TECHNICAL GUIDE

TP3501, TP2501,
TP1501, TP0501,
TK1501 AND TK0501

DURATOMIC® STEEL AND CAST IRON TURNING GRADES

SECO

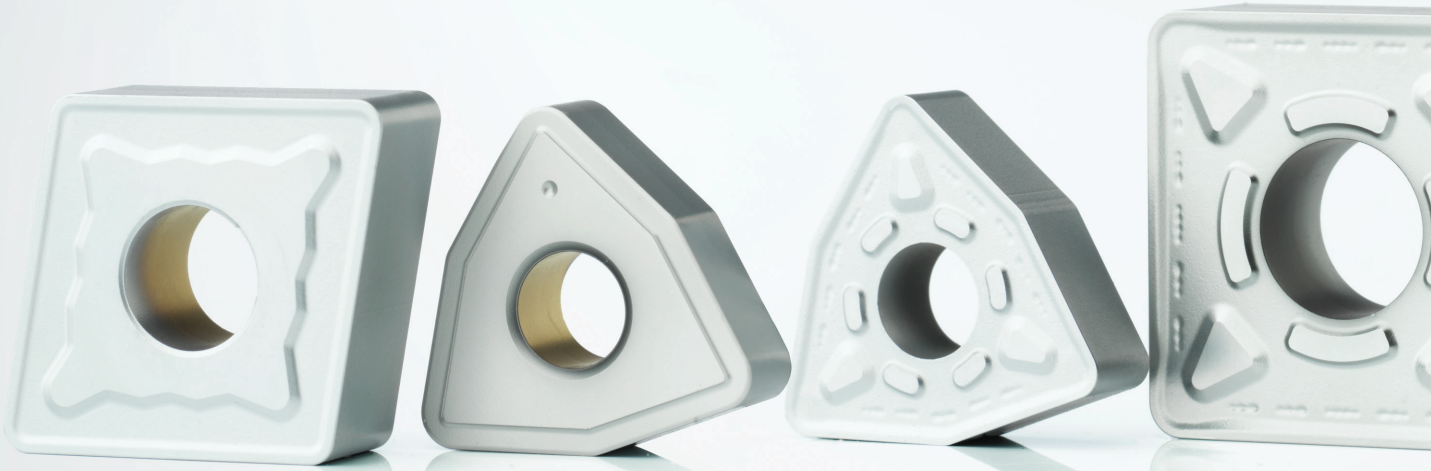
THE INDUSTRY'S BEST GRADES FOR STEEL AND CAST IRON TURNING

TP3501/TP2501/TP1501/TP0501 AND TK1501/TK0501

Steel turning remains one of the most common industrial processes in the world. Through the incorporation of Duratomic technology in our revolutionary TP2500 grade in 2007, Seco has built a lead this application area.

Over the past 10 years, we have continued extensive research into the technology that produces our Duratomic technology based coatings. We have now incorporated all of that knowledge into six new grades: TP3501, TP2501, TP1501 and TP0501 for steel turning and TK1501 and TK0501 for cast iron turning.

By keeping the same characteristics and strengths as their predecessors, these six grades represent a substantial improvement in both toughness and wear resistance. The new grades boost productivity, reliability and insert life to provide unmatched value.



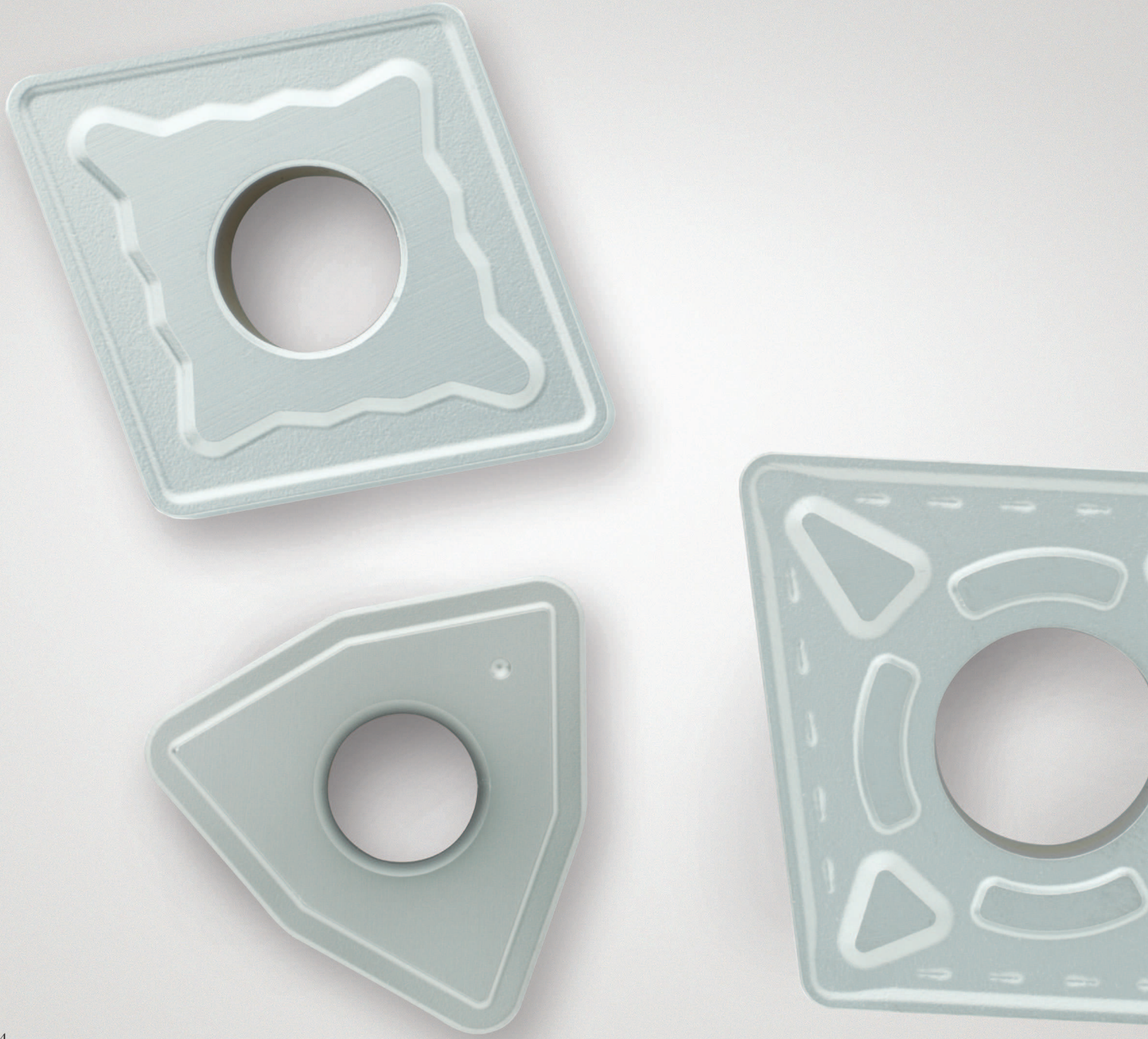
THE INDUSTRY'S BEST GRADES FOR STEEL AND CAST IRON TURNING

THE POWER OF DURATOMIC

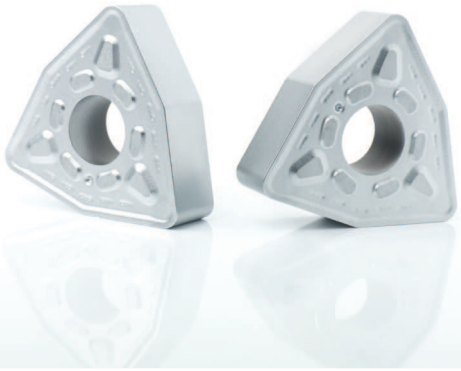
NEW PARADIGM IN INSERT COATINGS

Representing the industry's first tailored, *α*-based Al_2O_3 coating, Seco's introduction of Duratomic technology redefined how inserts could be applied. By controlling and ordering the atoms and crystals, we improved the mechanical properties and thermal and chemical inertness. Combined with increased toughness, this created performance far beyond the capabilities of traditional Al_2O_3 coatings. Additionally, the new coatings reduce the tendency of workpiece materials to adhere to the cutting edge.

With the refined Duratomic technology, we created a comprehensive selection of grades optimised for high and reliable performance in specific cutting materials and applications.



New features such as used-edge detection have been added, and we have deliberately focused on reducing our environmental impact by increasing both our own efficiency and that of our users. The new TP3501, TP2501, TP1501 and TP0501 grades together with TK1501 and TK0501 represent the culmination of these efforts and the industry's leading solution for turning steel and cast iron.



DURATOMIC TECHNOLOGY OPTIMIZED FOR HIGH AND RELIABLE PERFORMANCE

PRODUCT DESCRIPTION

THE STEEL GRADES

Our latest addition, TP3501 completes the grade range for steel turning, whereas TP2501, TP1501 and TP0501 Duratomic grades already have a solid track record of improving performance and productivity in steel turning.

From the first developed Duratomic technology grade chain in 2007, we have maintained the characteristics of each grade, while applying the vast knowledge we have gained on Duratomic technology and how it affects properties.

TP3501: HIGHLY SECURE PRODUCTIVITY

The Duratomic technology grade addition TP3501 is intended for the most demanding applications where enhanced edge toughness is required. TP3501 is the first choice when highly secure productivity is the priority over maximised cutting data, especially in steel and in workpieces mixed with stainless steel.

TP2501: VERSATILE PRODUCTIVITY

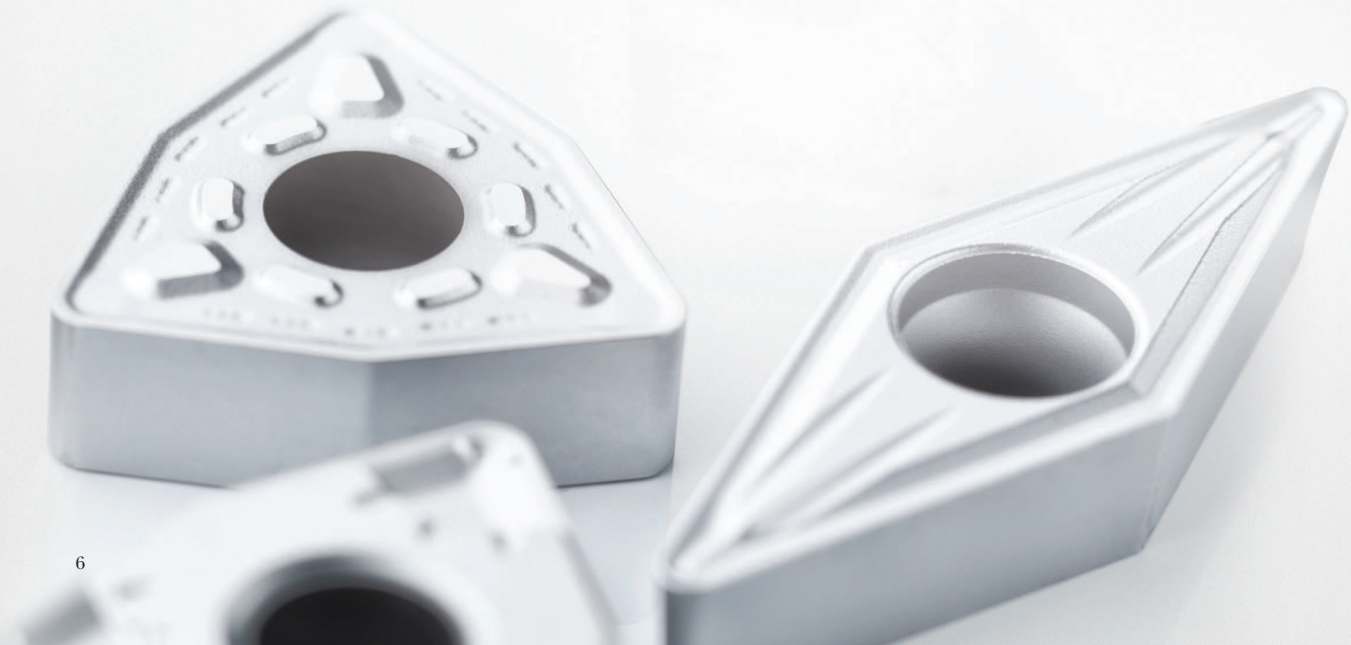
Where versatility is needed and working conditions may not be perfect, TP2501 is the first choice for maximising manufacturing output under varying productivity, cutting data and workpiece material requirements. An estimated 25% of steel turning applications feature working conditions that demand TP2501's grade design and properties.

TP1501: BALANCED PRODUCTIVITY

With well-balanced properties, TP1501 is the first choice for high performance for applications requiring high wear resistance and elevated cutting speeds. An estimated 20% of steel turning applications feature working conditions that demand TP1501's design properties, and it is generally most applicable to workpieces made from softer, low-alloy steels.

TP0501: HIGH-SPEED PRODUCTIVITY

The first choice for achieving the highest possible wear resistance and/or cutting speeds, TP0501 requires stable conditions to provide high performance. Ideal applications have high demands in dimensional stability, even under high thermal loads. TP0501 provides exceptional benefits when applied to very abrasive steels.



THE CAST IRON GRADES

Since the 2013 launch of our first Duratomic technology grades TK2001 and TK1001 for cast iron, we have further improved performance and productivity in both grey and nodular ductile cast irons.

TK1501: BALANCED PRODUCTIVITY IN CAST IRON

TK1501 is the first choice in nodular ductile cast iron turning providing a wide applicability with the characteristic high wear resistance from Duratomic technology based coatings.

TK1501 is highly productive in roughing and very reliable at more limited speeds in demanding applications in both grey cast iron and steels. For applications demanding the highest security and Duratomic technology performance, TK1501 with the new MR9 geometry delivers very good results.

TK0501: HIGH-SPEED PRODUCTIVITY IN CAST IRON

TK0501 is the first choice in grey cast iron turning while maintaining high productivity levels and achieving exceptional security in cast iron applications with significant material variations. TK0501 is capable of delivering long tool life and productivity in ductile cast irons. In up to one third of continuous cut applications, it may outperform TK1501. Additionally, TK0501 and MR9 are a good combination for high productivity in interrupted cut applications.

PRODUCT DESCRIPTION

TP3501
- Highly secure productivity

TP2501
- Versatile productivity

TP1501
- Balanced productivity

TP0501
- High-speed productivity

TK1501
- Balanced productivity in cast iron

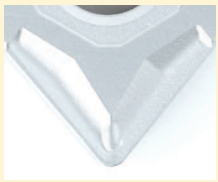
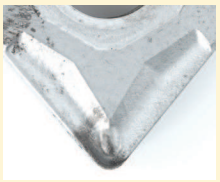
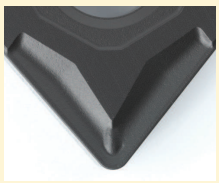
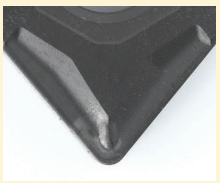
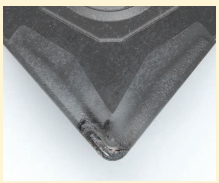
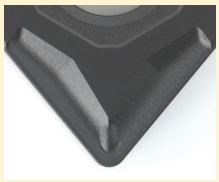
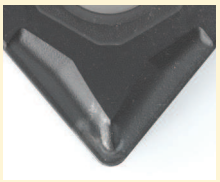
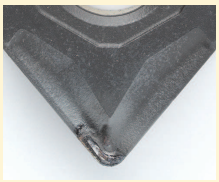
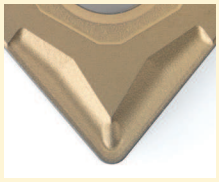
TK0501
- High-speed productivity in cast iron

EDGE INTELLIGENCE

SECO USED-EDGE DETECTION

With the new grades, Seco took into account users' need to reduce waste by quickly and accurately determining unused insert edges. A unique new approach to used-edge detection makes it very easy to identify unused edges with the naked eye, with the key feature being the fact that there is no impact on overall performance.

The used-edge detection was selected to give the highest possible contrast and excel in real-life working conditions in all new Duratomic technology grades.

Used-Edge Detection	New edge	10 seconds in cut	15 minutes in cut
			
All Black	New edge	10 seconds in cut	15 minutes in cut
			
Black/TiN-flank **Black/TiC-flank**	New edge	10 seconds in cut	15 minutes in cut
			
Classic TiN or TiN-top	New edge	10 seconds in cut	15 minutes in cut
			

CONCLUSION

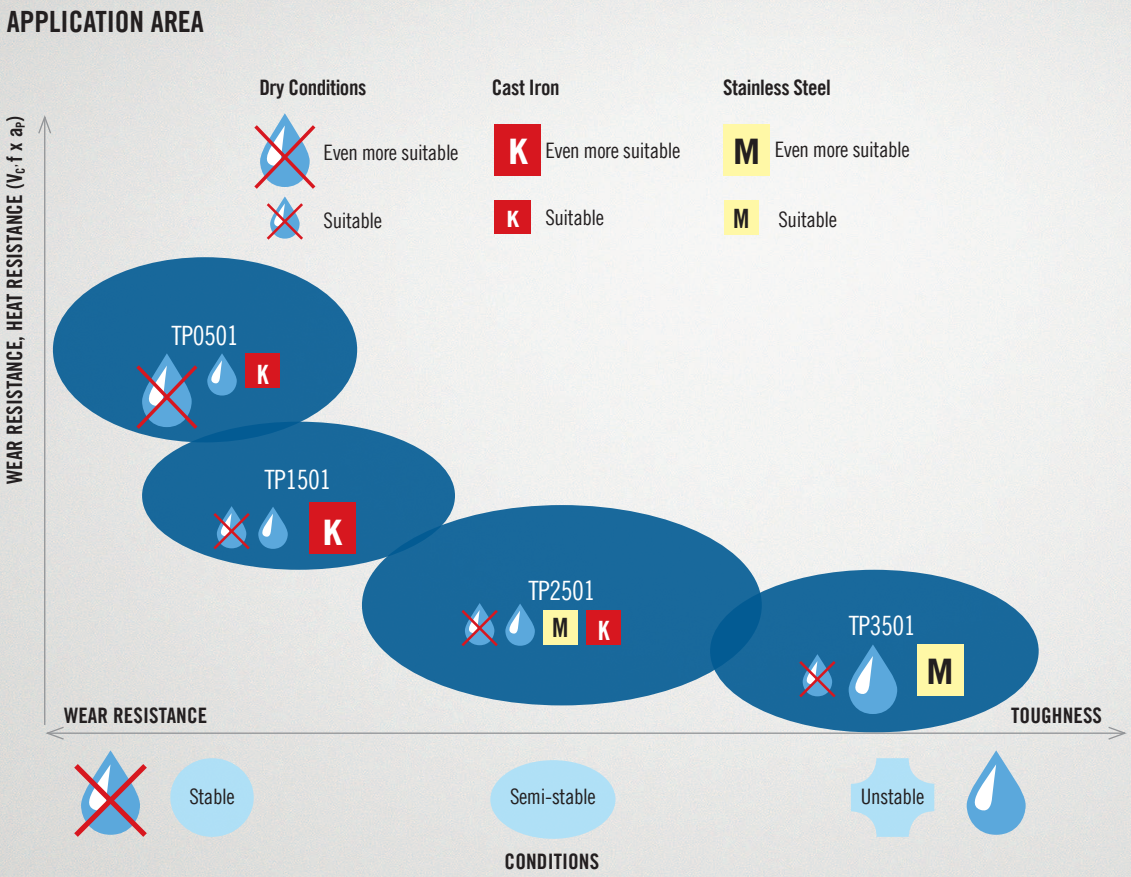
The classic gold-colored TiN rake face top gets a weak mark and often gives a significant reduction in performance. The black rake faces get hardly visible used-edge marks, but at least with Duratomic technology based coatings, they offer high performance. The chrome colored rake face of the new grades have a high-contrast mark from the used-edge detection.

SECO USED-EDGE DETECTION MEANS NOT WASTING PERFORMANCE FROM ANY EDGE

EDGE INTELLIGENCE

APPLICATION IN STEEL

The following chart illustrates the application area for using TP3501, TP2501, TP1501 and TP0501 in steel workpieces.

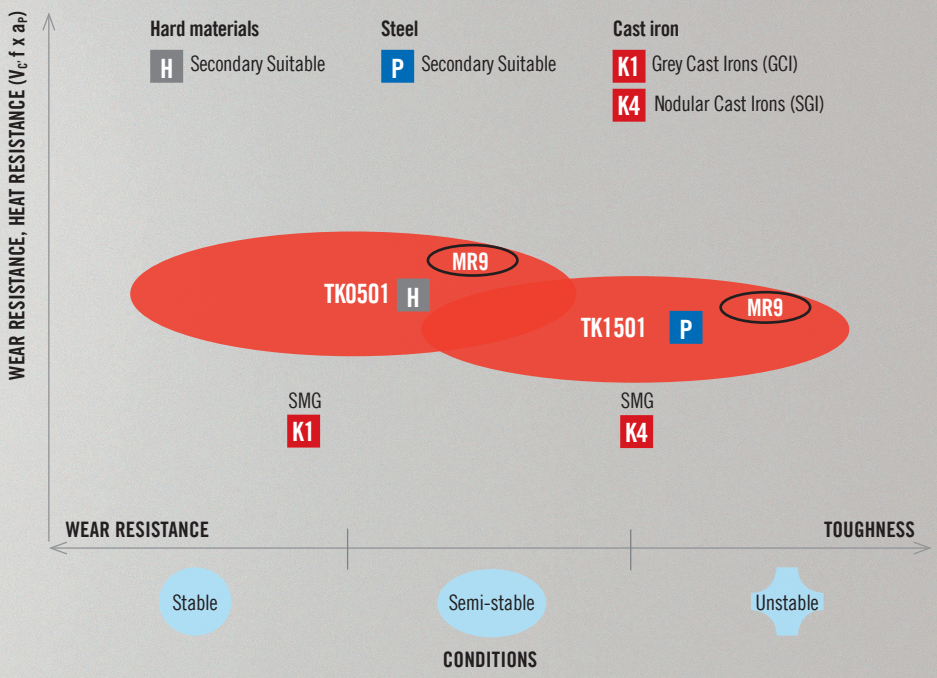


The grade chain provides a very versatile and comprehensive range to cover the whole steel turning area. TP2501 is the most versatile option, while TP3501 is the most secure choice. TP1501 provides competent performance and balanced productivity for applications in low-alloy steels or using lower speeds. TP0501 offers a high-heat profile in general steel machining, particularly in high-alloy steels.

APPLICATION IN CAST IRON

The following chart illustrates the application area for using TK1501 and TK0501 in cast iron workpieces.

APPLICATION AREA



TK1501 is the first choice in ductile cast iron. TK0501 is the first choice in the grey cast iron area. TK0501 also works well in continuous applications in ductile cast irons. TK1501 can be a better choice at limited speeds with better toughness in demanding grey cast iron applications.

Note: Combining the TK grades with the MR9 geometry increases their toughness drastically while keeping high wear resistance.

GRADES TO MEET EVERY NEED

EDGE INTELLIGENCE

CUTTING DATA & APPLYING SMG

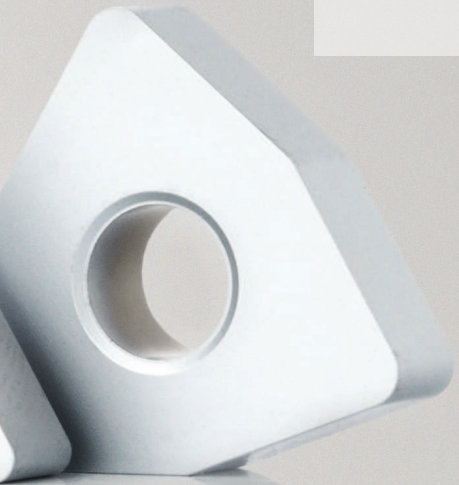
SMG	Description	TP0501		TP1501		TP2501		TP3501	
		f (mm/r)		f (mm/r)		f (mm/r)		f (mm/r)	
		0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4
P1	Free-cutting steels	780	610	690	510	590	450	510	335
P2	Low-alloy ferritic steels, C < 0.25%wt	760	590	680	495	560	460	495	330
P3	Case-hardening steels, C < 0.25%wt	620	510	500	400	570	465	360	250
P4	Low-alloy Quench & Temper steels, 0.25% < C < 0.67%wt	580	450	510	375	435	330	380	250
P5	Quench & Temper steels, 0.25% < C < 0.67%wt	520	435	420	335	405	330	300	220
P6	Low-alloy bearing steels, C > 0.67%wt	620	480	550	405	465	355	410	270
P7	Bearing steels, C > 0.67%wt	550	460	445	355	390	350	285	210
P8	Tool steels	520	435	420	335	405	330	270	180
P11	Ferritic & martensitic stainless steels	540	445	435	345	420	340	250	130
P12	Maraging and precipitation- hardening stainless steels	315	265	255	205	175	160	150	75

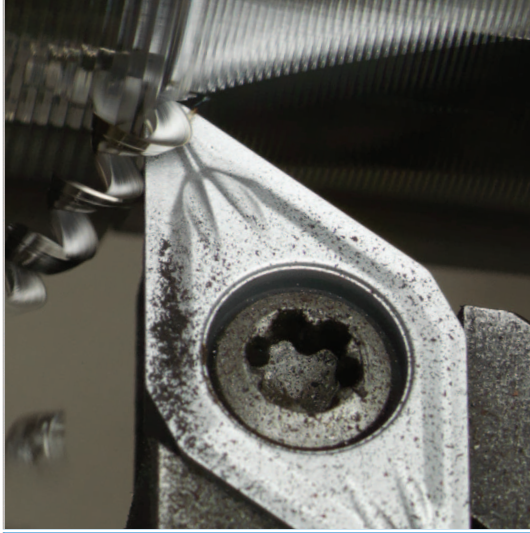
*Cutting speed in m/min

SMG	Description	TK0501		TK1501		TP1501	
		f (mm/r)		f (mm/r)		f (mm/r)	
		0.2	0.4	0.2	0.4	0.2	0.4
K1	Grey cast iron (GCI)	570	455	480	355	450	405
K2	Compacted graphite irons (CGI)	420	355	420	345	390	350
K3	Malleable cast irons (MCI)	355	300	355	290	330	295
K4	Nodular cast irons (SGI)	340	285	340	280	315	280
K5	Austempered ductile irons (ADI)	205	170	200	165	185	170
K6	Austentic lamellar cast irons	350	280	295	220	275	250
K7	Austentic nodular cast irons	260	215	260	210	240	215

*Cutting speed in m/min

The new SMG-based box label incorporates a QR code to provide a direct link to a product-specific cutting data page in MyPages.





QR CODE ON BOX LABEL PROVIDES A DIRECT LINK TO THE PRODUCT-SPECIFIC CUTTING DATA PAGE IN MY PAGES.

PRODUCT RANGE

OPTIMISING CHIP CONTROL

TPx501 and TKx501 grades are available in many insert shapes and geometries for light, medium and roughing operations. The following table illustrates the breadth of this range.

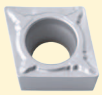
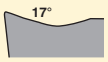
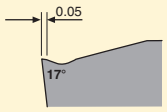
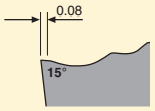
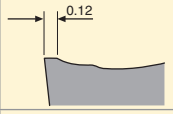
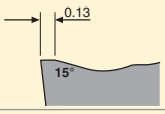
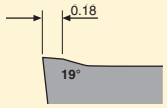
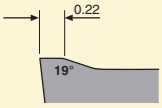
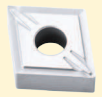
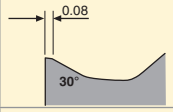
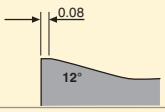
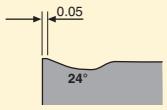
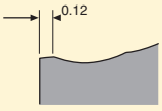
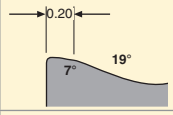
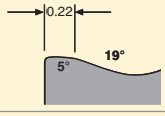
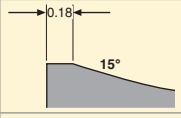
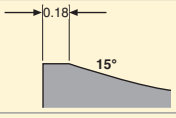
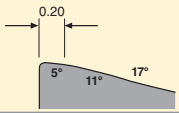
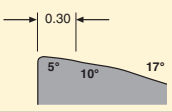
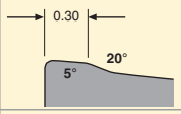
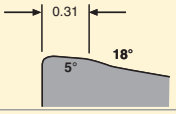
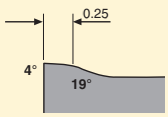
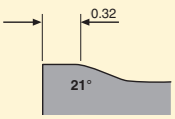
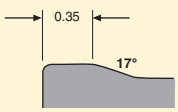
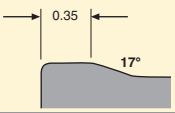
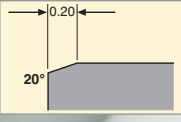
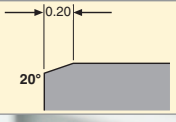
Type of operation

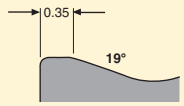
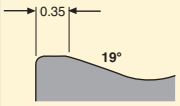
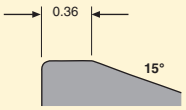
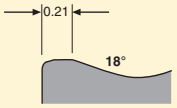
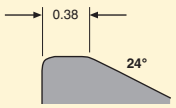
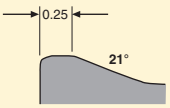
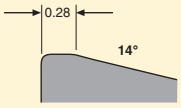
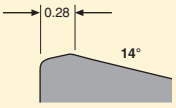
R/RR	POSITIVE NEGATIVE			R4 Neg	R5 Neg	RR6 Neg	R7 Neg		
MR							MR7 Neg	(xNMA) Neg	(MR9) Neg
M			Pos M3 Neg	M4 Neg	Pos M5 Neg	M6 Neg			
MF		Pos MF2 Neg			MF5 Neg				
F	Pos F1								
FF	Pos FF1 Neg	FF2 Neg							

Edge strength

COMPREHENSIVE PRODUCT RANGE FOR OPTIMISING CHIP CONTROL STEEL AND CAST IRON TURNING

INSERT PROFILE COMPARISON

Positive Inserts			Corner	Cutting Edge
	F1	For finishing, with a sharp cutting edge for easy-cutting properties.		
	MF2	For medium finishing, a versatile finishing to semi-finishing chipbreaker with light cutting action for positive inserts. Suitable for a wide range of cuts in steel and stainless steel applications, including boring.		
	M3	For general turning, a reliable semi-finishing to medium-roughing chipbreaker ensuring safe chip flow. Suitable for medium cuts in steel and stainless steel applications, including boring.		
	M5	For medium-rough and roughing, combines high edge strength with comparatively low cutting forces.		
Negative Double-Sided Inserts			**Corner**	**Cutting Edge**
	FF2	For finishing, intended for fine finishing and semi-finishing of steels and stainless steels. The positive, tight chip groove offers light cutting action combined with superior chip forming.		
	MF2	For finishing, good capacity for medium-rough machining		
	M3	For general turning, first choice for medium-rough machining and also the most versatile Seco chipbreaker		
	M4	Chipbreaker intended for cast iron. Positive rake angle with a narrow T-land gives low cutting forces. First choice for cast iron machining at high speeds.		
	MF5	For near net shape turning at high feeds		
	M5	For medium to roughing, intended for demanding operations at high feed rates in steel		
	M6	For medium to roughing, intended for semi-roughing and roughing of steel. A well-balanced design combining excellent chip control and relatively low cutting forces, which provides reliable cutting action in both continuous and interrupted cuts.		
	MR7	Secured choice for roughing and interrupted cut, suitable for high feed rates and depths of cut		
	MR9	The strongest chipbreaker intended for cast iron. The negative chamfers make it very suitable for high feeds in interrupted cuts and very reliable action in cast irons.		

Negative Single-Sided Inserts			Corner	Cutting Edge
	R4	For medium roughing with low cutting forces		
	R5	Recommended for medium- roughing of steel		
	RR6	For roughing of stainless steels and steel, a very easy-cutting chipbreaker for single-sided inserts		
	R7	For secure roughing and intermittent machining		

MR9 – THE STRONGEST EDGE THERE IS INTENDED FOR CAST IRON

QUICK GUIDE TO KEY TECHNICAL FEATURES

TP GRADES

TP3501

- **1st choice for highly-secure productivity in steels**
- When **toughness** is prioritised
- For more intermittent machining and with speed limitations
- From **roughing to finishing,** especially smaller components
- Also highly capable in stainless steels applications

TP2501

- **1st choice grade in steels**
- When **reliability** is prioritised
- For versatility and more intermittent machining
- From **roughing to finishing**
- Also capable in cast irons and stainless steel productivity

TP1501

- **1st choice in low-alloyed steels**
- When **applicability** is prioritised
- For versatile productivity and some intermittent machining
- More **finishing** and lower heat applications than TP0501
- Complement for intermittent machining of ductile cast iron

TP0501

- **1st choice in high-carbon steels**
- When **productivity** is prioritised
- For continuous cuts and long time in cut
- More **roughing** and higher speeds than TP1501
- Non-coolant machining opportunities and complement for grey cast iron

TK GRADES

TK1501

- **1st choice in ductile cast iron**
- When general cast iron **applicability** is required
- For versatile productivity and intermittent machining in most cast irons
- More suitable than TK0501 for applications with limited speeds and high reliability requirements
- In combination with MR9, the most secure productivity solution available
- When general performance in steel is also needed

TK0501

- **1st choice in grey cast iron**
- When **productivity** in all cast irons is prioritised
- For highest wear resistance in continuous cuts of all cast irons
- Higher speed and easier cast iron applications than TK1501
- With MR9, TK0501 is a very good solution
- When highest performance is needed, even in hardened steels

KEY TECHNICAL FEATURES

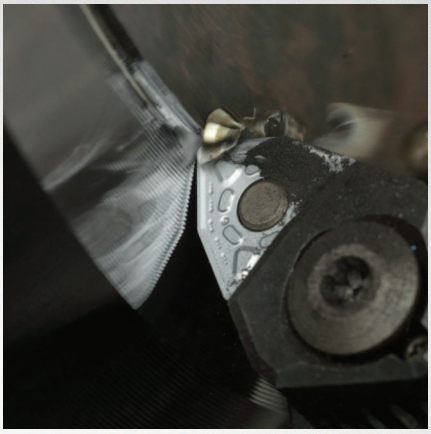
THE DURATOMIC TP AND TK GRADES:

- Increase your production
- Reduce your inventory
- Reduce your waste

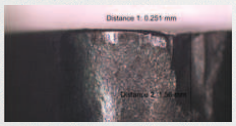
CASE STUDIES

TP3501
ROUGHING OF GEAR FORGING

Application	**Gear forging**
Work piece material	**C45**
SMG	**P4**
Tool criterium	**Surface finish from flank wear**
Cutting mode	**Interrupted cuts**
vc (m/min)	**180**
ap (mm)	**up over 3 mm**
f (mm/rev)	**up to 0.55 mm/rev**
Coolant	**No, due to interruptions**



Grade TP3501	Grade: TP3500
Insert CNMG160616-M5	Insert CNMG160616-M5



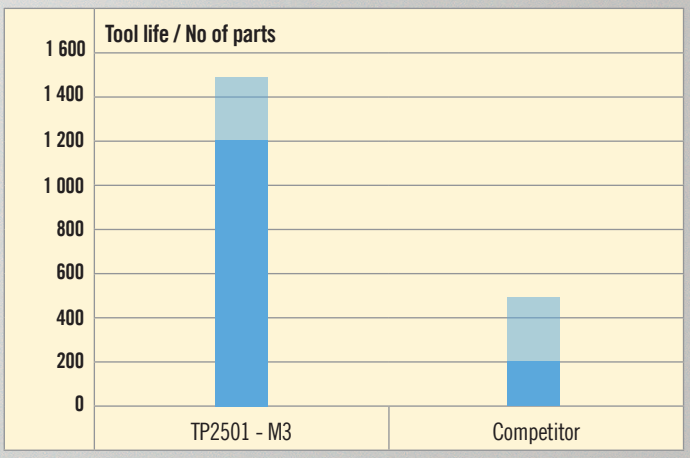
COMMENTS

The application has demanding intermittent parts that need both highly secure edge behavior and deformation resistance.

TP2501
SEMI-FINISHING OF DRIVER GEAR PART

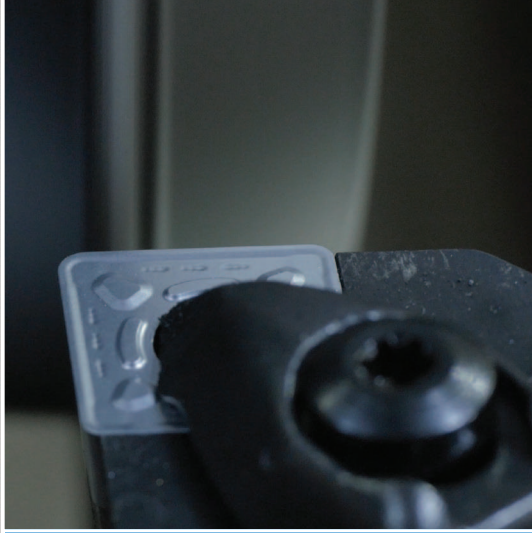
Part	**Driver gear**
Work piece material	**SCM415**
SMG	**SMG P3**
Cutting mode	**Internal interrupted cut**
Coolant	**Emulsion**

Grade	TP2501	Competitor insert
Insert	WNMG060404-M3	WNMG060404-...
Vc (m/min)	150	120
f (mm/rev)	0.25	0.25
ap (mm)	1.5	1.5
Tool life	1,200–1,500 parts	200–500 parts



COMMENTS

Customer expectations for improving process stability in small demanding component with interruptions were exceeded. Productivity increased 25%.



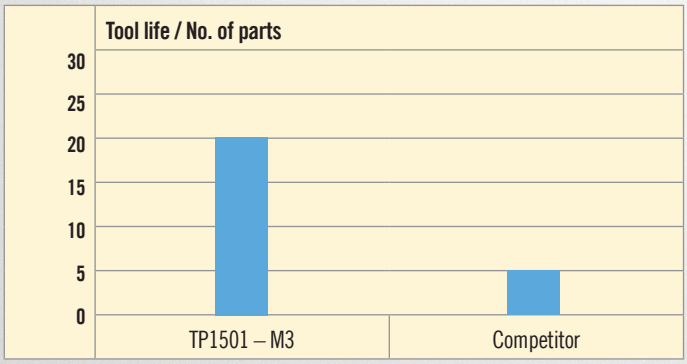
SECURE AND VERSATILE

CASE STUDIES

TP1501
INTERNAL SEMI-FINISHING OF PISTON

Part	**Piston**
Work piece material	**C60**
SMG	**SMG P3**
Cutting mode	**Continuous**
Coolant	**Emulsion**

Grade	TP1501	Competitor insert
Insert	TNMG160404-M3	TNMG160404-...
Vc (m/min)	260	240
f (mm/rev)	0.2	0.15
ap (mm)	1.5	1.5
Tool life	20 parts	5 parts



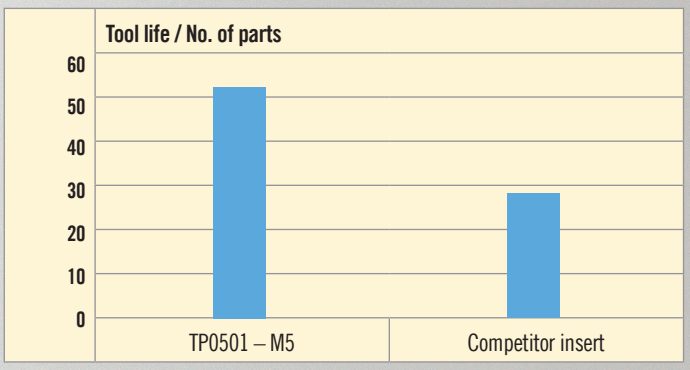
COMMENTS

In many ordinary steel applications, TP1501 provides major tool life or productivity gains while maintaining reliability.

TP0501
ROUGHING OF ROLLER BEARING

Part	**Bearing**
Work piece material	**100Cr6**
SMG	**SMG P7**
Cutting mode	**Continuous**
Coolant	**Emulsion**

Grade	TP0501	Competitor insert
Insert	TNMG220416-M5	TNMG220416-...
Vc (m/min)	300	300
f (mm/rev)	0.35–0.40	0.35–0.4
ap (mm)	2-4	2-4
Tool life	> 50 parts	< 30 parts



COMMENTS
Demonstrates the capability of TP0501 in roller bearing steel materials.

BALANCE AND SPEED

CASE STUDIES

TK1501
RELIABLE SHAFT MACHINING

Part	**Shaft**
Work piece material	**Ductile**
SMG	**SMG K4**
Vc (m/min)	**220**
f (mm/rev)	**0.26**
ap (mm)	**2**
Tool life	**45 parts**
Coolant	**Emulsion**

Grade	TK1501	Competitor insert
Insert	CNMG120408-M4	CNMG120408-...

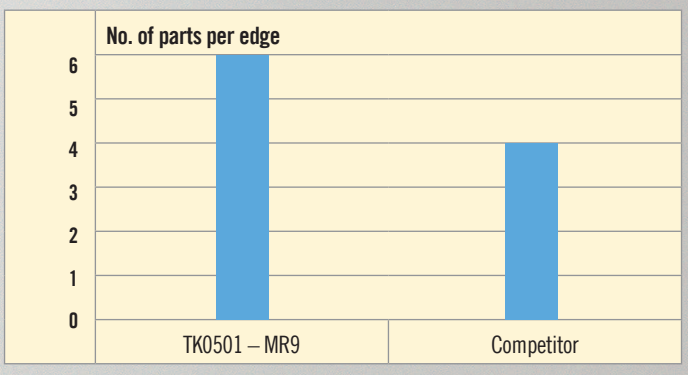
COMMENTS

Achieved higher wear resistance while maintaining a more reliable edge as compared to competitor. Note the edgeline behaviour after same time in cut.

TK0501
ROUGH BORING OF CYLINDER BLOCK

Part	**Cylinder block, some interruptions**
Operations	**Rough-Boring**
Workpiece material	**EN-GJS-600, Ductile iron**
SMG	**SMG K4**
Vc (m/min)	**150**
f (mm/rev)	**0.30**
ap (mm)	**2–4**
Coolant	**Yes, flood**

Grade	TK0501	Competitor
Insert	CNMA120412-MR9	CNMA120412...
Tool life	6 parts per edge	4 parts per edge



COMMENTS
Outperformed the competitor insert and achieved at least 50% more parts using the combination TK0501-MR9.

BALANCE AND SPEED IN CAST IRON

INDUSTRY APPLICATION AREAS

A GRADE TO MEET EVERY NEED

Local business and application environments may vary, but the main application areas of the Duratomic steel and cast iron grades are well defined:

GENERAL MACHINING APPLICATIONS
TP3501, TP1501 and TK1501 provide balanced performance in many applications. TP2501 is the single, most versatile productivity grade.

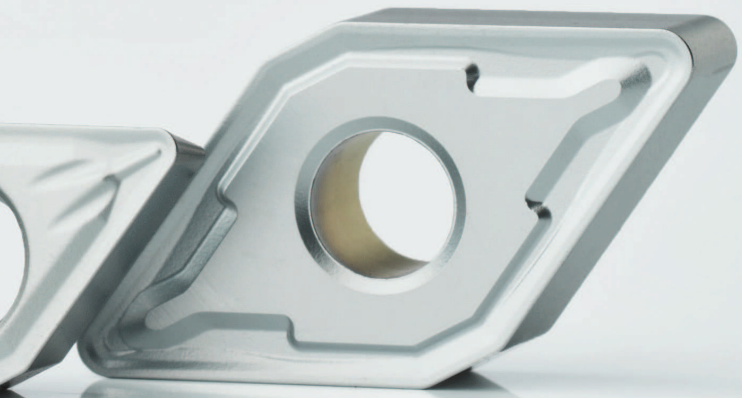
AUTOMOTIVE INDUSTRY APPLICATIONS (main and subcontractors)
The full product range is applicable for optimisation. TP1501 often provides a good starting point in steels. TK1501 is always a reliable performer in cast iron components.

BEARING INDUSTRY APPLICATIONS (automotive and general industrial use)
Full grade range is applicable. TP0501 may be the best performing solution, backed up with TP2501 and TP1501 for optimisation.

YOUR SECO BENEFITS

THE INDUSTRY'S STRONGEST STEEL AND CAST IRON OFFERING

- Edge Intelligence makes it easier to get the best out of every single edge.
- Duratomic technology enables significant performance gains.
- The application adapted grade range includes six powerful grades. Four new grades for steel (TP3501, TP2501, TP1501 and TP0501) with two new grades for cast iron (TK1501 and TK0501.) Complete application area coverage.
- Used-edge detection makes it easy to avoid discarding unused edges, minimises operator errors and eliminates costly inefficiencies.



GET THE BEST OUT OF EVERY SINGLE EDGE

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