Carbide Grade Selection

Choose the Carmex grade specifically formulated for your application from the following list:

Coated Grades

Grade	Description
BLU• (M10-M20) (K05-K20) (N10-N20) (S10-S20)	PVD triple layer coated sub-micron grade for stainless steels, cast iron, titanium, non ferrous metals and most of the high temperature alloys.
BMA (P20-P40) (K20-K30)	PVD TiALN coated sub-micrograin grade for stainless steels and exotic materials at medium to high cutting speeds.
P25C (P15-P35)	PVD TiN coated grade for treated and hard alloy steels (25 HRc & up) at medium to low cutting speeds.
MXC (K10-K20) (P10-P25)	PVD TiN coated micrograin for free cutting untreated alloy steels (below 30 HRc), for stainless steels and cast iron.
BXC•• (P30-P50) (K25-K40)	PVD TiN coated grade for low cutting speed. Works well with wide range of stainless steels.

Uncoated Grades

Grade	Description
P30* (P20-P30)	Carbide grade for carbon and cast steels, works well at medium to low cutting speeds.
K20* (K10-K30)	Carbide grade for non ferrous metals, aluminum and cast iron.

Note: Due to our unique and specialized production techniques, Carmex coated inserts provide superior cutting performance and exceptionally long tool life.

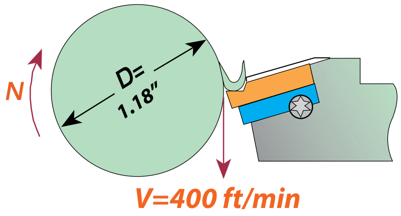
Recommended cutting speed (ft/min) for thread turning inserts

ISO Standard	Material		Condition	BLU	BMA	P25C	MXC	BXC	K20	P30
P	Non-Alloy Steel and Cast Steel, Free Cutting Steel	<0.25%C	Annealed	361-689	394-590	328-590	328-590	230-492		164-426
		≥0.25%C	Annealed							
		< 0.55%C	Quenched & Tempered							
		≥0.55%C	Annealed							
			Quenched & Tempered							
	Low Alloy Steel and Cast Steel (less than 5% alloying elements)		Annealed	295-459	262-426	230-394	230-394	197-295		164-262
			Quenched & Tempered							
	High Alloy Steel, Cast Steel, and Tool Steel		Annealed	230-295	197-262	164-197	180-230	164-197		131-164
			Quenched & Tempered							
M	Stainless Steel and Cast Steel		Ferritic/Martensitic	328-525	295-426	197-295	197-295	164-262	164-262	
			Martensitic							
			Austenitic							
K	Cast Iron Nodular (GGG)		Ferritic/Pearlitic	394-492	328-426		262-361	197-295		
			Pearlitic							
	Grey Cast Iron (GG)		Ferritic	459-492	394-426		295-328	213-297		
			Pearlitic							
	Malleable Cast Iron		Ferritic	361-459	328-426		262-328	197-279		
			Pearlitic							
N	Aluminum-Wrought Alloy		Not Cureable	2296-3280			1968-2624	1476-1968	1964-2624	1148-1640
			Cured							
	Aluminum-Cast, Alloyed	<=12% Si	Not Cureable	918-2460			565-1804	492-1148	656-1804	361-984
			Cured							
		>12% Si	High Temperature							
	Copper Alloys	>1% Pb	Free Cutting	623-1148			492-820	361-590	492-820	295-492
			Brass							
			Electrolytic Copper							
	Non Metallic		Duroplastics, Fiber Plastics				656-984	492-689	328-656	361-492
			Hard Rubber							
S	High Temp. Alloys, Super Alloys	Fe based	Annealed	98-213	82-197					
			Cured							
		Ni or Co based	Annealed							
			Cured							
			Cast							
	Titanium Alloys		Alpha+Beta Alloys Cured	131-164	115-148				115-148	
H	Hardened Steel		Hardened 45-50 HRc	131-164	115-148					
			Hardened 51-55 HRc							
			Hardened 56-62 HRc							
	Chilled Cast Iron		Cast	98-131	82-115					
	Cast Iron		Hardened	66-98	49-82					

- • Available for size 16 mm inserts only
- * Upon request
- •• For miniature and ultra miniature insert

Conversion of Cutting Speed to Rotational Speed

Conversion of a selected cutting speed to rotational speed is calculated by the following formula:



Example

$$N = \frac{V \times 12}{\pi \times D} = \frac{400 \times 12}{3.14 \times 1.18} = 1294 \text{ RPM}$$

Number of passes and depth of cut per pass for multitooth insert

	Pitch mm / TPI	Insert Size		No. of Teeth	Ordering Code	No. of Passes	Depth of Cut per pass			
		L (mm)	I.C.				1	2	3	4
ISO External	1.00	16	3/8	3	16 ER 1.0 ISO 3M	2	.015	.010		
	1.50	16	3/8	2	16 ER 1.5 ISO 2M	3	.017	.012	.008	
	1.50	22	1/2	3	22 ER 1.5 ISO 3M	2	.022	.015		
	2.00	22	1/2	2	22 ER 2.0 ISO 2M	3	.022	.016	.011	
	2.00	22	1/2	3	22 ER 2.0 ISO 3M	2	.030	.019		
	3.00	27	5/8	2	27 ER 3.0 ISO 2M	4	.023	.020	.017	.013
ISO Internal	1.00	16	3/8	3	16 IR 1.0 ISO 3M	2	.013	.010		
	1.50	16	3/8	2	16 IR 1.5 ISO 2M	3	.015	.011	.008	
	1.50	22	1/2	3	22 IR 1.5 ISO 3M	2	.020	.015		
	2.00	22	1/2	2	22 IR 2.0 ISO 2M	3	.020	.014	.010	
	2.00	22	1/2	3	22 IR 2.0 ISO 3M	2	.028	.018		
	3.00	27	5/8	2	27 IR 3.0 ISO 2M	4	.023	.018	.015	.012
UN External	16	16	3/8	2	16 ER 16 UN 2M	3	.017	.012	.009	
	16	22	1/2	3	22 ER 16 UN 3M	2	.023	.015		
	12	22	1/2	2	22 ER 12 UN 2M	3	.023	.017	.012	
	12	22	1/2	3	22 ER 12 UN 3M	2	.031	.020		
	8	27	5/8	2	27 ER 8 UN 2M	4	.024	.021	.018	.014
UN Internal	16	16	3/8	2	16 IR 16 UN 2M	3	.017	.011	.009	
	16	22	1/2	3	22 IR 16 UN 3M	2	.022	.015		
	12	22	1/2	2	22 IR 12 UN 2M	3	.021	.015	.012	
	12	22	1/2	3	22 IR 12 UN 3M	2	.029	.019		
	8	27	5/8	2	27 IR 8 UN 2M	4	.025	.020	.016	.012
Whitworth 55° External	14	16	3/8	2	16 ER 14 W 2M	3	.020	.015	.011	
	14	22	1/2	3	22 ER 14 W 3M	2	.028	.030		
	11	22	1/2	2	22 ER 11 W 2M	3	.026	.019	.013	
Whitworth 55° Internal	14	16	3/8	2	16 IR 14 W 2M	3	.020	.015	.011	
	14	22	1/2	3	22 IR 14 W 3M	2	.028	.018		
	11	22	1/2	2	22 IR 11 W 2M	2	.026	.019	.013	
NPT External	14	16	3/8	2	16 ER 14 NPT 2M	3	.021	.018	.017	
	11.5	22	1/2	2	22 ER 11.5 NPT 2M	4	.019	.019	.017	.013
	11.5	27	5/8	3	27 ER 11.5 NPT 3M	4	.020	.019	.017	.012
	8	27	5/8	2	27 ER 8 NPT 2M	4	.029	.026	.024	.021
NPT Internal	14	16	3/8	2	16 IR 14 NPT 2M	3	.021	.018	.017	
	11.5	22	1/2	2	22 IR 11.5 NPT 2M	4	.019	.019	.017	.013
	11.5	27	5/8	3	27 IR 11.5 NPT 3M	4	.020	.019	.017	.012
	8	27	5/8	2	27 IR 8 NPT 2M	4	.029	.026	.024	.021
API Round External	10	22	1/2	2	22 ER 10 APIRD 2M	3	.024	.020	.012	
	10	27	5/8	3	27 ER 10 APIRD 3M	2	.039	.016		
	8	27	5/8	2	27 ER 8 APIRD 2M	3	.031	.024	.016	
API Round Internal	10	22	1/2	2	22 IR 10 APIRD 2M	3	.024	.020	.012	
	10	27	5/8	3	27 IR 10 APIRD 3M	2	.039	.016		
	8	27	5/8	2	27 IR 8 APIRD 2M	3	.031	.024	.016	

Number of threading passes selection for single point inserts

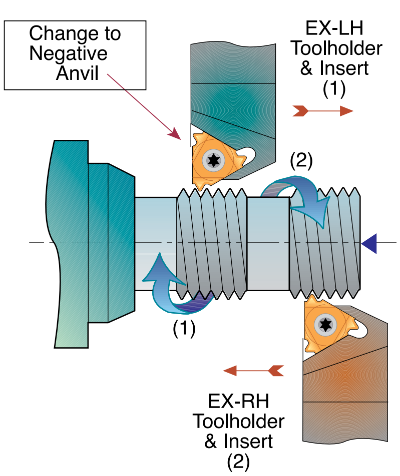
Pitch: mm TPI	0.5 48	0.8 32	1.0 24	1.25 20	1.5 16	1.75 14	2.0 12	2.5 10	3.0 8	4.0 6	6.0 4
Number of Passes	3-6	4-7	4-9	6-10	5-11	9-12	6-13	7-15	8-17	10-20	11-22

NOTES:

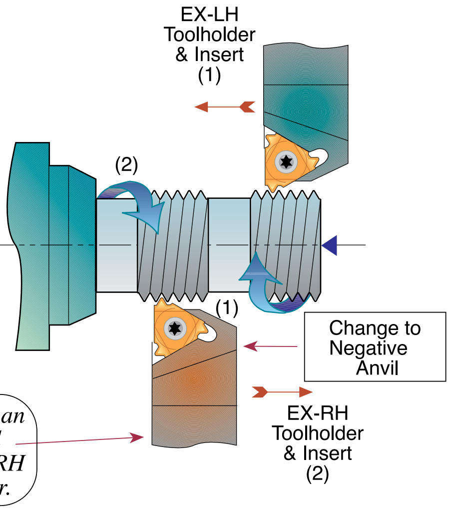
1. For most standard applications the middle of the range is a good starting point.
2. For most materials, the tougher the material, the higher the number of cutting passes you should select.
3. As a general rule of thumb, Fewer passes are better than more speed.

Thread Turning Methods

EX-RH Thread



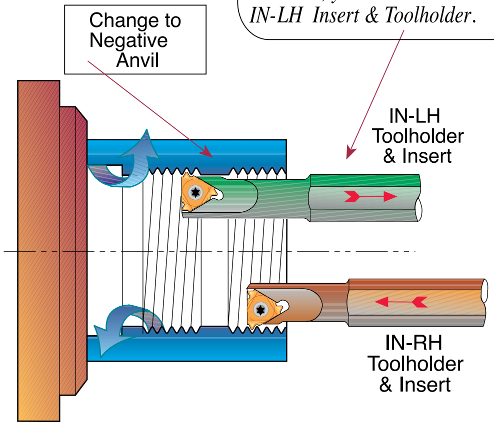
EX-LH Thread



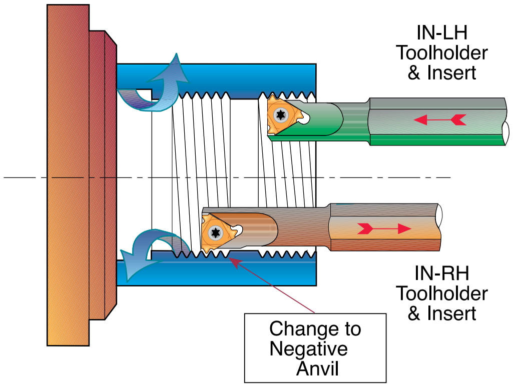
If you want to turn an EX-LH Thread and you only have EX-RH Insert & Toolholder.

IN-RH Thread

If you want to turn an IN-RH Thread but you prefer to pull the metal chips while Thread Turning outwards, you should use an IN-LH Insert & Toolholder.

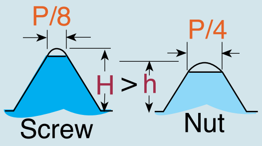


IN-LH Thread

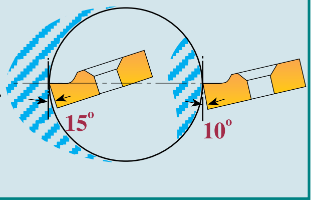


Important Points about Carmex Threading Inserts

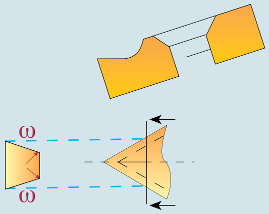
1. In most thread forms internal and external threads have different depth and radii, thus tools are not interchangeable



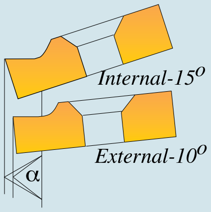
2. The Insert relief angle of a standard Carmex external toolholder is 10º; for an internal toolholder it is 15º. This 5º difference is to provide additional necessary radial clearance.



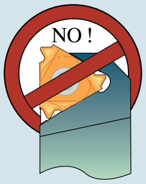
3. Our built-in relief angles ensure automatic insert flank angle clearance.



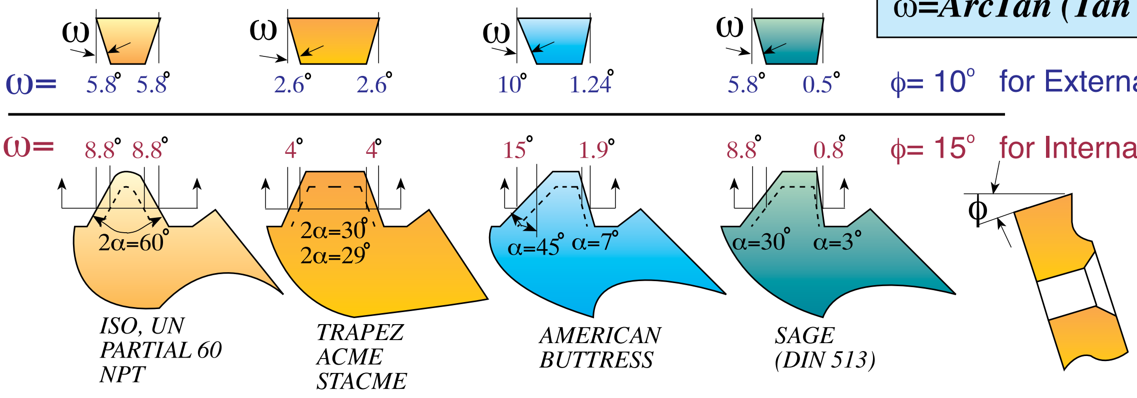
4. Profiles of Carmex internal & external threading inserts are precision ground to ensure accurate thread geometry when used in their corresponding toolholders. Using internal inserts with an external holder will result in distortion of angle and insert geometry.



5. Insert and toolholder should always match. An IN-RH insert must be used with an IN-RH toolholder. No mismatch is allowed.



Flank Clearance Angle ω



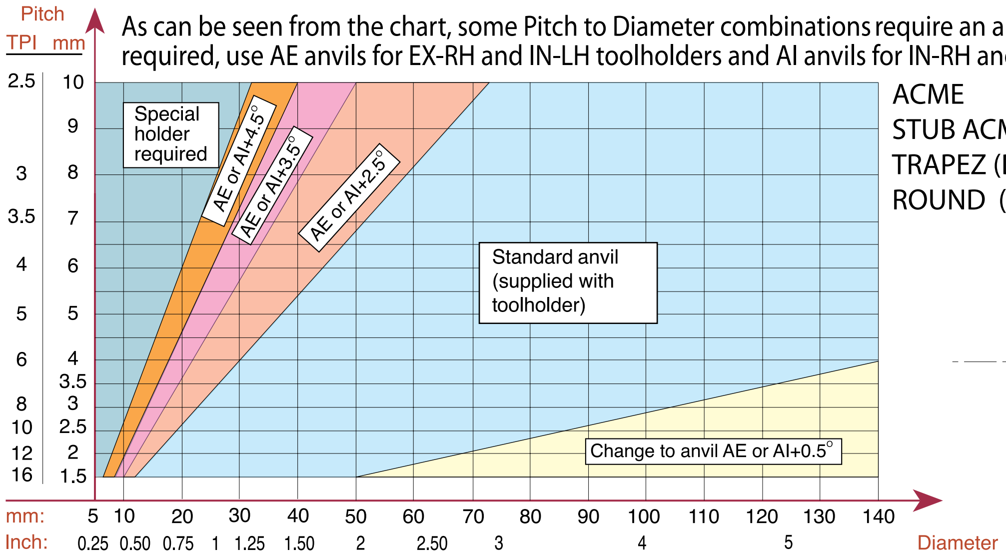
$\omega = \mathrm{ArcTan}\ (\mathrm{Tan}\ \alpha \times \mathrm{Tan}\ \phi)$

$\phi = 10^\circ$ for External toolholders

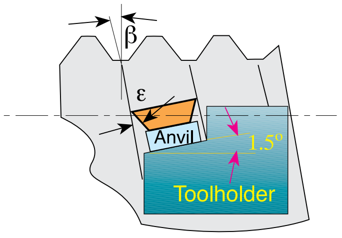
$\phi = 15^\circ$ for Internal toolholders

Anvil Change Recommendation

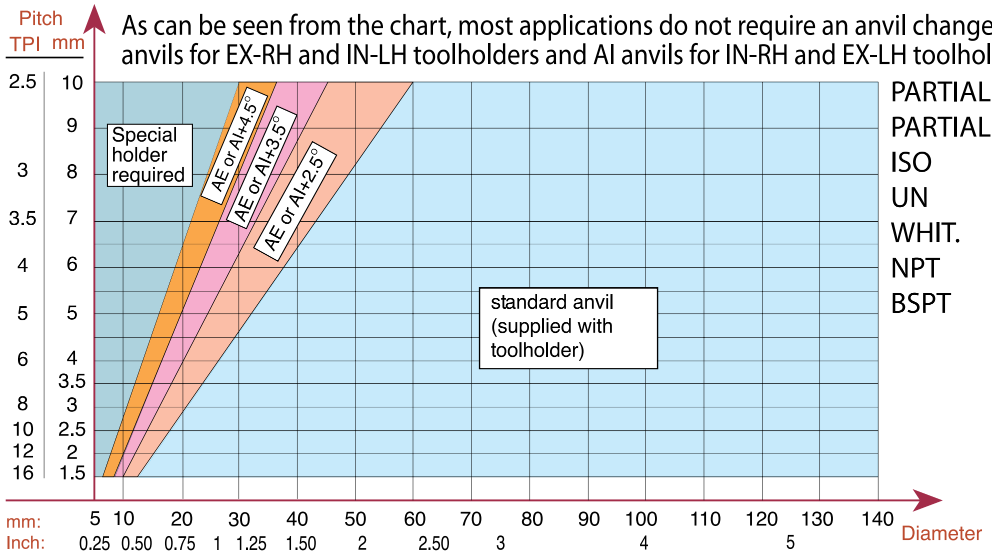
As can be seen from the chart, some Pitch to Diameter combinations require an anvil change. If change is required, use AE anvils for EX-RH and IN-LH toolholders and AI anvils for IN-RH and EX-LH toolholders.



ACME
STUB ACME
TRAPEZ (DIN 103)
ROUND (DIN 405)

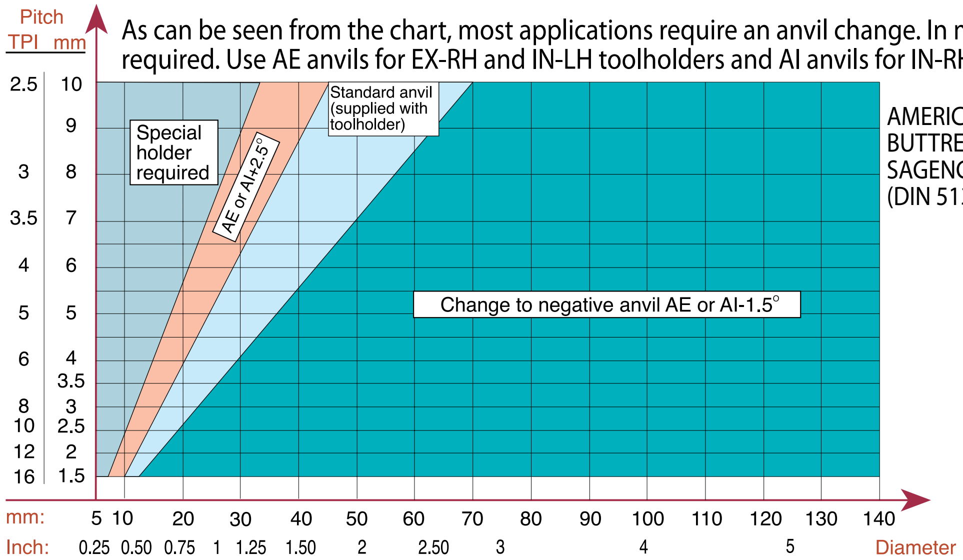


As can be seen from the chart, most applications do not require an anvil change. If change is required, use AE anvils for EX-RH and IN-LH toolholders and AI anvils for IN-RH and EX-LH toolholders.

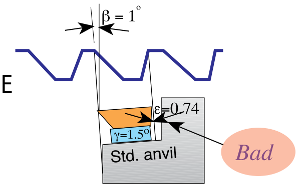


PARTIAL PROFILE 60°
PARTIAL PROFILE 55°
ISO
UN
WHIT.
NPT
BSPT

As can be seen from the chart, most applications require an anvil change. In most cases a negative anvil is required. Use AE anvils for EX-RH and IN-LH toolholders and AI anvils for IN-RH and EX-LH toolholders.

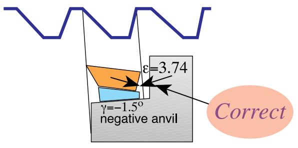


AMERICAN
BUTTRESS
SAGENGEWINDE
(DIN 513)



Before Anvil change

Replacing the standard anvil with an anvil with negative angle, will eliminate side rubbing



After Anvil Change

Thread Turning - Step by Step

Step 1 : Choose Thread Turning Method
Step 2 : Choose Insert
Step 3 : Choose Toolholder
Step 4 : Choose Insert Grade
Step 5 : Choose Thread Turning Speed
Step 6 : Choose Number of Threading Passes

In most cases the above mentioned 6 steps would be the steps needed to ensure a good thread. When cutting more complicated threads such as TRAPEZ, ACME, BUTTRESS or SAGE, it is advisable to check the effect of the thread "HELIX ANGLE" β on the "RESULTANT FLANK CLEARANCE" ε. If ε is smaller than 2°, an anvil change is required.

Step 7 : Find Thread Helix Angle
Step 8 : Choose Correct Anvil

EXAMPLES:

Example No. 1:

Step 1: Choose Thread Turning Method
from page 58, we chose **EX - RH Insert & Toolholder**

Step 2: Choose Insert from page 13: **16 ER 16 UN**

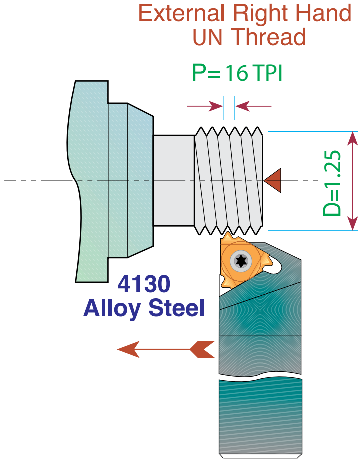
Step 3: Choose Toolholder from page 39: **SER 0750 K16**

Step 4: Choose Insert Grade from selection on page 56
Our choice for Alloy Steel is Grade **P25C**

Step 5: Choose Thread Turning Speed from chart on page 56,
we chose **330 ft/min**

Rotational Speed calculation: $N = \frac{330 \times 12}{\pi \times 1.25} = 1008$ rpm

Step 6: Choose Number of Threading passes
from table on page 57, we chose **8 passes**



Example No. 2:

Step 1: Choose Thread Turning Method from page 58
Usually, an IN-RH Toolholder and Insert will be chosen, however, in this particular case we prefer to pull the metal chips while thread turning outward, thus we chose to work with **IN-LH Insert & Toolholder**

Step 2: Choose Insert from page 13: **16 IL 12 UN**

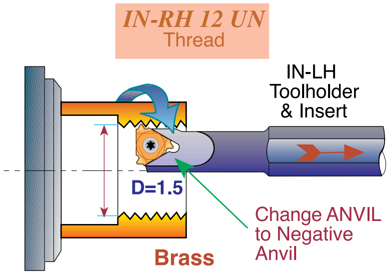
Step 3: Choose Toolholder from page 41: **SIL 1000 R16**
Note: since we thread cut IN-RH thread outward with an IN-LH tool, do not forget to replace the standard anvil (supplied with the holder) with a negative anvil **AE16-1.5**

Step 4: Choose Insert Grade from selection on page 56
Our choice for Brass is Grade **K20**

Step 5: Choose Thread Turning Speed from chart on page 56,
we chose **450 ft/min**

Rotational Speed calculation: $N = \frac{450 \times 12}{\pi \times 1.5} = 1146$ RPM

Step 6: Choose Number of Threading passes from table
on page 57, we chose **9 passes**



Example No. 3:

Step 1: Choose Thread Turning Method from page 58
We chose EX-RH Insert & Toolholder.

Step 2: Choose Insert from page 31: **16 ER 12 ABUT**

Step 3: Choose Toolholder from page 39: **SER 1000 M16**

Step 4: Choose Insert Grade from selection on page 56
Our choice for Stainless Steel is Grade **BMA**

Step 5: Choose Thread Turning Speed from chart on page 57
We chose 360 ft/min.
Rotational Speed calculation: $N = \frac{360 \times 12}{\pi \times 1.5} = 917$ RPM

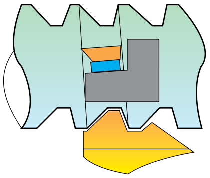
Step 6: Choose Number of Threading passes
from table on page 56. We chose **13 passes**

Step 7: Find Thread Helix Angle: on page 47
for Pitch of 12 TPI and 40 Diameter
Helix Angle as shown in the chart is 1°

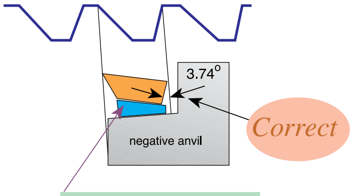
Step 8: Choose correct Anvil: As can be seen
from the chart on page 60, for AMERICAN
BUTTRESS Thread, for 12 TPI and 40 Diameter
a negative anvil **AE16-1.5** should replace the
standard anvil supplied with the toolholder

EX-RH. AMERICAN BUTTRESS
12 TPI on 1.5" diameter.

Stainless Steel 304



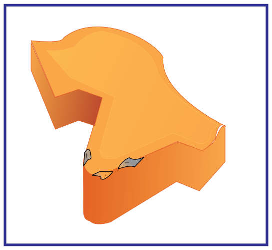
Replacing the standard anvil with an anvil with negative angle, will eliminate side rubbing



Anvil chosen: AE16-1.5

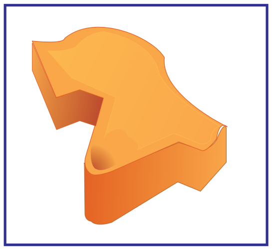
Troubleshooting

Chipping



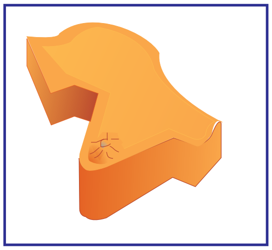
1. Use a tougher carbide grade
2. Eliminate tool overhang
3. Check if insert is correcting clamped
4. Eliminate vibration

Crater Wear



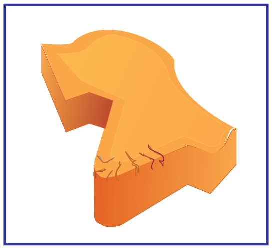
1. Reduce cutting speed
2. Apply coolant fluid
3. Use a harder carbide grade

Build-up Edge



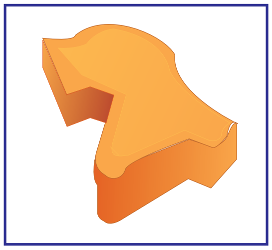
1. Increase cutting speed
2. Use a tougher carbide grade

Thermal Cracking



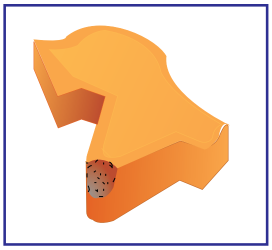
1. Reduce cutting speed
2. Apply coolant fluid
3. Use a tougher carbide grade

Deformation



1. Use a harder carbide grade
2. Reduce cutting speed
3. Reduce depth of cut
4. Apply coolant fluid

Fracture



1. Use a tougher carbide grade
2. Reduce depth of cut
3. Index insert sooner
4. Check machine and tool stability