19 –CS10**	27-10-CS10					
10,5	19,5	**60– 10,5 /19,5 –CS10**	-10,5					
11	20	**60– 11 /20 –CS10**	-11					
12	21	**60– 12 /21 –CS10**	-12					
13	21	**60– 13 /21 –CS10**	-13	34-035-60	HSS		24	10
13,5	21,5	**60– 13,5 /21,5 –CS12**	27-13,5–CS12					
14	22	**60– 14 /22 –CS12**	-14					
15	23	**60– 15 /23 –CS12**	-15					
15,5	23,5	**60– 15,5 /23,5 –CS12**	-15,5					
16	33	**60– 16 /33 –CS12**	27-16-CS12					
17	34	**60– 17 /34 –CS16**	27-17-CS16					
17,5	34,5	**60– 17,5 /34,5 –CS16**	-17,5					
18	35	**60– 18 /35 –CS16**	-18				30	11
19	35	**60– 19 /35 –CS16**	-19	34-063-60	090308X60			
20	36	**60– 20 /36 –CS16**	-20					
21	37	**60– 21 /37 –CS20**	27-21-CS20					
22	37	**60– 22 /37 –CS20**	-22					
23	38	**60– 23 /38 –CS20**	-23				32	13
24	39	**60– 24 /39 –CS20**	-24					
25	50	**60– 25 /50 –CS20**	-25					
26	51	**60– 26 /51 –CS25**	27-26-CS25					
27	52	**60– 27 /52 –CS25**	-27	34-121-60	150412X60		46	15
28	53	**60– 28 /53 –CS25**	-28					
29	54	**60– 29 /54 –CS25**	-29					
30	55	**60– 30 /55 –CS25**	-30					
31	60	**60– 31 /60 –CS32**	27-31-CS32					
32	61	**60– 32 /61 –CS32**	-32					
33	62	**60– 33 /62 –CS32**	-33	34-132-60	190408X60	58	50	21
34	63	**60– 34 /63 –CS32**	-34					
35	64	**60– 35 /64 –CS32**	-35					
36	69	**60– 36 /69 –CS32**	27-36-CS32					
37	70	**60– 37 /70 –CS32**	-37					
38	71	**60– 38 /71 –CS32**	-38					
39	72	**60– 39 /72 –CS32**	-39	34-142-60	190408X60	68	57	28
40	73	**60– 40 /73 –CS32**	-40					
41	74	**60– 41 /74 –CS32**	-41					
42	75	**60– 42 /75 –CS32**	-42					
43	76	**60– 43 /76 –CS32**	-43					
44	79	**60– 44 /79 –CS40**	27-44-CS40					
45	80	**60– 45 /80 –CS40**	-45					
46	81	**60– 46 /81 –CS40**	-46					
47	82	**60– 47 /82 –CS40**	-47					
48	83	**60– 48 /83 –CS40**	-48					
49	84	**60– 49 /84 –CS40**	-49	34-150-60	190408X60	78	63	30
50	85	**60– 50 /85 –CS40**	-50					
51	86	**60– 51 /86 –CS40**	-51					
52	87	**60– 52 /87 –CS40**	-52					
53	88	**60– 53 /88 –CS40**	-53					
54	89	**60– 54 /89 –CS50**	27-54-CS50					
55	90	**60– 55 /90 –CS50**	-55					
56	91	**60– 56 /91 –CS50**	-56					
57	92	**60– 57 /92 –CS50**	-57					
58	93	**60– 58 /93 –CS50**	-58					
59	94	**60– 59 /94 –CS50**	-59					
60	95	**60– 60 /95 –CS50**	-60					
61	96	**60– 61 /96 –CS50**	-61	34-160-60	190408X60	88	63	30
62	97	**60– 62 /97 –CS50**	-62					
63	98	**60– 63 /98 –CS50**	-63					
64	99	**60– 64 /99 –CS50**	-64					
65	100	**60– 65 /100 –CS50**	-65					
66	101	**60– 66 /101 –CS50**	-66					
67	102	**60– 67 /102 –CS50**	-67					
68	103	**60– 68 /103 –CS50**	-68					
69	104	**60– 69 /104 –CS50**	-69					

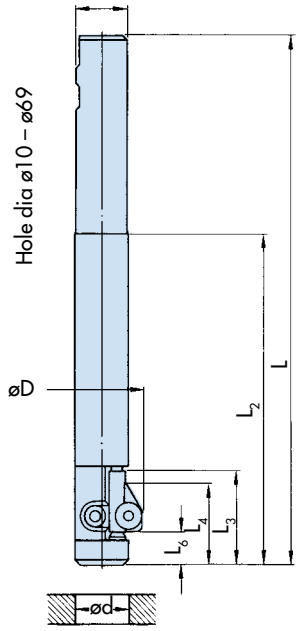
BACK CHAMFERING 30°

HOLE SIZE ø 4,5 – ø 69 mm





CS with weldon

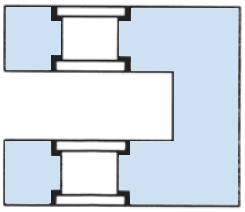


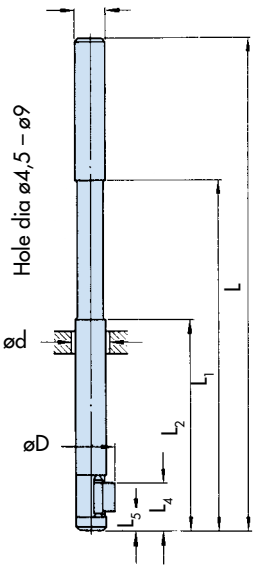
Hole dia	L	L_1	L_2
4,5 -6,5	120	80	40
7 - 9	140	100	60
10 -15,5	160		80
16 -30	240		100
31 -43	320		200
44 -69	400		200

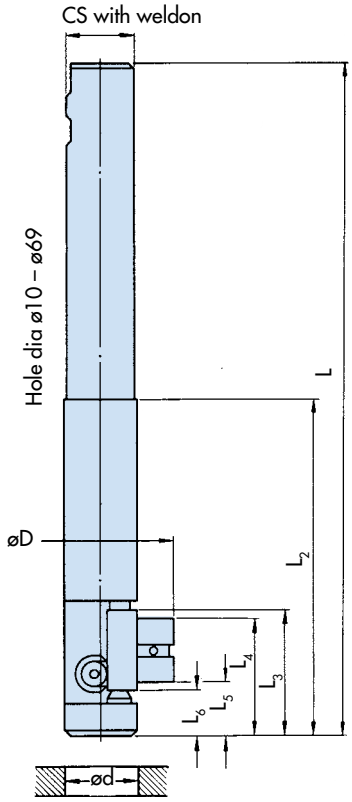
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_6
4,5	8	**30– 4,5 /8 –CS6**	27-4,5-CS6	34-011-30	HSS		11	5
5,5	9	**30– 5,5 /9 –CS6**	-5,5					
6,5	9,5	**30– 6,5 /9,5 –CS6**	-6,5					
7	14,4	**30– 7 /14,4 –CS8**	27-7-CS8	34-023-30	HSS		15	5
8,4	15,6	**30– 8,4 /15,6 –CS8**	-8,4					
9	16	**30– 9 /16 –CS8**	-9					
10	19	**30– 10 /19 –CS10**	27-10-CS10	34-035-30	HSS		24	10
10,5	19,5	**30– 10,5 /19,5 –CS10**	-10,5					
11	20	**30– 11 /20 –CS10**	-11					
12	21	**30– 12 /21 –CS10**	-12					
13	21	**30– 13 /21 –CS10**	-13					
13,5	21,5	**30– 13,5 /21,5 –CS12**	27-13,5–CS12					
14	22	**30– 14 /22 –CS12**	-14					
15	23	**30– 15 /23 –CS12**	-15					
15,5	23,5	**30– 15,5 /23,5 –CS12**	-15,5					
16	26	**30– 16 /26 –CS12**	27-16-CS12	34-061-30	090308X30		30	11
17	27	**30– 17 /27 –CS16**	27-17-CS16					
17,5	27,5	**30– 17,5 /27,5 –CS16**	-17,5					
18	28	**30– 18 /28 –CS16**	-18					
19	28	**30– 19 /28 –CS16**	-19					
20	29	**30– 20/29 –CS16**	-20					
21	30	**30– 21/30 –CS20**	27-21-CS20					
22	30	**30– 22/30 –CS20**	-22				32	13
23	31	**30– 23/31 –CS20**	-23					
24	32	**30– 24/32 –CS20**	-24					
25	40	**30– 25/40 –CS20**	27-25-CS20	34-102-30	150412X30		46	15
26	41	**30– 26/41 –CS25**	27-26-CS25					
27	42	**30– 27/42 –CS25**	-27					
28	43	**30– 28/43 –CS25**	-28					
29	44	**30– 29/44 –CS25**	-29					
30	45	**30– 30/45 –CS25**	-30					
31	51	**30– 31/51 –CS32**	27-31-CS32	34-130-30	190408X30	58	50	21
32	52	**30– 32/52 –CS32**	-32					
33	53	**30– 33/53 –CS32**	-33					
34	54	**30– 34/54 –CS32**	-34					
35	55	**30– 35/55 –CS32**	-35					
36	56	**30– 36/56 –CS32**	27-36-CS32	34-140-30	190408X30	68	57	28
37	57	**30– 37/57 –CS32**	-37					
38	58	**30– 38/58 –CS32**	-38					
39	59	**30– 39/59 –CS32**	-39					
40	60	**30– 40/60 –CS32**	-40					
41	61	**30– 41/61 –CS32**	-41					
42	62	**30– 42/62 –CS32**	-42					
43	63	**30– 43/63 –CS32**	-43					
44	64	**30– 44/64 –CS40**	27-44-CS40	34-150-30	190408X30	78	63	30
45	65	**30– 45/65 –CS40**	-45					
46	66	**30– 46/66 –CS40**	-46					
47	67	**30– 47/67 –CS40**	-47					
48	68	**30– 48/68 –CS40**	-48					
49	69	**30– 49/69 –CS40**	-49					
50	70	**30– 50/70 –CS40**	-50					
51	71	**30– 51/71 –CS40**	-51					
52	72	**30– 52/72 –CS40**	-52					
53	73	**30– 53/73 –CS40**	-53					
54	74	**30– 54/74 –CS50**	27-54-CS50	34-160-30	190408X30	88	63	30
55	75	**30– 55/75 –CS50**	-55					
56	76	**30– 56/76 –CS50**	-56					
57	77	**30– 57/77 –CS50**	-57					
58	78	**30– 58/78 –CS50**	-58					
59	79	**30– 59/79 –CS50**	-59					
60	80	**30– 60/80 –CS50**	-60					
61	81	**30– 61/81 –CS50**	-61					
62	82	**30– 62/82 –CS50**	-62					
63	83	**30– 63/83 –CS50**	-63					
64	84	**30– 64/84 –CS50**	-64					
65	85	**30– 65/85 –CS50**	-65					
66	86	**30– 66/86 –CS50**	-66					
67	87	**30– 67/87 –CS50**	-67					
68	88	**30– 68/88 –CS50**	-68					
69	89	**30– 69/89 –CS50**	-69					

FRONT AND BACK SPOTFACING

HOLE SIZE ø 4,5 – ø 69 mm



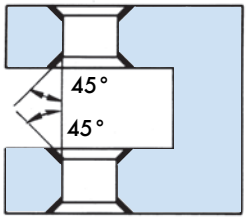




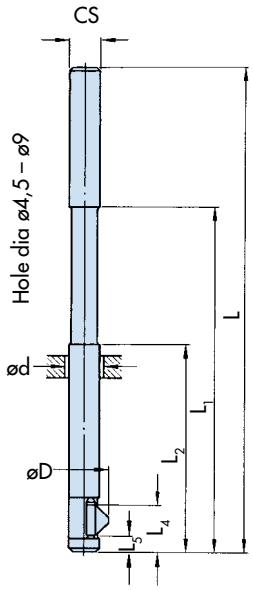
Hole dia	L	L_1	L_2
4,5 -6,5	120	80	40
7 - 9	140	100	60
10 -15,5	160		80
16 -30	240		100
31 -43	320		200
44 -69	400		200

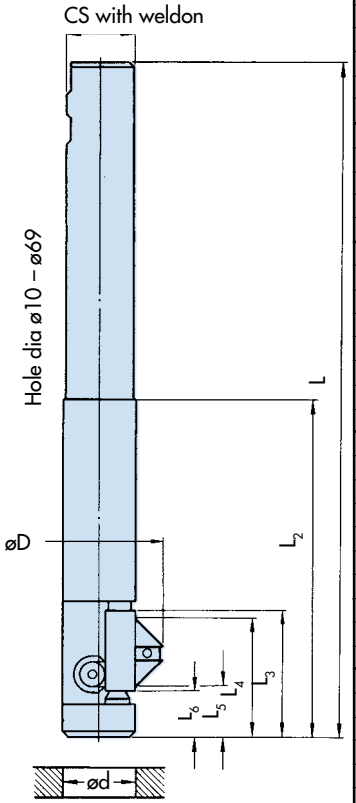
Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_5	L_6
4,5	8,3	**902– 4,5/8,3 –CS6**	27-4,5-CS6	36-010-0315	HSS		11	6	
5,5	11,3	**902– 5,5/11,3 –CS6**	-5,5	-0415					
6,5	13,3	**902– 6,5/13,3 –CS6**	-6,5	-0490					
7	14,4	**902– 7/14,4 –CS8**	27-7-CS8	36-020-0530	HSS		14	6	
8,4	18,2	**902– 8,4/18,2 –CS8**	-8,4	-020-0660					
9	19,6	**902– 9/19,6 –CS8**	-9	-0710					
10	19,6	**902– 10/19,6 –CS10**	27-10-CS10	36-030-0730	HSS		24	12	
10,5	21,1	**902– 10,5/21,1 –CS10**	-10,5	-0780					
11	22,6	**902– 11/22,6 –CS10**	-11	-0830					
12	25,6	**902– 12/25,6 –CS10**	-12	-040-0930	Brazed		23	11	
13	26,6	**902– 13/26,6 –CS10**	-13	-0980					
13,5	28,1	**902– 13,5/28,1 –CS12**	27-13,5–CS12	-050-1030					
14	29,6	**902– 14/29,6 –CS12**	-14	-1080					
15	32,6	**902– 15/32,6 –CS12**	-15	-1180					
15,5	34,1	**902– 15,5/34,1 –CS12**	-15,5	-1230					
16	33,6	**902– 16/33,6 –CS12**	27-16-CS12	36-070-1230	Brazed		28	13	
17	36,6	**902– 17/36,6 –CS16**	27-17-CS16	-1330					
17,5	38,1	**902– 17,5/38,1 –CS16**	-17,5	-1380					
18	39,6	**902– 18/39,6 –CS16**	-18	-1430					
19	40,6	**902– 19/40,6 –CS16**	-19	-080-1480					
20	43,6	**902– 20/43,6 –CS16**	-20	-1580					
21	46,6	**902– 21/46,6 –CS20**	27-21-CS20	-1680					
22	47,6	**902– 22/47,6 –CS20**	-22	-090-1730			30	15	
23	50,6	**902– 23/50,6 –CS20**	-23	-1830					
24	53,6	**902– 24/53,6 –CS20**	-24	-1930					
25	50,4	**902– 25/50,4 –CS20**	27-25-CS20	36-120-1870	Brazed		44	21	
26	53,4	**902– 26/53,4 –CS25**	27-26-CS25	-1970					
27	56,4	**902– 27/56,4 –CS25**	-27	-2070			42	22	
28	59,4	**902– 28/59,4 –CS25**	-28	-2170					
29	62,4	**902– 29/62,4 –CS25**	-29	-2270					
30	65,4	**902– 30/65,4 –CS25**	-30	-2370					
31	62	**902– 31/62 –CS32**	27-31-CS32(F/B)	36-130-2300	Brazed	58	49	30	21
32	65	**902– 32/65 –CS32**	-32	-2400					
33	68	**902– 33/68 –CS32**	-33	-2500					
34	71	**902– 34/71 –CS32**	-34	-2600					
35	74	**902– 35/74 –CS32**	-35	-2700					
36	71	**902– 36/71 –CS32**	27-36-CS32(F/B)	36-140-2650	Brazed	68	59	37	28
37	74	**902– 37/74 –CS32**	-37	-2750					
38	77	**902– 38/77 –CS32**	-38	-2850					
39	80	**902– 39/80 –CS32**	-39	-2950					
40	83	**902– 40/83 –CS32**	-40	-3050					
41	86	**902– 41/86 –CS32**	-41	-3150					
42	89	**902– 42/89 –CS32**	-42	-3250					
43	92	**902– 43/92 –CS32**	-43	-3350					
44	87	**902– 44/87 –CS40**	27-44-CS40(F/B)	36-150-3250	Brazed	78	66	42	30
45	90	**902– 45/90 –CS40**	-45	-3350					
46	93	**902– 46/93 –CS40**	-46	-3450					
47	96	**902– 47/96 –CS40**	-47	-3550					
48	99	**902– 48/99 –CS40**	-48	-3650					
49	102	**902– 49/102 –CS40**	-49	-3750					
50	105	**902– 50/105 –CS40**	-50	-3850					
51	108	**902– 51/108 –CS40**	-51	-3950					
52	111	**902– 52/111 –CS40**	-52	-4050					
53	114	**902– 53/114 –CS40**	-53	-4150					
54	109	**902– 54/109 –CS50**	27-54-CS50(F/B)	36-160-4050	Brazed	88	71	47	30
55	112	**902– 55/112 –CS50**	-55	-4150					
56	115	**902– 56/115 –CS50**	-56	-4250					
57	118	**902– 57/118 –CS50**	-57	-4350					
58	121	**902– 58/121 –CS50**	-58	-4450					
59	124	**902– 59/124 –CS50**	-59	-4550					
60	127	**902– 60/127 –CS50**	-60	-4650					
61	130	**902– 61/130 –CS50**	-61	-4750					
62	133	**902– 62/133 –CS50**	-62	-4850					
63	136	**902– 63/136 –CS50**	-63	-4950					
64	139	**902– 64/139 –CS50**	-64	-5050					
65	142	**902– 65/142 –CS50**	-65	-5150					
66	145	**902– 66/145 –CS50**	-66	-5250					
67	146	**902– 67/146 –CS50**	-67	-5250					
68	147	**902– 68/147 –CS50**	-68	-5250					
69	148	**902– 69/148 –CS50**	-69	-5250					

FRONT AND BACK CHAMFERING 45°



HOLE SIZE ø 4,5–ø 69 mm





Hole dia	L	L_1	L_2
4,5 -6,5	120	80	40
7 - 9	140	100	60
10 -15,5	160		80
16 -30	240		100
31 -43	320		200
44 -69	400		200

Hole dia ød	Facing dia øD	Complete tool	Spindle	Wing	Cutter/ Insert	L_3	L_4	L_5	L_6
4,5	8	**452– 4,5/8 –CS6**	27-4,5-CS6	35-011	HSS		11	6	
5,5	9	**452– 5,5/9 –CS6**	-5,5						
6,5	9,5	**452– 6,5/9,5 –CS6**	-6,5						
7	13,8	**452– 7/13,8 –CS8**	27-7-CS8	35-022	HSS		14	6	
8,4	15,0	**452– 8,4/15,0 –CS8**	-8,4						
9	15,4	**452– 9/15,4 –CS8**	-9						
10	19	**452– 10/19 –CS10**	27-10-CS10	35-035	HSS		24	11	
10,5	19,5	**452– 10,5/19,5 –CS10**	-10,5						
11	20	**452– 11/20 –CS10**	-11						
12	21	**452– 12/21 –CS10**	-12						
13	21	**452– 13/21 –CS10**	-13						
13,5	21,5	**452– 13,5/21,5 –CS12**	27-13,5–CS12						
14	22	**452– 14/22 –CS12**	-14						
15	23	**452– 15/23 –CS12**	-15						
15,5	23,5	**452– 15,5/23,5 –CS12**	-15,5						
16	27,8	**452– 16/27,8 –CS12**	27-16-CS12	35-060	Brazed		31	13	
17	28,8	**452– 17/28,8 –CS16**	27-17-CS16						
17,5	29,3	**452– 17,5/29,3 –CS16**	-17,5						
18	29,8	**452– 18/29,8 –CS16**	-18						
19	29,8	**452– 19/29,8 –CS16**	-19						
20	30,8	**452– 20/30,8 –CS16**	-20						
21	31,8	**452– 21/31,8 –CS20**	27-21-CS20						
22	31,8	**452– 22/31,8 –CS20**	-22						
23	32,8	**452– 23/32,8 –CS20**	-23				33	15	
24	33,8	**452– 24/33,8 –CS20**	-24						
25	40	**452– 25/40 –CS20**	27-25-CS20	35-102	Brazed		44	18	
26	41	**452– 26/41 –CS25**	27-26-CS25						
27	42	**452– 27/42 –CS25**	-27						
28	43	**452– 28/43 –CS25**	-28						
29	44	**452– 29/44 –CS25**	-29						
30	45	**452– 30/45 –CS25**	-30						
31	46	**452– 31/46 –CS32**	27-31-CS32(F/B)	35-130	Brazed	58	51	28	21
32	47	**452– 32/47 –CS32**	-32						
33	48	**452– 33/48 –CS32**	-33						
34	49	**452– 34/49 –CS32**	-34						
35	50	**452– 35/50 –CS32**	-35						
36	51	**452– 36/51 –CS32**	27-36-CS32(F/B)	35-140	Brazed	68	60	37	28
37	52	**452– 37/52 –CS32**	-37						
38	53	**452– 38/53 –CS32**	-38						
39	54	**452– 39/54 –CS32**	-39						
40	55	**452– 40/55 –CS32**	-40						
41	56	**452– 41/56 –CS32**	-41						
42	57	**452– 42/57 –CS32**	-42						
43	58	**452– 43/58 –CS32**	-43						
44	60	**452– 44/60 –CS40**	27-44-CS40(F/B)	35-150	Brazed	78	69	39	30
45	61	**452– 45/61 –CS40**	-45						
46	62	**452– 46/62 –CS40**	-46						
47	63	**452– 47/63 –CS40**	-47						
48	64	**452– 48/64 –CS40**	-48						
49	65	**452– 49/65 –CS40**	-49						
50	66	**452– 50/66 –CS40**	-50						
51	67	**452– 51/67 –CS40**	-51						
52	68	**452– 52/68 –CS40**	-52						
53	69	**452– 53/69 –CS40**	-53						
54	82	**452– 54/82 –CS50**	27-54-CS50(F/B)	35-160	Brazed	88	78	40	30
55	83	**452– 55/83 –CS50**	-55						
56	84	**452– 56/84 –CS50**	-56						
57	85	**452– 57/85 –CS50**	-57						
58	86	**452– 58/86 –CS50**	-58						
59	87	**452– 59/87 –CS50**	-59						
60	88	**452– 60/88 –CS50**	-60						
61	89	**452– 61/89 –CS50**	-61						
62	90	**452– 62/90 –CS50**	-62						
63	91	**452– 63/91 –CS50**	-63						
64	92	**452– 64/92 –CS50**	-64						
65	93	**452– 65/93 –CS50**	-65						
66	94	**452– 66/94 –CS50**	-66						
67	95	**452– 67/95 –CS50**	-67						
68	96	**452– 68/96 –CS50**	-68						
69	97	**452– 69/97 –CS50**	-69						

COMBINATION TABLE

In this table are listed all combinations, to do various spotfaces, which are possible with spindles and backspotfacing wings listed in the metric and inch catalogues.

Spindles are specified by hole diameter and listed along the top of each table horizontally. Wings are specified by part number and located vertically along the lefthand margin of the table. The spotfacing diameters these spindles and wings will produce are located in the several columns located below the hole diameters and to the right of the wing part numbers. These spotfacing diameters are given in mm.

To locate a particular combination, first select a hole dimension from those listed at the top of the chart. Second, follow the column of numbers below the hole dimension until you locate the required spotface diameter. Third, move to the left until you find a wing part number. This is the wing that is required for the spotface diameter selected.

The spindle used for the hole selected can be found in either the metric or inch catalogues, under hole diameter.

On page 27 all Cutters/Inserts (C) are specified.

C	Hole dia. Ø	4,5	4,75	5,5	5,55	6,35	6,5
	Wing						
A	37-011	8,0	8,2	9,0	9,0	9,3	9,5
A	-010-0315	8,3	8,5	9,3	9,3	9,6	9,8
A	-010-0335		8,9	9,7	9,7	10,0	10,2
A	-012			10,0	10,0	10,3	10,5
A	-013			10,5	10,5	10,8	11,0
A	-014			11,0	11,0	11,3	11,5
A	-010-0415			11,3	11,3	11,6	11,8
A	-010-0470					12,7	12,9
A	-015						13,0
A	-010-0490						13,3

C	Hole dia. Ø	7,0	7,1	7,9	8,4	8,7	9,0	9,5
	Wing							
A	37-020-0320	10,2	10,3	11,1	11,4	11,5	11,8	12.3
A	-020-0380	11,4	11,5	12,3	12,6	12,7	13,0	13,5
A	-021	11,8	11,9	12,7	13,0	13,1	13,4	13,9
A	-020-0480	13,4	13,5	14,3	14,6	14,7	15,0	15,5
A	-022	13,8	13,9	14,7	15,0	15,1	15,4	15,9
A	-023	14,4	14,5	15,3	15,6	15,7	16,0	16,5
A	-020-0540		14,7	15,5	15,8	15,9	16,2	16,7
A	-024			16,7	17,0	17,1	17,4	17,9
A	-020-0620			17,1	17,4	17,5	17,8	18,3
A	-025				17,6	17,7	18,0	18,5
A	-020-0650				18,0	18,1	18,4	18,9
A	-020-0660				18,2	18,3	18,6	19,1
A	-020-0680					18,7	19,0	19,5
A	-020-0710						19,6	20,1
A	-020-0760							21,1

C	Hole dia. Ø	10,0	10,3	10,5	11,0	11,1	11,9	12,0	12,7	13,0	13,5	14,0	14,3	15,0	15,1	15,5
	Wing															
A	37-030-0490	14,8	15,1	15,3	15,8	15,9	16,7	16,8	16,8	16,8	17,3	17,8	18,1	18,8	18,9	19,3
A	-031	15,5	15,8	16,0	16,5	16,6	17,4	17,5	17,5	17,5	18,0	18,5	18,8	19,5	19,6	20,0
A	-032	17,0	17,3	17,5	18,0	18,1	18,9	19,0	19,0	19,0	19,5	20,0	20,3	21,0	21,1	21,5
A	-030-0610	17,2	17,5	17,7	18,2	18,3	19,1	19,2	19,2	19,2	19,7	20,2	20,5	21,2	21,3	21,7
A	-030-0615	17,3	17,6	17,8	18,3	18,4	19,2	19,3	19,3	19,3	19,8	20,3	20,6	21,3	21,4	21,8
A	-033	17,5	17,8	18,0	18,5	18,6	19,4	19,5	19,5	19,5	20,0	20,5	20,8	21,5	21,6	22,0
A	-034	18,0	18,3	18,5	19,0	19,1	19,9	20,0	20,0	20,0	20,5	21,0	21,3	22,0	22,1	22,5
A	-035	19,0	19,3	19,5	20,0	20,1	20,9	21,0	21,0	21,0	21,5	22,0	22,3	23,0	23,1	23,5
A	-036	19,5	19,8	20,0	20,5	20,6	21,4	21,5	21,5	21,5	22,0	22,5	22,8	23,5	23,6	24,0
A	-030-0730	19,6	19,9	20,1	20,6	20,7	21,5	21,6	21,6	21,6	22,1	22,6	22,9	23,6	23,7	24,1
A	-037		20,3	20,5	21,0	21,1	21,9	22,0	22,0	22,0	22,5	23,0	23,3	24,0	24,1	24,5
A	-030-0760		20,5	20,7	21,2	21,3	22,1	22,2	22,2	22,2	22,7	23,2	23,5	24,2	24,3	24,7
A	-030-0780			21,1	21,6	21,7	22,5	22,6	22,6	22,6	23,1	23,6	23,9	24,6	24,7	25,1
A	-030-0815				22,3	22,4	23,2	23,3	23,3	23,3	23,8	24,3	24,6	25,3	25,4	25,8
C	-041							23,5	23,5	23,5	24,0	24,5	24,8	25,5	25,6	26,0
A	-030-0830				22,6	22,7	23,5	23,6	23,6	23,6	24,1	24,6	24,9	25,6	25,7	26,1
A	-030-0840					22,9	23,7	23,8	23,8	23,8	24,3	24,8	25,1	25,8	25,9	26,3
C	-042							24,0	24,0	24,0	24,5	25,0	25,3	26,0	26,1	26,5
A	-030-0920						25,3	25,4	25,4	25,4	25,9	26,4	26,7	27,4	27,5	27,9
C	-043							25,5	25,5	25,5	26,0	26,5	26,8	27,5	27,6	28,0
C	-040-0930							25,6	25,6	25,6	26,1	26,6	26,9	27,6	27,7	28,1
C	-044								26,0	26,0	26,5	27,0	27,3	28,0	28,1	28,5
C	-040-0965								26,3	26,3	26,8	27,3	27,6	28,3	28,4	28,8
C	-040-0980									26,6	27,1	27,6	27,9	28,6	28,7	29,1
H	-051										28,0	28,5	28,8	29,5	29,6	30,0
H	-050-1030										28,1	28,6	28,9	29,6	29,7	30,1
H	-052											29,0	29,3	30,0	30,1	30,5
H	-050-1080											29,6	29,9	30,6	30,7	31,1
I	-050-1110												30,5	31,2	31,3	31,7
J	-050-1180													32,6	32,7	33,1
J	-050-1190														32,9	33,3
J	-050-1230															34,1

C	Hole dia. Ø	15,9	16,0	16,7	17,0	17,5	18,0	18,3	19,0	19,1	19,8	20,0	20,6	21,0	21,4	22,0	22,2	23,0	23,8	24,0	24,6
	Wing																				
B	37-060-0750	23,9	24,0	24,7	25,0	25,5	26,0	26,0	26,0	26,1	26,8	27,0	27,6	28,0	28,0	28,0	28,2	29,0	29,8	30,0	30,6
B	-060-0775	24,4	24,5	25,2	25,5	26,0	26,5	26,5	26,5	26,6	27,3	27,5	28,1	28,5	28,5	28,5	28,7	29,5	30,3	30,5	31,1
B	-060-0785	24,6	24,7	25,4	25,7	26,2	26,7	26,7	26,7	26,8	27,5	27,7	28,3	28,7	28,7	28,7	28,9	29,7	30,5	30,7	31,3
C	-061	25,9	26,0	26,7	27,0	27,5	28,0	28,0	28,0	28,1	28,8	29,0	29,6	30,0	30,0	30,0	30,2	31,0	31,8	32,0	32,6
C	-060-0900	26,9	27,0	27,7	28,0	28,5	29,0	29,0	29,0	29,1	29,8	30,0	30,6	31,0	31,0	31,0	31,2	32,0	32,8	33,0	33,6
C	-060-0920	27,3	27,4	28,1	28,4	28,9	29,4	29,4	29,4	29,5	30,2	30,4	31,0	31,4	31,4	31,4	31,6	32,4	33,2	33,4	34,0
C	-060-0945	27,8	27,9	28,6	28,9	29,4	29,9	29,9	29,9	30,0	30,7	30,9	31,5	31,9	31,9	31,9	32,1	32,9	33,7	33,9	34,5
C	-060-0975	28,4	28,5	29,2	29,5	30,0	30,5	30,5	30,5	30,6	31,3	31,5	32,1	32,5	32,5	32,5	32,7	33,5	34,3	34,5	35,1
C	-060-1000	28,9	29,0	29,7	30,0	30,5	31,0	31,0	31,0	31,1	31,8	32,0	32,6	33,0	33,0	33,0	33,2	34,0	34,8	35,0	35,6
C	-060-1005	29,0	29,1	29,8	30,1	30,6	31,1	31,1	31,1	31,2	31,9	32,1	32,7	33,1	33,1	33,1	33,3	34,1	34,9	35,1	35,7
D	-062	29,9	30,0	30,7	31,0	31,5	32,0	32,0	32,0	32,1	32,8	33,0	33,6	34,0	34,0	34,0	34,2	35,0	35,8	36,0	36,6
D	-060-1125	31,4	31,5	32,2	32,5	33,0	33,5	33,5	33,5	33,6	34,3	34,5	35,1	35,5	35,5	35,5	35,7	36,5	37,3	37,5	38,1
D	-060-1150	31,9	32,0	32,7	33,0	33,5	34,0	34,0	34,0	34,1	34,8	35,0	35,6	36,0	36,0	36,0	36,2	37,0	37,8	38,0	38,6
D	-060-1155	32,0	32,1	32,8	33,1	33,6	34,1	34,1	34,1	34,2	34,9	35,1	35,7	36,1	36,1	36,1	36,3	37,1	37,9	38,1	38,7
D	-063	32,9	33,0	33,7	34,0	34,5	35,0	35,0	35,0	35,1	35,8	36,0	36,6	37,0	37,0	37,0	37,2	38,0	38,8	39,0	39,6
K	-070-1220	33,3	33,4	34,1	34,4	34,9	35,4	35,4	35,4	35,5	36,2	36,4	37,0	37,4	37,4	37,4	37,6	38,4	39,2	39,4	40,0
K	-070-1230		33,6	34,3	34,6	35,1	35,6	35,6	35,6	35,7	36,4	36,6	37,2	37,6	37,6	37,6	37,8	38,6	39,4	39,6	40,2
D	-090-1245															37,9	38,1	38,9	39,7	39,9	40,5
D	-090-1250															38,0	38,2	39,0	39,8	40,0	40,6
K	-070-1300			35,7	36,0	36,5	37,0	37,0	37,0	37,1	37,8	38,0	38,6	39,0	39,0	39,0	39,2	40,0	40,8	41,0	41,6
L	-070-1330				36,6	37,1	37,6	37,6	37,6	37,7	38,4	38,6	39,2	39,6	39,6	39,6	39,8	40,6	41,4	41,6	42,2
E	-090-1350															40,0	40,2	41,0	41,8	42,0	42,6
L	-070-1380					38,1	38,6	38,6	38,6	38,7	39,4	39,6	40,2	40,6	40,6	40,6	40,8	41,6	42,4	42,6	43,2
E	-091															41,0	41,2	42,0	42,8	43,0	43,6
M	-070-1430						39,6	39,6	39,6	39,7	40,4	40,6	41,2	41,6	41,6	41,6	41,8	42,6	43,4	43,6	44,2
M	-070-1445							39,9	39,9	40,0	40,7	40,9	41,5	41,9	41,9	41,9	42,1	42,9	43,7	43,9	44,5
M	-080-1480								40,6	40,7	41,4	41,6	42,2	42,6	42,6	42,6	42,8	43,6	44,4	44,6	45,2
M	-080-1490									40,9	41,6	41,8	42,4	42,8	42,8	42,8	43,0	43,8	44,6	44,8	45,4
M	-080-1560										43,0	43,2	43,8	44,2	44,2	44,2	44,4	45,2	46,0	46,2	46,8
N	-080-1580											43,6	44,2	44,6	44,6	44,6	44,8	45,6	46,4	46,6	47,2
N	-080-1640												45,4	45,8	45,8	45,8	46,0	46,8	47,6	47,8	48,4
O	-080-1680													46,6	46,6	46,6	46,8	47,6	48,4	48,6	49,2
O	-080-1700														47,0	47,0	47,2	48,0	48,8	49,0	49,6
O	-090-1730															47,6	47,8	48,6	49,4	49,6	50,2
O	-090-1750																48,2	49,0	49,8	50,0	50,6
P	-090-1830																	50,6	51,4	51,6	52,2
P	-090-1910																		53,0	53,2	53,8
Q	-090-1930																			53,6	54,2
Q	-090-1990																				55,4

C	Hole dia. Ø	25,0	25,4	26,0	26,2	27,0	27,8	28,0	28,6	29,0	29,4	30,0
	Wing											
D	37-101	33,0	33,4	34,0	34,2	35,0	35,8	36,0	36,6	37,0	37,4	38,0
D	-100-1235	37,7	38,1	38,7	38,9	39,7	40,5	40,7	41,3	41,7	42,1	42,7
D	-100-1250	38,0	38,4	39,0	39,2	40,0	40,8	41,0	41,6	42,0	42,4	43,0
D	-100-1300	39,0	39,4	40,0	40,2	41,0	41,8	42,0	42,6	43,0	43,4	44,0
D	-102	40,0	40,4	41,0	41,2	42,0	42,8	43,0	43,6	44,0	44,4	45,0
D	-100-1400	41,0	41,4	42,0	42,2	43,0	43,8	44,0	44,6	45,0	45,4	46,0
E	-110-1450	42,0	42,4	43,0	43,2	44,0	44,8	45,0	45,6	46,0	46,4	47,0
E	-110-1550	44,0	44,4	45,0	45,2	46,0	46,8	47,0	47,6	48,0	48,4	49,0
E	-111	45,0	45,4	46,0	46,2	47,0	47,8	48,0	48,6	49,0	49,4	50,0
E	-110-1750	48,0	48,4	49,0	49,2	50,0	50,8	51,0	51,6	52,0	52,4	53,0
F	-121	50,0	50,4	51,0	51,2	52,0	52,8	53,0	53,6	54,0	54,4	55,0
F	-120-1870	50,4	50,8	51,4	51,6	52,4	53,2	53,4	54,0	54,4	54,8	55,4
F	-120-1910		51,6	52,2	52,4	53,2	54,0	54,2	54,8	55,2	55,6	56,2
F	-120-1970			53,4	53,6	54,4	55,2	55,4	56,0	56,4	56,8	57,4
F	-120-1990				54,0	54,8	55,6	55,8	56,4	56,8	57,2	57,8
G	-120-2070					56,4	57,2	57,4	58,0	58,4	58,8	59,4
G	-120-2150						58,8	59, 0	59,6	60 0	60,4	61,0
G	-120-2170							59,4	60,0	60,4	60,8	61,4
G	-120-2230								61,2	61,6	62,0	62,6
G	-120-2270									62,4	62,8	63,4
G	-120-2310										63,6	64,2
G	-120-2370											65,4

C	Hole dia. Ø	30,2	31,0	31,8	32,0	32,5	33,0	33,3	34,0	34,1	34,9	35,0
	Wing											
D	37-130-1500	46,0	46,0	47,0	47,0	48,0	48,0	49,0	49,0	50,0	50,0	50,0
E	-130-1590	47,8	47,8	48,8	48,8	49,8	49,8	50,8	50,8	51,8	51,8	51,8
E	-130-1740	50,8	50,8	51,8	51,8	52,8	52,8	53,8	53,8	54,8	54,8	54,8
E	-130-1750	51,0	51,0	52,0	52,0	53,0	53,0	54,0	54,0	55,0	55,0	55,0
F	-131	54,0	54,0	55,0	55,0	56,0	56,0	57,0	57,0	58,0	58,0	58,0
F	-130-1910	54,2	54,2	55,2	55,2	56,2	56,2	57,2	57,2	58,2	58,2	58,2
G	-130-2150	59,0	59,0	60,0	60,0	61,0	61,0	62,0	62,0	63,0	63,0	63,0
G	-132	60,0	60,0	61,0	61,0	62,0	62,0	63,0	63,0	64,0	64,0	64,0
G	-130-2300	62,0	62,0	63,0	63,0	64,0	64,0	65,0	65,0	66,0	66,0	66,0
G	-130-2400			65,0	65,0	66,0	66,0	67,0	67,0	68,0	68,0	68,0
G	-130-2500					68,0	68,0	69,0	69,0	70,0	70,0	70,0
R	-130-2600							71,0	71,0	72,0	72,0	72,0
R	-130-2700									74,0	74,0	74,0

C	Hole dia. Ø	35,7	36,0	36,5	37,0	37,3	38,0	38,1	38,9	39,0	39,7	40,0	40,5	41,0	41,3	42,0	42,1	42,9	43,0
	Wing																		
E	37-140-1750	53,0	53,0	54,0	54,0	55,0	55,0	56,0	56,0	56,0	57,0	57,0	58,0	58,0	59,0	59,0	60,0	60,0	60,0
E	-140-1790	53,8	53,8	54,8	54,8	55,8	55,8	56,8	56,8	56,8	57,8	57,8	58,8	58,8	59,8	59,8	60,8	60,8	60,8
E	-140-1800	54,0	54,0	55,0	55,0	56,0	56,0	57,0	57,0	57,0	58,0	58 0	59,0	59,0	60,0	60,0	61,0	61,0	61,0
E	-140-1915	56,3	56,3	57,3	57,3	58,3	58,3	59,3	59,3	59,3	60,3	60,3	61,3	61,3	62,3	62,3	63,3	63,3	63,3
E	-140-1950	57,0	57,0	58,0	58,0	59,0	59,0	60,0	60,0	60,0	61,0	61,0	62,0	62,0	63,0	63,0	64,0	64,0	64,0
E	-140-2000	58,0	58,0	59,0	59,0	60,0	60,0	61,0	61,0	61,0	62,0	62,0	63,0	63,0	64,0	64,0	65,0	65,0	65,0
F	-140-2145	60,9	60,9	61,9	61,9	62,9	62,9	63,9	63,9	63,9	64,9	64,9	65,9	65,9	66,9	66,9	67,9	67,9	67,9
F	-141	63,0	63,0	64,0	64,0	65,0	65,0	66,0	66,0	66,0	67,0	67,0	68,0	68,0	69,0	69,0	70,0	70,0	70,0
F	-140-2315	64,3	64,3	65,3	65,3	66,3	66,3	67,3	67,3	67,3	68,3	68,3	69,3	69,3	70,3	70,3	71,3	71,3	71,3
G	-140-2500	68,0	68,0	69,0	69,0	70,0	70,0	71,0	71,0	71,0	72,0	72,0	73,0	73,0	74,0	74,0	75,0	75,0	75,0
G	-142	69,0	69,0	70,0	70,0	71,0	71,0	72,0	72,0	72,0	73,0	73,0	74,0	74,0	75 0	75,0	76,0	76,0	76,0
R	-140-2650	71,0	71,0	72,0	72,0	73,0	73,0	74,0	74,0	74,0	75,0	75,0	76,0	76,0	77,0	77,0	78,0	78,0	78,0
R	-140-2750			74,0	74,0	75,0	75,0	76,0	76,0	76,0	77,0	77,0	78,0	78,0	79,0	79,0	80,0	80,0	80,0
S	-140-2850					77,0	77,0	78,0	78,0	78,0	79,0	79,0	80,0	80,0	81,0	81,0	82,0	82,0	82,0
S	-140-2950							80,0	80,0	80,0	81,0	81,0	82,0	82,0	83,0	83,0	84,0	84,0	84,0
S	-140-3050										83,0	83,0	84,0	84,0	85,0	85,0	86,0	86,0	86,0
S	-140-3150												86,0	86,0	87,0	87,0	88,0	88,0	88,0
S	-140-3250														89,0	89,0	90,0	90,0	90,0
S	-140-3350																92,0	92,0	92,0

C	Hole dia. Ø	43,7	44,0	44,5	45,0	45,2	46,0	46,8	47,0	47,6	48,0	48,4	49,0	49,2	50,0	50,8	51,0	51,6	52,0	52,4	53,0
	Wing																				
F	37-150-2150	65,0	65,0	66,0	66,0	67,0	67,0	68,0	68,0	69,0	69,0	70,0	70,0	71,0	71,0	72,0	72,0	73,0	73,0	74,0	74,0
F	-150-2295	67,9	67,9	68,9	68,9	69,9	69,9	70,9	70,9	71,9	71,9	72,9	72,9	73,9	73,9	74,9	74,9	75,9	75,9	76,9	76,9
F	-150-2300	68,0	68,0	69,0	69,0	70,0	70,0	71,0	71,0	72,0	72,0	73,0	73,0	74,0	74,0	75,0	75,0	76,0	76,0	77,0	77,0
F	-150-2400	70,0	70,0	71,0	71,0	72,0	72,0	73,0	73,0	74,0	74,0	75,0	75,0	76,0	76,0	77,0	77,0	78,0	78,0	79,0	79,0
F	-150-2420	70,4	70,4	71,4	71,4	72,4	72,4	73,4	73,4	74,4	74,4	75,4	75,4	76,4	76,4	77,4	77,4	78,4	78,4	79,4	79,4
G	-150-2690	75,8	75,8	76,8	76,8	77,8	77,8	78,8	78,8	79,8	79,8	80,8	80,8	81,8	81,8	82,8	82,8	83,8	83,8	84,8	84,8
G	-150-2895	79,9	79,9	80,9	80,9	81,9	81,9	82,9	82,9	83,9	83,9	84,9	84,9	85,9	85,9	86,9	86,9	87,9	87,9	88,9	88,9
S	-150-2950	81,0	81,0	82,0	82,0	83,0	83,0	84,0	84,0	85,0	85,0	86,0	86,0	87,0	87,0	88,0	88,0	89,0	89,0	90,0	90,0
S	-151	86,0	86,0	87,0	87,0	88,0	88,0	89,0	89,0	90,0	90,0	91,0	91,0	92,0	92,0	93,0	93,0	94,0	94,0	95,0	95,0
S	-150-3250	87,0	87,0	88,0	88,0	89,0	89,0	90,0	90,0	91,0	91,0	92,0	92,0	93,0	93,0	94,0	94,0	95,0	95,0	96,0	96,0
S	-150-3350			90,0	90,0	91,0	91,0	92,0	92,0	93,0	93,0	94,0	94,0	95,0	95,0	96,0	96,0	97,0	97,0	98,0	98,0
S	-150-3400					92,0	92,0	93,0	93,0	94,0	94,0	95,0	95,0	96,0	96,0	97,0	97,0	98,0	98,0	99,0	99,0
S	-150-3450					93,0	93,0	94,0	94,0	95,0	95,0	96,0	96,0	97,0	97,0	98,0	98,0	99,0	99,0	100,0	100,0
S	-150-3550							96,0	96,0	97,0	97,0	98,0	98,0	99,0	99,0	100,0	100,0	101,0	101,0	102,0	102,0
T	-150-3650									99,0	99,0	100,0	100,0	101,0	101,0	102,0	102,0	103,0	103,0	104,0	104,0
T	-150-3750											102,0	102,0	103,0	103,0	104,0	104,0	105,0	105,0	106,0	106,0
T	-150-3850													105,0	105,0	106,0	106,0	107,0	107,0	108,0	108,0
T	-150-3950															108,0	108,0	109,0	109,0	110,0	110,0
T	-150-4050																	111,0	111,0	112,0	112,0
T	-150-4150																			114,0	114,0

C	Hole dia. Ø	53,2	54,0	54,8	55,0	55,6	56,0	56,4	57,0	57,1	57,9	58,0	58,7	59,0	59,5	60,0	60,3	61,0
	Wing																	
S	37-161	94,0	94,0	95,0	95,0	96,0	96,0	97,0	97,0	98,0	98,0	98,0	99,0	99,0	100,0	100,0	101,0	101,0
T	-162	108,0	108,0	109,0	109,0	110,0	110,0	111,0	111,0	112,0	112,0	112,0	113,0	113,0	114,0	114,0	115,0	115,0
T	-160-4050	109,0	109,0	110,0	110,0	111,0	111,0	112,0	112,0	113,0	113,0	113,0	114,0	114,0	115,0	115,0	116,0	116,0
T	-160-4150			112,0	112,0	113,0	113,0	114,0	114,0	115,0	115,0	115,0	116,0	116,0	117,0	117,0	118,0	118,0
T	-160-4250					115,0	115,0	116,0	116,0	117,0	117,0	117,0	118,0	118,0	119,0	119,0	120,0	120,0
T	-160-4350							118,0	118,0	119,0	119,0	119,0	120,0	120,0	121,0	121,0	122,0	122,0
T	-160-4450									121,0	121,0	121,0	122,0	122,0	123,0	123,0	124,0	124,0
U	-160-4550												124,0	124,0	125,0	125,0	126,0	126,0
U	-160-4650														127,0	127,0	128,0	128,0
U	-160-4750																130,0	130,0

C	Hole dia. Ø	61,1	61,9	62,0	62,7	63,0	63,5	64,0	64,3	65,0	65,1	65,9	66,0	66,7	67,0	67,5	68,0	68,3	69,0
	Wing																		
S	37-161	102,0	102,0	102,0	103,0	103,0	104,0	104,0	105,0	105,0	106,0	106,0	106,0	107,0	107,0	108,0	108,0	109,0	109,0
T	-162	116,0	116,0	116,0	117,0	117,0	118,0	118,0	119,0	119,0	120,0	120,0	120,0	121,0	121,0	122,0	122,0	123,0	123,0
T	-160-4050	117,0	117,0	117,0	118,0	118,0	119,0	119,0	120,0	120,0	121,0	121,0	121,0	122,0	122,0	123,0	123,0	124,0	124,0
T	-160-4150	119,0	119,0	119,0	120,0	120,0	121,0	121,0	122,0	122,0	123,0	123,0	123,0	124,0	124,0	125,0	125,0	126,0	126,0
T	-160-4250	121,0	121,0	121,0	122,0	122,0	123,0	123,0	124,0	124,0	125,0	125,0	125,0	126,0	126,0	127,0	127,0	128,0	128,0
T	-160-4350	123,0	123,0	123,0	124,0	124,0	125,0	125,0	126,0	126,0	127,0	127,0	127,0	128,0	128,0	129,0	129,0	130,0	130,0
T	-160-4450	125,0	125,0	125,0	126,0	126,0	127,0	127,0	128,0	128,0	129,0	129,0	129,0	130,0	130,0	131,0	131,0	132,0	132,0
U	-160-4550	127,0	127,0	127,0	128,0	128,0	129,0	129,0	130,0	130,0	131,0	131,0	131,0	132,0	132,0	133,0	133,0	134,0	134,0
U	-160-4650	129,0	129,0	129,0	130,0	130,0	131,0	131,0	132,0	132,0	133,0	133,0	133,0	134,0	134,0	135,0	135,0	136,0	136,0
U	-160-4750	131,0	131,0	131,0	132,0	132,0	133,0	133,0	134,0	134,0	135,0	135,0	135,0	136,0	136,0	137,0	137,0	138,0	138,0
U	-160-4850	133,0	133,0	133,0	134,0	134,0	135,0	135,0	136,0	136,0	137,0	137,0	137,0	138,0	138,0	139,0	139,0	140,0	140,0
U	-160-4950				136,0	136,0	137,0	137,0	138,0	138,0	139,0	139,0	139,0	140,0	140,0	141,0	141,0	142,0	142,0
U	-160-5050						139,0	139,0	140,0	140,0	141,0	141,0	141,0	142,0	142,0	143,0	143,0	144,0	144,0
U	-160-5150								142,0	142,0	143,0	143,0	143,0	144,0	144,0	145,0	145,0	146,0	146,0
U	-160-5250										145,0	145,0	145,0	146,0	146,0	147,0	147,0	148,0	148,0

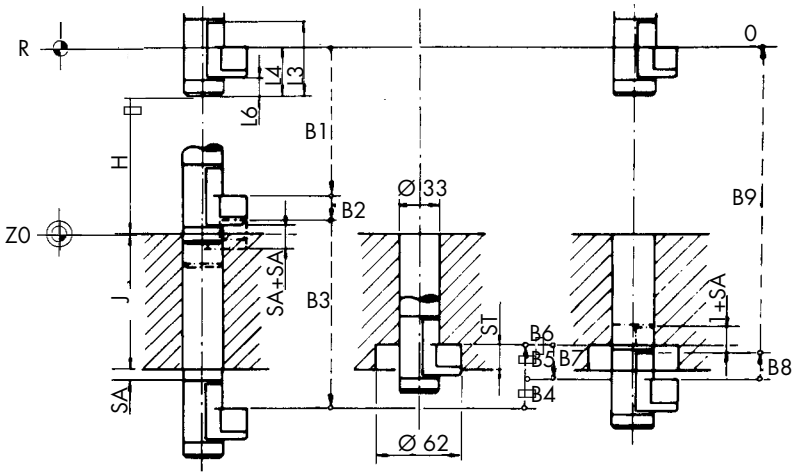
C	Hole dia. Ø	69,1	69,9	70,0	70,6	71,0	71,4	72,0	72,2	73,0	73,8	74,0	74,6	75,0	75,4	76,0	76,2
	Wing																
T	37-171	124,0	124,0	124,0	125,0	125,0	126,0	126,0	127,0	127,0	128,0	128,0	129,0	129,0	130,0	130,0	131,0
U	-172	140,0	140,0	140,0	141,0	141,0	142,0	142,0	143,0	143,0	144,0	144,0	145,0	145,0	146,0	146,0	147,0
U	-170-5250	141,0	141,0	141,0	142,0	142,0	143,0	143,0	144,0	144,0	145,0	145,0	146,0	146,0	147,0	147,0	148,0
U	-170-5350				144,0	144,0	145,0	145,0	146,0	146,0	147,0	147,0	148,0	148,0	149,0	149,0	150,0
U	-170-5450						147,0	147,0	148,0	148,0	149,0	149,0	150,0	150,0	151,0	151,0	152,0
U	-170-5550								150,0	150,0	151,0	151,0	152,0	152,0	153,0	153,0	154,0
U	-170-5650										153,0	153,0	154,0	154,0	155,0	155,0	156,0

Cutter/Insert (C)		
A HSS	H C-0820	O K-1450
B Brazed	I C-0900	P K-1550
C SPUN 080208	J C-1000	Q K-1650
D SPUN 090308	K K-1050	R EC20
E SPUN 120308	L K-1150	S EC25
F SPUN 150412	M K-1250	T EC32
G SPUN 190408	N K-1350	U EC40
ISO-K20 for Cast iron		ISO-P40 for Steel

FOR OPERATIONS IN YOUR NC/CNC MACHINE

ERIX TOOL

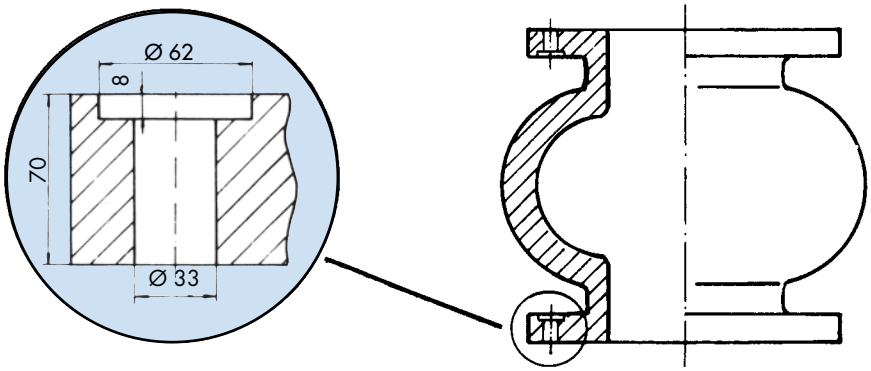
90–33/62–CS32
L3 = 58
L4 = 50
L6 = 21
H = 100
J = 70
ST = 8
SA = 5 (security distance)



MACHINE TIME

Workpiece: Flange according to drawing below
Material: Cast steel
Numbers of Components: 100
Numbers of Operation: 1200

Step	*Z-Length*	*Feed mm/min*	*Time*
B1	H + L6–SA=116	2000	3,5
B2	SA + SA=10	65	9,2
B3	J + (L3–L6)=107	2000	3,2
B4	SA + 4= 9	65	8,3
B5	(L3–L4)–4 + ST=12	58	12,4
B6	Rotation	–	3
B7	(L3–L4)+1=9	65	8,3
B8	1 + SA=6	65	5,6
B9	J–ST–SA+ (L3–L4)+H+L4=215	2000	6,5
		Tot. time	60,0



6 holes in each flange

RESULT

By using the ERIX Tool in this case…
Costs were reduced by 3 600 USD
or
60 hours were saved, which can be used for the machining of other components.

COST ANALYSIS

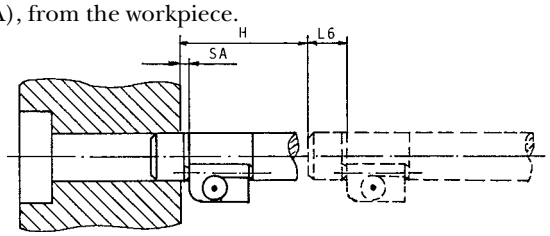
Tool:	**Conventional HSS-Tool with manual cutter change**	**ERIX Tool 90-33/62-CS32**
Cutter:	**HSS**	**Carbide inserts**
Cutting Speed:	**25 m/min**	**50 m/min**
Machining time:	**4,0 min**	**1,0 min**
Man and Machine costs:	**60 USD/hour**	**60 USD/hour**
Costs per spotfacing:	**4 USD**	**1 USD**
Total cost:	**4800 USD**	**1200 USD**

PROGRAMMING INSTRUCTIONS ON NEXT PAGE

ERIX-Tools up to Spindle Ø 30 mm (without guide tang)

1. Program - Step A1

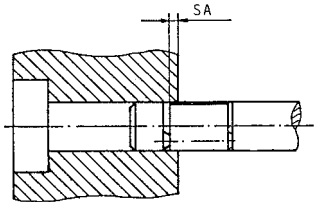
Counter-clockwise rotation at recommended speed: rapid feed until the wing is a few millimeters, security distance (SA), from the workpiece.



Rotation	: Counter-clockwise	
Speed	: RPM	S
Feed	: Rapid	F
Formula for Z	: H + L6 - SA	mm
Stop at Z+	: (L4 - L6) + SA	Z+

2. Program - Step A2

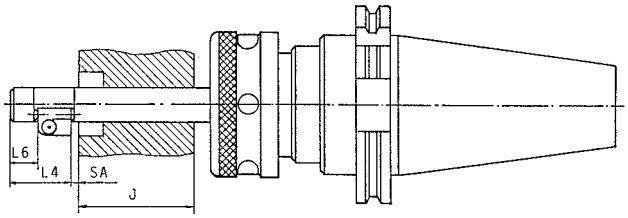
Counter-clockwise rotation: feedrate reduced to 0,2 mm per rev. until the wing has folded into the spindle recess.



Rotation	: Counter-clockwise	
Feed	: 0,2 mm/rev	
Feed/min	: Feed x Speed	F
Formula for Z	: SA + SA	mm
Stop at Z+	: (L4 - L6) - SA	Z+

3. Program - Step A3

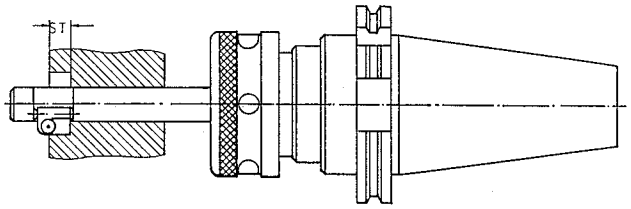
Counter-clockwise rotation: rapid feed forward until the entire length of the wing swings completely free.



Rotation	: Counter-clockwise	
Feed	: Rapid	F
Formula for Z	: J + (L4 - L6)	mm
Stop at Z-	: - (J + SA)	Z-

4. Program - Step A4

Reverse to clockwise rotation: cutting operation with feedrate according to recommendations.



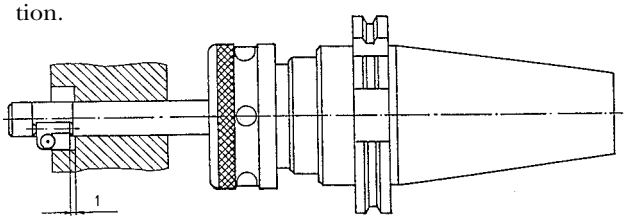
Rotation	: Clockwise	
Feed according to table	:	mm/rev
Feed/min	: Feed x Speed	F
Formula for Z	: SA + ST	mm
Stop at Z-	: - (J - ST)	Z-

5. Program - Step A5

Stop feeding and let the tool dwell for 5 seconds.

6. Program - Step A6

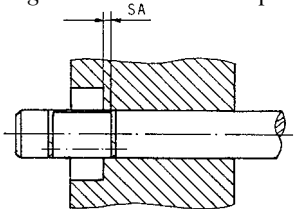
After spotfacing back the tool away until the wing swings completely free. Reverse again to counter-clockwise rotation.



Rotation	: Clockwise	
Feed	: Rapid	F
Distance for Z	: 1 mm	mm
Stop at Z-	: - (J - ST + 1)	Z-

7 Program - Step A7

Counter-clockwise rotation: reduce feedrate to 0,2 mm per rev. until the wing has folded into the spindle recess.



Rotation	: Counter-clockwise	
Feed	: 0,2 mm/rev	
Feed/min	: Feed x Speed	F
Formula for Z	: 1 + SA	mm
Stop at Z-	: - (J - ST - SA)	Z-

8. Program - Step A8

Rapid feed back to the starting point R.

Feed	: Rapid	F
Formula for Z	: J - ST - SA + H + L4	mm
Stop at Z+	: Reference point – R	Z+

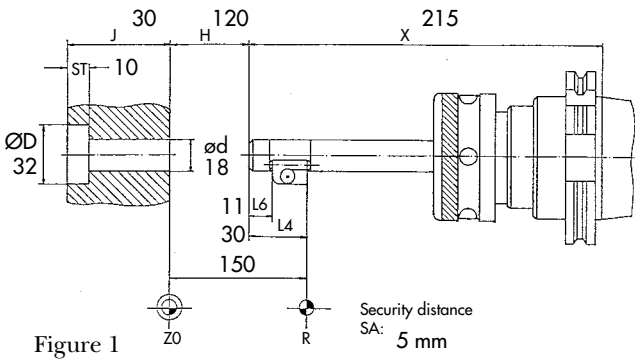


Figure 1

Workpiece		: Cast iron	
Speed	m/min	: 40	
Speed	RPM	: 320	S
Feed	mm/rev	: 0,16	
Feed/min	mm/min.	: 52	F

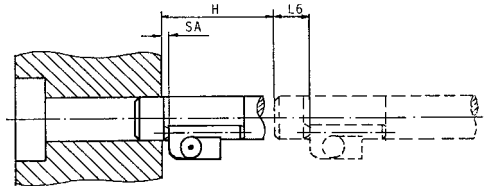
Step	Formula for Z	Z mm	Stop at Z	Speed RPM	Rotation	Feed
A1	H + L6 – SA	126	+ 24	320	Counter-clockwise	2000
A2	SA + SA	10	+ 14	320	Counter-clockwise	64
A3	J + (L4 – L6)	49	– 35	320	Counter-clockwise	2000
A4	SA + ST	15	– 20	320	Clockwise	52
A5	Rotation	0	– 20	320	Clockwise	stop
A6	1 mm	1	– 21	320	Clockwise	600
A7	1 + SA	6	– 15	320	Counter-clockwise	64
A8	J – ST – SA + H + L4	165	+ 150	320	Counter-clockwise	2000

ERIX-Tools – Spindle, over Ø 30 mm (with guide tang)

Set workpiece 0-Point and Tool reference point R (Please see figure 1, page 29).

1. Program - Step B1

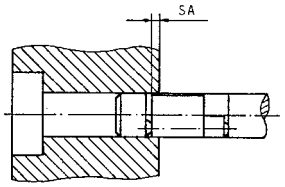
Counter-clockwise rotation at recommended speed: rapid feed until the wing is a few millimeters, security distance (SA), from the workpiece.



Rotation	: Counter-clockwise	
Speed	: RPM	S
Feed	: Rapid	F
Formula for Z-	: H + L6 - SA	mm
Stop at Z+	: (L4 - L6) + SA	Z+

2. Program - Step B2

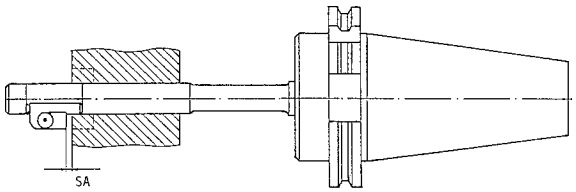
Counter-clockwise rotation: feedrate reduced to 0,2 mm per rev. until the wing has folded into the spindle recess.



Rotation	: Counter-clockwise	
Feed	: 0,2 mm/rev	
Feed/min	: Feed x Speed	F
Formula for Z	: SA + SA	mm
Stop at Z+	: (L4 - L6) - SA	Z+

3. Program - Step B3

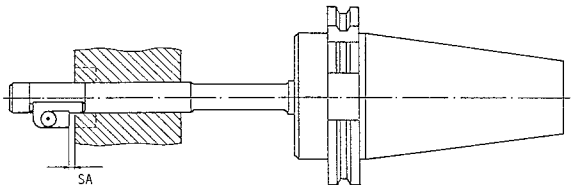
Counter-clockwise rotation: rapid feed forward until the entire length of the wing swings completely free.



Rotation	: Counter-clockwise	
Feed	: Rapid	F
Formula for Z	: J + (L3 - L6)	mm
Stop at Z-	: - (J + (L3–L4) + SA)	Z-

4. Program - Step B4

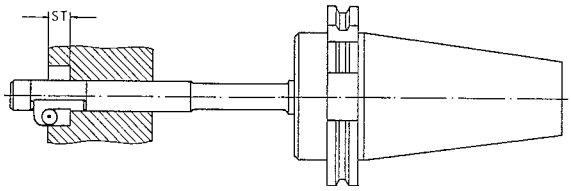
The guide tang enters the hole and will keep the wing in its working position.



Rotation	: Clockwise	
Feed	: max. 0.2 mm/rev	
Feed/min	: Feed x Speed	
Formula for Z	: SA + 4	mm
Stop at Z-	: - (J + (L3–L4) – 4)	Z-

5. Program - Step B5

Reverse to clockwise rotation: cutting operation with feedrate according to recommendations.



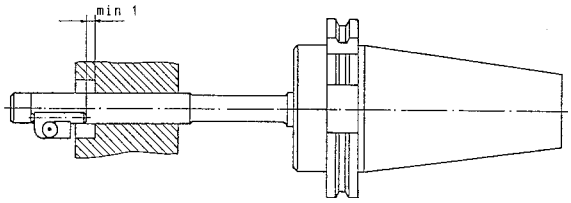
Rotation	: Clockwise	
Feed according to table	: mm/rev	
Feed/min	: Feed x Speed	F
Formula for Z	: (L3–L4) – 4 + ST	mm
Stop at Z-	: - (J - ST)	Z-

6. Program - Step B6

Stop feeding and let the tool dwell for 5 seconds.

7. Program - Step B7

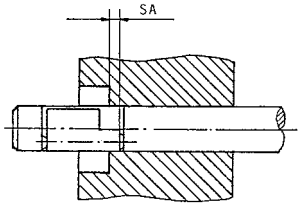
After spotfacing back the tool away until the wing swings completely free. Reverse again to counter-clockwise rotation.



Rotation	: Clockwise	
Feed	: Rapid	F
Formula for Z	: (L3 - L4) + 1	mm
Stop at Z-	: - (J - ST + (L3–L4) + 1)	Z-

8. Program - Step B8

Counter-clockwise rotation: reduce feedrate 0,2 mm per rev. until the wing has folded into the spindle recess. The guide tang will close the wing.



Rotation	: Counter-clockwise	
Feed	: max. 0.2 mm/rev	
Feed/min	: Feed x Speed	F
Formula for Z	: 1 + SA	mm
Stop at Z-	: - (J – ST + (L3–L4) – SA)	Z-

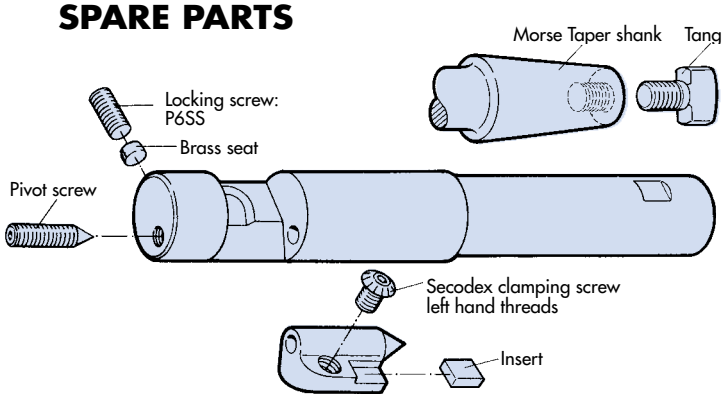
9. Program - Step B9

Rapid feed back to the starting point R.

Rotation	: Counter-clockwise	
Feed	: Rapid	F
Formula for Z	: J – ST – SA + (L3 – L4) + H + L4	mm
Stop at Z+	: Reference point R	Z+

SPARE PARTS

HOLE SIZE ø 4,5 – ø 30 mm



SPINDLE

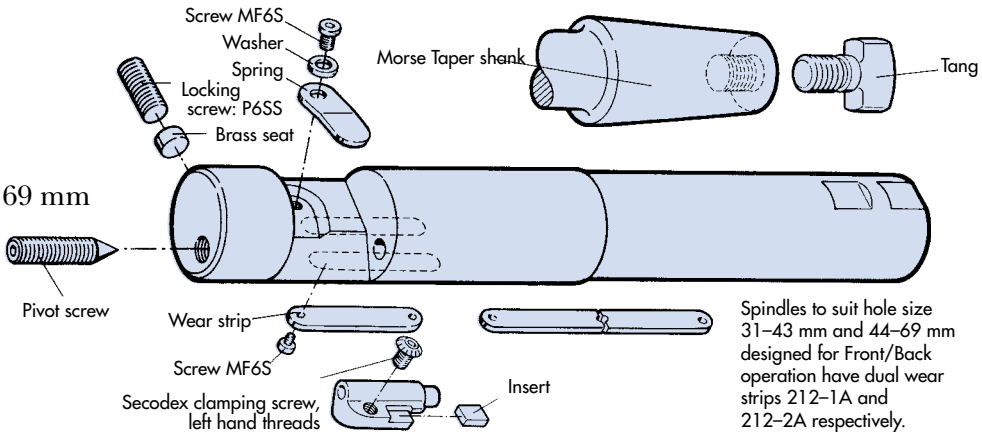
Hole dia ø	Pivot screw	Allen wrench	Locking screw	Allen wrench	Brass seat ø
4,5 - 6,5	211–1	0,89	M2x2,5	0,89	1,5
7 -9	–2	1,27	M2x2,5	0,89	1,5
10 -15,5	–3	2	M3x 4	1,5	2,2
16 -24	–4	3	M4x 5	2	3
25 -30	–5	5	M4x12	2	3

Hole dia ø	Tang
10-15,5	MK2
16-30	MK3

WING

Spotfacing and chamfering standard and semistandard wings		Clamping screw	Allen wrench
Standard	37 -041... -061	4-631	2,5
	37 -062... -102	5-639	3
	37 -111, -121	6-635	4
Semi-standard	37 -040 -0930... -060-1000	4-631	2,5
	37 -060 -1125... -100-1400	5-639	3
	37 -110 -1450... -120-2370	6-635	4
Cham-fering 45°	34 -063	5-639	3
	34 -121	6-635	4
Cham-fering 60°	34 -063 -60	5-639	3
	34 -121 -60	6-635	4
Cham-fering 30°	34 -061 -30	4-631	2,5
	34 -102 -30	5-639	3

HOLE SIZE ø 31 – ø 69 mm



Spindles to suit hole size 31–43 mm and 44–69 mm designed for Front/Back operation have dual wear strips 212–1A and 212–2A respectively.

SPINDLE

Hole dia ø	Pivot screw	Allen wrench	Locking screw	Allen wrench	Brass seat ø
31-35	211–6	5	M5x12	2,5	4
36-43	–7	6	M5x12	2,5	4
44-53	–8	8	M5x12	2,5	4
54-69	–8	8	M5x12	2,5	4

Hole dia ø	Spring	Washer	Screw for spring	Allen wrench
31-35	213–1	214–1	M4x8	2,5
36-43	–2	–1	M4x8	2,5
44-53	–3	–2	M5x10	3
54-69	–4	–2	M5x10	3

Hole dia ø	Wear strip	Screw	Allen wrench	Tang
31-35	212–1	M4x8	2,5	MK4
36-43	–1	M4x8	2,5	MK4
44-53	–2	M5x10	3	MK5
54-69	–2	M5x10	3	MK5

WING

Spotfacing and chamfering standard and semistandard wings		Clamping screw	Allen wrench
Standard	37 -131, -132	6-635	4
	37 -141, -142	6-645	4
	37 -151, -152, -162	8-649	5
Semi-standard	37 -130 -1500	5-639	3
	37 -130 -1750... -130-2700	6-635	4
	37 -140 -1750... -140-3350	6-645	4
	37 -150 -2150... -160-4450	8-649	5
	37 -160 -4550... -160-5250	2X8-649	5
Cham-fering 45°	34 -132	6-635	4
	34 -142	6-645	4
	34 -150, -160	8-649	5
Cham-fering 60°	34 -132 -60	6-635	4
	34 -142 -60	6-645	4
	34 -150 -60, -160-60	8-649	5
Cham-fering 30°	34 -130 -30	6-635	4
	34 -140 -30	6-645	4
	34 -150 -30, -160-30	8-649	5

The Erix Automatic Back Spotfacer was invented in the early 70's by an employee at Eriksbergs Mekaniska Verkstad in Gothenburg – one of the most famous shipyards in the world at that time.

Huge diesel engines for ship propulsion were manufactured in the machine shop. Several parts needed back spotfacing, which was difficult and time consuming using traditional methods. This new back spotfacing tool substantially improved the operation.

The production and marketing of this tool was handed over to a newly founded separate company in 1977. The name – with reference and reverence to the shipyard – was ERIX TOOL AB.

Since this time the automatic back spotfacer is sold worldwide. More than 30 representatives in most industrialized countries distribute the tool to manufacturers of very different kinds of products – from tiny camera parts to large nuclear powered machinery.

Other examples include: engines, turbines, pumps, valves, printing machines, road building machinery, farming equipment and both hand-operated and numerically controlled machine tools, just to mention some.

Sooner or later nearly every metal working industry will find the use of the Erix Automatic Back Spotfacer as an ideal solution. Whether it is a simple or a complicated operation, whether using a small hand-operated machine, or an enormous machine tool equipped for untended production, or even an automatic multi-spindle set-up the Erix Automatic Back Spotfacer will save you time and money.

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