62090

W-PRO

Superior finish on 3D complex surfaces

5-axis machining

MILLING

Profiling | Facing | High Feed

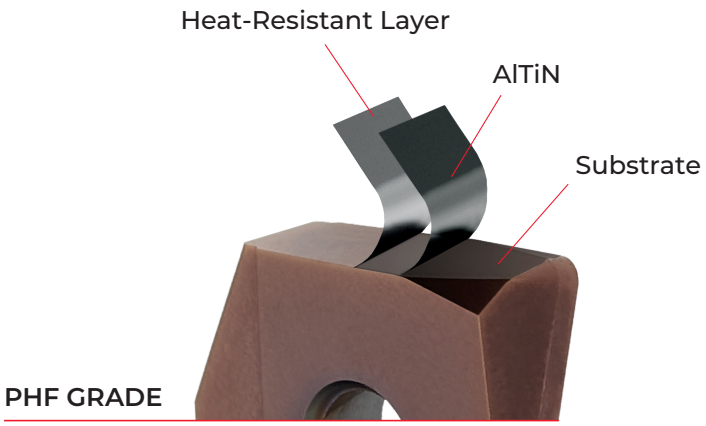
SINCE 1916

NEW PHF GRADE

In our commitment to high-performance cutting tools, we introduce the new PHF grade alongside our existing PHH grade. The PHF coating significantly advances machining hard and challenging materials, offering thermal stability, hardness, and excellent adhesion, thus enhancing process stability and efficiency in machining hardened steels.

PHF was specifically developed for machining hardened steels with a hardness greater than 50 HRC. These materials are not only extremely hard but also exhibit a certain level of toughness. Additionally, they often contain alloying elements that enhance corrosion resistance, making machining more challenging.

As the hardness of the material increases, so do the machining temperatures, making durable, heat-resistant coatings essential. PHF provides excellent thermal insulation, preventing heat from reaching the tool and efficiently dissipating it through the chip.



KEY BENEFITS OF THE PHF GRADE

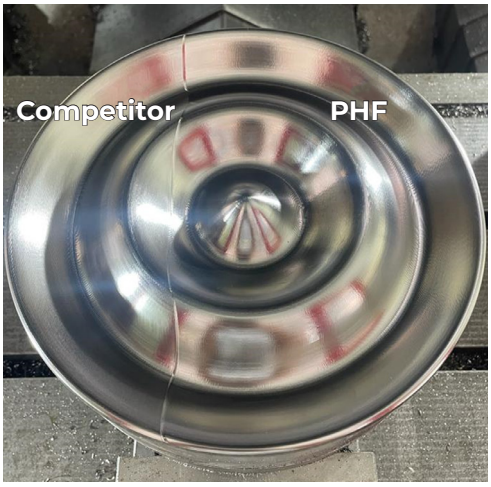
- Originally developed for machining hardened steels (over 50 HRC), it also demonstrates versatility with stainless steels, nickel-based alloys, titanium, and standard steels;
- High density coating with improved adhesion and reduced roughness;
- Heat-resistant layer for exceptional thermal stability and hardness;
- Prevents heat from affecting the tool, crucial for materials with poor heat conductivity;
- Improves chip and heat removal, contributing to high process stability;
- Heat is dissipated through the chip, preserving tool integrity and performance;
- Excellent adhesion to any tool geometry, optimizing wear resistance;
- Particularly successful in machining injection molds from hardened steels.

PHF GRADE | GRADES TEST REPORT

Toolholder: 016E62090-02-U016200
Insert: Competitor vs WCR - 16 PHF910
Workpiece Material: X155CrVMo-121 (60 HRC)
Operation: Finishing - Profiling
Coolant: Air

Cutting speed: V_C	100 m/min
Feed per tooth: f_Z	0,05 mm/t
Depth of cut: APMX	0,25 mm
Stepover : a_e	0,25 mm
Time	22h

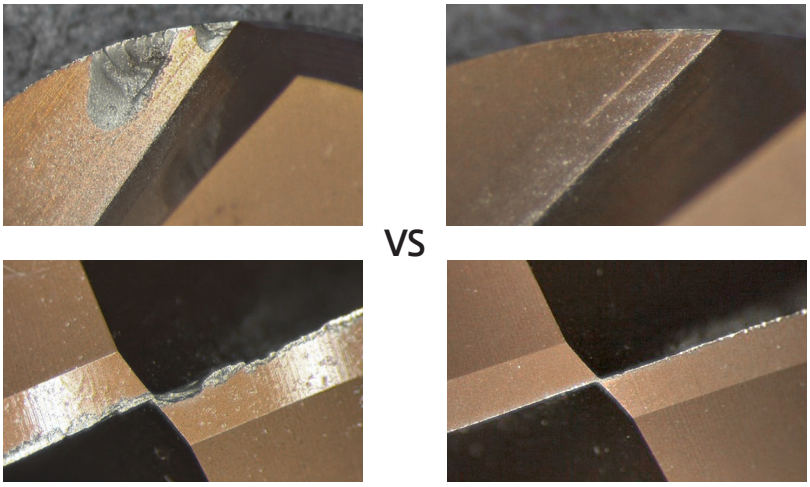
+30%
Tool Life



Surface finish comparison. Competitor vs PHF

Competitor grade

PHF grade

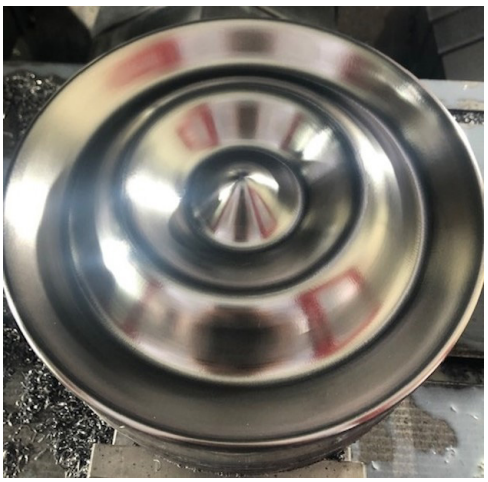


Real images

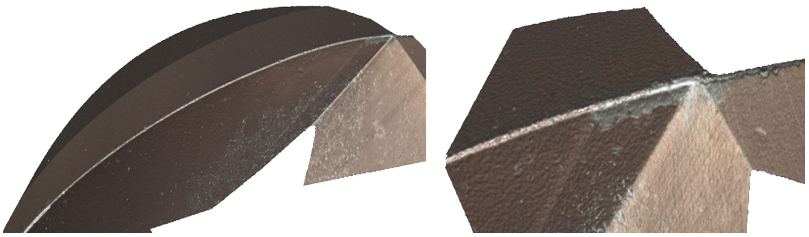
CHANGING CUTTING CONDITIONS - PHF GRADE

Cutting speed: V_C	125 m/min
Feed per tooth: f_Z	0,10 mm/t
Depth of cut: APMX	0,10 mm
Stepover : a_e	0,25 mm
Time	10h

-55%
Cycle Time


Surface finishing with more challenging cutting conditions

PHF grade

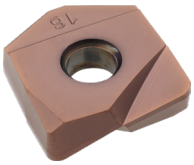

3D geometric survey

W-PRO 62090 INSERTS | WCR | WCL | WCX

WCR

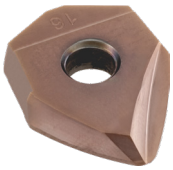
The WCR is a ball nose insert designed for the finishing and profiling of 3D surfaces. It features a unique helical profile, which ensures smooth cutting by reducing cutting forces.
It is available in a range of sizes from 08 to 20.

WCL



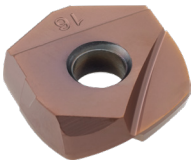
The WCL feature a square shape with corner radius. This radius can vary, providing different cutting geometries. This design combines the stability of a square insert with the smooth cutting characteristics of rounded edges.
It is available in a range of sizes from 08 to 20.

NEW WCX XT



5-axis machining: The WCX-XT features a multi-radius insert that combines two different cutting edges: the Ball radius, which is the ball nose tip, and the Tangential radius, which is the peripheral cutting edge with a large radius. This design creates a multi-purpose tool that combines the capabilities of both a tangential tool and a ball nose tool in one.
It is available in a range of sizes from 12 to 20.

NEW WCX LE



5-axis machining: The WCX-LE features a multi-radius insert that combines two large-radius cutting edges: the Lens radius, which forms a lens-shaped profile on the upper section, and the Barrel radius, which is a barrel-shaped profile on the peripheral section. This innovative design allows the tool to efficiently machine both bottom and wall surfaces with just one tool.
It is available in a range of sizes from 16 to 20.

NEW WCX HF

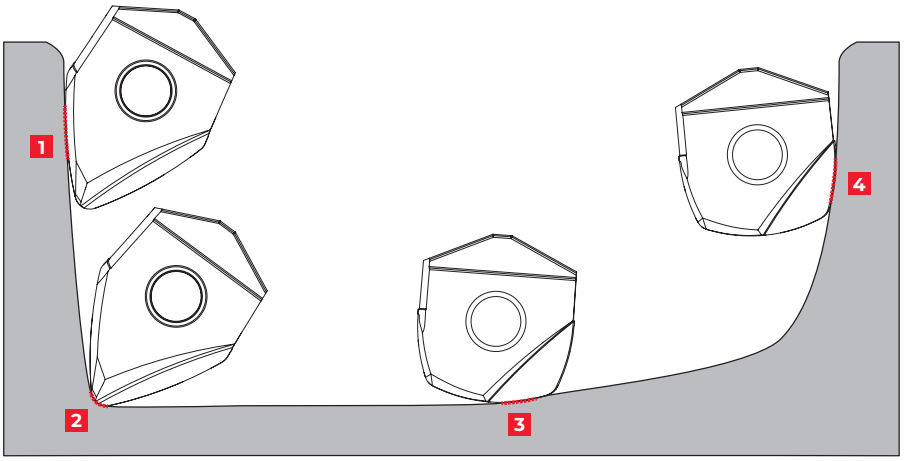
The WCX-HF features multi-radius and large radius principles combined with the chip thinning effect, resulting in a high-feed roughing tool that is distinctly different from previous geometries. It complements the W-PRO finishing line by providing an effective roughing solution.
It is available in a range of sizes from 08 to 20.

NEW WCX INSERTS | Barrel and lens geometries

With the introduction of new tangential, barrel and lens inserts, the W-PRO line is optimized for 5-axis machining of complex 3D surfaces and profiles, making it ideal for the mould, die and aerospace industries.

These advanced inserts are designed with larger radius cutting edges compared to traditional ball nose inserts, allowing for greater stepover or stepdown increments during machining. This results in significantly improved productivity while maintaining high-quality surface finishes, making the W-PRO an ideal choice for precision finishing operations on intricate geometries.

The WCX-XT and WCX-LE inserts are available in the PHF910 grade. This new coating offers high wear resistance due to the latest PVD coating technology, ensuring that the PHF910 provides exceptionally long tool life.



1 **WCX-XT** tangential radius
cutting edge for inclined surfaces

2 **WCX-XT** ball radius
cutting edge for corners

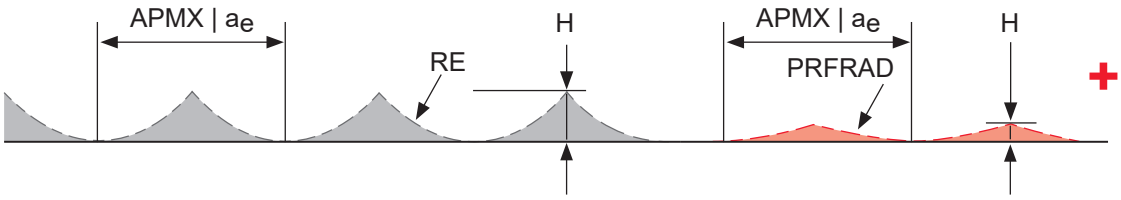
3 **WCX-LE** lens radius
cutting edge for bottom surfaces

4 **WCX-LE** barrel radius
cutting edge for wall surfaces

COMPARING WCX-XT AND WCX-LE WITH WCR BALL INSERT

With Same Stepdowns (APMX) or Stepovers (a_e)*

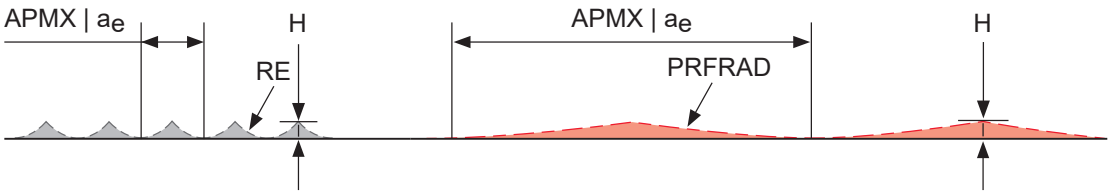
The WCX-XT and WCX-LE inserts achieves a lower cusp height (H) than a ball insert. This results in a significantly smoother surface finish, enhancing the overall quality of the machined part and reducing the need for secondary finishing operations.



+ SURFACE QUALITY

With Same Cusp Heights (H)

The WCX-XT and WCX-LE inserts enables larger stepdowns or stepovers* compared to a ball insert. This advantage boosts productivity by minimizing the number of tool passes needed, allowing for faster and more efficient material removal.



+ PRODUCTIVITY

WCX-XT | -LE
multi-radius insert

WCR
ball insert

* depending on the direction of a tool displacement after every pass.

W-PRO 62090

The W-PRO line is the combinatiom of the most refined inserts with exceptionally stable shanks, making it an ideal finishing solution for materials such as steels, stainless steels, cast irons and hardened steels.
The design allows users to position the insert consistently, with the same side always facing the same direction when mounted in the tool body. This ensures high repeatable accuracy, reliability, excellent surface quality, and predictable tool life.

Shank Type
Carbide shank in order to reduce vibrations.

Mounting type
Maximum runout of 0,02 mm is achieved by a high accuracy mounting

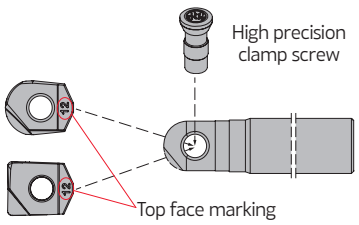
PROCEDURES FOR CLAMPING SCREWS Procedimentos para parafusos de aperto | Procedimientos para sujetar tornillos

1. Check the insert seat.
   Before assembly cutter it is important to ensure that the insert seat has not been damaged during machining or handling.

2. Clean the insert seat.
   Make sure that the insert seat is free from dust or chips from previous machining. If necessary, clean the insert seat with pressurised air.

3. Position the insert.
   Position the insert with the top face marking in the direction of screw placement and couple the insert into the cutter.

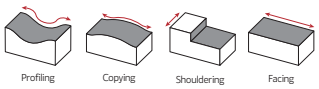
4. Lubricate the insert screw.
   Apply sufficient screw lubrication to prevent seizure. Lubricant should be applied in small quantity to the screw threads.

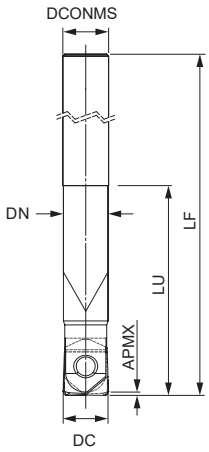


5. Always use a torque wrench to ensure that screws are correctly tightened (please confirm torque data). Excessive torque will negatively affect the performance of the tool and can cause screw and insert breakage. Unsufficient torque leads to insert movement, vibration and degrade the cutting result. Dedicated adjustable torque wrench can be ordered separately. Please do not press down the insert during tightening process.

Note: Always replace worn or damaged screws.

CAUTION	To avoid affecting tolerances do not tighten the screw without assembling the insert in the toolholder.



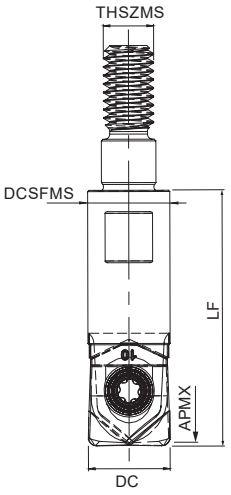


Cylindrical Carbide Shank

Tolerance R	Runout Tolerance
± 0,015	R 0,02

Order code Código	Reference Referência Referencia	CICT	Dimensions | Dimensões | Dimensiones (mm)					WT	Insert Pastilha Inserto	Stock
			DC	DCONMS	DN	LF	LU			
181156600	008E62090-02-U008140	2	8	8	7,7	140	35	0,09	WCR 08../WCL 08...	◈
181156700	010E62090-02-U010150	2	10	10	9,7	150	45	0,15	WCR 10.../WCL 10...	◈
181156800	010E62090-02-U010180	2	10	10	9,7	180	45	0,18	WCR 10.../WCL 10...	◈
181155700	012E62090-02-U012165	2	12	12	11,7	165	55	0,24	WCR 12.../WCL 12...	◈
181156900	012E62090-02-U012200	2	12	12	11,7	200	55	0,29	WCR 12.../WCL 12...	◈
181157000	016E62090-02-U016200	2	16	16	15,7	200	65	0,51	WCR 16.../WCL 16...	◈
181157100	016E62090-02-U016250	2	16	16	15,7	250	65	0,67	WCR 16.../WCL 16...	◈
181157200	020E62090-02-U020220	2	20	20	19,7	220	70	0,87	WCR 20.../WCL 20...	◈
181157300	020E62090-02-U020250	2	20	20	19,7	250	70	1,00	WCR 20.../WCL 20...	◈
181157400	020E62090-02-U020300	2	20	20	19,7	300	70	1,23	WCR 20.../WCL 20...	◈

◈ Stock item | Produto de stock | Itens de stock ◯ Available under request | Disponível sobre consulta | Disponible bajo consulta



Threaded Steel Shank

Tolerance R	Runout Tolerance
± 0,015	R 0,05

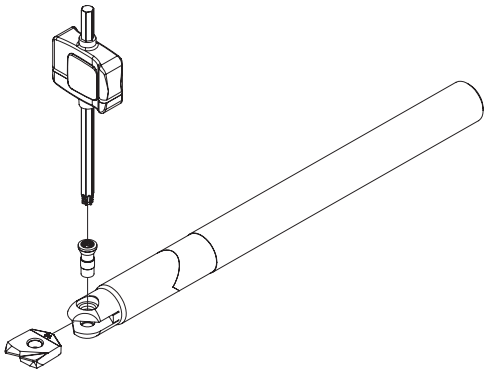
Order code Código	Reference Referência Referencia	CICT	Dimensions | Dimensões | Dimensiones (mm)				WT	Insert Pastilha Inserto	Stock
			DC	THSZMS	DCSFMS	LF			
181167000	010R62090-02-UM06030	2	10	M6	6,5	30	0,011	WCR 10.../WCL 10...	◈
181167100	012R62090-02-UM06030	2	12	M6	6,5	30	0,016	WCR 12.../WCL 12...	◈
181167200	016R62090-02-UM08030	2	16	M8	8,5	30	0,028	WCR 16.../WCL 16...	◈
181167300	020R62090-02-UM10035	2	20	M10	10,5	35	0,058	WCR 20.../WCL 20...	◈

◈ Stock item | Produto de stock | Itens de stock ◯ Available under request | Disponível sobre consulta | Disponible bajo consulta

SPARE PARTS Acessórios | Repuestos

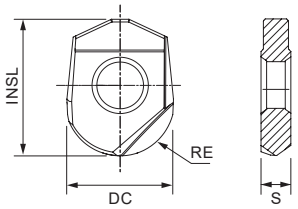
Order separately

Cutter DC	Insert Screw	Key (Torx)	Key (Torx - Nm)	Torque Value
8	P0300726	XT08	DT0812	1,2
10	P0350825	XT10	DT1020	2,0
12	P0501025	XT20	DT2050	5,0
16	P0501326	XT20	DT2050	5,0
20	P0601725	XT25	-	6,9



WCR Inserts | Pastilhas | Plaquitas

Ball

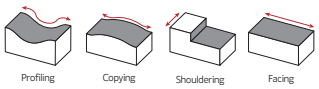


WCR

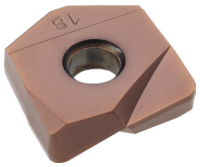
		P				M				K				H				Dimensions Dimensões Dimensiones (mm)			
		PVD				PVD				PVD				PVD							
	(2) Grade code	X4	8F	X6	4F	X4	8F	X6	4F	X4	8F	X6	4F	X4	8F	X6	4F				
(1) Geometry code	ISO Reference	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	INSL	RE	S	DC
1112900	WCR 08	◬	◍	◬	◉	◬	◍	◬	◉	◬	◍	◬	◉	◬	◍	◬	◉	9,7	4,0	2,1	8,0
1111914	WCR 10		◍	◬	◉		◍	◬	◉		◍	◬	◉		◍	◬	◉	12,0	5,0	2,7	10,0
1112099	WCR 12	◬	◍	◬	◉	◬	◍	◬	◉	◬	◍	◬	◉	◬	◍	◬	◉	14,6	6,0	3,2	12,0
1112100	WCR 16	◬	◍		◉	◬	◍		◉	◬	◍		◉	◬	◍		◉	16,6	8,0	4,2	16,0
1112101	WCR 20		◍		◉		◍		◉		◍		◉		◍		◉	20,0	10,0	5,2	20,0

◉ First choice | 1ª Escolha | 1ª Opción
◍ Stock Itens | Itens de stock
◬ Stock available until sold out | Stock disponível até acabar o stock | Stock disponible hasta acabar el stock
◯ Available under request | Disponível sobre consulta | Disponible bajo consulta

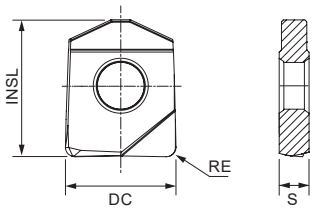
Insert Order Code: (1) Geometry code + (2) Grade code



WCL Inserts | Pastilhas | Plaquitas



Radius



WCL

		P				M				K				H				Dimensions Dimensões Dimensiones (mm)			
		PVD				PVD				PVD				PVD							
	(2) Grade code	X4	8F	X6	4F	X4	8F	X6	4F	X4	8F	X6	4F	X4	8F	X6	4F				
(1) Geometry code	ISO Reference	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	PHH603	PHF603	PHH910	PHF910	INSL	RE	S	DC
1112879	WCL-08 R0.3		●		●		●		●		●		●		●		●	9,7	0,3	2,1	8,0
1112880	WCL-08 R0.5		●		●		●		●		●		●		●		●	9,7	0,5	2,1	8,0
1112853	WCL-08 R1.0		●	◬	●		●	◬	●		●	◬	●		●	◬	●	9,7	1,0	2,1	8,0
1112881	WCL-10 R0.3	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	12,0	0,3	2,7	10,0
1112882	WCL-10 R0.5		●		●		●		●		●		●		●		●	12,0	0,5	2,7	10,0
1112848	WCL-10 R1.0	◬	●		●	◬	●		●	◬	●		●	◬	●		●	12,0	1,0	2,7	10,0
1112883	WCL-10 R1.5		●		●		●		●		●		●		●		●	12,0	1,5	2,7	10,0
1112884	WCL-10 R2.0		●	◬	●		●	◬	●		●	◬	●		●	◬	●	12,0	2,0	2,7	10,0
1112885	WCL-12 R0.3		●		●		●		●		●		●		●		●	14,6	0,3	3,2	12,0
1112886	WCL-12 R0.5		●		●		●		●		●		●		●		●	14,6	0,5	3,2	12,0
1112096	WCL-12 R1.0		●	◬	●		●	◬	●		●	◬	●		●	◬	●	14,6	1,0	3,2	12,0
1112887	WCL-12 R1.5	◬	●		●	◬	●		●	◬	●		●	◬	●		●	14,6	1,5	3,2	12,0
1112888	WCL-12 R2.0		●		●		●		●		●		●		●		●	14,6	2,0	3,2	12,0
1112889	WCL-12 R3.0		●		●		●		●		●		●		●		●	14,6	3,0	3,2	12,0
1112890	WCL-16 R0.3	◬	●		●	◬	●		●	◬	●		●	◬	●		●	16,6	0,3	4,2	16,0
1112891	WCL-16 R0.5		●		●		●		●		●		●		●		●	16,6	0,5	4,2	16,0
1112097	WCL-16 R1.0	◬	●		●	◬	●		●	◬	●		●	◬	●		●	16,6	1,0	4,2	16,0
1112892	WCL-16 R1.5		●		●		●		●		●		●		●		●	16,6	1,5	4,2	16,0
1112893	WCL-16 R2.0	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	16,6	2,0	4,2	16,0
1112894	WCL-16 R3.0	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	16,6	3,0	4,2	16,0
1112895	WCL-20 R0.3		●		●		●		●		●		●		●		●	20,0	0,3	5,2	20,0
1112896	WCL-20 R0.5		●		●		●		●		●		●		●		●	20,0	0,5	5,2	20,0
1112098	WCL-20 R1.0	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	20,0	1,0	5,2	20,0
1112897	WCL-20 R1.5		●	◬	●		●	◬	●		●	◬	●		●	◬	●	20,0	1,5	5,2	20,0
1112898	WCL-20 R2.0		●		●		●		●		●		●		●		●	20,0	2,0	5,2	20,0
1112899	WCL-20 R3.0	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	◬	●	20,0	3,0	5,2	20,0

● First choice | 1ª Escolha | 1ª Opción
● Stock Itens | Itens de stock
◬ Stock available until sold out | Stock disponível até acabar o stock | Stock disponible hasta acabar el stock
◯ Available under request | Disponível sobre consulta | Disponible bajo consulta

Insert Order Code: (1) Geometry code + (2) Grade code

GRADES SELECTION GUIDE Guia para selecção de graus | Tabla para selección de calidades

ISO	PSM	Material	HB (Brinell)	Grades ← Wear Resistance — Toughness → PHH603	PHF603	PHH910	PHF910
P	1	Unalloyed Steel	125-220	✓	✓	✓	✓
	2	Low-Alloyed Steel	220-280	✓	✓	✓	✓
	3	High-Alloyed Steel	280-380	✓	✓	✓	✓
M	4	SS - Ferritic / Martensitic	200-330	✓	✓	✓	✓
	5	SS - Austenitic	200-330	✓	✓	✓	✓
	6	SS - Austenitic-ferritic (Duplex)	230-260	✓	✓	✓	✓
K	7	Malleable Cast Iron	130-230	✓	✓	✓	✓
	8	Grey Cast Iron	180-245	✓	✓	✓	✓
	9	Nodular Cast iron	160-250	✓	✓	✓	✓
H	12	Hardened Steels	46-54 HRC	✓	✓	✓	✓
	13	Hardened Steels	55-62 HRC	✓	✓	✓	✓
	14	Hardened Steels	63-70 HRC	✓	✓	✓	✓

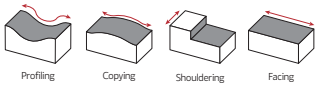
Good Conditions Average Conditions Difficult Conditions

RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

ISO	PSM	Material	HB (Brinell)	Vc (m/min) ← Wear Resistance — Toughness → PHH603	PHF603	PHH910	PHF910	Feed fz (mm/t) WCR	WCL
P	1	Unalloyed Steel	125-220	180-310	180-310	140-270	140-270	0,15-0,45	0,10-0,30
	2	Low-Alloyed Steel	220-280	180-300	180-300	140- 260	140- 260	0,15-0,40	0,10-0,25
	3	High-Alloyed Steel	280-380	180-280	180-280	140-220	140-220	0,10-0,40	0,10-0,25
M	4	SS - Ferritic / Martensitic	200-330	170-300	170-300	130-260	130-260	0,15-0,35	0,10-0,25
	5	SS - Austenitic	200-330	160-290	160-290	120-250	120-250	0,15-0,35	0,10-0,25
	6	SS - Austenitic-ferritic (Duplex)	230-260	150-270	150-270	110-230	110-230	0,15-0,30	0,08-0,20
K	7	Malleable Cast Iron	130-230	200-380	200-380	180-370	180-370	0,10-0,50	0,10-0,35
	8	Grey Cast Iron	180-245	180-360	180-360	180-350	180-350	0,10-0,45	0,10-0,30
	9	Nodular Cast iron	160-250	160-310	160-310	160-290	160-290	0,10-0,40	0,10-0,30
H	12	Hardened Steels	46-54 HRC	90-270	90-270	80-260	80-260	0,05-0,20	0,05-0,15
	13	Hardened Steels	55-62 HRC	80-200	80-200	70-180	70-180	0,05-0,15	0,04-0,12
	14	Hardened Steels	63-70 HRC	70-180	70-180	70-160	70-160	0,04-0,12	0,04-0,10

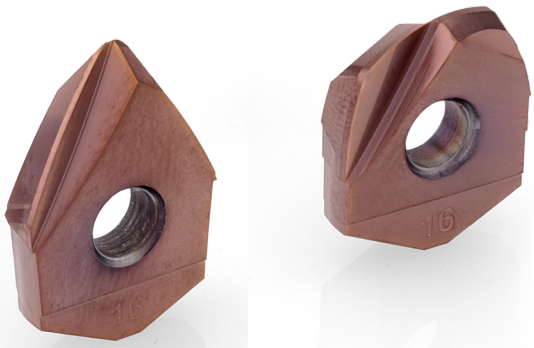
Determine the APMX or a_e :

	WCR		WCL	
Insert size	APMX (mm)	A_e max (mm)	APMX (mm)	A_e max (mm)
08	4,0	0,8	2,5	0,8
10	5,0	1,0	3,0	1,0
12	6,0	1,2	4,0	1,2
16	8,0	1,6	5,0	1,6
20	10,0	2,0	6,0	2,0

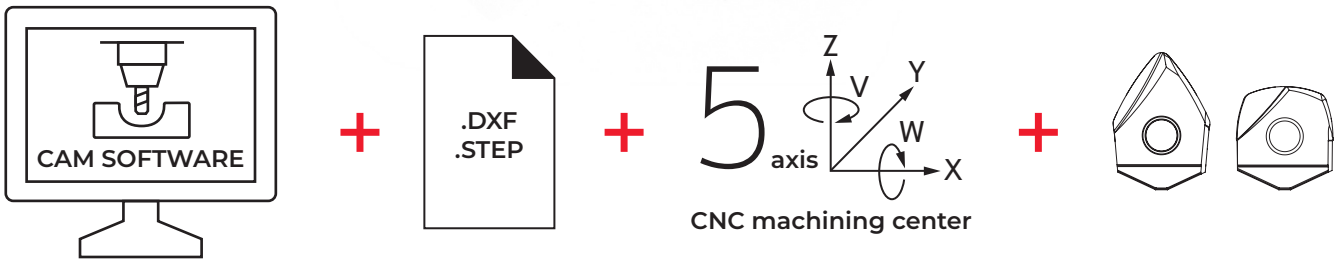


BOOSTED PRODUCTIVITY WITH 5-AXIS MACHINING

Produtividade reforçada com maquinação 5 eixos | Mayor productividad con el mecanizado en 5 ejes



To take full advantage of the capabilities of the WCX-XT and WCX-LE, follow these steps to ensure optimal performance and efficiency:



- **CAM software:**
  A CAM software equipped with 5-axis strategies and free-form surface machining capabilities allows users to fully harness the potential of W-PRO 62090. This ensures optimized toolpaths and increased machining efficiency across complex geometries.

- **.DXF | .STEP file:**
  Downloadable directly from our website, these cut profile files can be easily uploaded to most CAM software. This guarantees precise machining by providing accurate data and minimizing errors in the machining process.

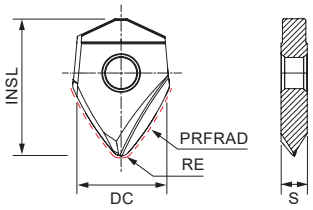
- **5-axis machining*:**
  In a 5-axis continuous machining center, the tool operates with complete freedom, allowing it to perform at its most efficient. This configuration enables faster, more accurate machining with fewer steps and better access to intricate geometries.

- **WCX-XT | WCX-LE:**
  These multi-radius inserts combines two large-radius cutting edges, designed to capitalize on the latest machining technologies. It ensures optimal performance, resulting in faster machining times and superior surface finishes.

***Note:** In the absence of 5-axis machining capabilities, follow the machining methods described in the inserts chapter.

NEW WCX-XT Inserts | Pastilhas | Plaquitas

Tangential



WCX XT

		P	M	K	H
		PVD	PVD	PVD	PVD
	(2) Grade code	4F	4F	4F	4F
(1) Geometry code	ISO Reference	PHF910	PHF910	PHF910	PHF910

Dimensions Dimensões Dimensiones (mm)				
INSL	RE	PRFRAD	S	DC
14,6	1,2	30,0	3,2	12,0
16,6	1,6	40,0	4,2	16,0
20,0	2,0	50,0	5,2	20,0

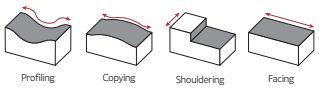
First choice | Primeira opção | 1ª opción — Stock item | Produto de stock | Itens de stock — Available under request | Disponível sobre consulta | Disponible bajo consulta

Insert Order Code: (1)Geometry code + (2)Grade code

RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

				Tangential Radius			
ISO	PSM	Material	HB (Brinell)	Vc (m/min)	fz (mm/t)	APMX (mm)	ae (mm)
P	1	Unalloyed Steel	125-220	750 (250-900)	0,15 (0,10-0,40)	See the table in the next page	0,01 (0,05-0,30)
	2	Low-Alloyed Steel	220-280	720 (200-800)	0,15 (0,08-0,30)		0,01 (0,05-0,30)
	3	High-Alloyed Steel	280-380	520 (200-700)	0,15 (0,05-0,30)		0,01 (0,05-0,30)
M	4	SS - Ferritic / Martensitic	200-330	650 (200-800)	0,15 (0,05-0,30)		0,01 (0,05-0,30)
	5	SS - Austenitic	200-330	650 (200-800)	0,15 (0,05-0,30)		0,01 (0,05-0,30)
	6	SS - Austenitic-ferritic (Duplex)	230-260	650 (200-800)	0,15 (0,05-0,25)		0,01 (0,05-0,20)
K	7	Malleable Cast Iron	130-230	720 (250-900)	0,20 (0,10-0,30)		0,01 (0,05-0,30)
	8	Grey Cast Iron	180-245	720 (250-900)	0,20 (0,10-0,30)		0,01 (0,05-0,30)
	9	Nodular Cast iron	160-250	720 (250-900)	0,20 (0,10-0,30)		0,01 (0,05-0,30)
H	12	Hardened Steels	46-54 HRC	320 (100-400)	0,10 (0,05-0,20)		0,08 (0,02-0,20)
	13	Hardened Steels	55-62 HRC	280 (80-320)	0,10 (0,05-0,15)		0,05 (0,01-0,20)
	14	Hardened Steels	63-70 HRC	280 (70-320)	0,10 (0,05-0,15)		0,05 (0,01-0,20)

				Ball Radius			
ISO	PSM	Material	HB (Brinell)	Vc (m/min)	fz (mm/t)	APMX (mm)	ae (mm)
P	1	Unalloyed Steel	125-220	750 (250-900)	0,05 (0,02-0,20)	0,10 (0,05-0,30)	See the table in the next page
	2	Low-Alloyed Steel	220-280	750 (200-800)	0,05 (0,02-0,20)	0,10 (0,05-0,25)	
	3	High-Alloyed Steel	280-380	700 (200-700)	0,05 (0,02-0,20)	0,10 (0,05-0,25)	
M	4	SS - Ferritic / Martensitic	200-330	750 (200-800)	0,05 (0,02-0,20)	0,10 (0,05-0,25)	
	5	SS - Austenitic	200-330	750 (200-800)	0,05 (0,02-0,20)	0,10 (0,05-0,20)	
	6	SS - Austenitic-ferritic (Duplex)	230-260	750 (200-800)	0,05 (0,02-0,20)	0,10 (0,05-0,20)	
K	7	Malleable Cast Iron	130-230	750 (250-900)	0,05 (0,02-0,20)	0,10 (0,05-0,30)	
	8	Grey Cast Iron	180-245	750 (250-900)	0,05 (0,02-0,20)	0,10 (0,05-0,30)	
	9	Nodular Cast iron	160-250	750 (250-900)	0,05 (0,02-0,20)	0,10 (0,05-0,30)	
H	12	Hardened Steels	46-54 HRC	500 (100-400)	0,05 (0,02-0,20)	0,08 (0,02-0,15)	
	13	Hardened Steels	55-62 HRC	450 (80-320)	0,05 (0,02-0,20)	0,05 (0,01-0,15)	
	14	Hardened Steels	63-70 HRC	450 (70-320)	0,05 (0,02-0,20)	0,05 (0,01-0,15)	

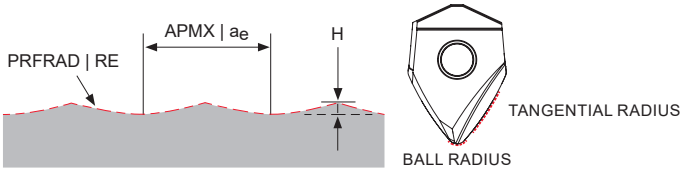


RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

Determine the APMX or a_e according to the desired cusp height:

Insert	PRFRAD	Tangential Radius H - Cusp Height (mm)							RE	Ball Radius H - Cusp Height (mm)						
		0,0005	0,0010	0,0020	0,0030	0,0040	0,0050	0,0100		0,0005	0,0010	0,0020	0,0030	0,0040	0,0050	0,0100
WCX-12 XT 1.2-30.0	30,0	0,35	0,49	0,69	0,85	0,98	1,10	1,55	1,2	0,07	0,10	0,14	0,17	0,20	0,22	0,31
WCX-16 XT 1.6-40.0	40,0	0,40	0,57	0,80	0,98	1,13	1,26	1,79	1,6	0,08	0,11	0,16	0,20	0,23	0,25	0,36
WCX-20 XT 2.0-50.0	50,0	0,45	0,63	0,89	1,10	1,26	1,41	2,00	2,0	0,09	0,13	0,18	0,22	0,25	0,28	0,40

Tangential Radius	Ball Radius
$APMX = 2\sqrt{PRFRAD^2 - (PRFRAD - H)^2}$	$a_e = 2\sqrt{RE^2 - (RE - H)^2}$



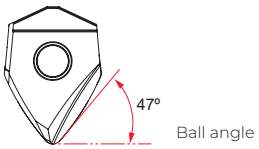
For high overhang conditions consider the next:

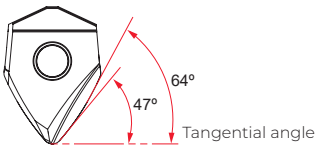
Vc1 = Vc x k

Vc1 - Recommended cutting speed for high overhang
Vc - Recommended cutting speed
k - Overhang factor

Overhang ratio	Factor (k)
3<DC	1,00
3<DC<5	0,70
5<DC<6	0,60
6<DC<7	0,50
DC>7	0,45

MACHINING METHODS Métodos de maquinação | Métodos de mecanizado





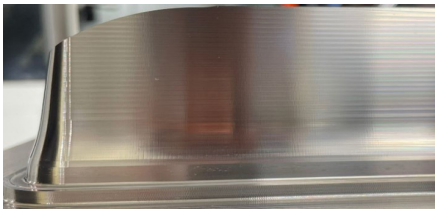
In 3-Axis machining usable range of:
- Ball angle: between 0° and 47°.
- Tangential angle: between 47° and 64°.

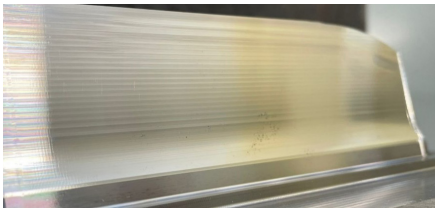
WCX-XT TEST REPORT Relatório de Teste WCX-XT | Informe de Prueba WCX-XT

Workpiece Material: 1.2738 steel (36-40 HRC)

Toolholder: 016E62090-02-U016200
Insert: WCX 16-XT 1.6-40.0 PHF910
Operation: Finishing - 5-axis

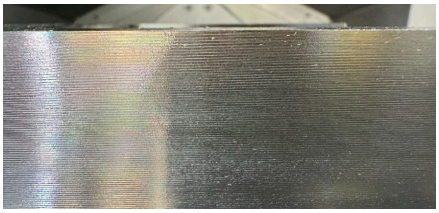
Cutting speed: V_c	520 m/min
Feed per tooth: f_z	0,15 mm/t
Depth of cut: APMX	1,13 mm
Stepover : a_e	0,10 mm
Time	10 min

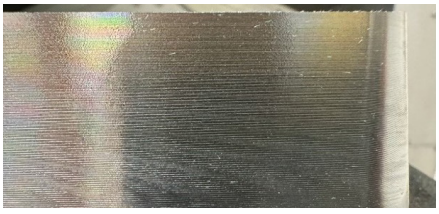




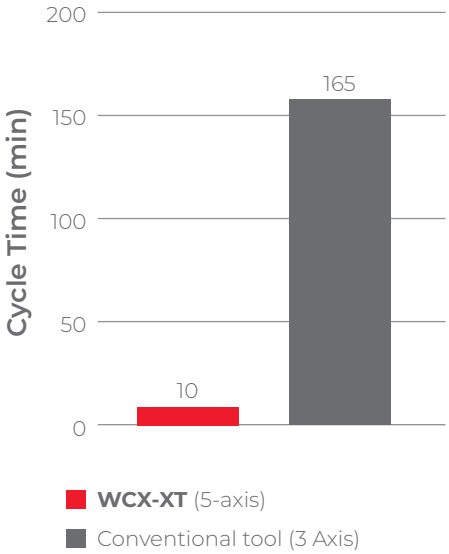
Toolholder: Conventional tool - D16 Z2 R0,8
Operation: Finishing - 3 Axis

Cutting speed: V_c	200 m/min
Feed per tooth: f_z	0,10 mm/t
Depth of cut: APMX	0,15 mm
Stepover : a_e	0,20 mm
Time	165 min

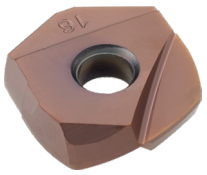




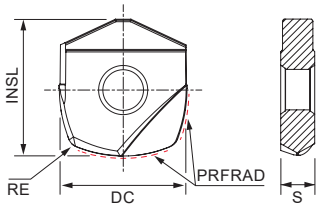
-94% Cycle time



NEW WCX-LE Inserts | Pastilhas | Plaquitas



Lens



WCX LE

		P	M	K	H	Dimensions Dimensões Dimensiones (mm)				
		PVD	PVD	PVD	PVD					
	(2) Grade code	4F	4F	4F	4F					
(1) Geometry code	ISO Reference	PHF910	PHF910	PHF910	PHF910	INSL	RE	PRFRAD	S	DC
1113412	WCX-16 LE 1.5-16.0	◉	◉	◉	◉	16,6	1,5	16,0	4,2	16,0
1113529	WCX-16 LE 5.0-16.0	○	○	○	○	16,6	5,0	16,0	4,2	16,0
1113530	WCX-20 LE 1.9-20.0	◉	◉	◉	◉	20,0	1,9	20,0	5,2	20,0
1113531	WCX-20 LE 6.0-16.0	○	○	○	○	20,0	6,0	20,0	5,2	20,0

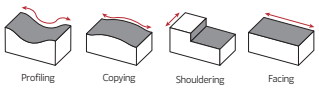
◉ First choice | Primeira opção | 1ª opción ◉ Stock item | Produto de stock | Itens de stock ○ Available under request | Disponível sobre consulta Disponible bajo consulta

Insert Order Code: (1) Geometry code + (2) Grade code

RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

				Barrel Radius			
ISO	PSM	Material	HB (Brinell)	Vc (m/min)	fz (mm/t)	APMX (mm)	ae (mm)
P	1	Unalloyed Steel	125-220	650 (250-900)	0,20 (0,15-0,45)	See the table in the next page	0,10 (0,05-0,30)
	2	Low-Alloyed Steel	220-280	600 (200-800)	0,20 (0,10-0,35)		0,10 (0,05-0,30)
	3	High-Alloyed Steel	280-380	400 (200-700)	0,20 (0,10-0,35)		0,10 (0,05-0,30)
M	4	SS - Ferritic / Martensitic	200-330	500 (200-800)	0,20 (0,10-0,35)		0,10 (0,05-0,30)
	5	SS - Austenitic	200-330	500 (200-800)	0,20 (0,10-0,35)		0,10 (0,05-0,30)
	6	SS - Austenitic-ferritic (Duplex)	230-260	500 (200-800)	0,20 (0,10-0,30)		0,10 (0,05-0,20)
K	7	Malleable Cast Iron	130-230	600 (250-900)	0,25 (0,20-0,50)		0,10 (0,05-0,30)
	8	Grey Cast Iron	180-245	600 (250-900)	0,25 (0,20-0,50)		0,10 (0,05-0,30)
	9	Nodular Cast iron	160-250	600 (250-900)	0,25 (0,20-0,50)		0,10 (0,05-0,30)
H	12	Hardened Steels	46-54 HRC	250 (100-400)	0,15 (0,10-0,30)		0,08 (0,02-0,20)
	13	Hardened Steels	55-62 HRC	220 (80-320)	0,15 (0,10-0,25)		0,05 (0,01-0,20)
	14	Hardened Steels	63-70 HRC	220 (70-320)	0,15 (0,10-0,25)		0,05 (0,01-0,20)

				Lens Radius			
ISO	PSM	Material	HB (Brinell)	Vc (m/min)	fz (mm/t)	APMX (mm)	ae (mm)
P	1	Unalloyed Steel	125-220	750 (250-900)	0,25 (0,20-0,45)	0,10 (0,05-0,30)	See the table in the next page
	2	Low-Alloyed Steel	220-280	720 (200-800)	0,25 (0,15-0,35)	0,10 (0,05-0,30)	
	3	High-Alloyed Steel	280-380	520 (200-700)	0,25 (0,15-0,35)	0,10 (0,05-0,30)	
M	4	SS - Ferritic / Martensitic	200-330	650 (200-800)	0,25 (0,15-0,35)	0,10 (0,05-0,30)	
	5	SS - Austenitic	200-330	650 (200-800)	0,25 (0,15-0,35)	0,10 (0,05-0,30)	
	6	SS - Austenitic-ferritic (Duplex)	230-260	650 (200-800)	0,25 (0,10-0,30)	0,10 (0,05-0,20)	
K	7	Malleable Cast Iron	130-230	720 (250-900)	0,40 (0,20-0,50)	0,10 (0,05-0,30)	
	8	Grey Cast Iron	180-245	720 (250-900)	0,40 (0,20-0,50)	0,10 (0,05-0,30)	
	9	Nodular Cast iron	160-250	720 (250-900)	0,40 (0,20-0,50)	0,10 (0,05-0,30)	
H	12	Hardened Steels	46-54 HRC	320 (100-400)	0,20 (0,10-0,30)	0,08 (0,02-0,20)	
	13	Hardened Steels	55-62 HRC	280 (80-320)	0,20 (0,10-0,25)	0,05 (0,01-0,20)	
	14	Hardened Steels	63-70 HRC	280 (70-320)	0,20 (0,10-0,25)	0,05 (0,01-0,20)	

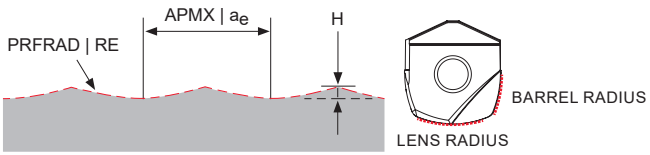


RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

Determine the APMX or a_e according to the desired cusp height:

Insert	Barrel Radius							Lens Radius						
	PRFRAD	H - Cusp Height (mm)						PRFRAD	H - Cusp Height (mm)					
		0,0010	0,0020	0,0030	0,0040	0,0050	0,0100		0,0010	0,0020	0,0030	0,0040	0,0050	0,0100
WCX-16 LE 1.5-16.0 WCX-16 LE 5.0-16.0	30,0	0,36	0,51	0,62	0,72	0,80	1,55	30,0	0,36	0,51	0,62	0,72	0,80	1,55
WCX-20 LE 1.9-20.0 WCX-20 LE 6.0-16.0	0,40	0,57	0,69	0,80	0,89	1,26	1,26	0,40	0,57	0,69	0,80	0,89	1,26	1,26

Lens Radius	Barrel Radius
$APMX = 2\sqrt{PRFRAD^2 - (PRFRAD - H)^2}$	$a_e = 2\sqrt{PRFRAD^2 - (PRFRAD - H)^2}$



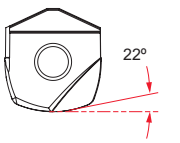
For high overhang conditions consider the next:

Vc1 = Vc x k

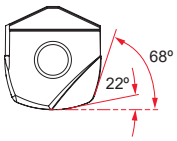
Vc1 - Recommended cutting speed for high overhang
Vc - Recommended cutting speed
k - Overhang factor

Overhang ratio	Factor (k)
3<DC	1,00
3<DC<5	0,70
5<DC<6	0,60
6<DC<7	0,50
DC>7	0,45

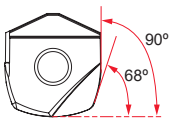
MACHINING METHODS Métodos de maquinação | Métodos de mecanizado



Lens angle

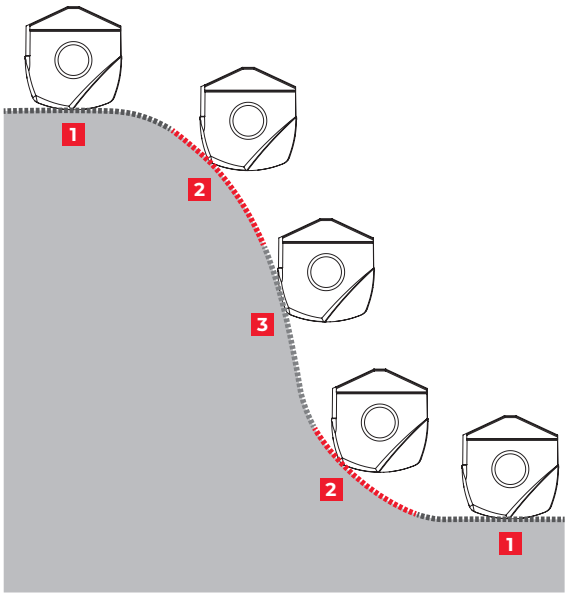


Corner angle



Barrel angle

In 3-Axis machining usable range of:
- Lens angle: between 0° and 22°.
- Corner angle: between 22° and 68°.
- Barrel angle: between 68° and 90°.



1 **WCX-LE** lens radius
cutting edge for bottom surfaces - large stepover

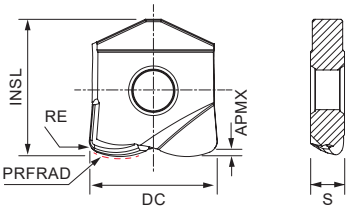
2 **WCX-LE** corner radius
cutting edge for inclined surfaces - small stepover

3 **WCX-LE** barrel radius
cutting edge for wall surfaces - large stepdown

Note: In 5-axis machining, the tool must be tilted to avoid cutting into the center where Vc=0 m/min. This tilt angle should not exceed 22°.

NEW WCX-HF Inserts | Pastilhas | Plaquitas

High feed



WCX HF

		P	M	K	H	Dimensions Dimensões Dimensiones (mm)					
		PVD	PVD	PVD	PVD						
	(2) Grade code	4F	4F	4F	4F						
(1) Geometry code	ISO Reference	PHF910	PHF910	PHF910	PHF910	INSL	RE	PRFRAD	S	APMX	DC
1113376	WCX-08 HF 0.6-03.4	●	●	●	●	9,7	0,6	3,4	2,1	0,40	8,0
1113377	WCX-10 HF 0.8-04.6	●	●	●	●	12,0	0,8	4,6	2,7	0,50	10,0
1113378	WCX-12 HF 1.0-06.0	●	●	●	●	14,6	1,0	6,0	3,2	0,50	12,0
1113379	WCX-16 HF 1.4-08.0	●	●	●	●	16,6	1,4	8,0	4,2	0,55	16,0
1113380	WCX-20 HF 1.8-10.0	●	●	●	●	20,0	1,8	10,0	5,2	0,55	20,0

● First choice | Primeira opção | 1ª opción ● Stock item | Produto de stock | Itens de stock ○ Available under request | Disponível sobre consulta Disponible bajo consulta

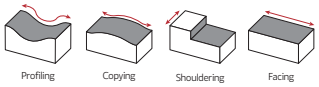
Insert Order Code: (1) Geometry code + (2) Grade code

RECOMMENDED CUTTING CONDITIONS Condições de corte recomendadas | Condiciones de corte recomendables

ISO	PSM	Material	HB (Brinell)	Vc (m/min)			Feed fz (mm/t)			Plunging	
				ae=25%	ae=50%	ae=100%	ae=25%	ae=50%	ae=100%	Vc (m/min)	fz (mm/t)
P	1	Unalloyed Steel	125-220	300	280	170	0,044 x DC	0,038 x DC	0,023 x DC	160	0,004 x DC
	2	Low-Alloyed Steel	220-280	280	250	230	0,044 x DC	0,038 x DC	0,023 x DC	140	0,004 x DC
	3	High-Alloyed Steel	280-380	200	180	150	0,040 x DC	0,036 x DC	0,020 x DC	120	0,004 x DC
M	4	SS - Ferritic / Martensitic	200-330	180	160	150	0,035 x DC	0,035 x DC	0,018 x DC	110	0,003 x DC
	5	SS - Austenitic	200-330	120	110	100	0,035 x DC	0,033 x DC	0,018 x DC	100	0,003 x DC
	6	SS - Austenitic-ferritic (Duplex)	230-260	80	70	60	0,033 x DC	0,031 x DC	0,018 x DC	60	0,003 x DC
K	7	Malleable Cast Iron	130-230	170	150	130	0,034 x DC	0,032 x DC	0,021 x DC	110	0,003 x DC
	8	Grey Cast Iron	180-245	220	200	180	0,033 x DC	0,035 x DC	0,021 x DC	120	0,003 x DC
	9	Nodular Cast iron	160-250	160	140	120	0,034 x DC	0,032 x DC	0,021 x DC	110	0,003 x DC
H	12	Hardened Steels	46-54 HRC	90	85	70	0,026 x DC	0,021 x DC	0,014 x DC	70	0,002 x DC
	13	Hardened Steels	55-62 HRC	90	85	70	0,026 x DC	0,021 x DC	0,014 x DC	70	0,002 x DC
	14	Hardened Steels	63-70 HRC	90	85	70	0,026 x DC	0,021 x DC	0,014 x DC	70	0,002 x DC

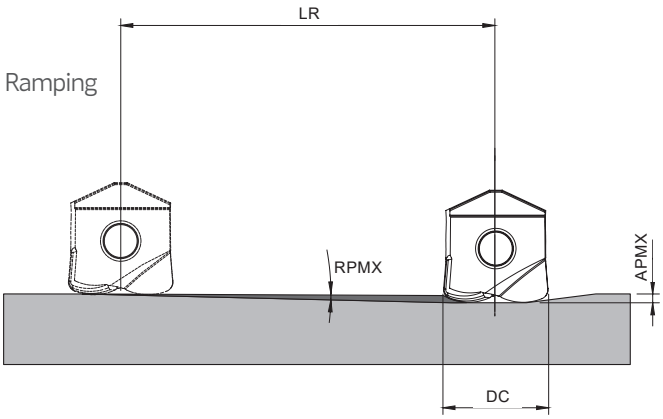
Determine the APMX:

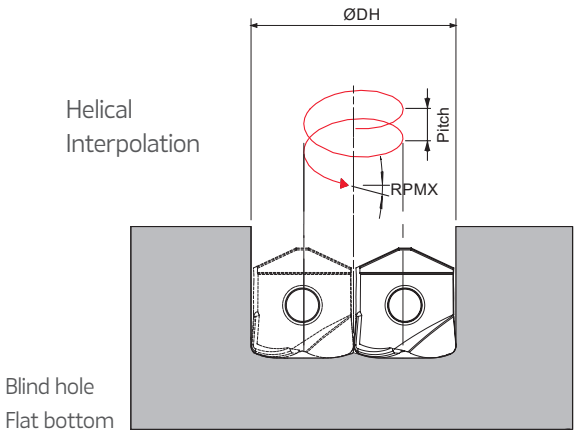
Insert size	APMX (mm)
WCX-08 HF 0.6-03.4	0,40
WCX-10 HF 0.8-04.6	0,50
WCX-12 HF 1.0-06.0	0,50
WCX-16 HF 1.4-08.0	0,55
WCX-20 HF 1.8-10.0	0,55



RAMPING AND HELICAL INTERPOLATION

Descida em rampa e interpolação helicoidal | Bajada en rampa e interpolación circular





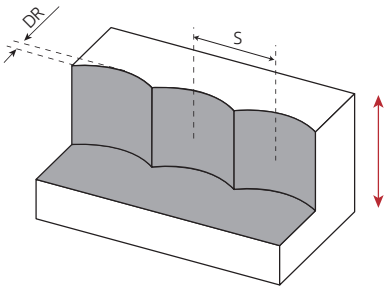
ØDi = ØDH - DC

DC	Ramping			Helical Interpolation			Max Angle (°)
	RPMX	APMX	Min LR	ØDHmin	ØDHmax	Max Pitch/Rev.	
8	1,5	0,40	15,3	10,7 -	- 16,0	0,21 0,40	1,5 1,0
10	1,5	0,50	19,1	13,3 -	- 20,0	0,25 0,50	1,5 1,0
12	1,5	0,50	19,1	16,0 -	- 24,0	0,32 0,50	1,5 0,8
16	1,5	0,55	21,0	21,3 -	- 32,0	0,42 0,55	1,5 0,6
20	1,5	0,55	21,0	26,7 -	- 40,0	0,53 0,55	1,5 0,5

Note: During helical interpolation do not exceed APMX.

PLUNGING Mergulho | Plunge

S max and DR corresponding cutting diameter DC (mm)					
DR (mm)	DC (mm)				
	8	10	12	16	20
1,0	2,6	3,0	3,3	3,9	4,4
2,0	3,5	4,0	4,5	5,3	6,0
3,0	-	4,6	5,2	6,2	7,1
4,0	-	-	5,7	6,9	8,0
5,0	-	-	-	7,4	8,7
6,0	-	-	-	7,7	9,2
7,0	-	-	-	-	9,5

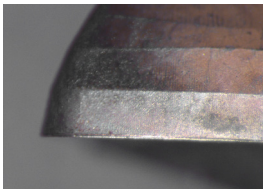


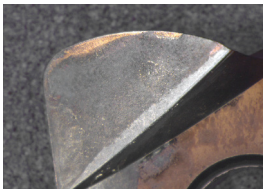
WCX-XT TEST REPORT Relatório de Teste WCX-XT | Informe de Prueba WCX-XT

Workpiece Material: 1.2738 steel (36-40 HRC)
Toolholder: 016E62090-02-U016200
Insert: WCX 16 HF 1.4-08.0 PHF910

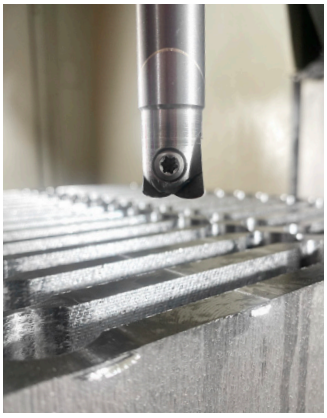
Operation: Helical Interpolation | Slotting

Cutting speed: V_c	150 m/min
Feed per tooth: f_z	0,80 mm/t
Depth of cut: APMX	0,60 mm
Stepover : a_e	16 mm
Ramp Depth	0,55 mm
Time	45 min





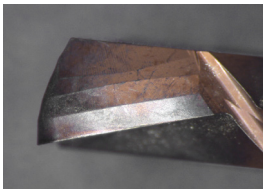
Flank and Rake wear after 45 min

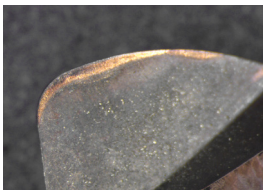


Helical Interpolation and slotting operations

Operation: Interrupted Pocket Milling

Cutting speed: V_c	150 m/min
Feed per tooth: f_z	0,80 mm/t
Depth of cut: APMX	0,60 mm
Stepover : a_e	9,60 mm
Ramp Depth	0,55 mm
Time	22 min

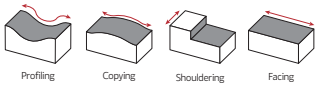




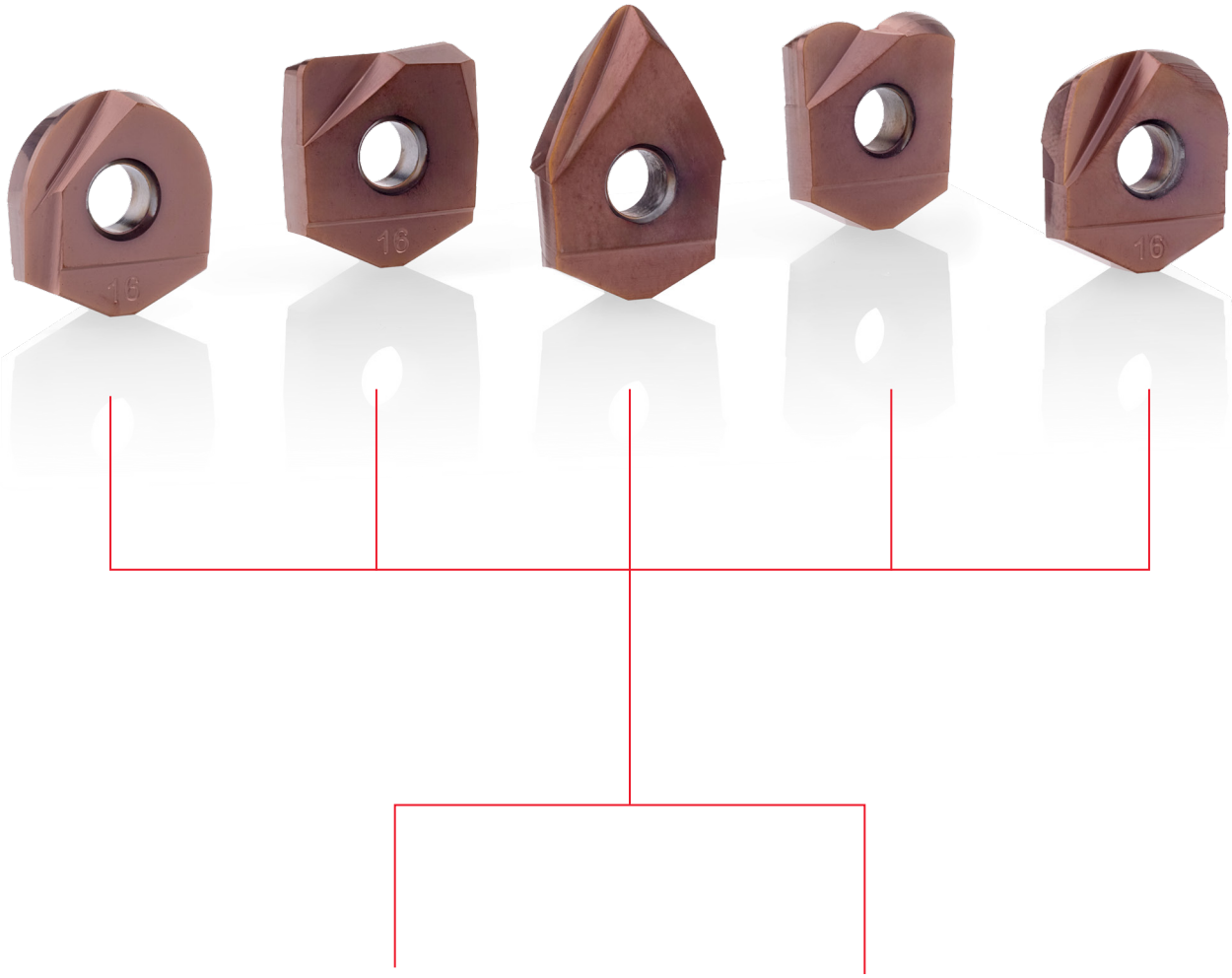
Flank and Rake wear after 67 min

Interrupted Pocket milling operation

The full test duration is 67 minutes, consisting of 45 minutes of helical interpolation and slotting machining, and an additional 22 minutes of interrupted pocket milling, all without any noticeable wear on the cutting edge.



ONE CLAMP, FIVE INSERT GEOMETRIES Um Sistema de Fixação, Cinco Geometrias | Un Sistema de Sujeción, Cinco Geometrías



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