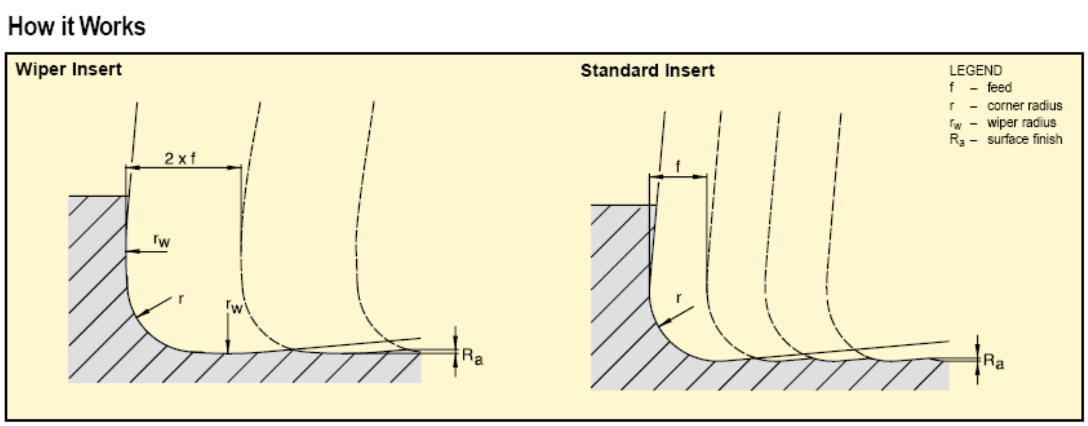
Technical Tip #131 – Benefits of Using Wiper Inserts in Turning Applications

Achieve Double Productivity with the Same Surface Finish or a Better Workpiece Finish

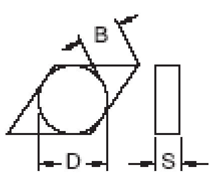
Milling inserts have used wiper technology to improve surface finishes for years. By applying a facet (flat) or a wiper to the insert, improvements to the milled part surface are achieved.

This same technology is being applied to turning applications. As a result, in many applications a subsequent grinding operation can be eliminated.
Figure 1 shows how this technology works. The large "wiper radius" on the insert edge gives an optimal surface finish on your workpiece.



(Figure 1)

NOTE: The insert "B" dimension changes a little and the nose is not a true radius all the way around from the tangent points to the cutting edges. (Figure 2)



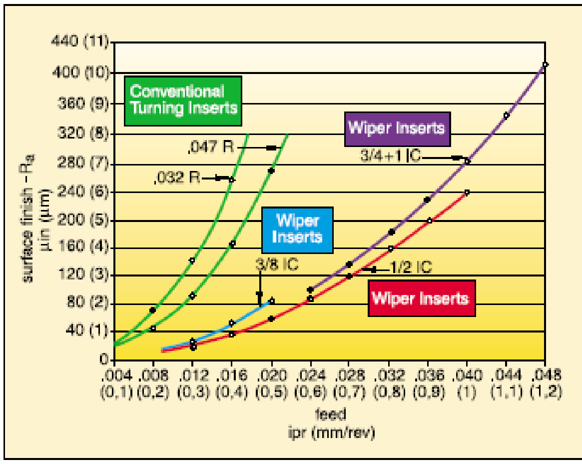
(Figure 2)

The wiper insert provides two major benefits to the user:

By substituting a wiper insert for an insert with a standard radius geometry -- while maintaining the same feed rate per revolution -- the surface finish produced will be about two times better. *For example: You are using a standard negative insert such as a CNMG432MN at a feed rate of .012 inch / revolution, and can obtain a 64 RMS. If you switch to a negative wiper insert such as a CNMG432MW, you can expect to achieve a 32 RMS finish.* (See Figure 3)

Negative Wiper Inserts – Application Technology

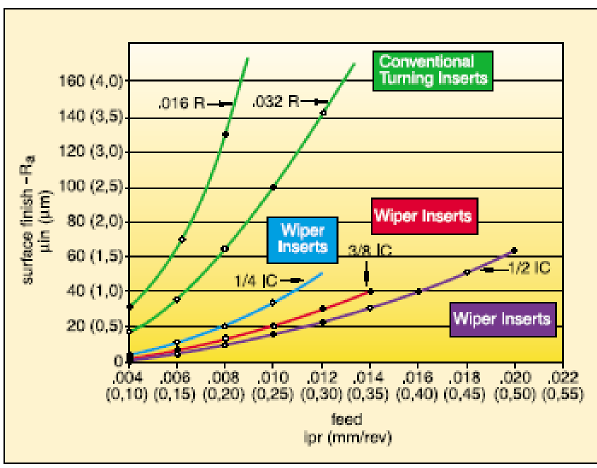
Surface Finish



Theoretical Surface Finish – R_a µin. (µm)											
insert	feed rate – ipr (mm/rev)										
FW, MW & RW	.008 (0,2)	.012 (0,3)	.016 (0,4)	.020 (0,5)	.024 (0,6)	.028 (0,7)	.032 (0,8)	.036 (0,9)	.040 (1)	.044 (1,1)	.048 (1,2)
3/8 IC	14 (0,3)	30 (0,75)	50 (1,3)	80 (2)	—	—	—	—	—	—	—
1/2 IC	—	23 (0,6)	41 (1)	63 (1,6)	91 (2,2)	120 (3)	160 (4)	200 (5)	250 (6,2)	—	—
3/4 + 1 IC	—	—	—	—	103 (2,6)	141 (3,5)	184 (4,6)	232 (5,8)	287 (7,2)	347 (8,7)	413 (10,3)

Positive Wiper Inserts – Application Technology

Surface Finish



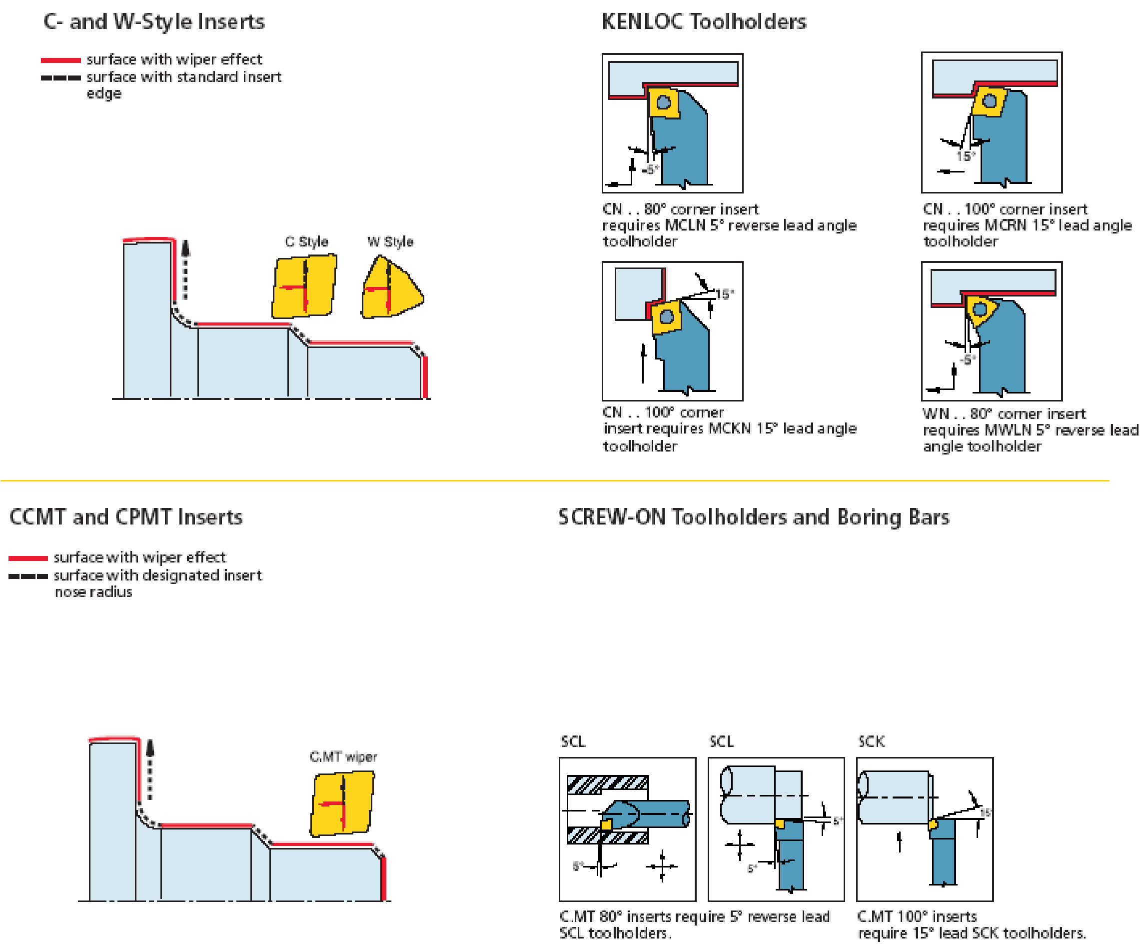
Theoretical Surface Finish – R_a µin. (µm)										
insert	feed rate – ipr (mm/rev)									
FW, MW	.002 (0,05)	.004 (0,10)	.006 (0,15)	.008 (0,20)	.010 (0,25)	.012 (0,30)	.014 (0,35)	.016 (0,40)	.018 (0,45)	.020 (0,50)
1/4 IC	1 (0,03)	6 (0,15)	14 (0,35)	22 (0,55)	35 (0,90)	49 (1,25)	—	—	—	—
3/8 IC	1 (0,02)	4 (0,10)	8 (0,20)	14 (0,35)	22 (0,55)	30 (0,75)	39 (1,00)	—	—	—
1/2 IC	1 (0,02)	2 (0,06)	6 (0,15)	10 (0,25)	16 (0,40)	24 (0,60)	31 (0,80)	39 (1,00)	51 (1,30)	63 (1,60)

(Figure 3)

You are also able to double the feed rate per revolution while achieving the same surface finish as with a standard radius turning insert. For example, *you are using a standard negative insert such as a CNMG432MN at a feed rate of .006 inch / revolution and able to obtain a 32 RMS. You can increase the feed rate to .012 inch / revolution and expect to achieve the same 32 RMS surface finish. Essentially wiper inserts are applied as higher feed rate alternatives to the same insert style and grade.* (See Figure 3)

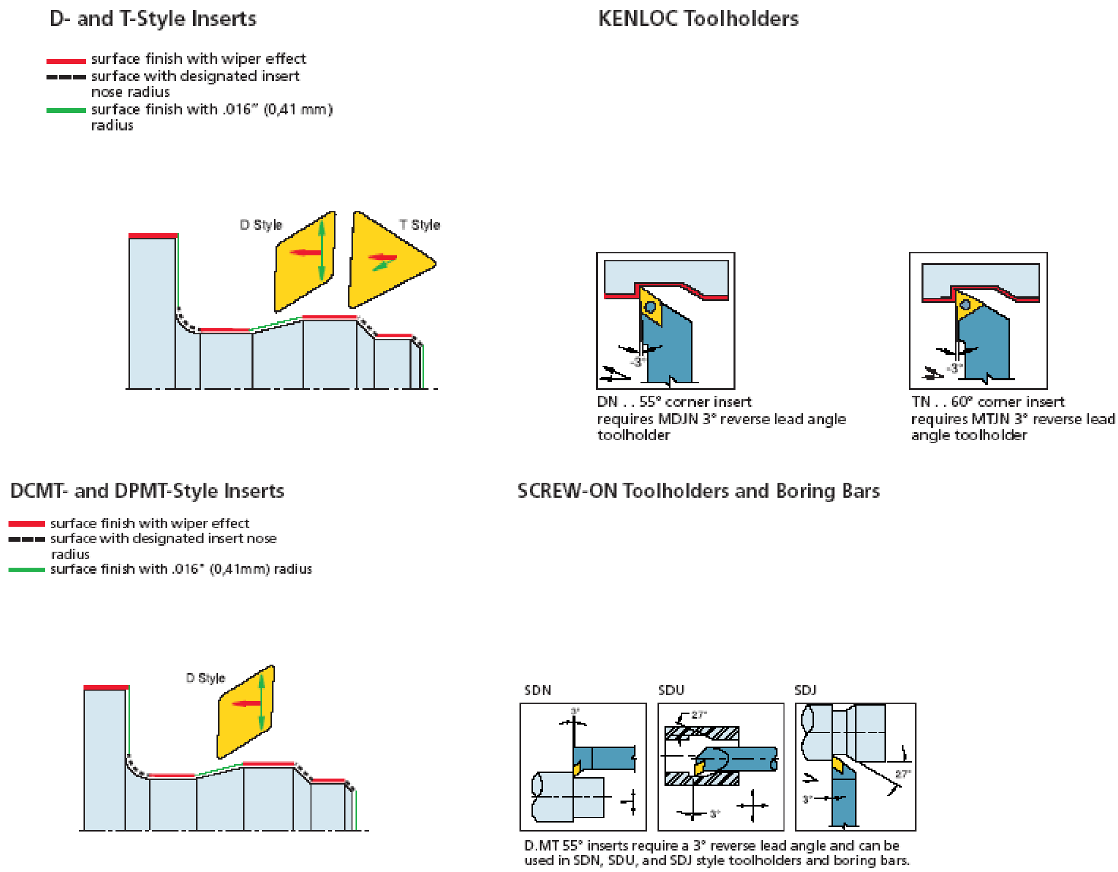
Limitations of Wiper Inserts

Due to alterations to the standard wiper insert configuration, inserts have limited application range. For limitations on C- and W-style negative inserts and C-style positive inserts, see Figure 4. For example, when using an 80-degree diamond style insert, (such as CNMG…), the insert must be used in a holder at the 5-degree (-5) reverse lead (80-degree edge) or with a 15-degree lead (100-degree edge).



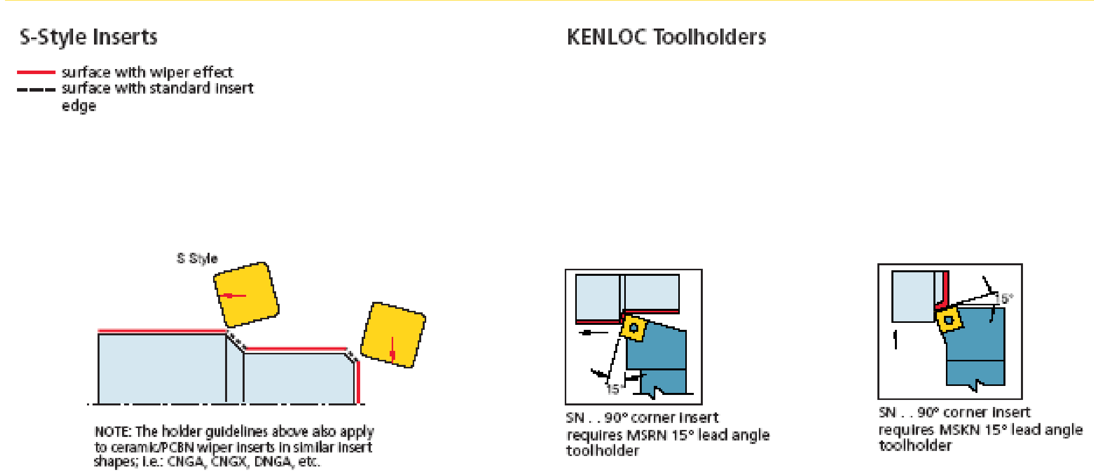
(Figure 4)

For limitations on D- and T negative-shaped inserts, and D-shaped positive inserts, see Figure 5.



(Figure 5)

For limitations on S-shaped negative inserts, see Figure 6 below.



(Figure 6)

Theoretical Surface Finish – Ra vs. Feed Rate

Negative Inserts

Surface Finish

Carbide and Ceramic Inserts

Theoretical Surface Finish – R_a µ in. (µ m)											
insert	feed rate – ipr (mm/rev)										
FW, MW, & RW IC	.008 (0,2)	.012 (0,3)	.016 (0,4)	.020 (0,5)	.024 (0,6)	.028 (0,7)	.032 (0,8)	.036 (0,9)	.040 (1)	.044 (1,1)	.048 (1,2)
3/8" (9,53 mm)	14 (0,3)	30 (0,75)	50 (1,3)	80 (2)	—	—	—	—	—	—	—
1/2" (12,7 mm)	—	23 (0,6)	41 (1)	63 (1,6)	91 (2,2)	120 (3)	160 (4)	200 (5)	250 (6,2)	—	—
3/4" + 1" (19,05 mm) (25,4 mm)	—	—	—	—	103 (2,6)	141 (3,5)	184 (4,6)	232 (5,8)	287 (7,2)	347 (8,7)	413 (10,3)

Solid and Tipped CBN Inserts

Theoretical Surface Finish – R_a µ in. (µ m)					
insert	feed rate – ipr (mm/rev)				
Insert Size and Type IC	.004 (0,1)	.006 (0,15)	.008 (0,2)	.012 (0,3)	.016 (0,4)
FW 1/2" (12,7 mm)	3 (0,06)	6 (0,14)	10 (0,26)	23 (0,6)	41 (1,0)
MW 1/2" (12,7 mm)	2 (0,05)	4 (0,11)	7 (0,19)	17 (0,42)	29 (0,75)

Positive Inserts

Surface Finish

Carbide and Ceramic Inserts

Theoretical Surface Finish – R_a µ in. (µ m)										
insert	feed rate – ipr (mm/rev)									
FW, MW IC	.002 (0,05)	.004 (0,10)	.006 (0,15)	.008 (0,20)	.010 (0,25)	.012 (0,30)	.014 (0,35)	.016 (0,40)	.018 (0,45)	.020 (0,50)
1/4" (6,35 mm)	1 (0,03)	6 (0,15)	14 (0,35)	22 (0,55)	35 (0,90)	49 (1,25)	—	—	—	—
3/8" (9,53 mm)	1 (0,02)	4 (0,10)	8 (0,20)	14 (0,35)	22 (0,55)	30 (0,75)	39 (1,00)	—	—	—
1/2" (12,7 mm)	1 (0,02)	2 (0,06)	6 (0,15)	10 (0,25)	16 (0,40)	24 (0,60)	31 (0,80)	39 (1,00)	51 (1,30)	63 (1,60)

Tipped CBN Inserts

Theoretical Surface Finish – R_a µ in. (µ m)				
insert	feed rate – ipr (mm/rev)			
Insert Size and Type IC	.004 (0,10)	.006 (0,15)	.008 (0,20)	.012 (0,30)
FW 1/4" (6,35 mm)	6 (0,14)	13 (0,32)	22 (0,58)	—
MW 3/8" (9,53 mm)	4 (0,11)	9 (0,24)	17 (0,43)	38 (0,97)

Concerns

The wiper geometry on the insert creates added tool pressure. This is due to the slightly higher cutting forces wiper inserts generate, compared to a standard radius insert. A general rule to follow is wiper inserts will generate nearly twice as much tool pressure as standard inserts. Be careful when attempting to apply wiper inserts on parts with a large diameter-to-length ratio or "slender " or thin-walled parts.

Additional Benefits of Using Wiper Inserts in Roughing Applications

Wiper inserts can provide significant advantages in a rough turning operations. The slightly higher cutting forces generated by the wiper insert is not a factor in a roughing operation. Consistent results in finishing operations are greatly influenced by the condition of the workpiece material before the last pass is taken. If chatter exists after the rough pass, it will continue to the finish pass and be very difficult to remove. Thus, if a wiper insert is used in the turning operation prior to finishing, the workpiece will have a superior surface for the final cut by the finishing tool. This enhanced surface before finishing will improve the ability of the finishing insert to hold size longer and cut more accurately.

Using wiper inserts for roughing will improve surfaces for better finishing cuts, regardless if a wiper insert is used for the final finishing cuts. The wiper insert geometry also provides additional insert strength for longer tool life.

Using a wiper insert for rough or finish turning should be your first consideration. However, do the research before you select a wiper insert as your tool of choice. Optimize productivity by increasing feed rates while maintaining surface finish, or double the feed rate while maintaining finish requirements.

Bottom line: **increased productivity, machine uptime, and tool life** (in number of parts machined with the same insert).