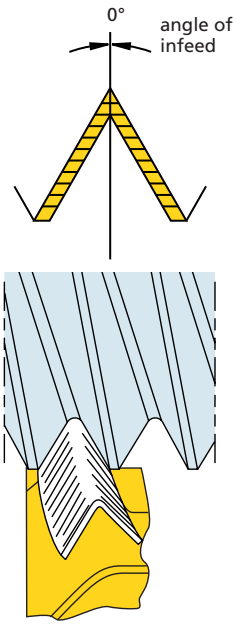
Infeed Angle

radial



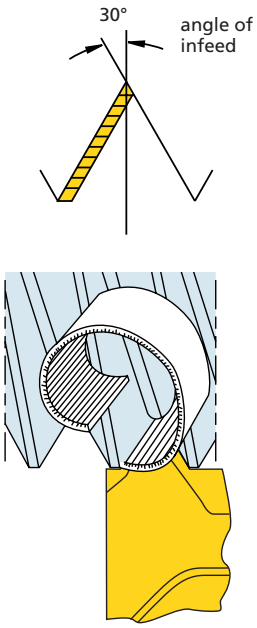
advantage –

- Cutting on both sides of the thread form places all of the cutting edge in the cut and protects edge from chipping.

disadvantage –

- Tool develops a channel chip that may be difficult to handle.
- Tip chipping occurs when cutting high-tensile materials.
- Burr condition is increased.
- Entire cutting edge is engaged at finish of thread, causing increased tendency to chatter.

flank



advantage –

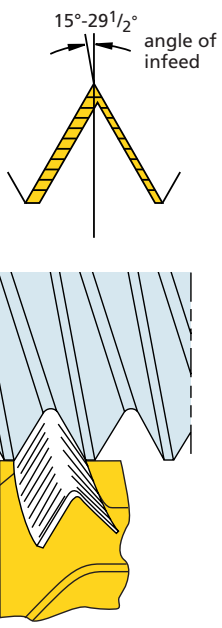
- Cutting with the leading edge of the threading tool gives the chip a definite flow out of the thread form area. This reduces the burr problem on the trailing edge of the tool. To avoid bad surface finish, chipping, or excessive flank wear due to rubbing of the trailing edge, the infeed angle should be 3° to 5° smaller than the angle of the thread. This is a type of modified flank.

disadvantage –

- Trailing edge of threading insert may drag or rub, and tends to chip.
- Torn or poor surface finish threads result when cutting soft, gummy materials like low-carbon steels, aluminum, and stainless steels.

preferred methods

modified flank



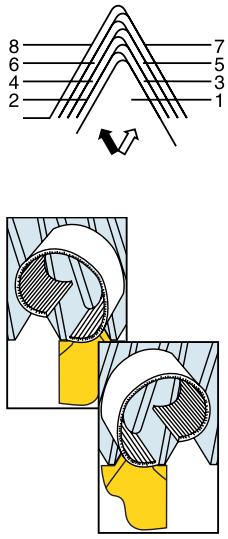
advantage –

- Tool cuts both sides of thread form and, therefore, is protected from chipping similar to 0° infeed. Channel-type chip develops but uneven chip thickness helps remove the chip similar to flank infeed.
- This is the preferred method, especially when used with a chip control insert.

disadvantage –

- Similar disadvantages as with 0° infeed, although reduced somewhat in magnitude as cutting forces are better equalized and chip flow is much less of a problem.

alternating flank



advantage –

- Increased tool life because both edges are used equally. NOTE: Some machine tools may require special programming techniques to achieve this method of infeed.

disadvantage –

- Difficult to cut on conventional machinery.

Machining Guidelines When Using Chip Control Inserts

Kennametal insert technology brings chip control to your Top Notch and laydown threading operations. The specially-designed geometries effectively break the chip in most applications. Our positive rake design lowers cutting pressures, which in turn lowers damaging heat generation. The result is better tool life. Long, stringy chips no longer mar the workpiece surface finish. The danger to operators when removing long chips from the workpiece and chuck is eliminated. All of these benefits combine to improve the productivity of your threading operations.

Machine Programming

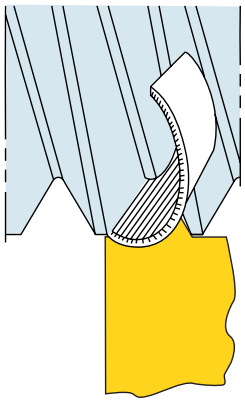
Modern CNC controls allow the programmer to easily adjust infeed angle, the number of passes, and depth of cut for each pass.

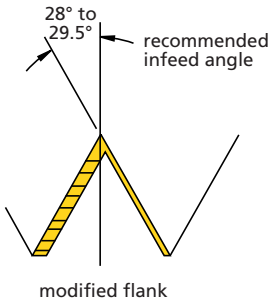
The chip-control threading insert performs best at an infeed angle of 28° to 29.5°, although 20° to 30° is acceptable. Also, it is important to maintain a minimum of .005 inch (0,13 mm) depth of cut on every pass. For more consistent chip control, it is recommended that a constant value between .005 inch - .010 inch (0,13 mm - 0,25 mm) be used.

The Last Pass

Some CNC controls require the last pass to be at a 0° infeed angle. The chip will not break on the last pass at a 0° infeed angle. On most carbon and alloy steels, the last pass can remain at .005 inch (0,13 mm) depth of cut and produce an acceptable finish. For some materials, a .001 inch - .003 inch (0,02 mm - 0,08 mm) spring pass may be used to improve surface finish, however, chipbreaking action may be compromised.

Infeed Angle

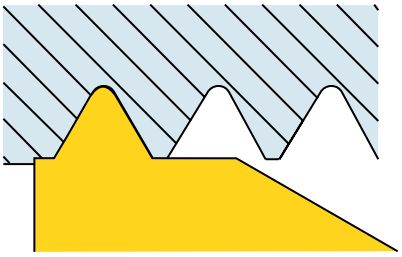




In order to effectively and consistently break the chip, it is important to use an infeed angle between 28° and 29.5°. Do not apply chip-control inserts at infeed angles less than 20°.

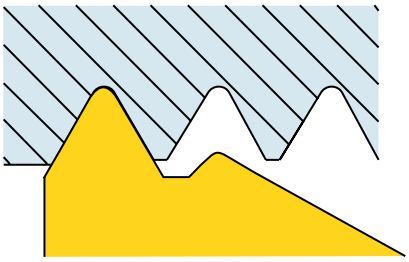
Full vs. Partial Profile – Available for Both TOP NOTCH and LT Insert Styles

full profile



- Thread dimensions are according to established standards.
- High thread concentricity is obtained since the major and minor diameters are machined concurrently.
- Machining costs are reduced since the final threading pass machines the crest exactly, eliminating the need for an extra operation or deburring.

partial profile



- The same insert can be used for various pitches, within a defined range.
- Provides flexibility for non-standard thread forms.

Formulas

	to find	given	formula
inch	sfm	D (inch) rpm	$sfm = \frac{\pi \times D}{12"} \times rpm$
	rpm	D (inch) sfm	$rpm = \frac{sfm \times 12"}{D \times \pi}$
metric	m/min	D (mm) rpm	$m/min = \frac{\pi \times D}{1000} \times rpm$
	rpm	D (mm) m/min	$rpm = \frac{m/min \times 1000}{D \times \pi}$

legend
sfm = surface feet per minute
m/min = meters per minute
rpm = revolutions per minute
D = part diameter
π = 3.1416

maximum cutting speeds

Maximum cutting speed is often limited by the maximum travel speed (ipm or mm/min) of the tool allowed by the machine. Check your maximum speed with the following formulas.

inch formula: maximum cutting speed (sfm) = part diameter (inch) x 3.14 x tpi x $\frac{\text{max ipm (inch/min.)}}{12"}$

metric formula: maximum cutting speed (m/min.) = part diameter (mm) x 3.14 x (1/pitch) x $\frac{\text{max mm/min.}}{1000\ mm}$

Recommendation for Threading Infeed Passes

TPI	48-32	28-24	20-16	14-12	11.5 -9	8-6	5-4	3-2
metric pitch (mm)	0,50-0,75	0,80-1,0	1,25-1,5	1,75-2,0	2,5-3,0	3,5-4,0	4,5-6,0	8,0
Thread Type	recommended number of passes							
common V-thread forms ISO, UN, UNJ, NPT, Whitworth, BSPT, API Rotary Shoulder	4-5	5-6	6-8	8-10	9-12	12-15	14-16	15-25
Acme, Trapez, Round, API Round	-	-	5-6	7-8	10-11	12-13	13-15	18-20
Stub Acme, API Buttress	-	-	5	5-6	7-8	8-10	10-12	14-16
American Buttress	-	-	7-8	9-10	11-12	13-15	17-19	22-24

Maintain minimum .002 inch (0,05 mm) infeed on last passes to avoid workhardening and excessive abrasion of the threading tool, for more detailed recommendations, see technical data on our website at www.kennametal.com

Constant Volume Infeed Values for Threading Operations

In most applications, use of CNC canned cycles produce only marginally successful results. This is the case as these programs do not satisfy the .002 inch (0,05 mm) minimum depth of cut specification recommended.

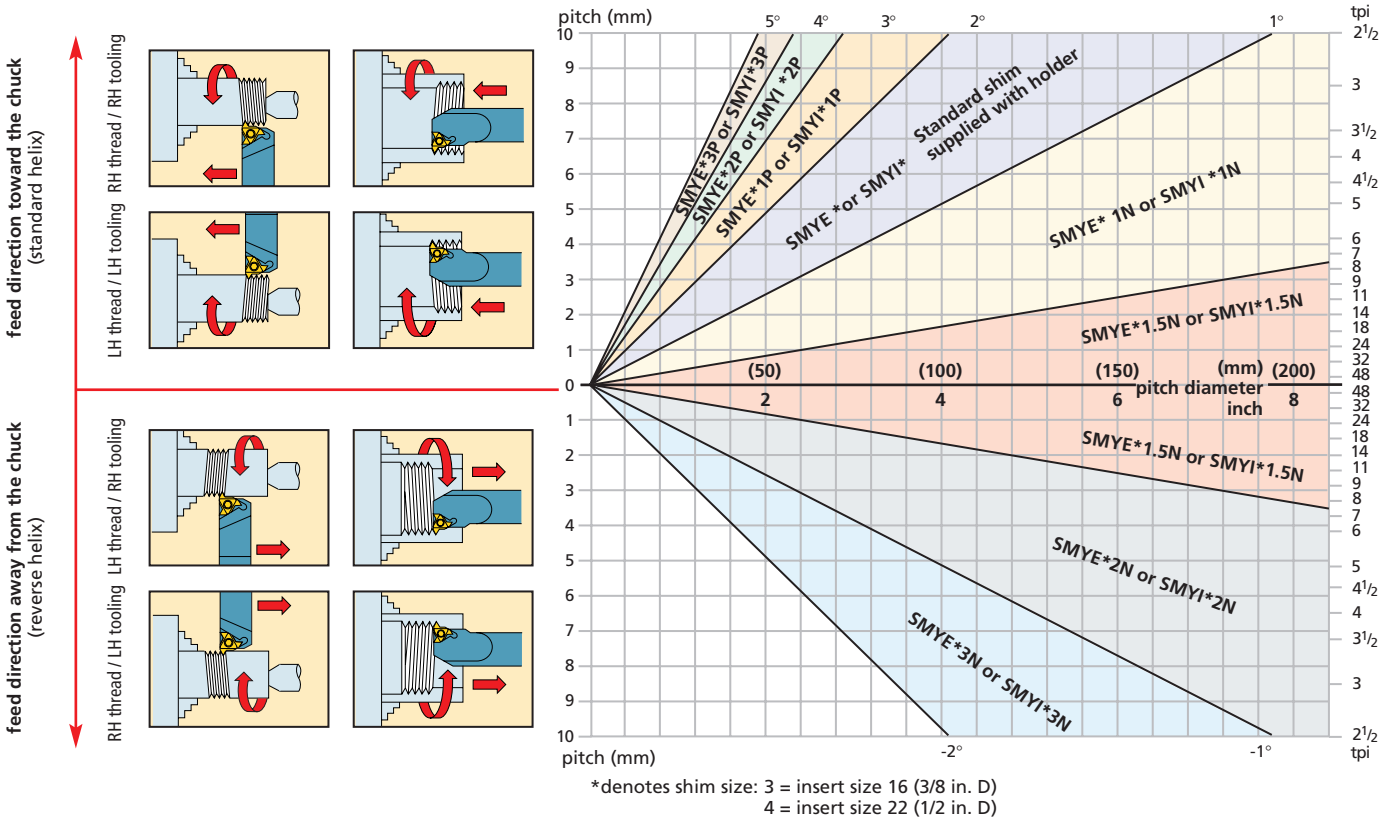
Example:

Infeed per pass formula: accumulated depth = initial doc x $\sqrt{\#\ pass}$
For example, an 8-pitch external thread has a depth of .0789 inch. Twenty-five percent of .0789 = approximately .0197 inch (This is the infeed /doc for the first pass.)

.0197 x $\sqrt{2}$ = .0278
.0278 - .0197 = .0082 (This is the infeed/doc for the second pass.)

.0197 x $\sqrt{3}$ = .0341
.0341 - .0278 = .0063 (This is the infeed/doc for the third pass.)

.0197 x $\sqrt{4}$ = .0394
.0394 - .0341 = .0053 (This is the infeed/doc for the fourth pass.)



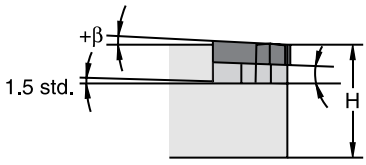
*denotes shim size: 3 = insert size 16 (3/8 in. D)
4 = insert size 22 (1/2 in. D)

NOTE: For multi-start threads, use the lead value instead of the pitch.

Helix Methods

standard helix method:

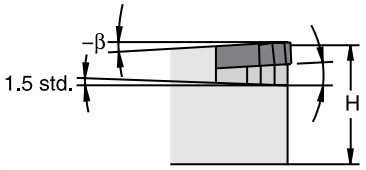
Used when RH thread is cut with RH tool, or LH thread with LH tool.



reverse helix method:

Used when RH thread is cut with LH tool, or when LH thread is cut with RH tool.

Dimension "H" is constant at every shim and insert combination. All toolholders are supplied with 1.5° lead angle.

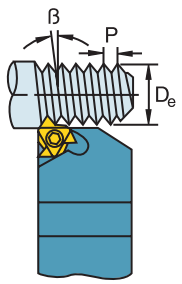


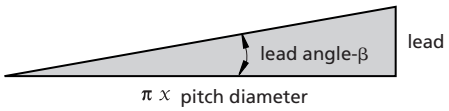
Selection of Shims – LT System
Diagram of Thread Lead Angles

To calculate the lead angle of a given thread, use this formula:

$$\beta = \text{Arctan} \frac{P \times S}{\pi D_e}$$

ß = thread lead angle
D_e = effective pitch diameter of thread (where P = 1/tpi for inch dimensions)
tpi = threads per inch
S = number of starts (= #1 for standard thread)
P = pitch
multiple-start, lead = P x S





Slanted Shim Kit

insert size	shim size (D)	ordering code	contains slanted shims
16	3/8"	ABY3	SM-YE4-2P,1P,1N,2N,3N SM-YI4-2P,1P,1N,2N,3N
22	1/2"	ABY4	SM-YE4-2P,1P,1N,2N,3N SM-YI4-2P,1P,1N,2N,3N

Since you might occasionally need different shims other than those supplied with our standard toolholders, we strongly recommend that shim kits be readily available in every tool shop.

Technical Data

LT Shim Selection Table – Inch

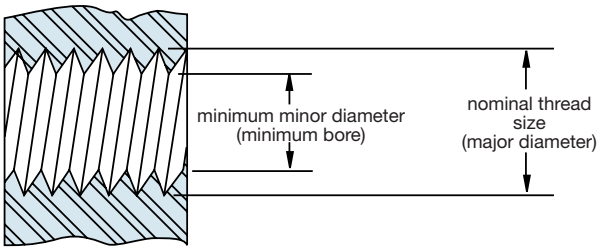
Insert Size	toolholder		Shim Ordering Code							
	external	internal				standard				
LT-16 (3/8")	RH	LH	SM-YE3-3P	SM-YE3-2P	SM-YE3-1P	SM-YE3	SM-YE3-1N	SM-YE3-1.5N	SM-YE3-2N	SM-YE3-3N
	LH	RH	SM-YI3-3P	SM-YI3-2P	SM-YI3-1P	SM-YI3	SM-YI3-1N	SM-YE3-1.5N	SM-YI3-2N	SM-YI3-3N
LT-22 (1/2")	RH	LH	SM-YE4-3P	SM-YE4-2P	SM-YE4-1P	SM-YE4	SM-YE4-1N	SM-YE4-1.5N	SM-YE4-2N	SM-YE4-3N
	LH	RH	SM-YI4-3P	SM-YI4-2P	SM-YI4-1P	SM-YI4	SM-YI4-1N	SM-YI4-1.5N	SM-YI4-2N	SM-YI4-3N
TPI		Pitch (mm)	Pitch Diameter (inch)							
72						.12 - .31	.32 - .84	>.84	.84 - .32	.31 - .12
		0,35				.12 - .30	.31 - .84	>.84	.84 - .31	.30 - .12
64						.14 - .35	.36 - .95	>.95	.95 - .36	.35 - .14
		0,40				.14 - .35	.36 - .96	>.96	.96 - .36	.35 - .14
56		0,45				.16 - .40	.41 - 1.09	>1.09	1.09 - .41	.40 - .16
		0,50			.11 - .16	.17 - .44	.45 - 1.20	>1.20	1.20 - .45	.44 - .17
48					.12 - .17	.18 - .46	.47 - 1.27	>1.27	1.27 - .47	.46 - .18
44					.13 - .19	.20 - .51	.52 - 1.38	>1.38	1.38 - .52	.51 - .20
		0,60		.10 - .12	.13 - .20	.21 - .53	.54 - 1.44	>1.44	1.44 - .54	.53 - .21
40				.11 - .13	.14 - .21	.22 - .56	.57 - 1.52	>1.52	1.52 - .57	.56 - .22
		0,70		.12 - .15	.16 - .23	.24 - .62	.63 - 1.68	>1.68	1.68 - .63	.62 - .24
36				.12 - .15	.16 - .23	.24 - .62	.63 - 1.69	>1.69	1.69 - .63	.62 - .24
		0,75	.11 - .12	.13 - .16	.17 - .25	.26 - .66	.67 - 1.80	>1.80	1.80 - .67	.66 - .26
32			.12 - .13	.14 - .17	.18 - .26	.27 - .70	.71 - 1.90	>1.90	1.90 - .71	.70 - .27
		0,80	.12 - .13	.14 - .17	.18 - .26	.27 - .71	.72 - 1.91	>1.91	1.91 - .72	.71 - .27
28			.14 - .14	.15 - .19	.20 - .30	.31 - .80	.81 - 2.17	>2.17	2.17 - .81	.80 - .31
27			.14 - .15	.16 - .20	.21 - .31	.32 - .83	.84 - 2.25	>2.25	2.25 - .84	.83 - .32
		1,00	.15 - .16	.17 - .21	.22 - .33	.34 - .89	.90 - 2.39	>2.39	2.39 - .90	.89 - .34
24			.16 - .17	.18 - .23	.24 - .35	.36 - .94	.95 - 2.53	>2.53	2.53 - .95	.94 - .36
		1,25	.19 - .20	.21 - .27	.28 - .42	.43 - 1.11	1.12 - 2.99	>2.99	2.99 - 1.12	1.11 - .43
20			.19 - .21	.22 - .27	.28 - .42	.43 - 1.13	1.14 - 3.04	>3.04	3.04 - 1.14	1.13 - .43
18			.21 - .23	.24 - .31	.32 - .47	.48 - 1.26	1.27 - 3.38	>3.38	3.38 - 1.27	1.26 - .48
		1,50	.22 - .25	.26 - .33	.34 - .50	.51 - 1.34	1.35 - 3.59	>3.59	3.59 - 1.35	1.34 - .51
16			.24 - .26	.27 - .35	.36 - .53	.54 - 1.41	1.42 - 3.80	>3.80	3.80 - 1.42	1.41 - .54
		1,75	.26 - .29	.30 - .38	.39 - .59	.60 - 1.56	1.57 - 4.19	>4.19	4.19 - 1.57	1.56 - .60
14			.27 - .30	.31 - .40	.41 - .61	.62 - 1.62	1.63 - 4.34	>4.34	4.34 - 1.63	1.62 - .62
13			.29 - .32	.33 - .43	.44 - .66	.67 - 1.74	1.75 - 4.68	>4.68	4.68 - 1.75	1.74 - .67
		2,00	.30 - .33	.34 - .44	.45 - .67	.68 - 1.78	1.79 - 4.79	>4.79	4.79 - 1.79	1.78 - .68
12			.32 - .35	.36 - .46	.47 - .71	.72 - 1.89	1.90 - 5.07	>5.07	5.07 - 1.90	1.89 - .72
11.5			.33 - .37	.38 - .49	.50 - .74	.75 - 1.97	1.98 - 5.29	>5.29	5.29 - 1.98	1.97 - .75
11			.34 - .38	.39 - .51	.52 - .78	.79 - 2.06	2.07 - 5.53	>5.53	5.53 - 2.07	2.06 - .79
		2,50	.37 - .42	.43 - .55	.56 - .84	.85 - 2.23	2.24 - 5.98	>5.98	5.98 - 2.24	2.23 - .85
10			.38 - .42	.43 - .56	.57 - .86	.87 - 2.27	2.28 - 6.08	>6.08	6.08 - 2.28	2.27 - .87
9			.42 - .47	.48 - .62	.63 - .95	.96 - 2.52	2.53 - 6.75	>6.75	6.75 - 2.53	2.52 - .96
		3,00	.45 - .50	.51 - .66	.67 - 1.02	1.03 - 2.68	2.69 - 7.18	>7.18	7.18 - 2.69	2.68 - 1.03
8			.47 - .53	.54 - .70	.71 - 1.08	1.09 - 2.84	2.85 - 7.60	>7.60	7.60 - 2.85	2.84 - 1.09
		3,50	.52 - .59	.60 - .77	.78 - 1.19	1.20 - 3.13	3.14 - 8.38	>8.38	8.38 - 3.14	3.13 - 1.20
7			.54 - .61	.62 - .80	.81 - 1.23	1.24 - 3.25	3.26 - 8.68	>8.68	8.68 - 3.26	3.25 - 1.24
		4,00	.60 - .67	.68 - .89	.90 - 1.36	1.37 - 3.58	3.59 - 9.57	>9.57	9.57 - 3.59	3.58 - 1.37
6			.63 - .71	.72 - .94	.95 - 1.44	1.45 - 3.79	3.80 - 10.13	>10.13	10.13 - 3.80	3.79 - 1.45
		5,00	.75 - .84	.85 - 1.11	1.12 - 1.70	1.71 - 4.48	4.49 - 11.97	>11.97	11.97 - 4.49	4.48 - 1.71
5			.76 - .86	.87 - 1.13	1.14 - 1.73	1.74 - 4.55	4.56 - 12.16	>12.16	12.16 - 4.56	4.55 - 1.74
4.5			.84 - .95	.96 - 1.26	1.27 - 1.92	1.93 - 5.06	5.07 - 13.51	>13.51	13.51 - 5.07	5.06 - 1.93
		6,00	.90 - 1.01	1.02 - 1.33	1.34 - 2.04	2.05 - 5.37	5.38 - 14.36	>14.36	14.36 - 5.38	5.37 - 2.05
4			.95 - 1.07	1.08 - 1.41	1.42 - 2.16	2.17 - 5.69	5.70 - 15.20	>15.20	15.20 - 5.70	5.69 - 2.17
Inclination Angle			4.5	3.5	2.5	1.5	.5	0	-.5	-1.5
feed direction			standard helix (feed toward the chuck)						reverse helix (feed away from the chuck)	

1. Select TPI or pitch from the left-hand columns.
2. Follow row to specified pitch diameter and the correct feed direction.
3. Follow the column to the top for the required shim based on the toolholder and insert size.

Insert Size	toolholder		Shim Ordering Code (metric mm)							
	external	internal				standard				
LT-16 (3/8")	RH	LH	SM-YE3-3P	SM-YE3-2P	SM-YE3-1P	SM-YE3	SM-YE3-1N	SM-YE3-1.5N	SM-YE3-2N	SM-YE3-3N
	LH	RH	SM-YI3-3P	SM-YI3-2P	SM-YI3-1P	SM-YI3	SM-YI3-1N	SM-YI3-1.5N	SM-YI3-2N	SM-YI3-3N
LT-22 (1/2")	RH	LH	SM-YE4-3P	SM-YE4-2P	SM-YE4-1P	SM-YE4	SM-YE4-1N	SM-YE4-1.5N	SM-YE4-2N	SM-YE4-3N
	LH	RH	SM-YI4-3P	SM-YI4-2P	SM-YI4-1P	SM-YI4	SM-YI4-1N	SM-YI4-1.5N	SM-YI4-2N	SM-YI4-3N
TPI		Pitch (mm)	Pitch Diameter (mm)							
72						3,1 - 8	8 - 21,4	> 21,4	21,4 - 8	8 - 3,1
		0,35				3 - 8	8 - 21,3	> 21,3	21,3 - 8	8 - 3
64						3,4 - 9	9 - 24,1	> 24,1	24,1 - 9	9 - 3,4
		0,40				3,5 - 9,1	9,1 - 24,3	> 24,3	24,3 - 9,1	9,1 - 3,5
56		0,45				3,9 - 10,3	10,3 - 27,6	> 27,6	27,6 - 10,3	10,3 - 3,9
		0,50			2,8 - 4,3	4,3 - 11,4	11,4 - 30,4	> 30,4	30,4 - 11,4	11,4 - 4,3
48					3 - 4,6	4,6 - 12,1	12,1 - 32,2	> 32,2	32,2 - 12,1	12,1 - 4,6
44					3,3 - 5	5 - 13,2	13,2 - 35,1	> 35,1	35,1 - 13,2	13,2 - 5
		0,60		2,6 - 3,4	3,4 - 5,2	5,2 - 13,7	13,7 - 36,5	> 36,5	36,5 - 13,7	13,7 - 5,2
40				2,8 - 3,6	3,6 - 5,5	5,5 - 14,5	14,5 - 38,6	> 38,6	38,6 - 14,5	14,5 - 5,5
		0,70		3 - 4	4 - 6,1	6,1 - 16	16 - 42,6	> 42,6	42,6 - 16	16 - 6,1
36				3,1 - 4	4 - 6,1	6,1 - 16,1	16,1 - 42,9	> 42,9	42,9 - 16,1	16,1 - 6,1
		0,75	2,8 - 3,2	3,3 - 4,3	4,3 - 6,5	6,5 - 17,1	17,1 - 45,6	> 45,6	45,6 - 17,1	17,1 - 6,5
32			3 - 3,4	3,4 - 4,5	4,5 - 6,9	6,9 - 18,1	18,1 - 48,3	> 48,3	48,3 - 18,1	18,1 - 6,9
		0,80	3 - 3,5	3,5 - 4,6	4,6 - 6,9	6,9 - 18,2	18,2 - 48,6	> 48,6	48,6 - 18,2	18,2 - 6,9
28			3,4 - 3,9	3,9 - 5,2	5,2 - 7,9	7,9 - 20,7	20,7 - 55,1	> 55,1	55,1 - 20,7	20,7 - 7,9
27			3,6 - 4,1	4,1 - 5,4	5,4 - 8,2	8,2 - 21,4	21,4 - 57,2	> 57,2	57,2 - 21,4	21,4 - 8,2
		1,00	3,8 - 4,3	4,3 - 5,7	5,7 - 8,7	8,7 - 22,8	22,8 - 60,8	> 60,8	60,8 - 22,8	22,8 - 8,7
24			4 - 4,6	4,6 - 6	6 - 9,2	9,2 - 24,1	24,1 - 64,3	> 64,3	64,3 - 24,1	24,1 - 9,2
		1,25	4,7 - 5,4	5,4 - 7,1	7,1 - 10,8	10,9 - 28,5	28,5 - 76	> 76	76 - 28,5	28,5 - 10,8
20			4,8 - 5,5	5,5 - 7,2	7,2 - 11	11 - 28,9	29 - 77,2	> 77,2	77,2 - 28,9	29 - 11
18			5,3 - 6,1	6,1 - 8	8 - 12,2	12,2 - 32,2	32,2 - 85,8	> 85,8	85,8 - 32,2	32,2- 12,2
		1,50	5,7 - 6,5	6,5 - 8,5	8,5 - 13	13 - 34,2	34.2 - 91.2	> 91,2	91,2 - 34,2	34,2 - 13
16			6 - 6,9	6,9 - 9	9 - 13,8	13,8 - 36,2	36,2 - 96,5	> 96,5	96,5 - 36,2	36,2 - 13,8
		1,75	6,6 - 7,6	7,6 - 10	10 - 15,2	15,2 - 39,9	39,9 - 106,4	> 106,4	106,4 - 39,9	39,9 - 15,2
14			6,9 - 7,9	7,9 - 10,3	10,3 - 15,7	15,7 - 41,4	41,4 - 110,3	> 110,3	110,3 - 41,4	41,4 - 15,7
13			7,4 - 8,5	8,5 - 11,1	11,1 - 17	17 - 44,5	44,5 - 118,8	> 118,8	118,8 - 44,5	44,5 - 17
		2,00	7,6 - 8,7	8,7 - 11,4	11,4 - 17,4	17,4 - 45,6	45,6 - 121,6	> 121,6	121,6 - 45,6	45,6 - 17,4
12			8 - 9,2	9,2 - 12	12,1 - 18,4	18,4 - 48,2	48,3 - 128,7	> 128,7	128,7 - 48,2	48,3 - 18,4
11.5			8,4 - 9,6	9,6 - 12,6	12,6 - 19,2	19,2 - 50,3	50,3 - 134,3	> 134,3	134,3 - 50,3	50,3 - 19,2
11			8,8 - 10	10 - 13,1	13,1 - 20	20 - 52,6	52,6 - 140,4	> 140,4	140,4 - 52,6	52,6 - 20
		2,50	9,5 - 10,8	10,8 - 14,2	14,2 - 21,7	21,7 - 57	57 - 152	> 152	152 - 57	57 - 21,7
10			9,6 - 11	11 - 14,5	14,5 - 22	22 - 57,9	57,9 - 154,4	> 154,4	154,4 - 57,9	57,9 - 22
9			10,7 - 12,2	12,2 - 16,1	16,1 - 24,5	24,5 - 64,3	64,3 - 171,6	> 171,6	171,6 - 64,3	64,3 - 24,5
		3,00	11,4 - 13	13 - 17,1	17,1 - 26	26 - 68,4	68,4 - 182,4	> 182,4	182,4 - 68,4	68,4 - 26
8			12 - 13,8	13,8 - 18,1	18,1 - 27,6	27,6 - 72,4	72,4 - 193	> 193	193 - 72,4	72,4 - 27,6
		3,50	13,3 - 15,2	15,2 - 19,9	19,9 - 30,4	30,4 - 79,8	79,8 - 212,8	> 212,8	212,8 - 79,8	79,8 - 30,4
7			13,8 - 15,7	15,7 - 20,7	20,7 - 31,5	31,5 - 82,7	82,7 - 220,6	> 220,6	220,6 - 82,7	82,7 - 31,5
		4,00	15,2 - 17,3	17,3 - 22,8	22,8 - 34,7	34,7 - 91,2	91,2 - 243,2	> 243,2	243,2 - 91,2	91,2 - 34,7
6			16 - 18,3	18,3 - 24,1	24,1 - 36,7	36,7 - 96,5	96,5 - 257,4	> 257,4	257,4 - 96,5	96,5 - 36,7
		5,00	19 - 21,7	21,7 - 28,5	28,5 - 43,4	43,4 - 114	114 - 304	> 304	304 - 114	114 - 43,4
5			19,3 - 22	22 - 28,9	28,9 - 44,1	44,1 - 115,8	115,8 - 308,8	> 308,8	308,8 - 115,8	115,8 - 44,1
4.5			21,4 - 24,5	24,5 - 32,1	32,1 - 49	49 - 128,7	128,7 - 343,1	> 343,1	343,1 - 128,7	128,7 - 49
		6,00	22,7 - 26	26 - 34,2	34,2 - 52,1	52,1 - 136,8	136,8 - 364,8	> 364,8	364,8 - 136,8	136,8 - 52,1
4			24,1 - 27,5	27,5 - 36,2	36,2 - 55,1	55,1 - 144,8	144,8 - 386	> 386	386 - 144,8	144,8 - 55,1
Inclination Angle			4.5	3.5	2.5	1.5	.5	0	-.5	-1.5
feed direction			standard helix (feed toward the chuck)						reverse helix (feed away from the chuck)	

1. Select TPI or pitch from the left-hand columns.
2. Follow row to specified pitch diameter and the correct feed direction.
3. Follow the column to the top for the required shim based on the toolholder and insert size.

The following charts list the largest thread pitch that can be applied on internal applications using TOP NOTCH threading inserts for 60° V-threading and Acme threading. For Buttress threading, see pages C67-C68.



Inch-sized 60° V-Threading Limits

**internal threading limitations
NT-1, NT-2 V-threading inserts**

threads per inch	nominal thread size		minimum minor diameter (inch)	
	NT-2	NT-1	NT-2	NT-1
6	1 7/8	–	1.695	–
7	1 3/4	–	1.595	–
8	1 5/8	–	1.490	–
9	1 9/16	–	1.442	–
10	1 1/2	15/16	1.392	.830
11	1 7/16	15/16	1.339	.830
11 1/2	1 3/8	15/16	1.281	.830
12	1 3/8	9/16	1.285	.472
13	1 5/16	9/16	1.229	.472
14	1 1/4	9/16	1.173	.472
16	1 1/4	9/16	1.182	.472
18	1 1/8	9/16	1.065	.472
20	1 1/8	1/2	1.071	.440
24*	1 1/16	1/2	1.017	.440

*Twenty-four threads per inch and finer can be cut with an NT-2 insert provided the minor diameter is 1.000 inch or larger (.440 inch or larger with NT-1).

**internal threading limitations
NT-3 and 4 V-threading inserts**

threads per inch	nominal thread size	minimum minor diameter (inch)
4**	3	2.729
4 1/2**	2 7/8	2.634
5	2 3/4	2.534
6	2 1/2	2.320
7	2 1/4	2.095
8	2	1.865
9	1 15/16	1.817
10	1 7/8	1.767
11	1 13/16	1.714
11 1/2	1 3/4	1.656
12	1 3/4	1.660
13	1 5/8	1.542
14	1 9/16	1.485
16*	1 7/16	1.370

*Sixteen threads per inch and finer can be cut provided minor diameter is 1.370 inch or larger.
**NT-4 insert only.

Metric 60° V-Threading Limits

Internal threading limitations NT-1 and NT-2 60° V-threading

thread pitch (mm)	nominal thread size		minimum minor thread diameter (mm)	
	NT-2	NT-1	NT-2	NT-1
4,00	M48 x 4.00	-	43,67	-
3,00	M42 x 3.00	-	38,75	-
2,50	M39 x 2.50	M24 x 2,50	36,29	21,29
2,00	M33 x 2.00	M15 x 2,00	30,84	12,84
1,75	M32 x 1.75	M15 x 1,75	30,11	13,11
1,50	M32 x 1.50	M15 x 1,50	30,38	13,38
1,25	M29 x 1.29	M14 x 1,25	27,65	12,65
1,00*	M27 x 1.00	M14 x 1,00	25,92	12,92
0,75	M22 x 0.75	M12 x 0,75	21,19	11,19

*Thread pitch of 1 mm and less can be cut with an NT-2 insert provided the core thread diameter is 25 mm or larger (11 mm or larger with NT-1).

Internal threading limitations NT-3 and NT-4 60° V-threading

thread pitch (mm)	nominal thread size	minimum minor thread diameter (mm)
6,00**	M76 x 6.00	69,50
5,50**	M73 x 5.50	67,05
5,00	M70 x 5.00	64,59
4,00	M64 x 4.00	59,67
3,00	M52 x 3.00	48,75
2,50	M48 x 2.50	45,29
2,00	M42 x 2.00	39,84
1,75	M40 x 1.75	38,11
1,50*	M38 x 1.50	36,38

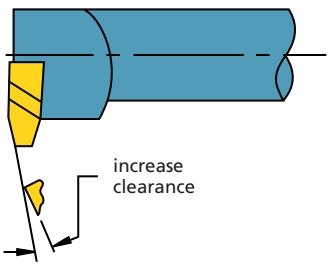
*Thread pitch of 1,5 mm and less can be cut provided core thread diameter is 35 mm or larger.
**NT-4-insert only.

Acme Threading Limits

**internal threading limitations
NA and NAS-2, 3, 4, and 6 Acme threading inserts**

threads per inch	nominal thread size	minimum minor diameter	
		inch	mm
2**	5	4.500	114,3
2 1/2**	4 1/2	4.100	104,1
3**	4	3.665	93,1
4	3 1/2	3.250	82,6
5	3	2.800	71,1
6	2 1/2	2.333	59,3
8	2 1/4	2.125	54,0
10	2	1.900	48,3
12	1 3/4	1.667	42,4
14	1 5/8	1.554	39,5
16*	1 1/2	1.438	36,5

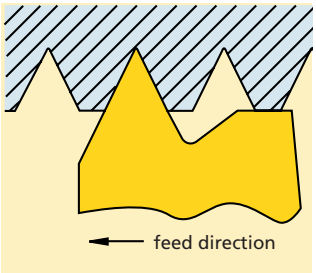
*Sixteen threads per inch and finer can be cut provided minor diameter is 1.438 inch (36,5 mm) or larger.
**NA-6 insert only.



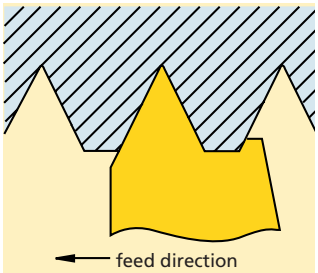
Additional secondary clearance can be ground on leading edge of insert to provide sufficient helical clearance for machining coarser threads and multiple start threads.

Modified standard inserts may be furnished for machining threads outside of the limits shown.

60° V-Thread Crest Turning Application Data



NTC crest turning insert for 12 threads per inch and finer (P ≤ 2,0 mm)



NTC crest turning insert for 11 threads per inch and coarser (P ≥ 3,0 mm)

NOTE: NTC inserts automatically control root to crest dimensions. Therefore, in setting up threading operations with NTC inserts, one need only check the OD or ID at the thread crest for correct dimensions.

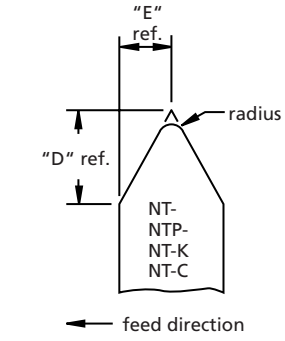
"J" thread note for catalog

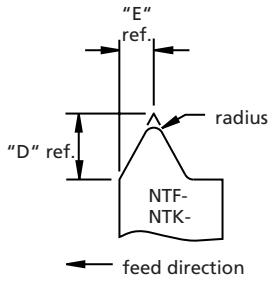
The controlled root radius thread form (MIL-S-8879A) is defined for the external thread only. To machine the corresponding internal thread, choose any insert that will cut a unified class 2B thread, then bore the minor diameter to size. Refer to MIL-S-8879A for the correct "J" thread minor diameter values.

Controlled Root Radius Specifications for UNJ Threads

insert catalog number	nose radius on insert (inch)	thread radius per MIL-S-8879A (inch)
NJ-3020R/L8 NJP-3020R/L8	.0188/.0198	.0188/.0226
NJ-3014R/L12 NJP-3014R/L12	.0125/.0135	.0125/.0150
NJ-3010R/L16 NJP-3010R/L16	.0094/.0104	.0094/.0113
NJF-3012R/L14 NJK-3012R/L14	.0107/.0117	.0107/.0129
NJF-3010R/L16 NJK-3010R/L16	.0094/.0104	.0094/.0113
NJF-3009R/L18 NJK-3009R/L18	.0083/.0093	.0083/.0100
NJF-3008R/L20 NJK-3008R/L20	.0075/.0085	.0075/.0090
NJF-3007R/L24 NJK-3007R/L24	.0063/.0073	.0063/.0075
NJF-3006R/L28 NJK-3006R/L28	.0054/.0064	.0054/.0064
NJF-3005R/L32 NJK-3005R/L32	.0047/.0056	.0047/.0056

60° V-Thread Application Data





insert description	insert	"D" ref.** (inch)	"E" ref.** (inch)	recommended threads per inch* (TPI)		recommended metric thread pitch (mm)	
				external	internal	external	internal
	NT-1	.075	.044	–	24 tpi to 12 tpi	–	1,00 to 2,00
	NT-2	.113	.075	36 tpi to 8 tpi	20 tpi to 7 tpi	0,70 to 3,00	1,25 to 3,50
	NT-2-K	.113	.075	36 tpi to 8 tpi	20 tpi to 7 tpi	0,70 to 3,00	1,25 to 3,50
	NTF-2	.062	.040	44 tpi to 14 tpi	24 tpi to 12 tpi	0,60 to 1,75	1,00 to 2,00
	NTK-2	.062	.040	44 tpi to 14 tpi	24 tpi to 12 tpi	0,60 to 1,75	1,00 to 2,00
	NTP-2	.113	.075	36 tpi to 8 tpi	20 tpi to 7 tpi	0,70 to 3,00	1,25 to 3,50
	NT-3	.148	.097	20 tpi to 6 tpi	12 tpi to 5 tpi	1,25 to 4,00	2,00 to 5,00
	NT-3-K	.148	.097	20 tpi to 6 tpi	12 tpi to 5 tpi	1,25 to 4,00	2,00 to 5,00
	NT-3-C	.148	.097	11 tpi to 6 tpi	6 tpi (only)	2,50 to 4,00	4,00 only
	NT-3-CK	.148	.097	11 tpi to 6 tpi	6 tpi (only)	2,50 to 4,00	4,00 only
	NTF-3	.083	.054	44 tpi to 10 tpi	24 tpi to 9 tpi	0,60 to 2,50	1,00 to 2,50
	NTK-3	.083	.054	44 tpi to 10 tpi	24 tpi to 9 tpi	0,60 to 2,50	1,00 to 2,50
	NTP-3	.148	.097	20 tpi to 6 tpi	12 tpi to 5 tpi	1,25 to 4,00	2,00 to 5,00
	NT-4	.196	.127	20 tpi to 4 tpi	12 tpi to 4 tpi	1,25 to 6,25	2,00 to 6,25
	NT-4-K	.196	.127	20 tpi to 4 tpi	12 tpi to 4 tpi	1,25 to 6,25	2,00 to 6,25
	NT-4-C	.196	.127	11 tpi to 4 1/2 tpi	6 tpi to 4 1/2 tpi	2,50 to 5,50	4,00 to 5,50
	NT-4-CK	.196	.127	11 tpi to 4 1/2 tpi	6 tpi to 4 1/2 tpi	2,50 to 5,50	4,00 to 5,50
	NTF-4	.083	.054	44 tpi to 10 tpi	24 tpi to 9 tpi	0,60 to 2,50	1,00 to 2,50
	NTK-4	.083	.054	44 tpi to 10 tpi	24 tpi to 9 tpi	0,60 to 2,50	1,00 to 2,50
	NTP-4	.196	.127	20 tpi to 4 tpi	12 tpi to 4 tpi	1,25 to 6,25	2,00 to 6,25

*Based on maximum insert radius size and class 2A and 2B thread specifications.
**For metric D and E dimensions, multiply by 25.4

API Thread Form for the LT and TOP NOTCH Threading Systems

API Thread Forms
Insert Application Chart for API Rotary Shouldered Connections

thread form	Kennametal insert		tool joint application	minimum box size*
	cresting	non-cresting		
V-.038R 2" tpf 4 tpi	NDC-4038R/L2 LT22-E/NR4API382	ND-3038R/L	2-3/8 API internal flush 2-7/8 API internal flush 3-1/2 API internal flush 4 API internal flush 4-1/2 API internal flush 5-1/2 API internal flush 6-5/8 API internal flush 4 API full hole API #23 API #26 API #31 API #35 API #38 API #40 API #44 API #46 API #50	API #31 2-7/8 IF
V-.038R 3" tpf 4 tpi	NDC-4038R/L3 LT22-E/NR4API383	ND-3038R/L	API #56 API #61 API #70 API #77	API #56
V-.050 2" tpf 4 tpi	NDC-4050R/L2 LT22-E/NR4API502	ND-4050R/L	5-1/2 API full hole 6-5/8 API regular 6-5/8 API full hole	5-1/2 API full hole
V-.050 3" tpf 4 tpi	NDC-4050R/L3 LT22-E/NR4API503	ND-4050R/L	5-1/2 API regular 7-5/8 API regular 8-5/8 API regular	5-1/2 API regular
V-.040 3" tpf 5 tpi	NDC-3040R/L3 NDC-4040R/L3 LT22-E/NR5API403	ND-3040R/L ND-4040R/L	2-3/8 API regular 2-7/8 API regular 3-1/2 API regular 4-1/2 API regular	3-1/2 API regular

*Minimum box size that can be threaded with a standard Top Notch insert due to minimum bore requirement.

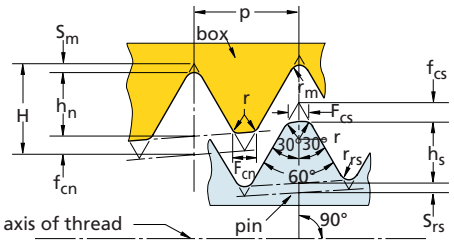
API Thread Forms
Product Thread Dimensions – Rotary Shouldered Connections (inch)

thread form	taper in. per ft.	thread height, not truncated H	thread height, truncated $h_n = h_s$	root truncation $S_m = S_{rs}$ $f_m = f_{rs}$	crest truncation $f_{cn} = f_{cs}$	width of flat		root radius $r_m = r_{rs}$	radius at thread corners r	pitch p
						crest $f_{cn} = f_{cs}$	crest $f_m = f_{rs}$			
V-.038R	2	.216005	.121844	.038000	.056161	.065	—	.038	.015	.250
V-.038R	3	.215379	.121381	.038000	.055998	.065	—	.038	.015	
V-.040	3	.172303	.117842	.020000	.034461	.040	—	.020	.015	.200
V-.050	3	.215379	.147303	.025000	.043076	.050	—	.025	.015	.250
V-.050	2	.216005	.147804	.025000	.043201	.050	—	.025	.015	

all dimensions in inches

V-.040 and V-.050 Product Thread Form

taper shown exaggerated

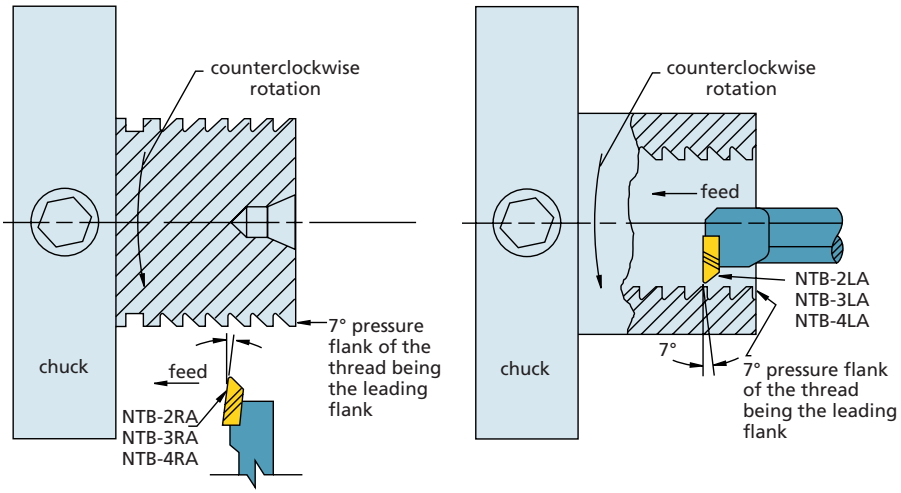


Casing and Tubing Round Thread (Height Dimensions)

thread element		10 threads per inch p = .1000	8 threads per inch p = .1250
H	= .866p	.08660	.10825
$H_s = h_n$	= .626p – .007	.05560	.07125
$S_{rs} = S_m$	= .120p + .002	.01400	.01700
$S_{cs} = S_{cn}$	= .120p + .005	.01700	.02000

American Buttress Application Guidelines for the TOP NOTCH Threading System

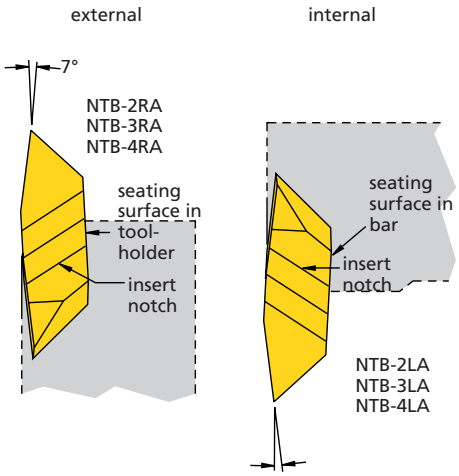
American Buttress (7° Pressure Flank Leading) NTB-A Inserts - PUSH-type



external Buttress
7° pressure flank leading

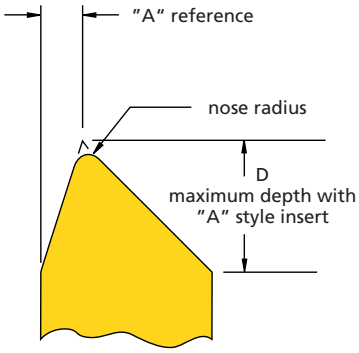
internal Buttress
7° pressure flank leading

Insert versus Toolholder Orientation



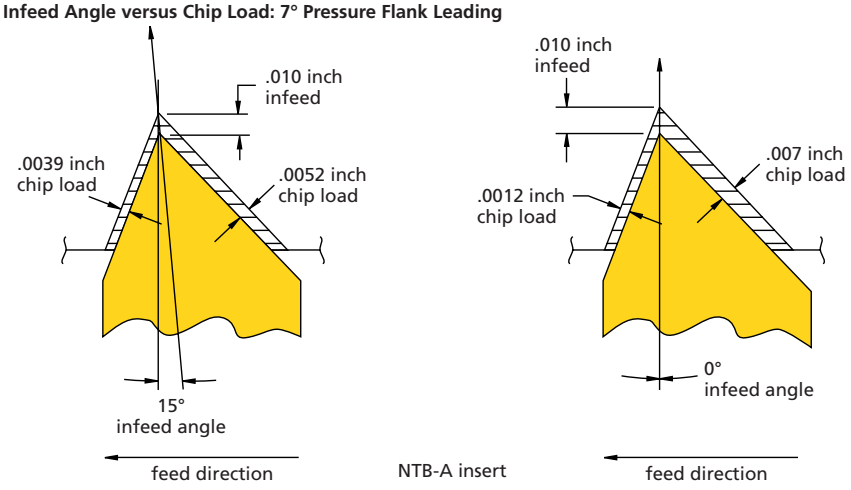
7° pressure flank leading

Reference Dimensions



insert	D (inch)	"A" ref. (inch)	nose radius (inch)	pitch based on maximum radius
NTB-2A	.133	.024	.002-.004	16-20 tpi
NTB-3A	.171	.031	.005-.008	8-16 tpi
NTB-4A	.218	.049	.008-.012	4-6 tpi

Infeed Angle versus Chip Load: 7° Pressure Flank Leading



NOTE: For balanced chip load, 15° infeed angle is suggested.

Internal Threading Limitations

internal threading limitations
NTB-2A Buttress threading inserts

threads per inch	nominal thread size	minimum minor diameter (inch)
8	1 3/4	1.600
10	1 5/8	1.505
12	1 1/2	1.400
16	1 1/4	1.175
20	1 1/16	1.002

internal threading limitations
NTB-3 and 4A Buttress threading inserts

threads per inch	nominal thread size	minimum minor diameter (inch)
4*	2 1/2	2.200
5	2 1/4	2.010
6	2	1.800
8	1 3/4	1.600
10	1 5/8	1.505
12**	1 1/2	1.400

*NTB-4A insert only
**16 or 20 threads per inch can be cut provided minor diameter is 1.375 inch or larger.

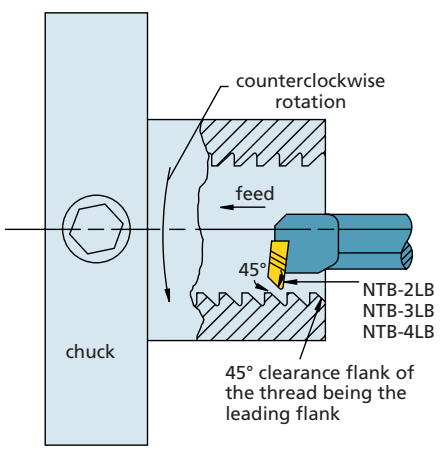
Threads Per Inch versus Maximum Root Radius Chart (inch)

threads per inch	20	16	12	10	8	6	5	4	3	2 1/2	2	1 1/2	1 1/4	1
maximum root radius	.0036	.0045	.0059	.0071	.0089	.0119	.0143	.0179	.0238	.0286	.0357	.0476	.0572	.0714

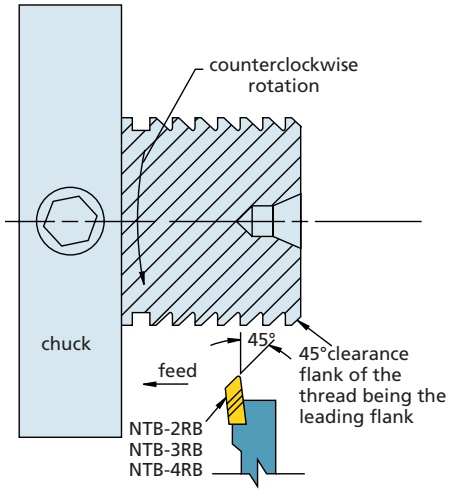
NOTE: Special Buttress forms are available upon request.

American Buttress Application Guidelines for the TOP NOTCH System

American Buttress (45° Clearance Flank Leading): NTB-B Inserts - PULL-type

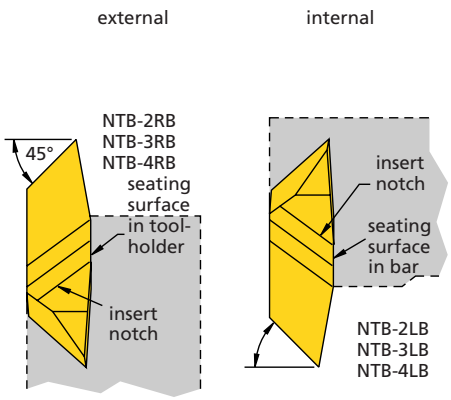


internal Buttress
45° clearance flank leading



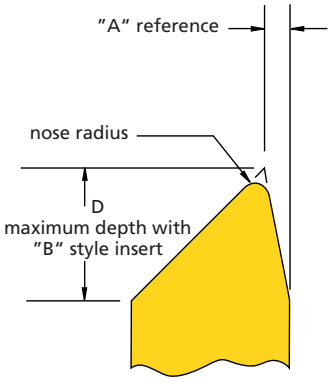
external Buttress
45° clearance flank leading

Insert versus Toolholder Orientation



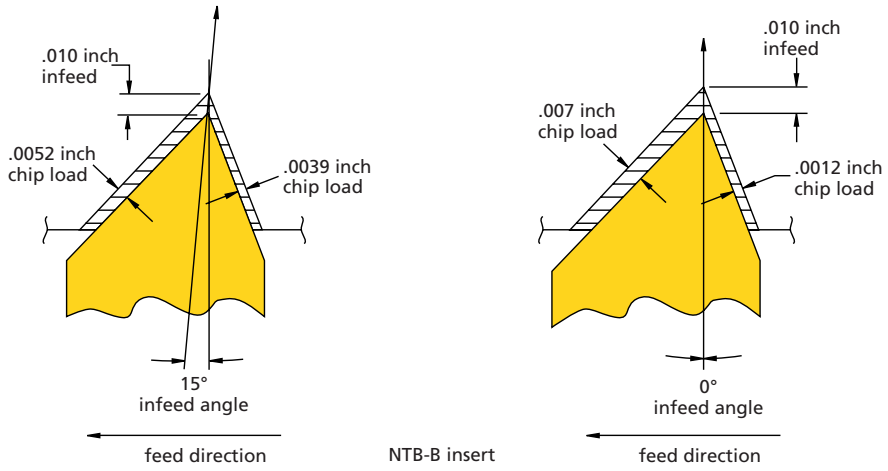
45° clearance flank leading

Reference Dimensions



insert	D (inch)	"A" ref. (inch)	nose radius (inch)	pitch based on maximum radius
NTB-2B	.133	.024	.002-.004	16-20 tpi
NTB-3B	.171	.031	.005-.008	8-16 tpi
NTB-4B	.218	.049	.008-.012	4-6 tpi

Infeed Angle versus Chip Load: 45° Clearance Flank Leading



NOTE: For balanced chip load, a reverse 15° infeed angle is suggested.

Internal Threading Limitations

internal threading limitations
NTB-2B Buttress threading insert

threads per inch	nominal thread size	minimum minor diameter (inch)
8	1 3/4	1.600
10	1 5/8	1.505
12	1 1/2	1.400
16	1 1/4	1.175
20	1 1/16	1.002

internal threading limitations
NTB-3 and 4B Buttress threading insert

threads per inch	nominal thread size	minimum minor diameter (inch)
4*	2 7/8	2.575
5	2 3/4	2.510
6	2 3/8	2.175
8	2 1/8	1.975
10	1 7/8	1.755
12	1 5/8	1.525
16	1 1/2	1.407
20	1 7/16	1.378

*NTB-4B insert only