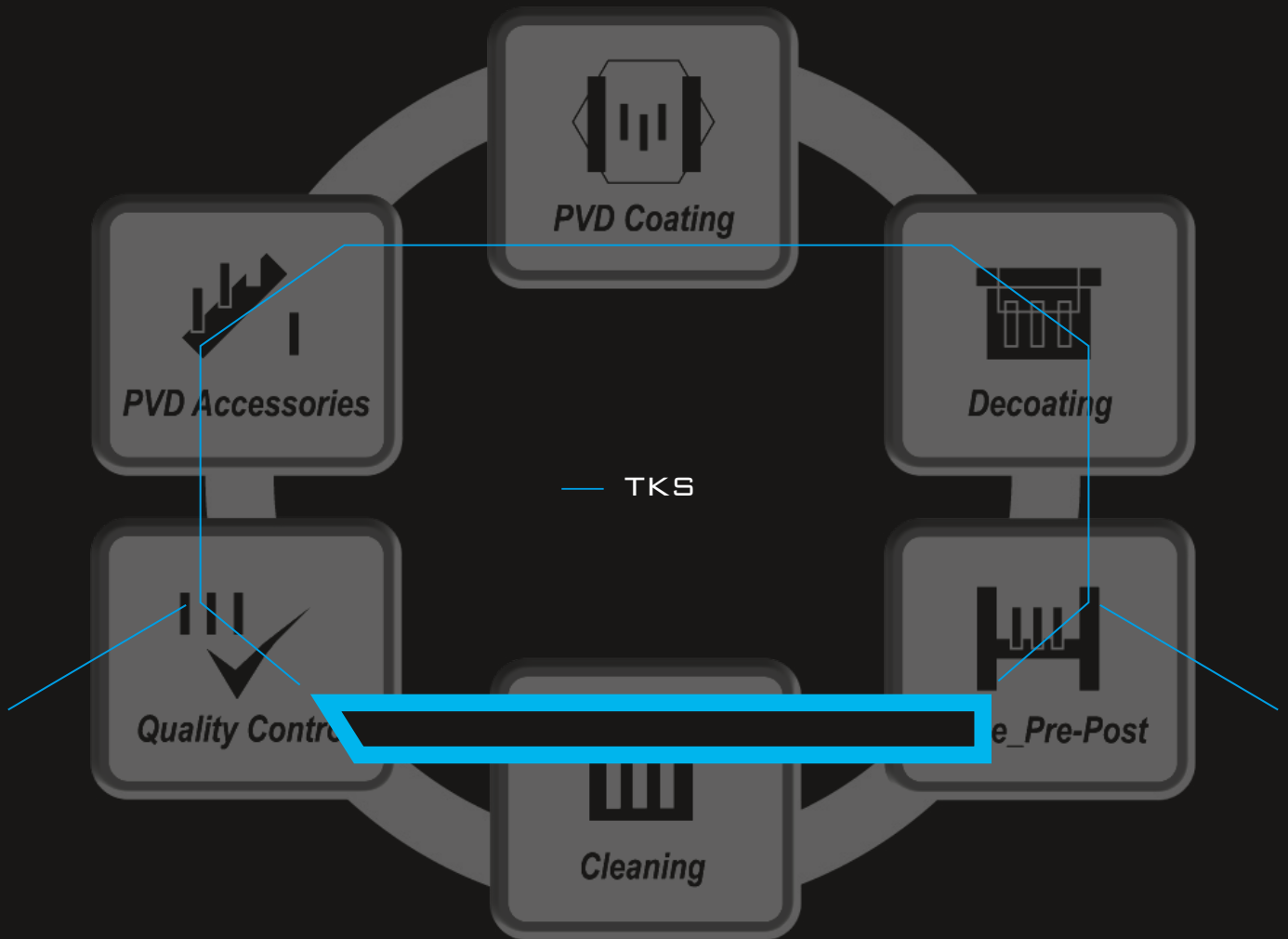




## PLATIT COATING INTELLIGENCE



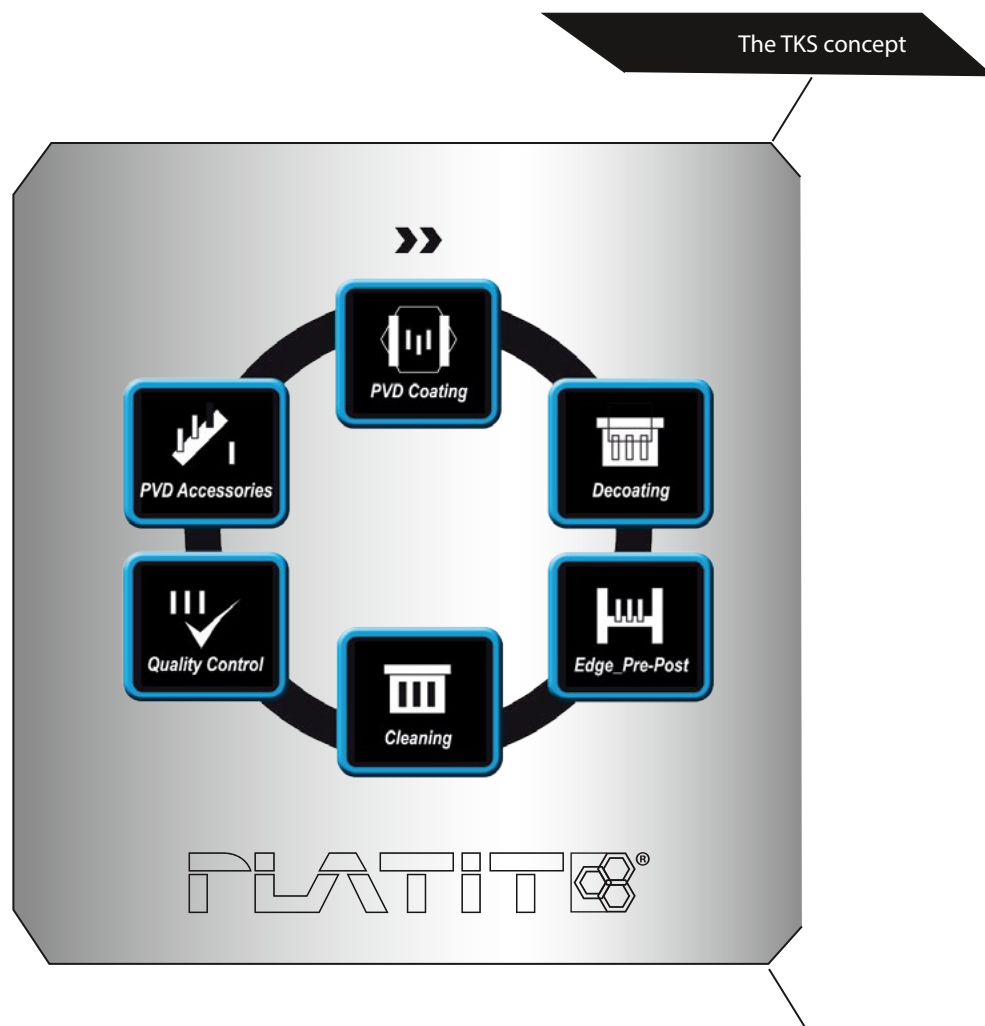
# Turnkey solutions

## OVERVIEW

PLATIT's turnkey system with complete solutions for upstream and downstream steps for hard coating is ideally suited for seamless integration into the tool manufacturing and regrinding process.

PLATIT provides and integrates everything needed for a successful coating center:

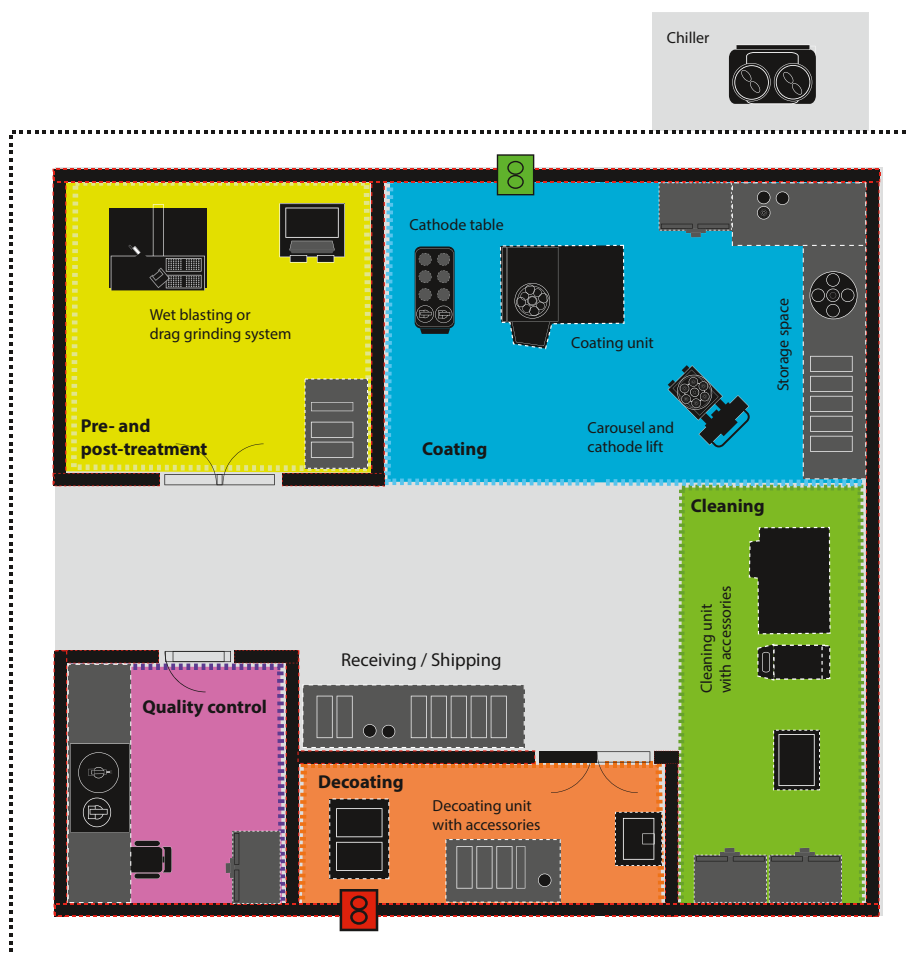
- Depending on the requirements, different dimensions of coating chambers for the coating of small to oversized substrates
- Comprehensive coating know-how
- Equipment for decoating high-speed steel and carbide
- Equipment for edge pre-treatment
- Vacuum-assisted single-chamber cleaning units
- Systems for easy quality control of the coating
- Equipment for post-treatment, such as polishing
- PVD production accessories from sleeves to handling systems and chillers



## PLANNING AND IMPLEMENTATION

### View\_TKS Layout

PLATIT cooperates with partner companies to offer a wide range of peripheral equipment for upstream and downstream steps of the coating process. Flexibly tailored to the various applications, PLATIT's processes are integrated into its customers' tool manufacturing and thus guarantee an independent, stable and innovative production process.



Typical workflow in a coating center with PLATIT's turnkey solutions:

- |    |                              |     |                          |
|----|------------------------------|-----|--------------------------|
| 1. | Receipt of goods             | 7.  | Coating                  |
| 2. | Preliminary cleaning         | 8.  | Unloading of a batch     |
| 3. | Optional: decoating          | 9.  | Optional: post-treatment |
| 4. | Optional: edge pre-treatment | 10. | Quality control          |
| 5. | Fine-cleaning                | 11. | Goods output             |
| 6. | Preparation for coating      |     |                          |

Some modules (decoating, pre- and post-treatment) should be set up in a separate room from the coating units. Chiller must be placed separately.

## OVERVIEW

Decoating / stripping is an important prerequisite for recoating at a high level of quality. The old, used coating is removed so that the new one will adhere well to the reground tool and achieve a high degree of performance. Regrinding without decoating leads to a reduction of the tool's lifespan.

### Decoating in coating centers\_Conventional process

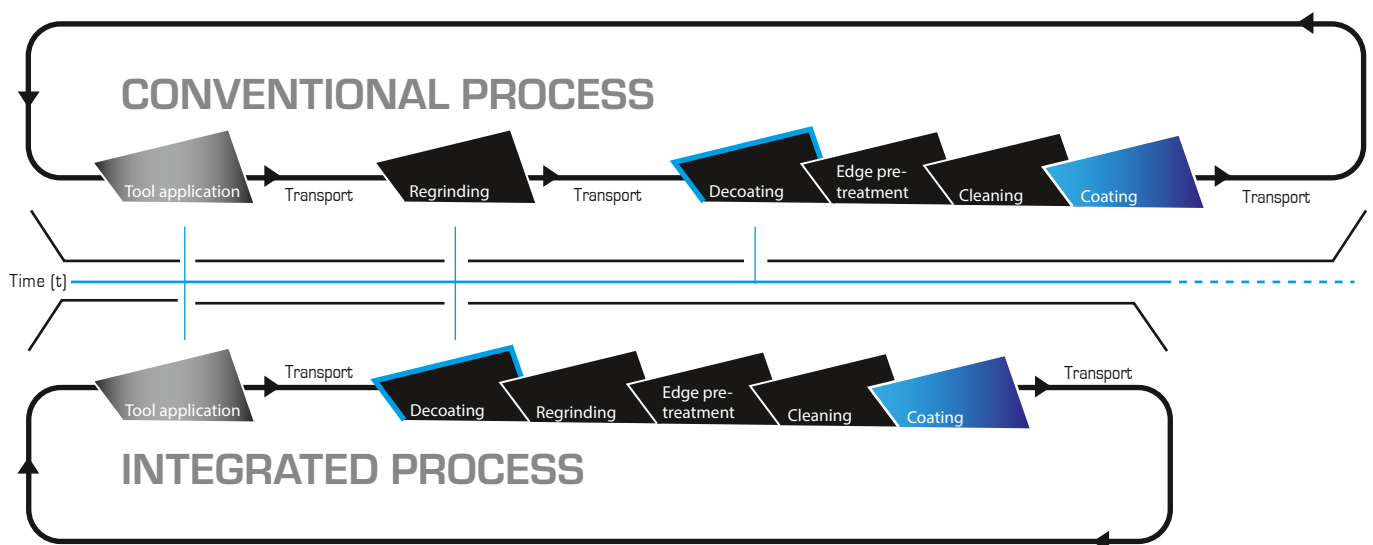
In coating centers, tools are usually decoated after regrinding. However, decoating after regrinding can damage the final geometry of the tool and increase the risk of poor adhesion. In addition, packaging, transport and repackaging involve the risk of damaging the tool.

### Decoating integrated into the tool regrinding process\_Integrated process

By integrating the decoating process into the tool regrinding process, decoating can take place before the regrinding.

Advantages:

- Elimination of transport and packaging
- Less damage caused by handling
- Chemical destruction after regrinding is prevented
- Edge pre-treatment is fully effective
- Adhesion is optimized
- The tool performs almost as well as a new one



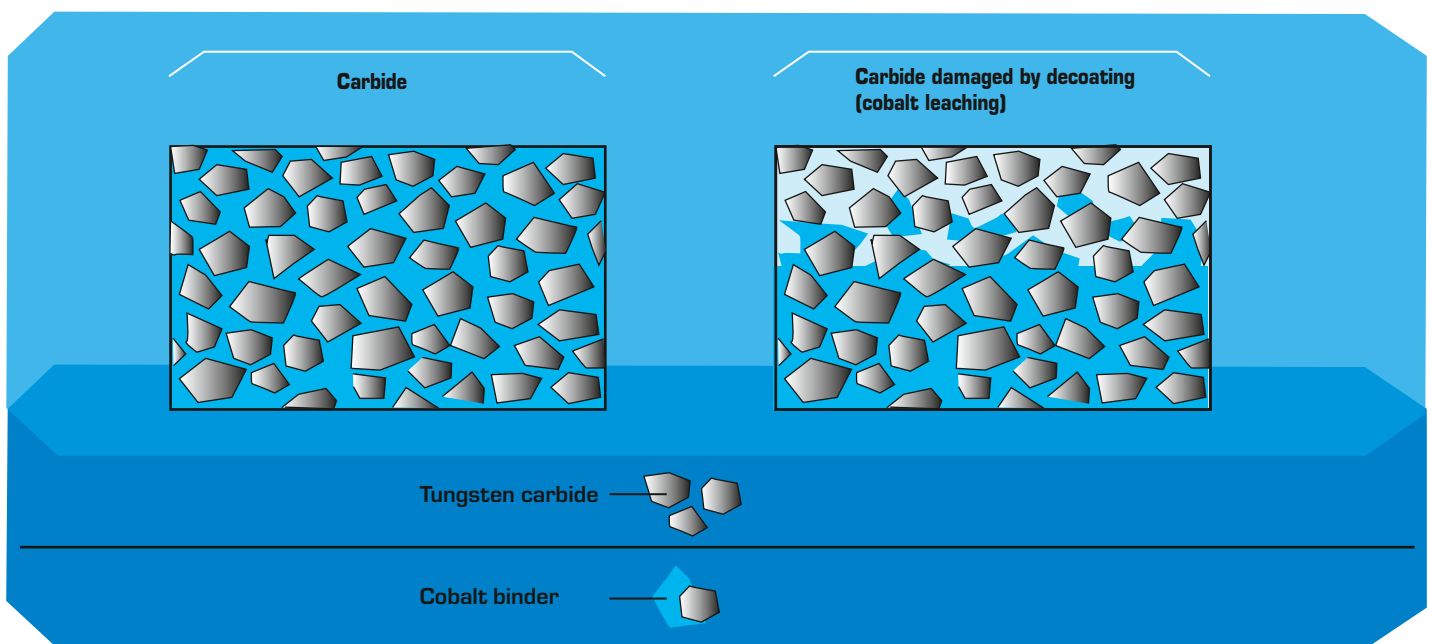
## COBALT LEACHING

In decoating carbide, the biggest challenge is to avoid damaging the substrates. The most common damage is caused by cobalt leaching.

Cobalt leaching refers to the removal of the cobalt binder from the top layer of the carbide. The most common reasons are:

- Chemical decoating
- Aqueous cleaning
- Water-cooled grinding
- Grinding too fast with a blunt grinding wheel

The coating of cobalt-leached carbide is not effective. Although the coating will adhere well to the top tungsten carbide layer, the tungsten carbide, along with the coating, will not adhere to the base material due to the lack of cobalt binder.



### PLATIT<sub>®</sub> Decoating unit concepts

PLATIT offers two types of decoating units—for carbide and high-speed steel—which can be customized according to the customer's requirements.

# Decoating

## DECOATING UNITS

### PLATIT CT20 (patented)\_Ultra-fast decoating unit


CT decoating systems from PLATIT set new standards in decoating, especially for carbide tools. The problem of cobalt leaching is circumvented by protecting the substrate with a TiN adhesion layer as the decoating process of the CT systems will not attack the TiN layer. For the CT20, the decoating cycle all the way to the TiN adhesion layer will take less than three minutes. The end of the process is automatically detected by built-in electronics. The adhesion layer is not removed and therefore «overcoated» after regrinding and pretreatment. A service life comparable to that of a new tool is achieved.

Features

**Fastest decoating process worldwide**

**Multiple coatings can be removed as well**

**Decoating time is less than 3 minutes all the way to the TiN adhesion layer**



**Environm. friendly**


**Common chemicals available worldwide**

**Decoating cycle stops automatically at TiN adhesion layer**

**CT20**      **Max. tool dimensions**    ø 200 x 250 mm

Additional advantages:

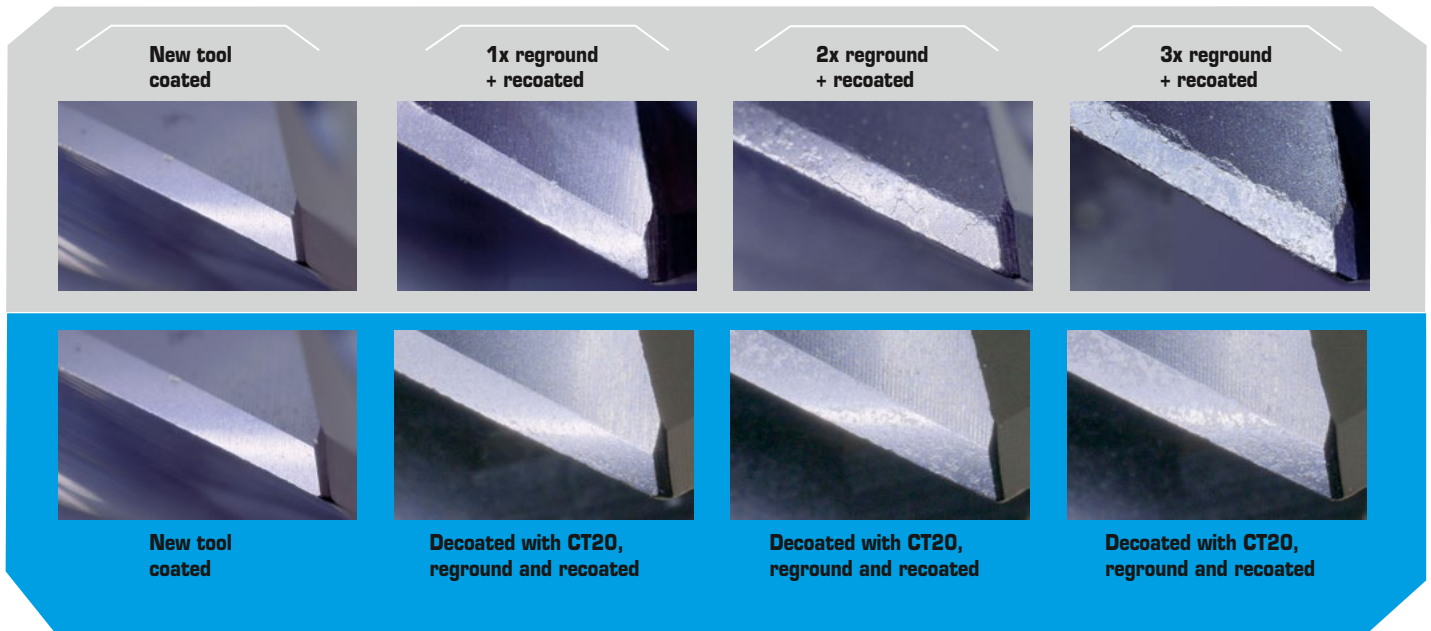
- A single recipe for a wide variety of nitride coatings with a TiN adhesion layer, independent of tool size
- Special holders for shank tools, hobs, inserts etc. to avoid attacking uncoated areas
- The process takes place at room temperature, neither heating nor cooling is required
- The end of the process will be automatically detected, which greatly simplifies the operator's work

	Pi111	Pi411	PL711	PL1011	Pi1511	
TiN	N	N	N	N	N	
TiCN		N		N		
TiAlN	Y	Y		Y		3 min*
TiAlCN		Y		Y		3 min*
AlTiN	Y	Y		Y	Y	3 min*
CrN	OPT	OPT	N	OPT		2 min*
CrTiN	Y	Y		Y		3 min*
ZrN	Y	Y		Y		2 min*
AlCrN	N	OPT		N	OPT	2 min*
AlTiCrN	Y	Y		N		3 min*
ALL4	N	OPT		N		3 min*
nACo	Y	Y		Y	Y	3 min*
nACRo	N	OPT		N	OPT	3 min*
TiXCo3	N	Y		Y	Y	3 min*
TiXCo4		Y				3 min*
PSiX		OPT				3 min*
BorAC		OPT			OPT	2 min*
BorAX		N				

\* Up to the TiN adhesion layer  
 ⌚ Decoating time for 2 µm, ø 10 mm  
 Y = can be decoated with CT20 / N = cannot be decoated with CT20  
 OPT = optionally decoatable, depends on other factors  
 Empty = coating cannot be deposited by the specific coating unit

# REGRINDING

Regrinding and recoating without decoating  
 Decoating with CT20, regrinding and recoating



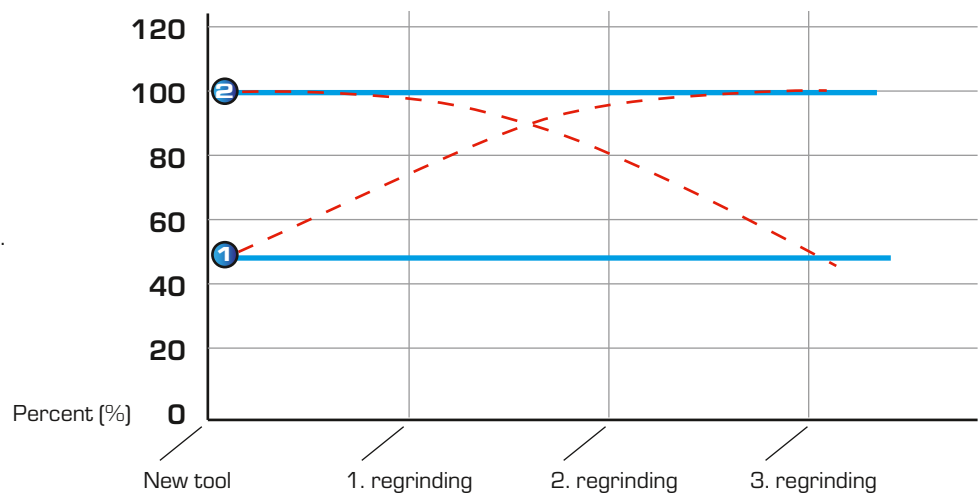
Explanation:

**Red**

Without decoating, roughness increases and tool life decreases.

**Blue**

Roughness and tool life remain constant, if the tool gets decoated with PLATIT CT20 before regrinding.



Without decoating

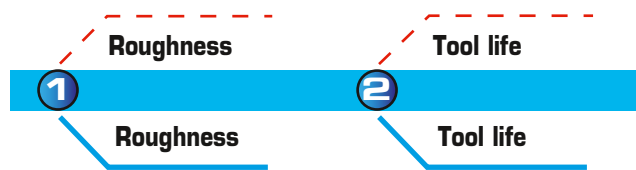
Roughness

Tool life

Decoating with CT20

Roughness

Tool life

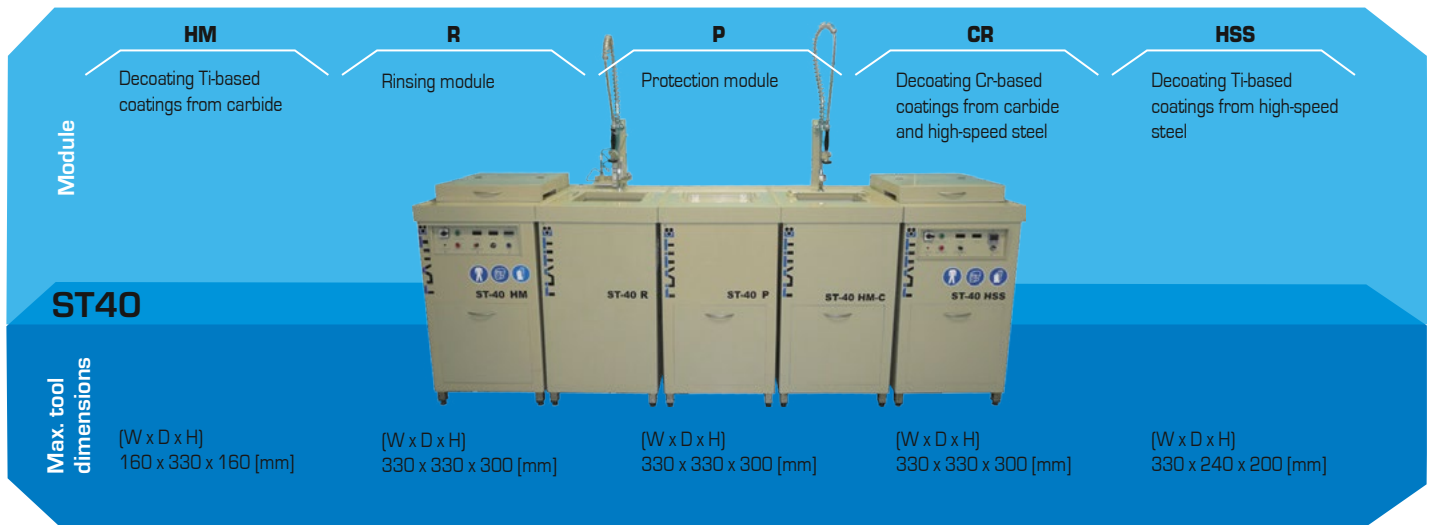


# Decoating

## DECOATING UNITS

### PLATIT ST40\_Conventional decoating unit

ST decoating units from PLATIT stand for great safety and flexibility. Depending on the module, they decoat Ti- or Cr-based coatings on carbide or high-speed steel.



### ST40\_Carbide shank tools

A	B <sub>1</sub>	C	D
TiN	4 - 5 h	T-HM	HM
TiCN	6 - 8 h	T-HM	HM
TiAlN	10 - 18 h	T-HM	HM
TiAlCN	-	-	-
AlTiN	10 - 18 h	T-HM	HM
CrN	0,5 - 3 h	C	Cr
CrTiN	-	-	-
ZrN	-	-	-
AlCrN	0,5 - 2 h	C	Cr
AlTiCrN	-	-	-
ALL4	-	-	-
nACo	9 - 11 h	T-HM	HM
nACRo	0,5 - 2 h	C	Cr
TiXCo <sub>3</sub>	5 - 9 h	T-HM	HM
TiXCo <sub>4</sub>	-	-	-
PSiX	10 - 18 h	T-HM	HM
BorAC	-	-	-
BorAX	-	-	-

### ST40\_High-speed steel hobs

A	B <sub>2</sub>	C	D
TiN	~ 1 h	T-HSS	HSS
TiCN	~ 2 h	T-HSS	HSS
TiAlN	1 - 2 h	T-HSS	HSS
TiAlCN	-	-	-
AlTiN	1 - 2 h	T-HSS	HSS
CrN	0,5 - 3 h	C	Cr
CrTiN	-	-	-
ZrN	-	-	-
AlCrN	0,5 - 2 h	C	Cr
AlTiCrN	-	-	-
ALL4	-	-	-
nACo	0,5 - 2 h	T-HSS	HSS
nACRo	0,5 - 2 h	C	Cr
TiXCo <sub>3</sub>	1 - 3 h	T-HSS	HSS
TiXCo <sub>4</sub>	-	-	-
PSiX	1 - 2 h	T-HSS	HSS
BorAC	-	-	-
BorAX	-	-	-

<b>A</b> Coating	<b>B<sub>1</sub></b> Decoating time for 2 μm, ø 10 mm	<b>B<sub>2</sub></b> Decoating time for 2 μm, ø 80 x 180 mm	<b>C</b> Decoating recipe*	<b>D</b> Module
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\* Decoating chemicals available through the worldwide distribution network of Borer AG, Zuchwil, Switzerland

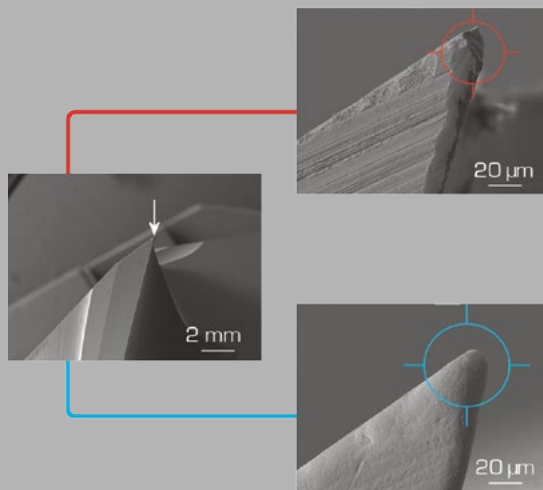


# Edge pre-treatment

## OVERVIEW

The edge pre-treatment is a very important process in a turnkey system designed to utilize the full potential of a coating. The main aim of edge pre-treatment is to increase the edge's stability and thus the tool's performance.

Typical cutting-edge from a high-end tool manufacturer



Comparison



Advantages of cutting-edge rounding:

- Reduces chipping
- Reduces what is referred to as an “antenna effect” in PVD coatings on sharp edges and thus reduces the stress in the coating
- The more an edge is rounded, the thicker the coatings can be
- Higher cutting-edge stability
- Avoids cutting-edge breakouts and flaking of the coating during the machining process
- Increase of the tool's lifespan despite a “blunt” cutting-edge

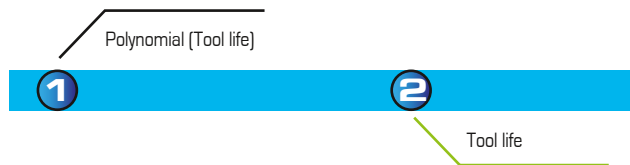
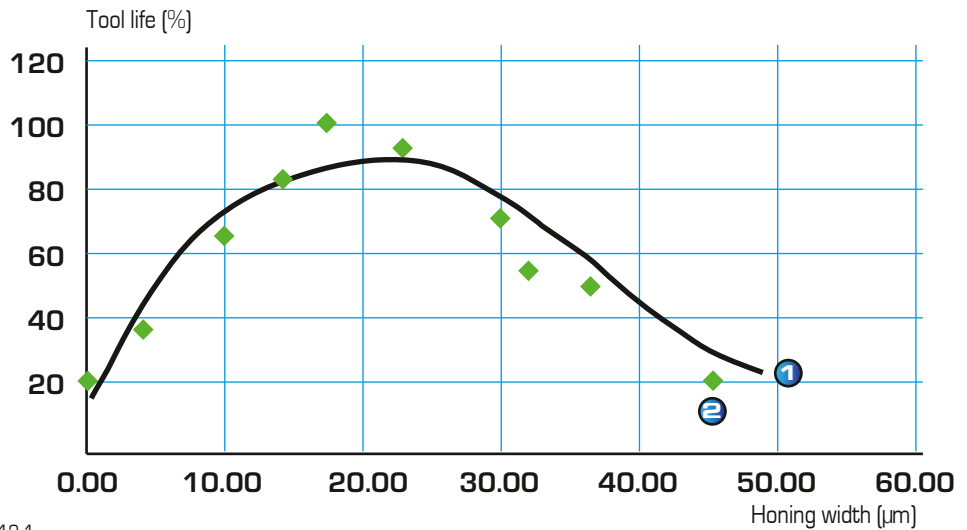
# Edge pre-treatment

## INFLUENCE OF CUTTING-EDGE ROUNDING

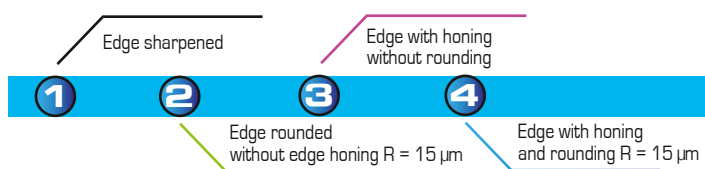
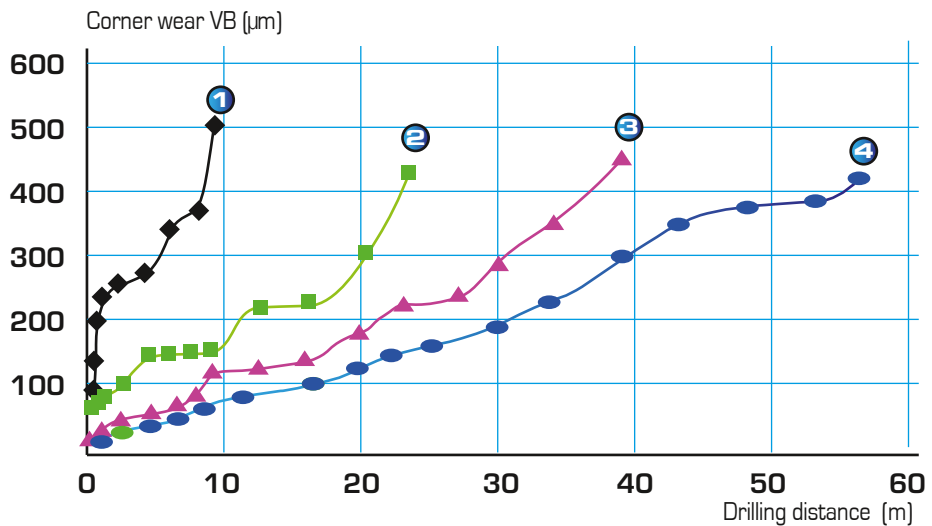
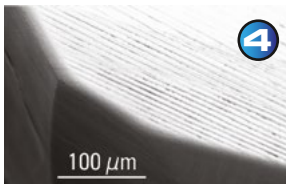
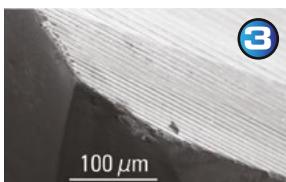
### Influence of cutting-edge rounding when milling high-alloy steel:



Tool: end mill, D10, z = 4  
 Workpiece material: 1.2379; X155CrVMo12-1  
 $a_p = 1.5 \times d$   
 $a_e = 0.25 \times d$   
 $v_c = 150 \text{ m/min}$   
 $f_z = 0.05 \text{ mm/z}$   
 Source: GFE, Germany  
 Coating: nACRo



### Influence of cutting-edge rounding when drilling:



Tool: blind holes, VHM drill, D5  
 Workpiece material: cold work steel; 1.2379; X155CrVMo12-1; HRC22  
 Dry air cooling  
 $a_p = 15 \text{ mm}$   
 $v_c = 75 \text{ m/min}$   
 $f_z = 0.15 \text{ mm/z}$   
 Coating: nACo

## METHODS FOR EDGE PRE-TREATMENT

Different materials and tools require different methods of edge pre-treatment. Below is an overview of the most common ones:

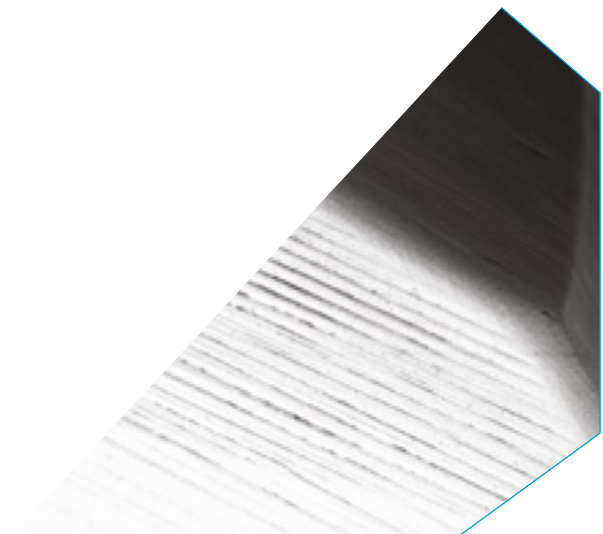
Method		Dry blasting	Wet blasting	Drag grinding	Brushing	Magnet finish
<b>Tool type</b>	Drills	+	++	++	+++	+++
	End mills	+	++	+++	+++	+++
	Inserts	++	+++	+	++	+
	Hobs	++	+++	+	+	-
	Punches	-	+++	+++	-	-
	Molds and dies	++	+++	-	-	-
<b>Characteristics</b>	Stability	+++	+++	+++	+++	+++
	Flexibility	+++	+++	++	++	++
	Productivity	+	+++	++	++	++
	Groove polishing possible	Limited	Yes	Yes	Yes	Limited
	Automation solutions possible	Yes	Yes	Yes	Yes	Yes
	Special characteristics	Blasting media sticks to the surface	Universally usable	Smooth surface	Individual treatment for cutting-edges and surfaces possible	Especially for micro-tools

+++ High quality and high efficiency

++ High quality or high efficiency

+ Low quality and/or low efficiency

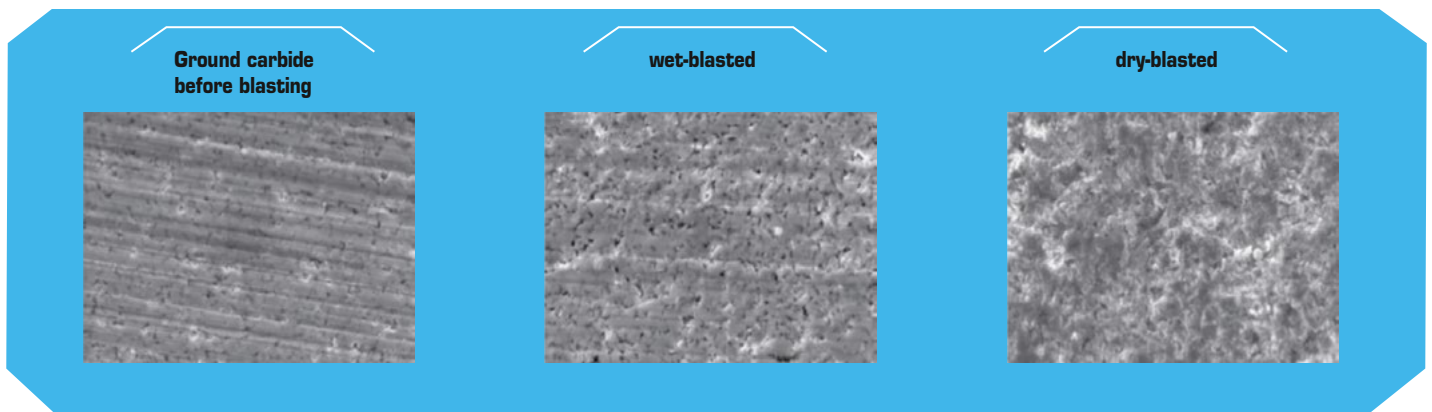
- Not suitable for the system



# Edge pre-treatment

## WET AND DRY BLASTING

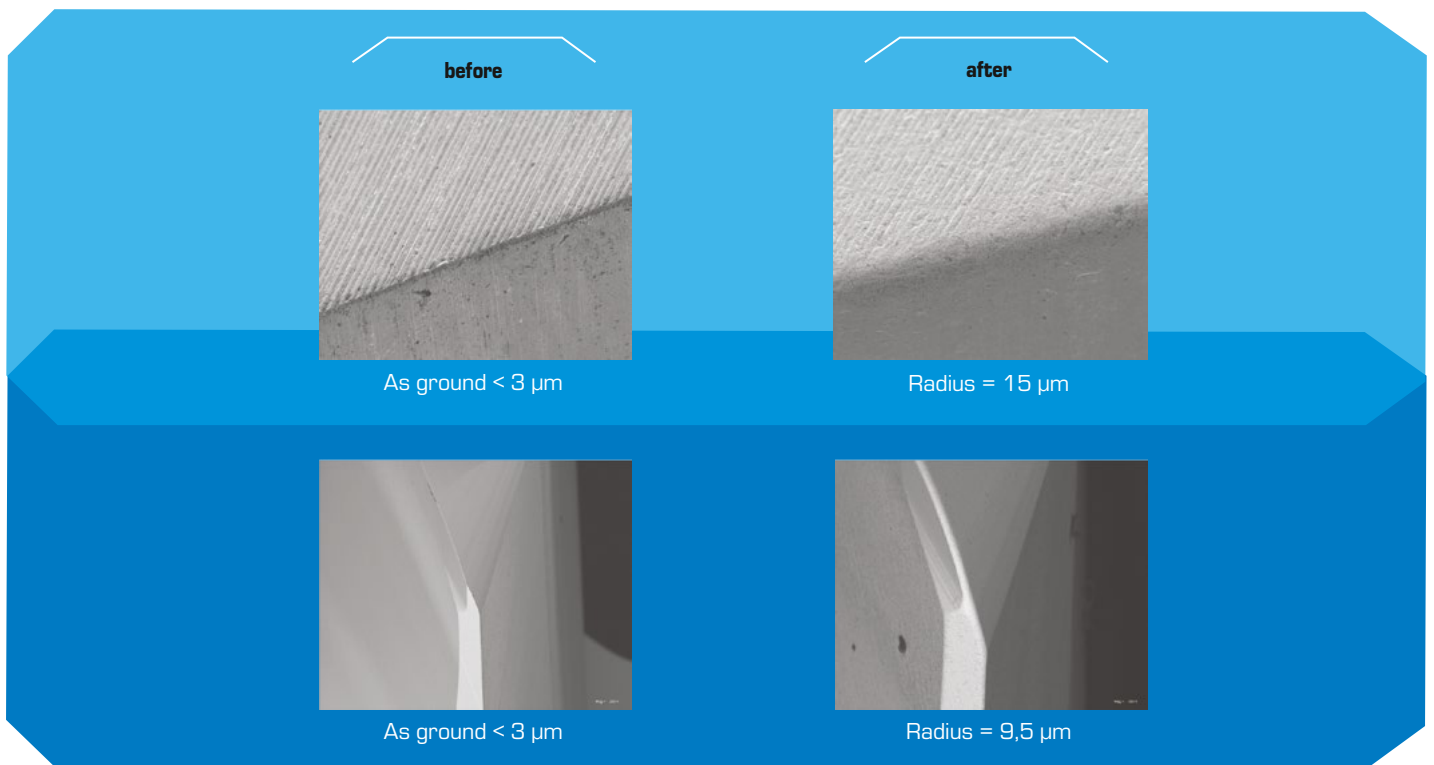
### Comparison of wet and dry blasting:



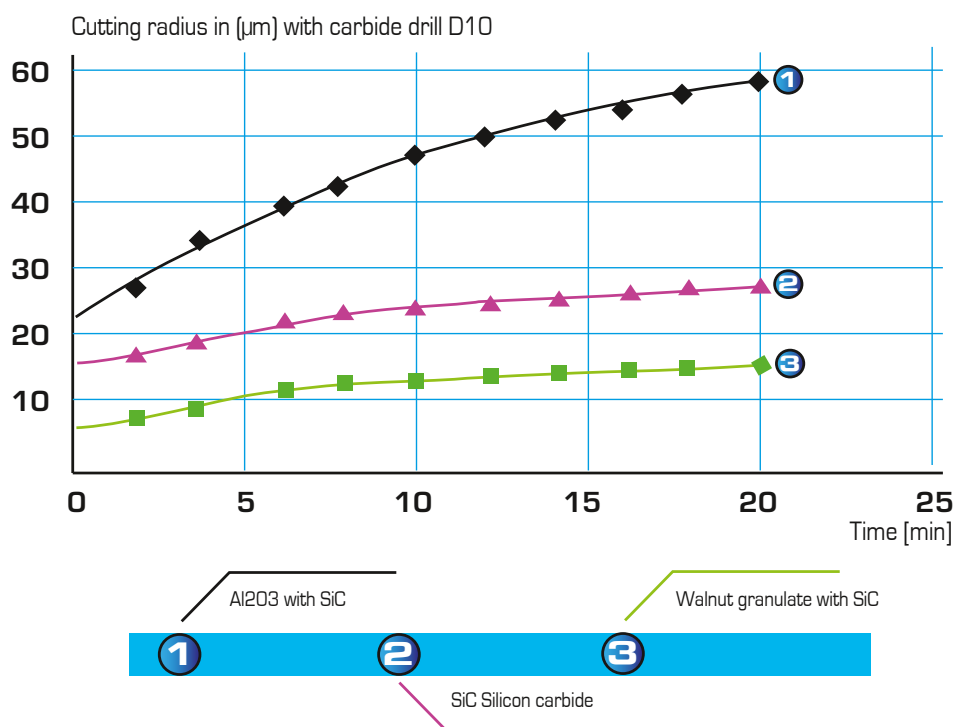
Comparison	Wet	Dry
Surface roughness	Sa = 0.05 µm; Sz = 0.32 µm Slightly shiny surface	Sa = 0.11 µm; Sz = 1.14 µm
Residual material after blasting	Risk of cobalt leaching due to the water	Smearing of the residual material
Coating adhesion	HF1	HF1 - HF3
Edge rounding	Good to control	Difficult to control
Grain size	Mesh 320 (50 µm), coarse, for edge rounding Mesh 400 (37 µm), medium, for surface activation Mesh 500 (30 µm), fine, for polishing	
Typical micro-blasting time [min] for hobs ø 80 mm; R = 10 µm	3	6
Advantages and disadvantages	<ul style="list-style-type: none"> <li>• Pre-cleaning not necessary</li> <li>• Drying needed after blasting</li> <li>• Difficult to clean after interruption</li> <li>• Fewer abrasive inclusions in the tool surface</li> <li>• High productivity</li> <li>• Low surface roughness at the same edge rounding</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-cleaning necessary</li> <li>• No need for drying after blasting</li> <li>• Easy handling even after interruption</li> <li>• More abrasive inclusions in the tool surface</li> <li>• Deburring without damaging the cutting-edge</li> <li>• Activation of the surface with the option to coat immediately afterwards</li> </ul>

## DRAG GRINDING

Cutting-edge rounding and surface quality before and after the drag grinding process:



Depending on the required edge rounding, different media are applied.



## OVERVIEW

A clean metallic surface is necessary for coating. Contamination such as grinding residue, oil or dust weaken the coating's adhesion.

The industrial single-chamber cleaning units from PLATIT are the result of a partnership with Eurocold:

- Chamber sizes adapted to coating units by PLATIT
- Fully automatic cleaning process including vacuum drying
- Intuitive touch screen with real-time process parameters
- Remote diagnosis and maintenance
- Independent of environmental conditions as the system is closed

PLATIT offers two different standard sizes of single-chamber cleaning units, which can be tailored to individual customer needs on request, e.g. in terms of:

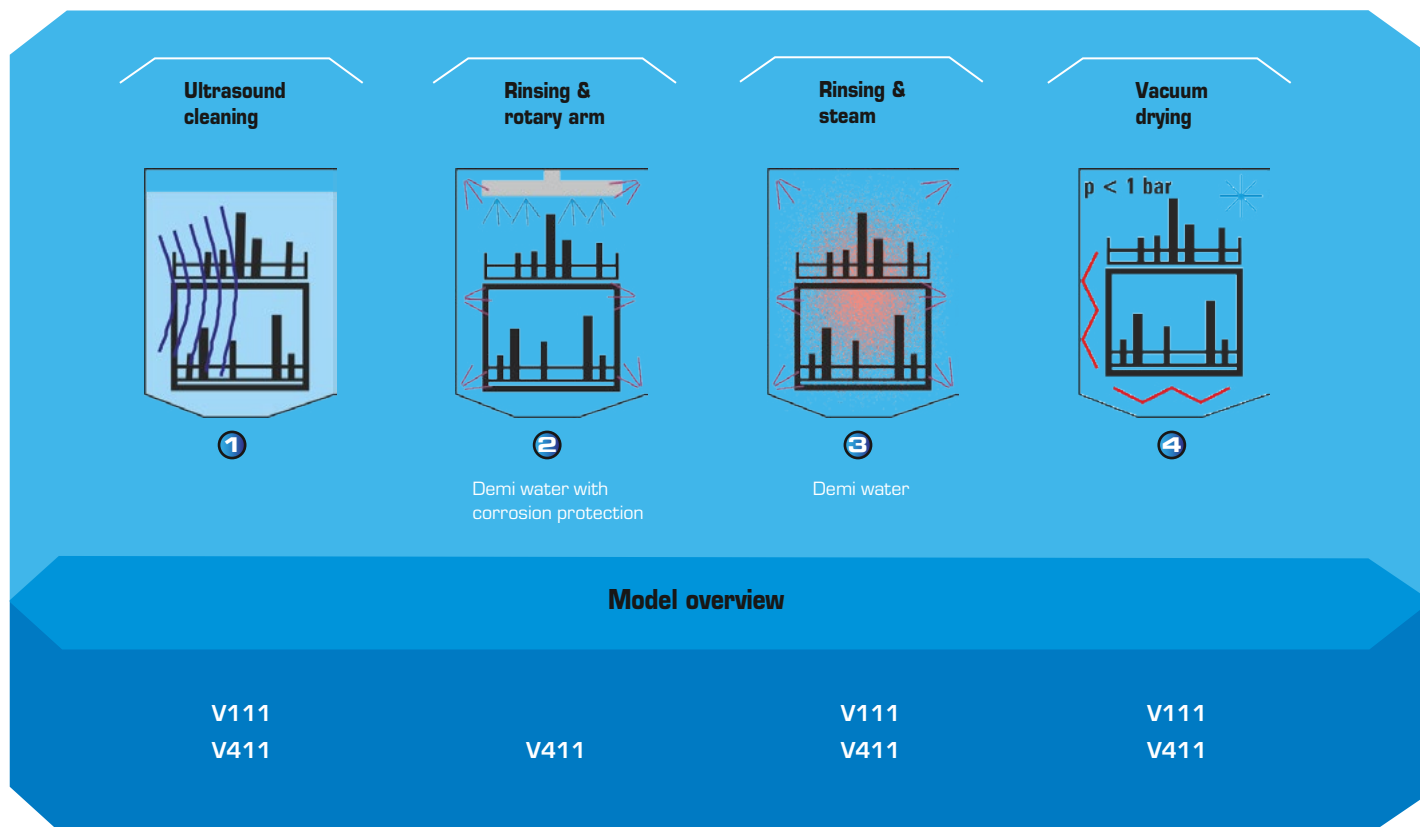
- Number of cleaning baths
- Bath filtration
- Immersion rinsing



Cleaning unit	V111	V411
Chamber volume [mm]	W 350 x D 390 x H 480	W 500 x D 500 x H 500
Loading for shank tools ø 10 x 70 [mm]	504 pcs.	1008 pcs.
Max. load [kg]	150	200
Cycle times [min]	Approx. 45	Approx. 45

## CLEANING PROCESS

Cleaning cycle:



Advantages of a single-chamber cleaning unit compared to a cleaning line:

	Single-chamber cleaning unit	Cleaning line
<b>Footprint</b>	Compact	Very big (long)
<b>Sensitive to environment</b>	No	Yes (lower with housing)
<b>Evaporation</b>	No	Yes
<b>Ventilation necessary</b>	No	Yes
<b>Controlled atmosphere</b>	Yes	Limited
<b>Throughput</b> (with the same bath size)	Low	High
<b>Detergent selection</b>	Limited	Full flexibility
<b>Detergent carry-over</b>	No	Yes
<b>Oscillation</b>	No	Yes
<b>Heavy tools</b>	Easy handling	Depends on crane
<b>Investment</b>	Medium	High
<b>Energy consumption</b>	Medium	High

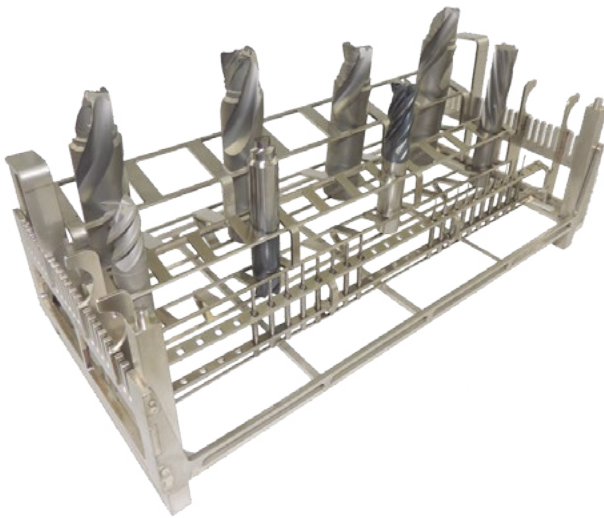
## CLEX® – MODULAR HOLDER SYSTEM

### CleX® for shank tools

Flexible holders for the cleaning and decoating of shank tools.

Advantages:

- Tools of different diameters can be cleaned and decoated together
- Up to 150 % more tools compared to conventional systems
- CleX® carrier can be handled with loaded tools
- CleX® baskets are stackable
- Lightweight construction – low shadowing
- Minor contact surfaces – no washing stains
- Inclined surfaces – good water drainage
- Stainless-steel construction – high temperature resistance and long service life



Cleaning unit		V111	V411
CleX® frame		4 baskets	8 baskets
CleX® carrier	Shank diameter (mm)	Tool/CleX®	Tool/CleX®
CleX® S3	3	30	210
CleX® S5	5	26	182
CleX® S6	6	24	168
CleX® S8	8	20	140
CleX® S10	10	18	108
CleX® S12	12	16	96
CleX® S14	14	15	60
CleX® S16	16	13	52
CleX® S18	18	12	48
CleX® S20	20	11	44
CleX® S25	25	9	27
CleX® S32	32	7	21





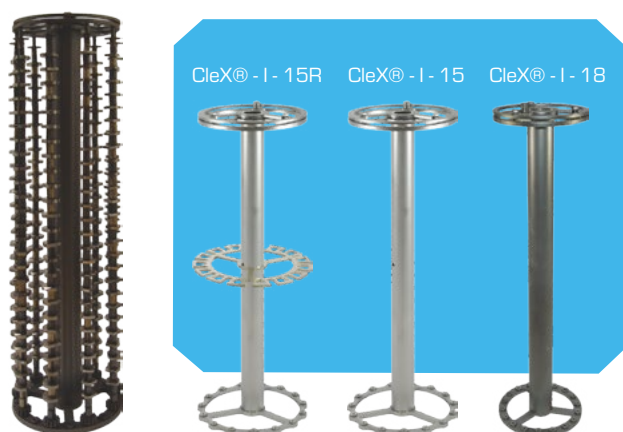
## HOLDER SYSTEM CLEAN FLEXIBLE FOR CLEANING AND DECOATING

### CleX® for inserts

Flexible holders for inserts for minimal handling during pre-treatment, post-treatment and coating. Without reloading, up to 500 different inserts can pass through the following sequence of processes at the same time:

- Edge pre-treatment by wet or dry blasting
- Cleaning
- Coating
- Post-treatment by wet or dry blasting

With wet and dry blasting, all sides of the inserts are treated. Especially suitable for inserts with holes.



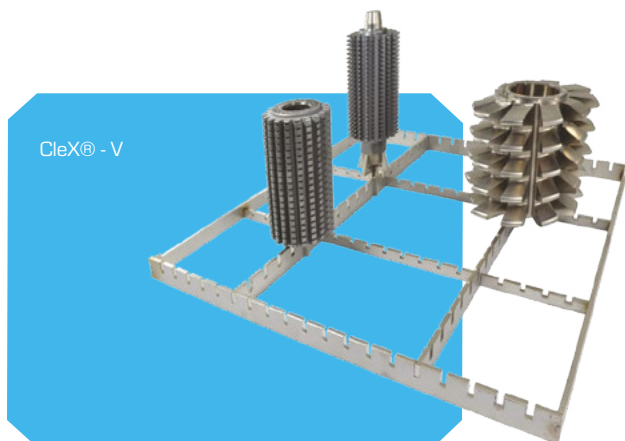
	Optimized for edge length □ [mm]	Insert hole min. diameter [mm]
CleX® for inserts with 15 pos. and support ring	14	2.4
CleX® for inserts with 15 pos.	14	3.7
		4.2
		5.2
CleX® for inserts with 18 pos.	18 x 8.5	3.7
	9 x 19.0	4.2
	6 x 29.4	5.2
		6.2

### CleX® for hobs and cutting wheels

Flexible holders for the cleaning and decoating of hobs and cutting wheels.

Advantages:

- Hobs and cutting wheels with different diameters and lengths can be cleaned together
- Stainless-steel construction with high temperature resistance and long service life



Hob with a hole	Diameter of a hole [mm]
CleX® V-HB L80	> 14
CleX® V-HB L160	> 14
Hob with a shank	Diameter of a shank [mm]
CleX® V-HS 32	32
CleX® V-HS X	Individual
Cutting wheel	Outer diameter [mm]
CleX® V-G	≤ 200

# Quality control

## OVERVIEW

Thickness and adhesion are important characteristics of a coating. They need to be controlled and monitored to guarantee a constant level of performance.

### PQCS\_PLATIT Quality Control Software

PQCS is a quality control software developed by PLATIT. The software is optimized for easy and fast data acquisition by recording batch photos, coating thickness and adhesion. All data is stored in a database to generate a coating report and provide a graphical representation of quality trends.



Advantages:

- Simple user interface
- Generating a coating report step by step to record the coating quality
- Automatic database entries including customer information, batch information and a photo, calo and Rockwell image
- User-defined fields can be integrated
- The data can be filtered and represented graphically to recognize quality trends

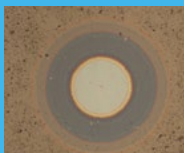
### Methods for quality control

The basic quality control methods of a PVD coating are::

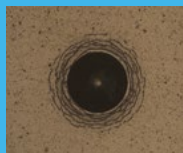
- Coating thickness measurement using a calo tester on test plates and tools
- Adhesion evaluation using a Rockwell or scratch tester

Products and integration services available from PLATIT.

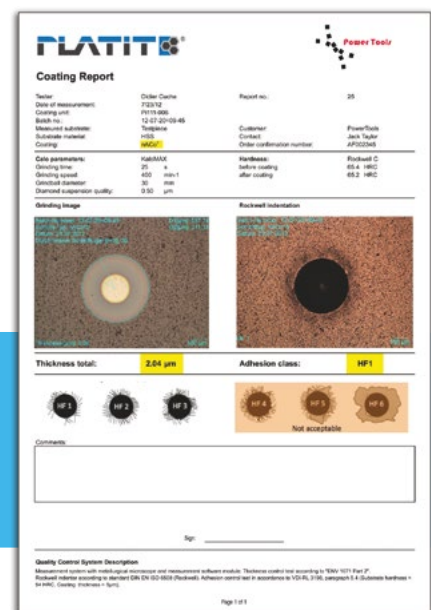
Calo test

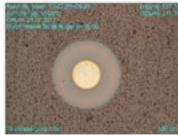
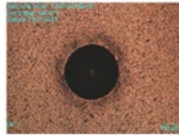










Rockwell test



Scratch test



PLATIT®		Power Tools	
<b>Coating Report</b>			
Tester:	Order Code:	Project no.:	25
Date of measurement:	7/28/12		
Coating unit:	P111-000		
Batch no.:	12-07-20-03-45	Customer:	Fluor-Tech
Manufactured substrate:	Substrate	Contact:	Jack Taylor
Substrate material:	MS2	Order confirmation number:	#107204
Coating:	MS2		
Coat parameters:	SARMAX	Hardness:	Rockwell C
Drying time:	25 s	before coating:	65.4 HRC
Drying speed:	450 mm/1	after coating:	65.2 HRC
Control diameter:	30 mm		
Control suspension quality:	0.50 µm		
Obtaining image:		Rockwell indentation:	
			
Thickness total:	2.04 µm	Adhesion class:	HF1
			
			
Comments:			
Sign: _____			
<small>Quality Control System Description Measurement system with metrological microscope and measurement software module. Thickness control test according to ISO 1571 Part 21. Rockwell hardness according to standard DIN EN ISO 6503 (Rockwell). Adhesion control test according to ISO 4520, paragraph 3.4. Substrate hardness = 65HRC. Coating thickness = 1 µm.</small>			
Page 1 of 1			

Coating report

## OVERVIEW

### Objectives of post-treatment:

- Removal of droplets after coating
- Reduction of surface roughness
- Improved chip flow

One of the problems that can arise without post-treatment of the surfaces is the jamming of the chips, which can cause a tool such as a drill to break.

### Overview of the most common post-treatment methods:

Method		Wet blasting	Drag grinding	Polishing
<b>Tool type</b>	Drills	+++	++	+++
	End mills	+++	+++	+++
	Inserts	+++	+	+
	Hobs	+++	+	-
	Punches	+++	+++	+++
	Molds and dies	++	-	+++
	<b>Characteristics</b>	Stability	+++	+++
	Flexibility	++	+	+++
	Productivity	+++	++	+
	Groove polishing possible	+	++	+++
	Droplet removal possible	+	++	+++
	Automation solutions possible	Yes	Yes	No
	Special characteristics	Universally usable	Smooth surface	Very smooth surface

- +++ High quality and high efficiency
- ++ High quality or high efficiency
- + Low quality and/or low efficiency
- Not suitable for the system

If the post-treatment is too intense, the edge will become exposed. This will lead to:

- Immediate full and direct contact of the cutting-edge with the workpiece material
- Low thermal and chemical insulation
- Low coating thickness near the cutting-edge
- A larger cutting-edge radius, which results in a larger surface area without coating
- The impression of a defective coating



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