DIA EDGE

P801B

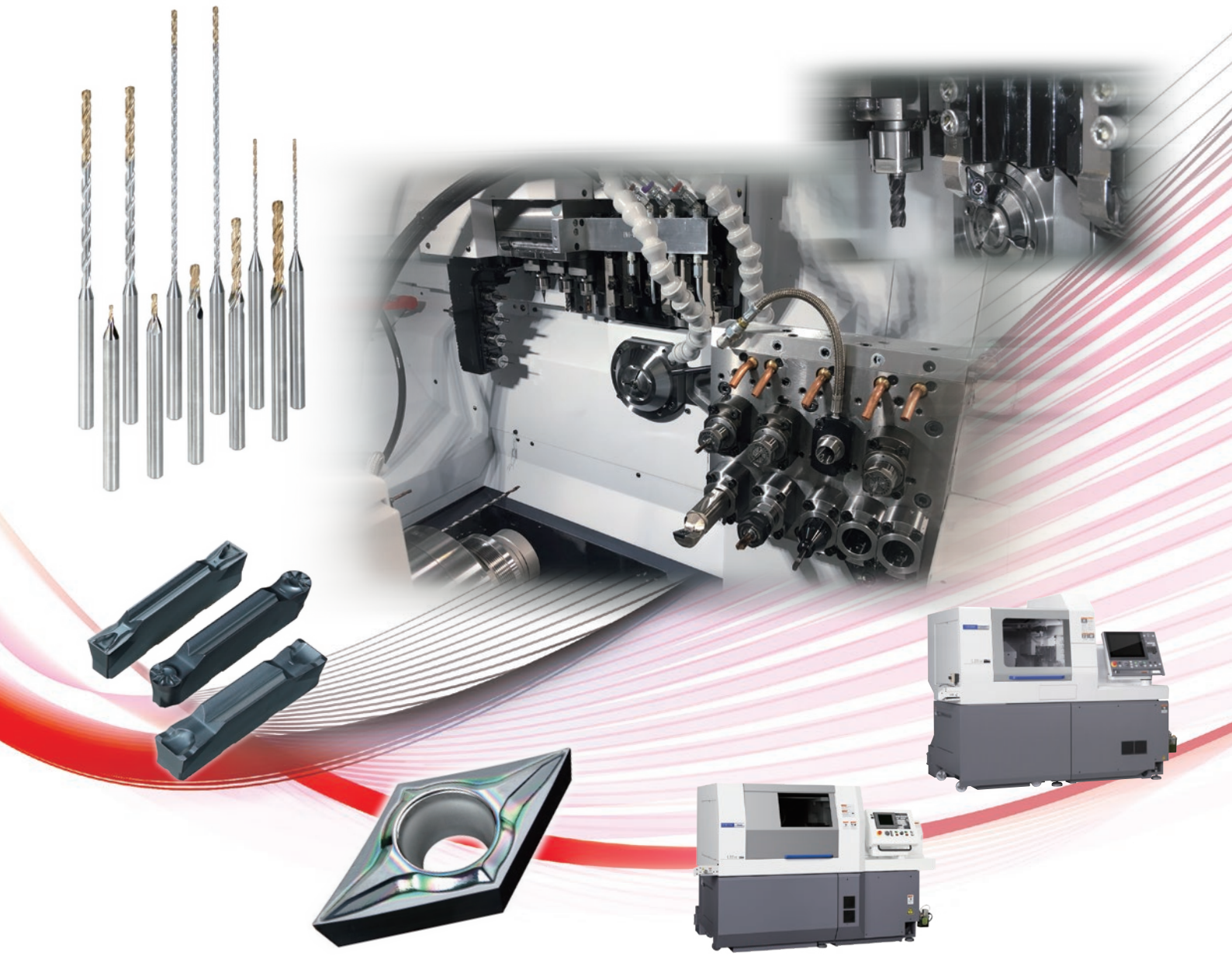
Take your productivity to the next level

With next-generation processing technology

LFV technology

*LFV is a registered trademark of Citizen Watch Co., Japan

Cutting Tool Series Available for LFV technology



MITSUBISHI MATERIALS

Breaking Chips with Low Frequency Vibration

CUTTING EDGE

CITIZEN MACHINERY × MITSUBISHI MATERIALS

Cooperation: Citizen Machinery Co., Ltd.

Fundamentally Changing Chip Control

Chip control is one of the problems to be addressed in the use of small automatic turning machines employed in automobile parts production and small precision machining of parts in the manufacture of medical equipment and OA devices. If chips are not produced or handled well, they can become entangled and result in reduced tool life, damaged product surfaces and even machine breakdowns. In other words, chip control is a priority factor for improving tool life. This in turn promotes a stable level of quality and for optimisation of machining efficiency, high pressure coolant that breaks chips directly and inserts with suitable chipbreakers should be used. Citizen Machinery took a completely new approach to chip control with low frequency vibration cutting technology. In autumn 2013, Citizen Machinery attracted attention both at home and abroad by introducing a machine that incorporated this technology. Yoshimitsu Oita of Mitsubishi Materials Sales Division and Akira Sato of Mitsubishi Materials Development Division visited Takaichi Nakaya and Kazuhiko Sannomiya at the Citizen Machinery Development Division to interview them about the concept and future of low frequency vibration cutting technology.

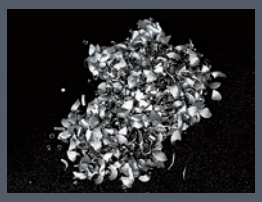
Applying Neutralisation to Completely Break Chips

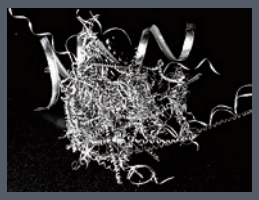
Oita (Mitsubishi Materials): Chip control is an important problem that machining tool manufacturers need to address, and my interest in Citizen's machine development is rooted in this problem. Nakaya (Citizen Machinery): It started with a request from our customer and some proposals involving the application of LFV. We were aware of the need for chip control and our discussions led to the idea that LFV would provide a solution, this prompted us to work on joint development.

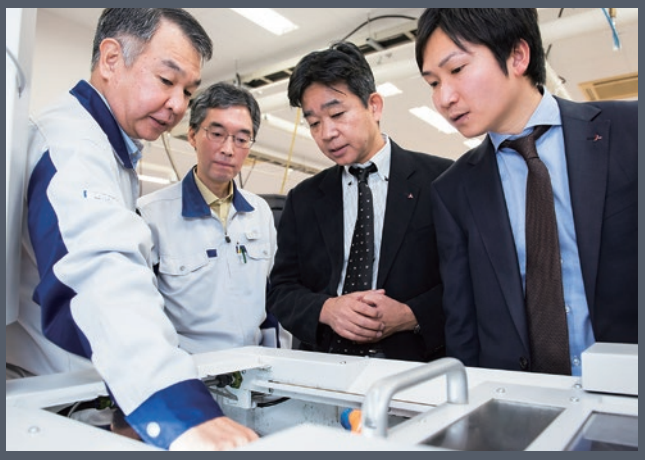
Sato (Mitsubishi Materials): Generally, machine tools should not vibrate, right?Nakaya: Sure. It is important that machine tools do not vibrate. When the customer made the request involving LFV, I wondered whether it would be possible to maintain the accuracy of machining and whether the machine would be able to withstand the vibration. However, I understood the potential of LFV technology, which gave me the confidence I needed to work on this technical development.

Sato: The biggest problem with automating manufacturing sites is chip control and the biggest problem with chips is the damage they do to tools. There are many other problems with chip control, problems such as rough surface finishes and shortened tool life, etc. Oita: Machine operation rates are the key to productivity (cost) in machining mass-production parts on automatic lathes. Once chips get entangled in the machine, the flow of chips changes and this causes surface damage. In the worst case, this may cause machine stoppage. Being able to discharge chips reliably, surface finishes are guaranteed, general problems during machining decrease and overall productivity increases. We are very excited about using LFV and it helps to achieve good results.

Nakaya: We think that cutting processes that we developed utilizing the LFV would make it possible to break and discharge chips utilizing neutralisation during cutting, prevent the increase of temperature on the cutting edge and lead to expanded tool life.







Shifting to a Time in Which Difficult-to-Cut Materials Become Easy-to-Cut Materials

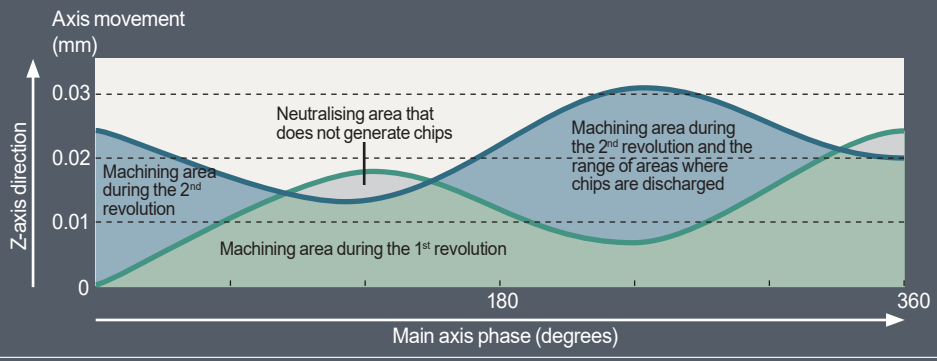
In 2014, Citizen Machinery released the VC03, a two-axis lathe with LFV. What was the most difficult challenge during the development of the VC03?

Nakaya: The major characteristics of the VC03 are shown in the bottom figure on page 27. The basic concept is zero vibration in machine tool development, so it was very difficult at first for us to accept the idea of actually trying to cause vibration. What I mean is that if the LFV vibration frequency matches the vibration of each component, the machine itself will vibrate, making machining impossible. In spite of this, we proceeded with development. LFV can completely break chips, reduce cutting resistance under specific conditions, reduce temperature at the cutting edge and increase tool life. LFV has proved to be an innovative solution for manufacturing.

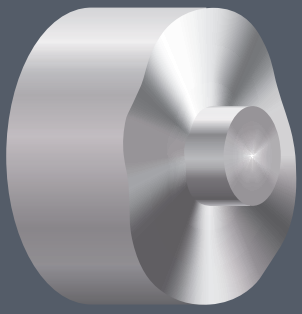
Low Frequency Vibration Cutting LFV technology

Citizen Machinery's unique control technology synchronizes the vibration of the servo axis with the revolution of the main axis. LFV breaks chips into small pieces and discharges them during operation. This addresses all the problems caused by entangled chips during difficult-to-cut material machining and deep hole drilling. LFV is the most advanced machining.

■ Z-axis direction movement synchronized with the revolution of the main axis and low frequency vibration wave



■ Image of cutting



*Ko No Ryosan, Mass Customization, CITIZEN, LFV, MultiStationMachiningCell and Ocean technology is a registered trademark of Citizen Watch Co., Japan

Sannomiya (Citizen Machinery): I feel that we have achieved something great if the technology we develop can solve problems for our customers. It is a great pleasure for us to see that LFV technology has made our customers happy and it has been highly regarded since we launched the product.
How do you think manufacturing will change in the future?
Nakaya: Citizen Machinery set the goal of “Ko No Ryosan”*, mass customization in Citizen style as a business concept in 2013. The concept promotes innovative manufacturing for customer-oriented production and was established to achieve high productivity while ensuring the same level of efficiency in both mass and small-lot production. A wide range of forms and materials will be processed in product lines, this requires a unified chip control system such as LFV that applies to all materials and machining. We need to continue with the development of new machining technology to expand this concept.

Sannomiya: We are dreaming about expanding our technology to make difficult-to-cut materials into easy-to-cut materials in the near future. LFV has significantly reduced the length of chips and has made it possible to reduce chip entanglement even with difficult-to-cut materials so that chips are easy to remove. This reduction in length of the chips also leads to easier disposal by recyclers, which makes it environmentally friendly.
Nakaya: I believe that LFV will change the concept of machining technology significantly. Based on the concept of LFV, tool geometries and design changes; and as soon as we reduce chip entanglement to zero, design flexibility can also increase. The future is filled with potential. We have a wide range of ideas that we are looking into and tool manufacturers will also be engaging in research and development.
Oita: Innovation will come if we can discuss tool geometries, design and parts with manufacturers and identify the ideal match between technology and individual tools. This could fundamentally change machining strategies at manufacturing sites.

CUTTING EDGE

CITIZEN MACHINERY × MITSUBISHI MATERIALS

Nakaya: In the manufacture of large machines, safety becomes an issue when operators leave the cover open during manufacturing to remove chips manually. They do this because they want to prevent damage caused by entangled chips, but it is dangerous. LFV provides excellent chip control to enable safe and automated machine operation. We will continue to expand the application of LFV technology in VC03 to other machines to promote safe operation in other manufacturing processes.
Sato: We also put energy into tool development from the standpoint of our customers and want to provide innovative machining methods that prove valuable for manufacturing sites around the world.
Oita: Mitsubishi Materials has established a cutting-edge technology development team and our young engineers are also engaged in tool development.
Sato: LFV technology made it possible to discharge chips completely, which showed us the possibility of producing new tools with a wide range of functions such as tools exclusively for LFV cutting.
Considering the progress of such new technology and machine tools, we would like to continue developing tools that are useful at actual customers manufacturing sites.

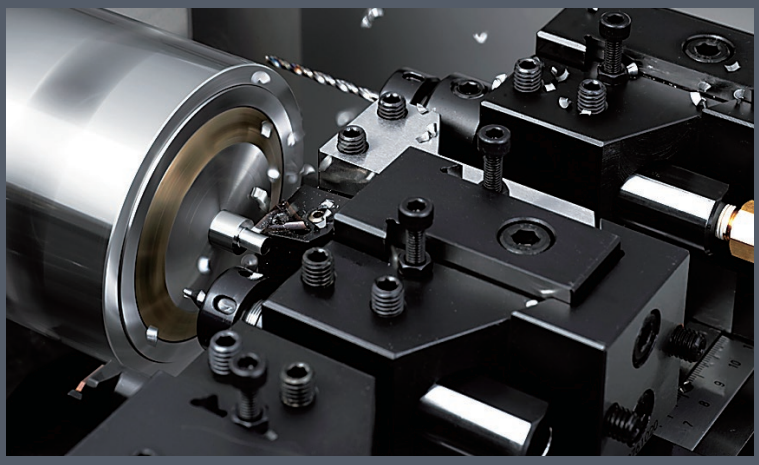
From YOUR GLOBAL CRAFTSMAN STUDIO 003, published by Mitsubishi Materials on April 2016. The positions listed are as of the time of the interview.

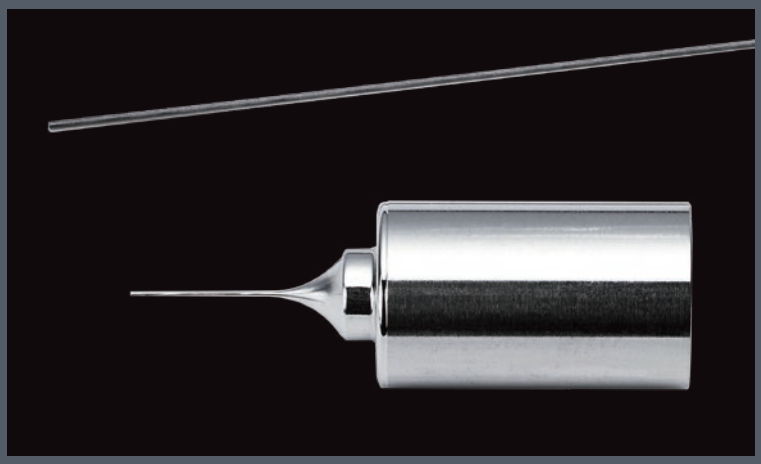
Takaichi Nakaya,
Deputy-Director,
Development and Design Department,
Development Division,
Citizen Machinery Co., Ltd.

Kazuhiko Sannomiya,
Chief, Solution Development Section,
Development Division,
Citizen Machinery Co., Ltd.

Yoshimitsu Oita,
Manager, Business Development & Planning Department, Sales Division,
Advanced Materials & Tools Company,
Mitsubishi Materials Corporation

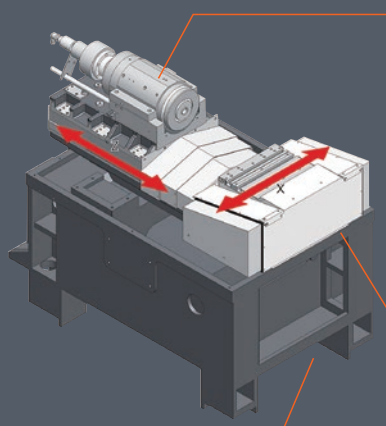
Akira Sato,
Drill, CBN & PCD Products Development Centre, Research & Development Division,
Advanced Materials & Tools Company,
Mitsubishi Materials Corporation





VC03 – Mechanism for High Precision

Symmetric heating system frame and bed, wing-type head stock and external coolant tank are basic VCO3 specifications required to prevent time-dependent thermal displacement and processing heat from being conducted to the machine body. Its built-in motor is equipped with a forced cooling function, is beltless and vibration resistant, which promotes smooth revolution and highly precise product formation. The combination of peripheral devices such as an in-out stocker and a high-speed gantry loader, whose service time is only 3.5 seconds can respond to a wide range of systematic automation.

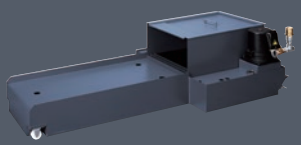


■ Wing-Type Head Stock

Only the wing section of the main axis is connected to the slide, which enables the centre of the sleeve to float. The structure allows even heat generation and prevents conduction to the head stock.

■ Symmetric Heating System

A unified casting base with symmetric structure allows excellent symmetric heat conduction. This mitigates the impact of heat generation on machining accuracy.



■ External Tank

The coolant tank is installed between the machine legs to separate it from the machine body to reduce the impact of heat from coolant and chips that absorb cutting heat.

CNC Automatic Lathe " VC03 "

*Ko No Ryosan, Mass Customization, CITIZEN, LFV, MultiStationMachiningCell and Ocean technology is a registered trademark of Citizen Watch Co., Japan

Equipment Available with LFV technology

CITIZEN MACHINERY × MITSUBISHI MATERIALS

LFV technology

*LFV is a registered trademark of Citizen Watch Co., Japan

Cincom

Sliding Headstock Type Automatic CNC Lathe
Cincom L20

Sliding Headstock Type Automatic CNC Lathe
Cincom L12

Sliding Headstock Type Automatic CNC Lathe
Cincom L32

Sliding Headstock Type Automatic CNC Lathe
Cincom M16

Sliding Headstock Type Automatic CNC Lathe
Cincom M32

Sliding Headstock Type Automatic CNC Lathe
Cincom D25

MultiStationMachiningCell

Sliding Headstock Type Automatic CNC Lathe
Cincom A20

MultiStationMachiningCell
MC20

Miyano

CNC Automatic Lathe
Miyano VC03

Fixed Headstock Type CNC Automatic Lathe
Miyano BNA42GTY

Fixed Headstock Type CNC Automatic Lathe
Miyano BNA42SY

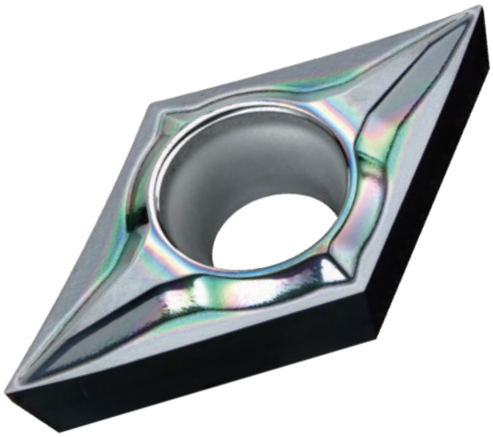
Fixed Headstock Type CNC Automatic Lathe
Miyano ANX42SYY

CITIZEN MACHINERY Official Website

PVD Coated Grades for High Precision and Small Parts Machining

MS9025/MS7025

Please refer to page 8



Solid Carbide

TRISTAR Drill Series

DVAS

Please refer to page 17

Cutting Off and Grooving System

GY/GW Series

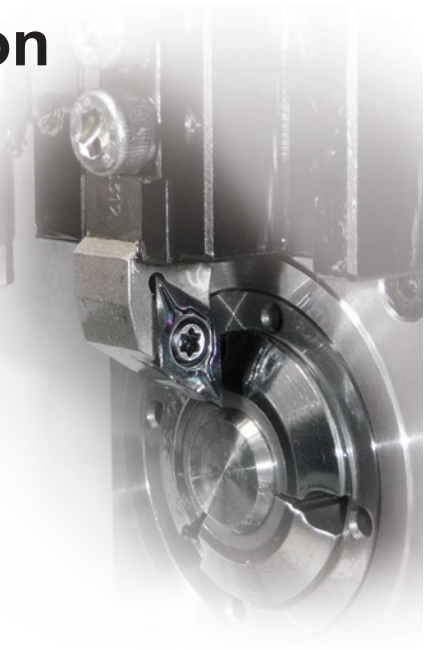
GY holder : GYSL1915JX00 type
*Line up of sizes exclusively for Cincom L32

GY holder : GYSL2012JX00 type
*Line up of sizes exclusively for Miyano BNA42GTY

GW holder : GWSL2020-◌◌-M type
*Compatible with Miyano ANX42SYY sub-spindle

Please refer to page 25 and 27

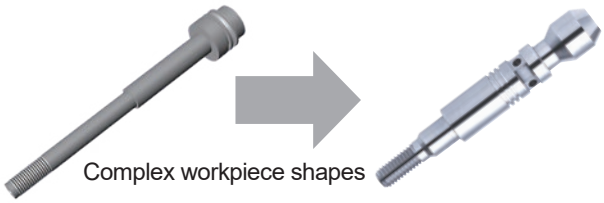
Transformation of Machining on Swiss-Type Automatic Lathes



The first parts to be machined on swiss-type automatic lathes were watch components. Their use soon expanded to machining electrical parts for home appliances, printers as well as automobile component applications such as sensors and electrification technology parts. The high precision capability of Swiss-type lathes has also lent itself to the machining of parts essential to daily life. These parts include robotic and medical implants as well as simple, but essential, parts for water taps. Expanding the type of applications is not the only modern advancement, even higher precision, productivity and quality has become necessary.

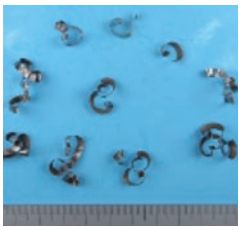
Due to changes in materials and component geometries, various problems have arisen that need solutions:

- Complex workpiece shapes
- Ever more difficult-to-cut materials
- Tighter dimensional tolerances

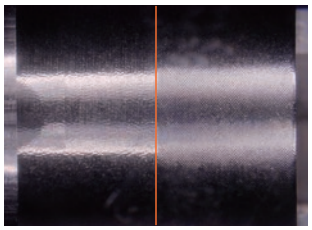


Complex workpiece shapes

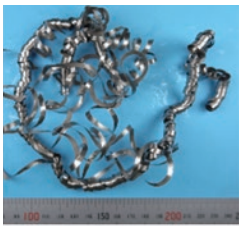
With the establishment of LFV (Low Frequency Vibration Cutting) technology by Citizen Machinery Co., Ltd., Mitsubishi Materials has been focusing on the development and commercialization of tools that are specialized for LFV.



LFV



LFV conventional machining



conventional machining

- Development of new coatings adapted to workpiece materials and machining methods
- Optimisation of welding, wear and fracture resistance
- High precision machining enabled by developments of high quality cutting edge geometries

*LFV is a registered trademark of Citizen Watch Co., Japan

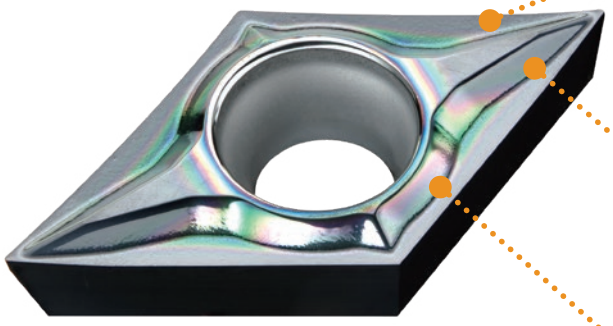
Chip Breaker System for Front Turning

FS-P Breaker LS-P Breaker

Chip breaker suitable for LFV technology

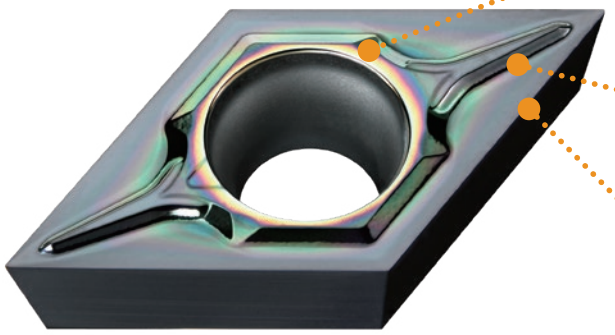
For Micro-Low Depth of Cut

FS-P Breaker



For Medium to High Depth of Cut

LS-P Breaker



Curved Cutting Edge

The curved cutting edge reduces cutting resistance and enables smooth chip evacuation. It also enables good initial entry to the workpiece and resists vibration and oscillation during machining.

High Chip Breaker Wall

The high chip breaker wall ensures that the chips separate properly and prevents the workpiece from being damaged when chips are discharged.

Polishing (Mirror-Surface)

Welding resistance and chip evacuation are greatly improved.

Large Pocket

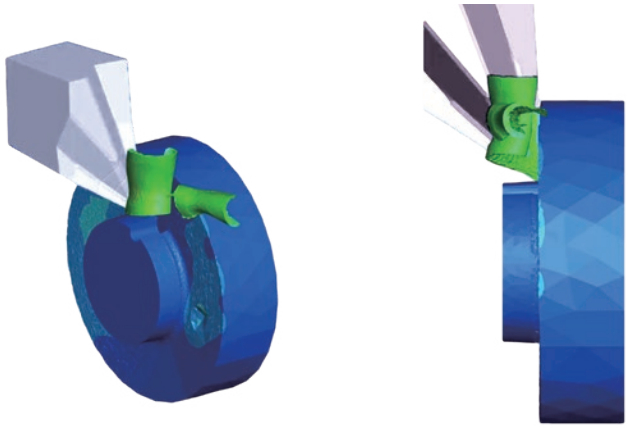
The large pocket enhances chip evacuation during high depths of cut and suppresses chip clogging.

Parallel Cutting Edge

The parallel cutting edge greatly improves fracture resistance during high depths of cut.

Chip Breakup Simulation of FS-P Breaker Using LFV technology Function

It was confirmed that the chips were separated and ejected smoothly.



<Simulation Conditions>
Workpiece Material : SUS304
(Φ8 Bar-shaped material)
Cutting Speed : vc =60 m/min
Feed per Rev. : f =0.05 mm/rev
Depth of Cut : ap = 2.0 mm
With controlled
vibration frequency : D=1.5 / rev.
Vibration ratio : Q=2.0

*LFV is a registered trademark of Citizen Watch Co., Japan

Environmentally Friendly Product

2022-017 JTA ECO PRODUCT

Please refer to the page 12 for more information on certified environmentally friendly products.

MS Series - PVD Coated Grades for High Precision and Small Parts Machining

MS7025

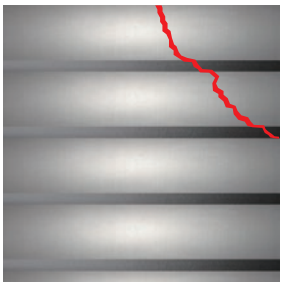
NEW

Dramatically improved welding and wear resistance in low feed machining with a more precise nano-multilayer coating

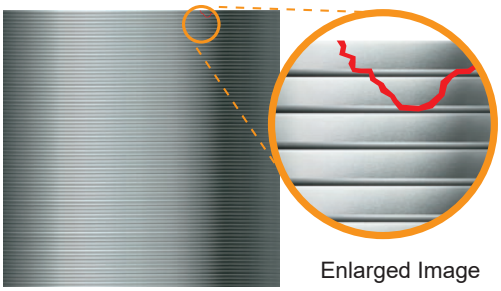
Features

Nano-Multilayer Coating

By combining the high lubrication layer with excellent welding resistance, and the high hardness layer with a greater wear resistance that suppresses the progress of wear at the nano-level, the film damage is significantly reduced and the welding and wear resistance are dramatically improved.



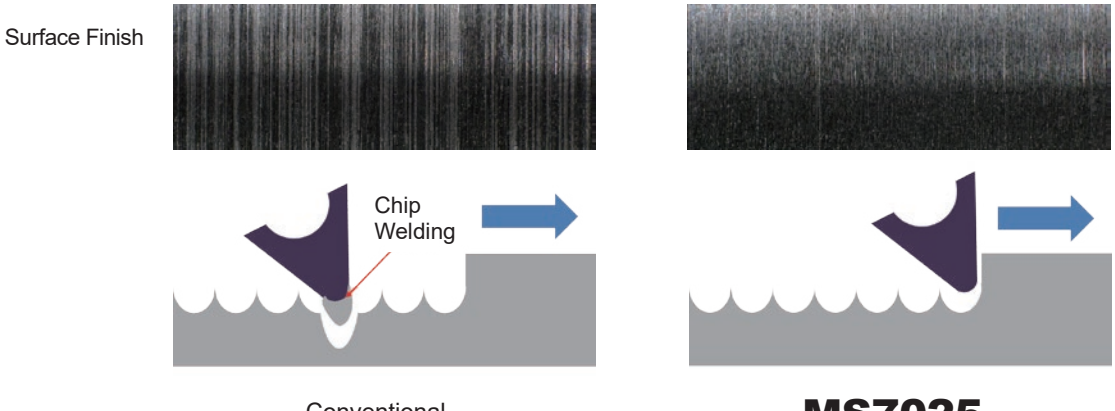
Conventional Multilayer Coating



Nano-Multilayer Coating

Effects of the High Lubrication Layer

The nano-level, high lubrication layer suppresses built-up edge caused by chip welding which tends to occur in low feed machining and in addition reduces machining marks on the component surface.



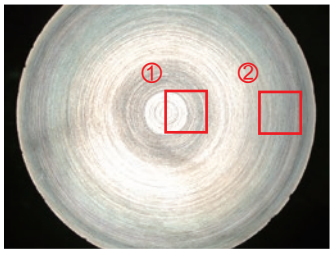
Please see here for details including item list.

Cutting Performance

Comparison of End Face Machined Surfaces Using 3D Analysis

Achieves stable machining even during end face machining where the cutting speed is liable to change.

Workpiece Material : JIS S45C



MS7025

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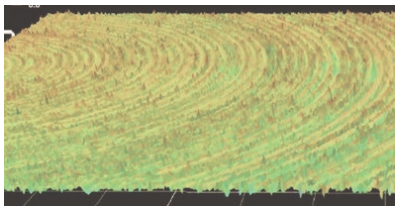

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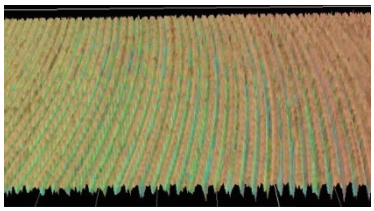
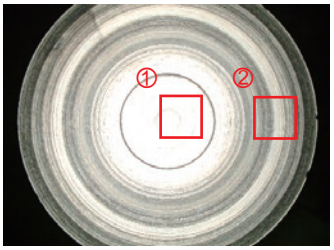
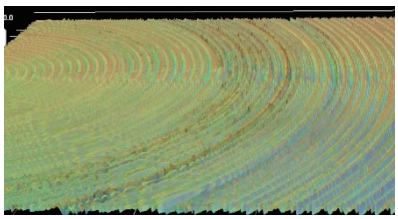
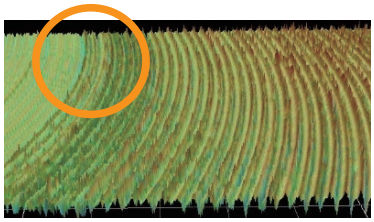


Good Surface Finish



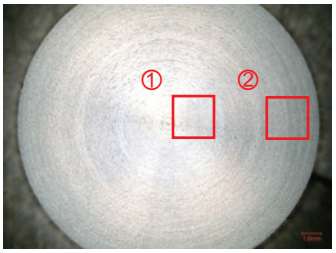
Conventional





Changes in surface quality caused by machining marks

Workpiece Material : JIS SUS304



MS7025

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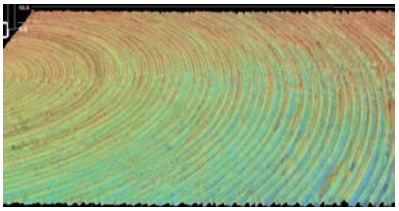

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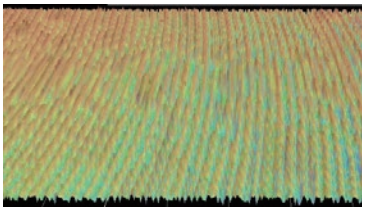
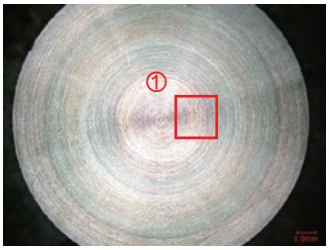
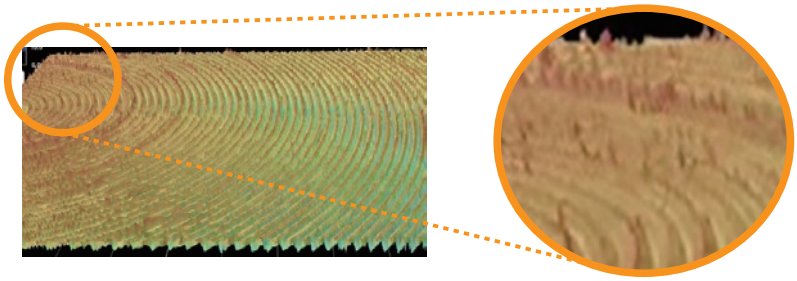


Good Surface Finish

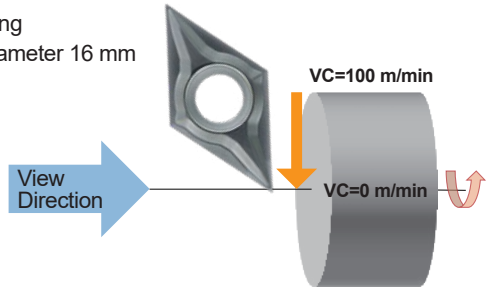


Conventional



Rougness can occur in the low speed area (near the centre)

Image of Facing
Workpiece Diameter 16 mm



<Cutting Conditions>

Workpiece Material	: Notation Above
Inserts	: DCGT11T302
Cutting Speed	: vc = Max. 100 m/min
Feed per Rev.	: f =0.02 mm/rev
Depth of Cut	: ap = 0.2 mm
Cutting Mode	: Wet Cutting (Oil)

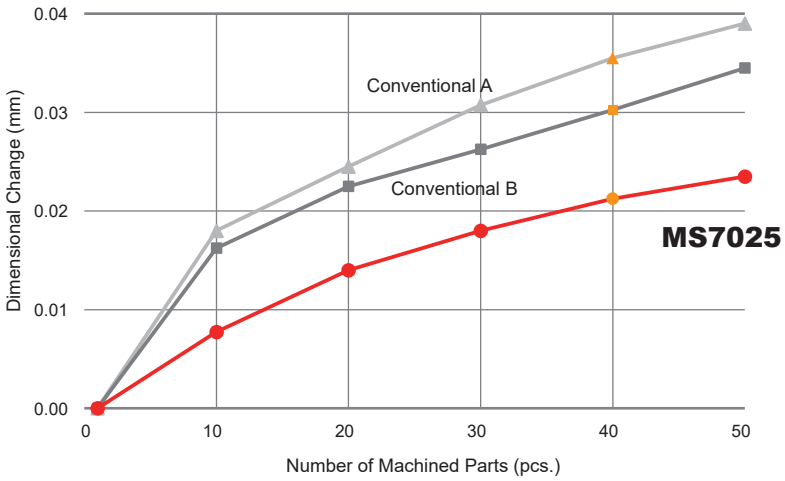
Please see here for details including item list.

Cutting Performance

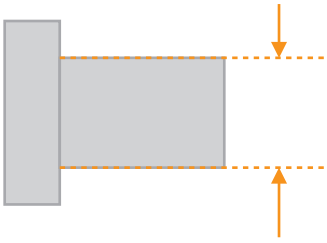
Comparison of Dimensional Change in Low Feed Machining

When machining at low feed rate conditions, dimensional changes are reduced and the quality of the machined surface is improved.

Workpiece Material : JIS SUS440C



Dimensional Change
The amount of dimensional change is based on the first component machined



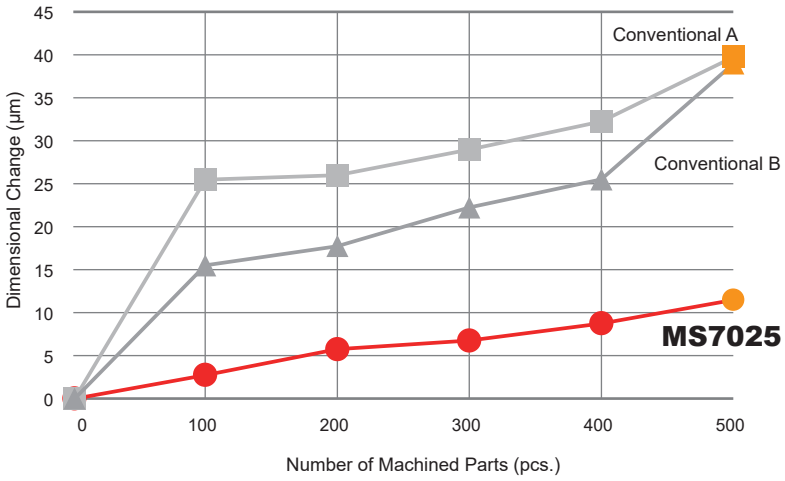
<Cutting Conditions>

Workpiece Material	: JIS SUS440C
Inserts	: DCGT11T301
Cutting Speed	: vc = 70 m/min
Feed per Rev.	: f =0.02 mm/rev
Depth of Cut	: ap = 1.5 mm
Cutting Mode	: Wet Cutting (Oil)

After 40 piece machining

MS7025 | Conventional A | Conventional B

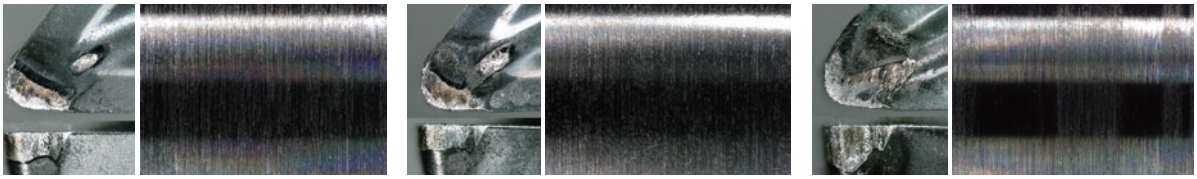
Workpiece Material : ELCH2S



<Cutting Conditions>

Workpiece Material	: ELCH2S
Inserts	: DCGT11T302
Cutting Speed	: vc = 240 m/min
Feed per Rev.	: f =0.03 mm/rev
Depth of Cut	: ap = 0.3 mm
Workpiece Material Length	: 15 mm
Cutting Mode	: Wet Cutting (Oil)

After 500 piece machining



MS7025 | Conventional A | Conventional B

Environmentally Friendly Product

This product has been certified as an environmentally friendly product in the machine tool industry by the Japan Cutting & Wear-resistant Tool Association. This is a product unique to the industry, in harmony with the environment, and with the aim of fulfilling the social responsibilities of the machine tool industry.

The Japan Cutting & Wear-resistant Tool Association evaluates the product's environmental impact during the manufacturing and usage stages and issues a certification according to the evaluation score.

For People, Society and the Earth

More information about MITSUBISHI MATERIALS' efforts to address social and environmental issues can be found in the website below or by scanning the QR code.

https://mmc.disclosure.site/en/

Environmentally Friendly Product

2021-001 JTA ECO PRODUCT

Please refer to the page 12 for more information on certified environmentally friendly products.

MS Series - PVD Coated Grades for High Precision and Small Parts Machining

MS9025

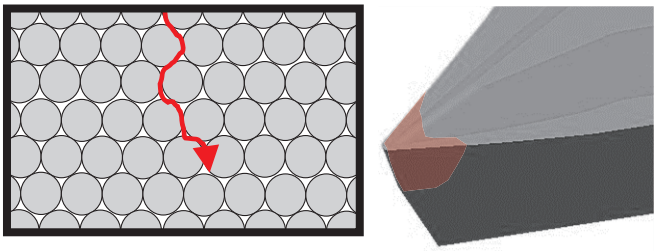
Effective reduction of notch wear with a balance of wear and fracture resistance.

Features

Improved Cemented Carbide

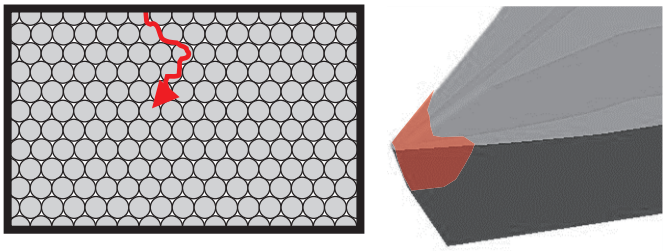
Thermal conductivity has been improved by optimising the grain size and therefore reducing the boundary contact between the WC particles. This optimisation reduces the temperature of the cutting edge during machining.

MS9025



Reducing the cutting edge temperature by improved thermal conductivity.

Conventional



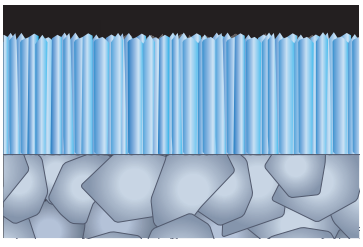
Higher cutting edge temperatures due to more particle boundary contact.

Smooth Surface of The Coating

The even surface of the coating has been achieved by first making the carbide substrate smooth, then by promoting straight growth of the coating crystals. This leads to excellent welding resistance.

*By Image

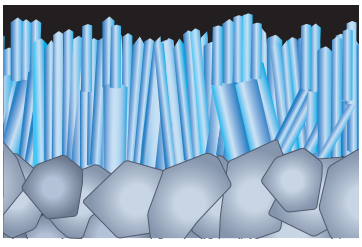
MS9025



Smooth Cemented Carbide

Straight crystal growth.
Smooth carbide surface.
Excellent welding resistance.

Conventional



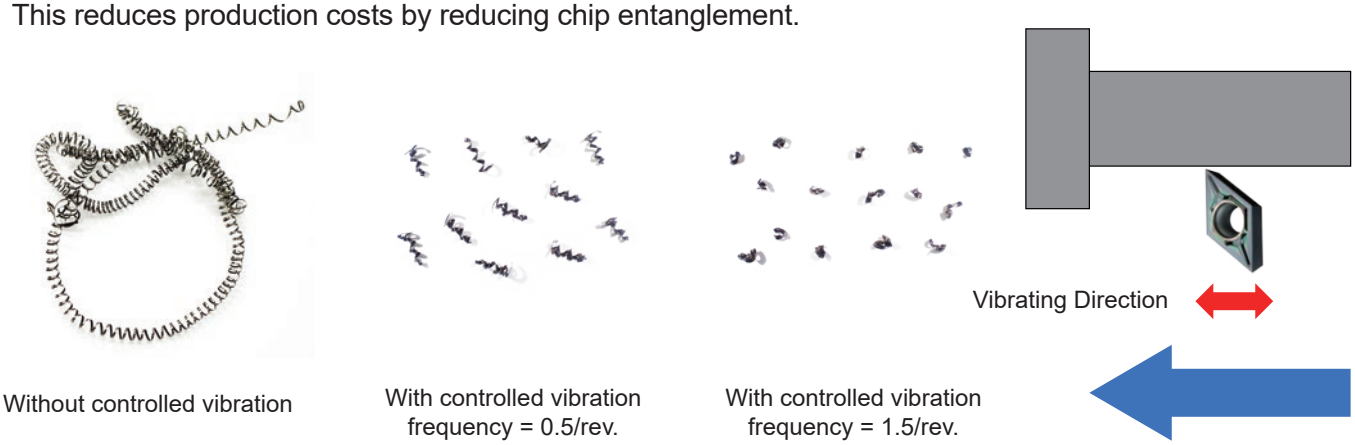
Rough Cemented Carbide

Random crystal growth direction.
Performance is variable due to defects and voids in the surface.

Please see here for details including item list.

Cutting Performance of LFV* technology

Using new machine technology to deliberately vibrate the tool in relation to the cutting direction is an effective way of breaking chips.
This reduces production costs by reducing chip entanglement.



Without controlled vibration

With controlled vibration frequency = 0.5/rev.

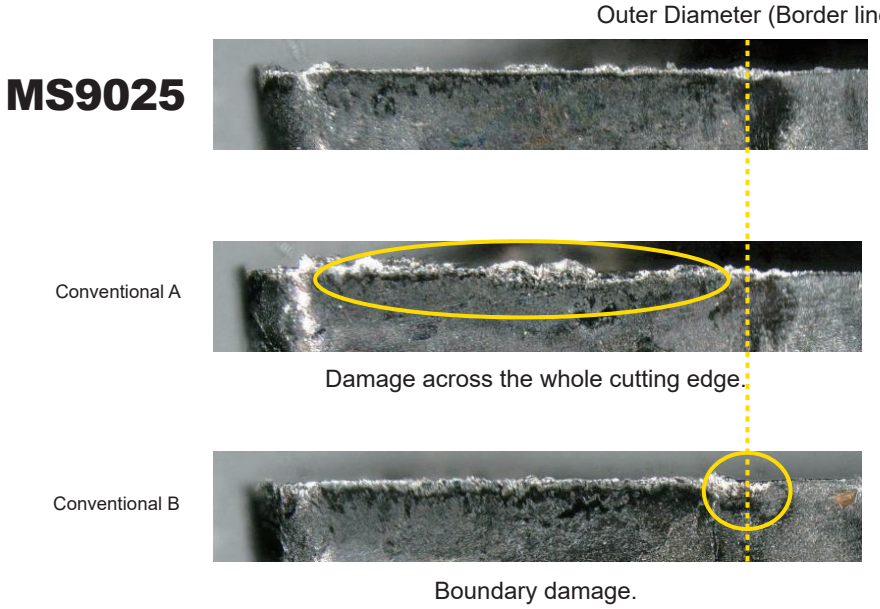
With controlled vibration frequency = 1.5/rev.

Challenges of controlled vibration machining:
Compared to standard machining there is a greater chance of edge chipping due to the extra stress on the cutting edge and also because of the impact of work hardening.

Benefits of using MS9025 for LFV technology

1. Excellent fracture resistance due to the inherent toughness of the base material.
2. Effectively suppresses boundary wear damage during machining of difficult-to-cut materials.
   This is achieved by the optimised cemented carbide grain size that reduces thermal conductivity and heating of the cutting edge.

After 500 passes at 15m per pass

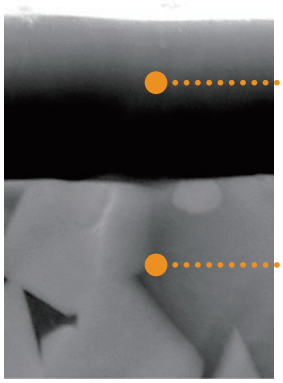


<Cutting Conditions>

Workpiece Material	: JIS SUS304
Inserts	: DCGT11T302M
Cutting Speed	: vc = 100 m/min
Feed per Rev.	: f =0.05 mm/rev
Depth of Cut	: ap = 1.0 mm
Vibration Mode	: Mode1
Cutting Mode	: External Continuous Cutting Wet Cutting (Oil)

*LFV is a registered trademark of Citizen Watch Co., Japan

High Al-rich(Al,Ti)N Single Layer Coating Technology

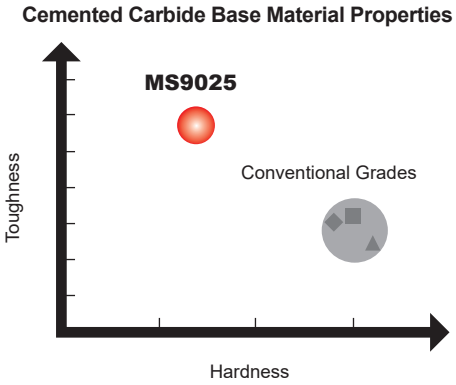


Al-rich (Al,Ti)N

Superior Flank Wear Resistance
Superior Crater Wear Resistance
Excellent Welding Resistance

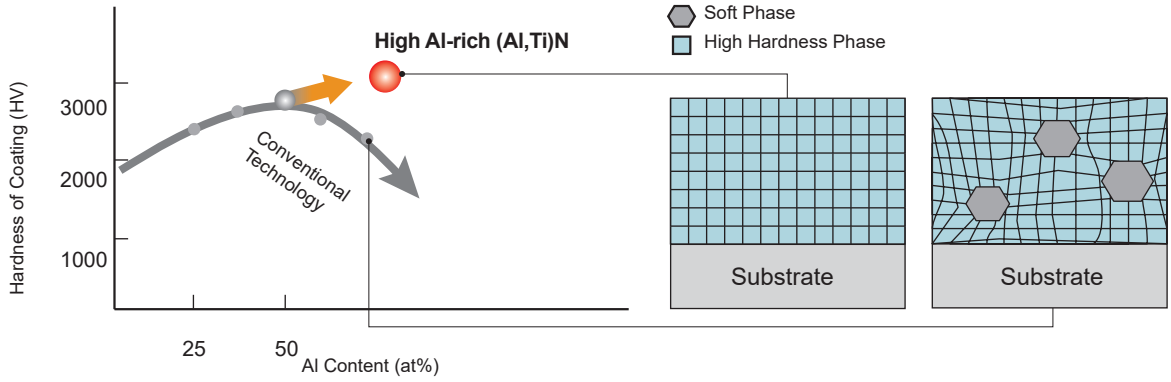
Special Cemented Carbide for MS9025

Superior Fracture Resistance
Excellent Chipping Resistance



High Al and Conventional Coating Comparison

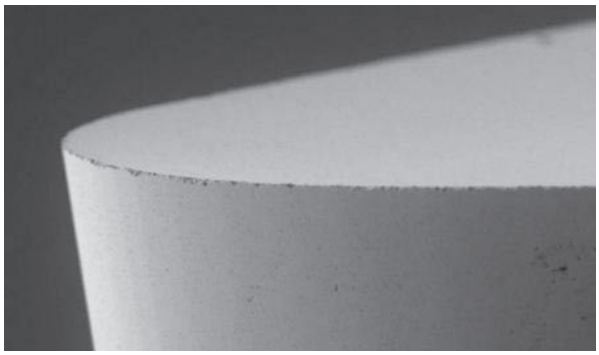
The high Al-rich (Al, Ti)N single layer coating provides stabilization of the high hardness phase and succeeds in dramatically improving wear, creater and welding resistance.



Extremely High Quality Cutting Edge

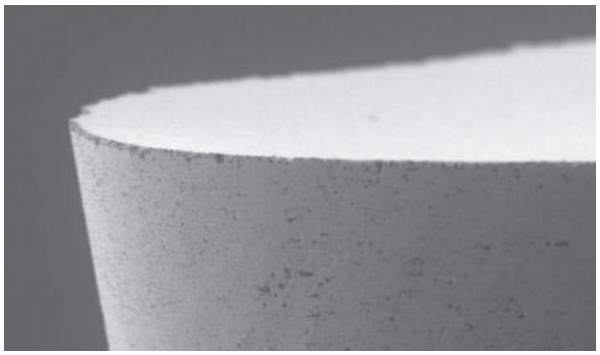
Technology that provides superior dimensional stability and reduces burrs.

MS9025



Rz=0.14 µm

Conventional

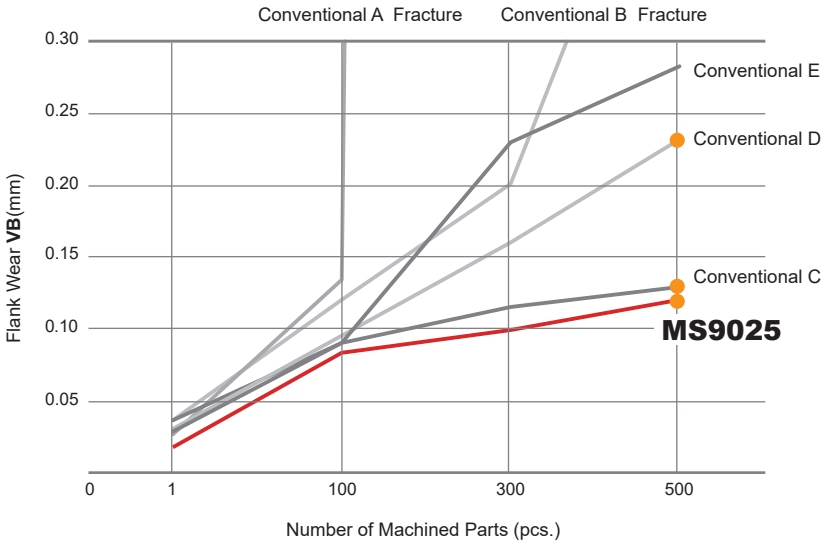


Rz=0.61 µm

Please see here for details including item list.

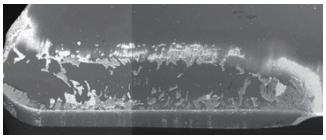
Cutting Performance

Stainless Steel JIS SUS440C, Wear Resistance Comparison

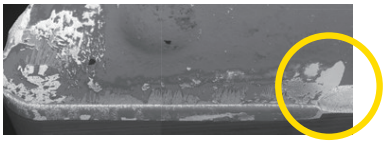


<Cutting Conditions>
Workpiece Material : JIS SUS440C
Inserts : DCGT11T302
Machining Methods : External
Continuous Cutting
Cutting Speed : vc = 100 m/min
Feed per Rev. : f =0.08 mm/rev
Depth of Cut : ap = 1.0 mm
Cutting Mode : Wet Cutting (Oil)

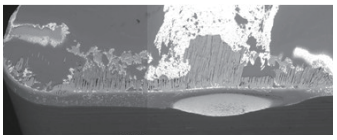
Taken after machining 500 Parts



MS9025



Conventional C : Flaking

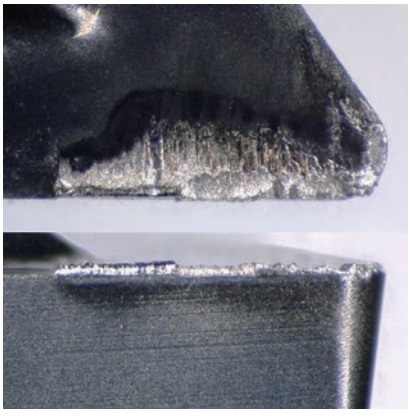


Conventional D : Base material exposure

Stainless Steel JIS SUS304, Cutting Edge Comparison

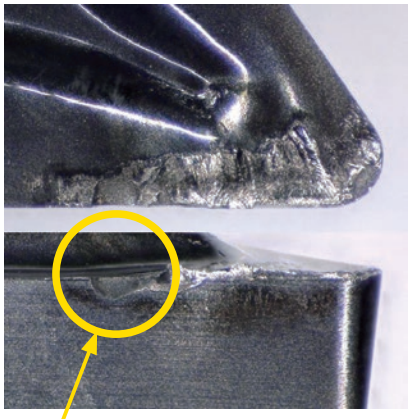
Taken after machining 500 Parts

MS9025



VB=0.03 mm

Conventional



VB=0.07 mm

<Cutting Conditions>
Workpiece Material : JIS SUS304
Inserts : DCGT11T302
Machining Methods : External
Continuous Cutting
Cutting Speed : vc = 57 m/min
Feed per Rev. : f =0.03 mm/rev
Depth of Cut : Rough ap = 0.05 mm
Finish ap = 0.02 mm
Cutting Mode : Wet Cutting (Oil)

Solid Carbide

TRISTAR Drill Series

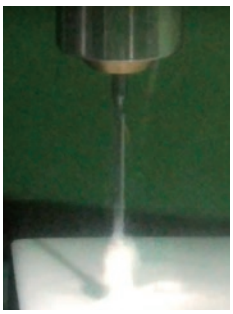
DVAS

Mini Size ø1.0 mm – ø2.9 mm
L/D=2 – 50

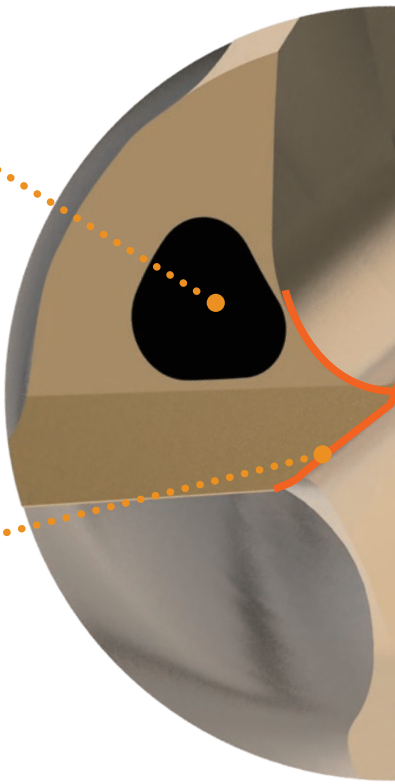
FAST, RELIABLE and ACCURATE.
New standards enabled by the Five Technologies.

Advanced Coolant Hole

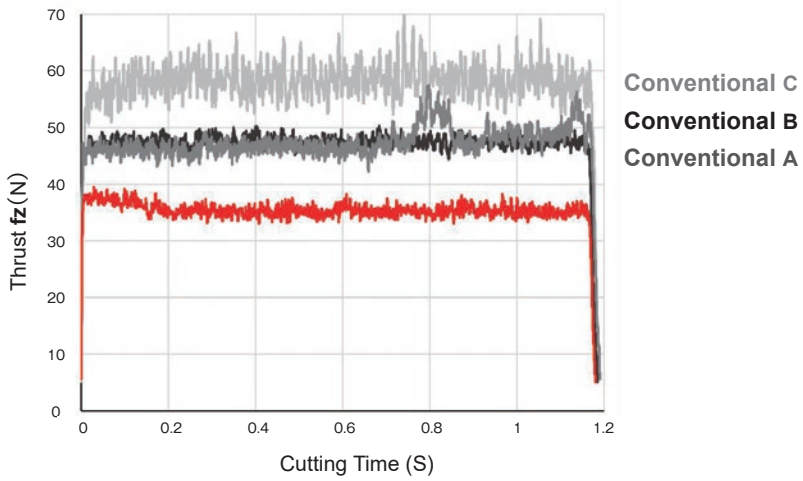
DVAS



Conventional



XR Point Thinning



Environmentally Friendly Product

2021-021 JTA ECO PRODUCT

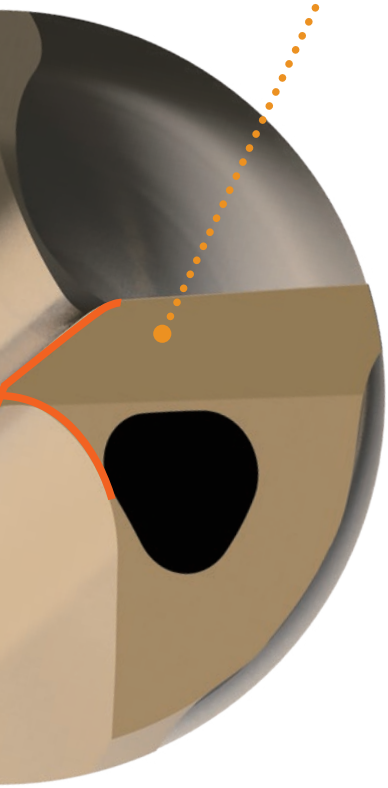
Please see here for details including item list.

Please refer to the page 12 for more information on certified environmentally friendly products.

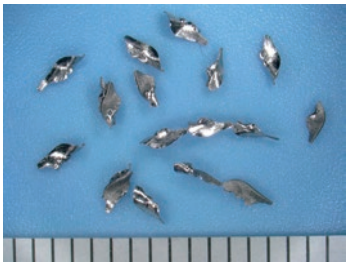
LFV technology

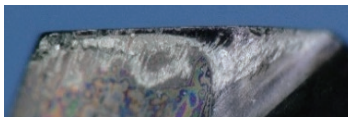
Improved chip evacuation during drilling

Tough and Sharp Cutting Edge Design

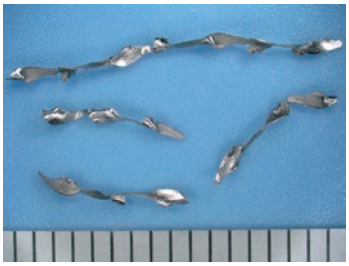


DVAS





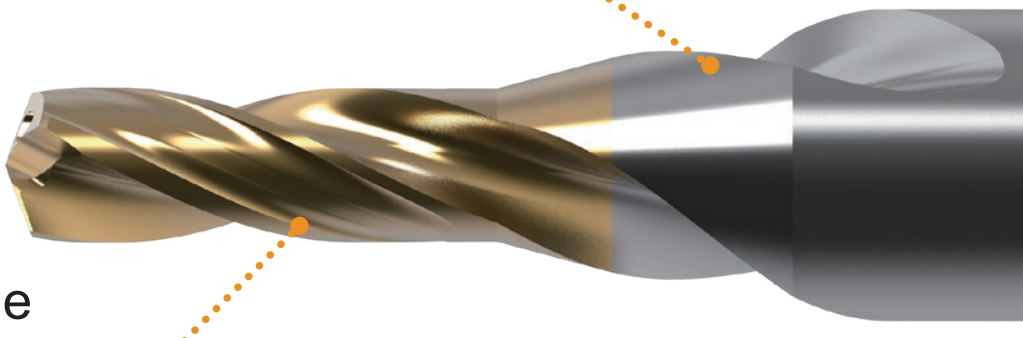
Conventional



Large crater wear and fracture of the outer edge.

Achieves high productivity with excellent chip evacuation and long tool life.

Unique Rigid Form

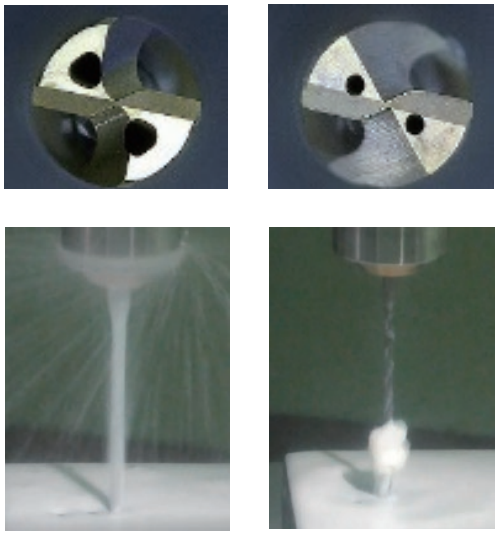


Coated Grade
DP1120

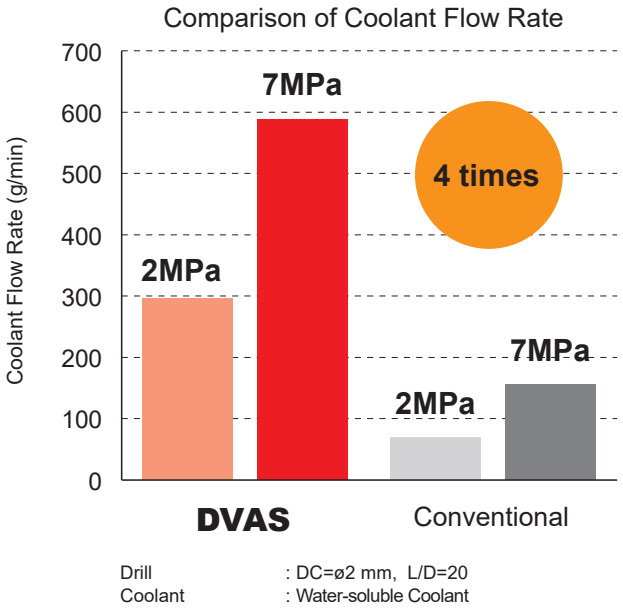
*LFV is a registered trademark of Citizen Watch Co., Japan

Mitsubishi Material's unique coolant holes with TRI-Cooling Technology.

TRI-Cooling is optimal for small-diameter drills and can achieve more than double the conventional coolant discharge volume. This can dramatically improve chip discharge and heat dissipation, contributing greatly to tool life stability.



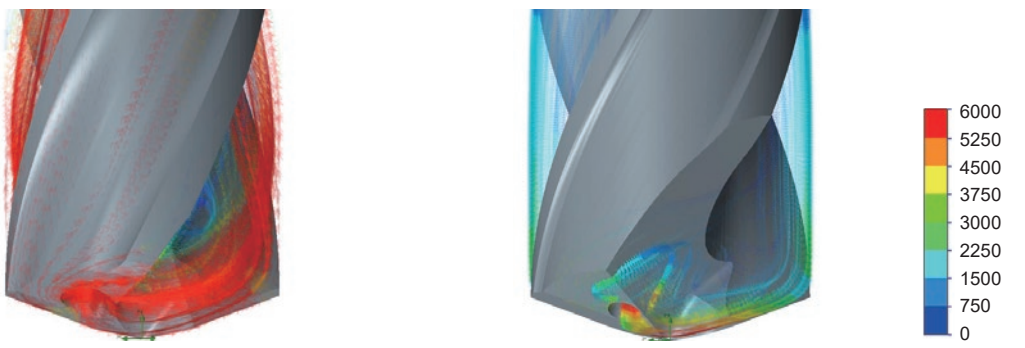
DVAS Conventional



Large coolant holes reduce tool damage due to the improved cooling effect thereby greatly increasing tool life.

Increased coolant flow provides effective cooling even in difficult applications or when using an oil based cutting fluid.

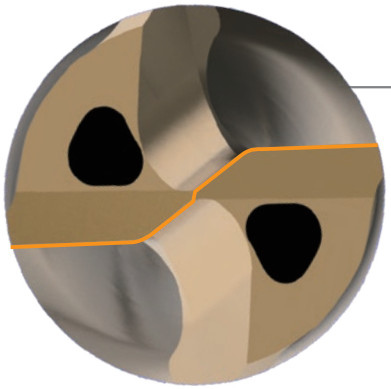
Coolant Flow Speed Simulation



DVAS Conventional

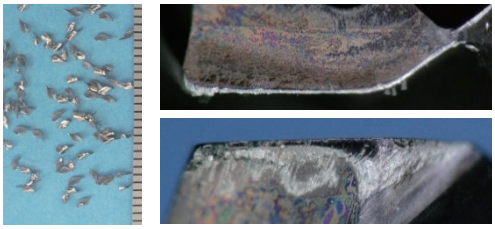
YouTube

Please see here for details including item list.



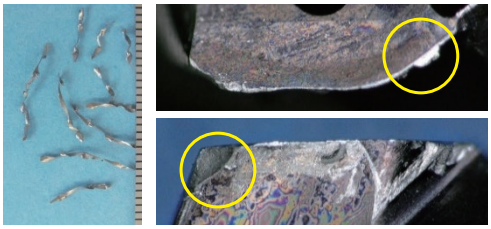
Tough, sharp cutting edge design.

The straight cutting edge and thinned point are connected with a smoothly curved geometry that significantly improves fracture resistance. The geometry of the rake angles and lands also improves wear and chip disposal.



DVAS

Large crater wear and fracture of the outer edge.



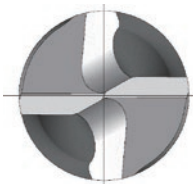
Conventional

<Cutting Conditions>
Workpiece Material : JIS SCM440
Tool : DC=ø2 mm, L/D=20
Cutting Speed : vc= 50 m/min
Feed per Rev. : fr= 0.06 mm/rev.
Cutting Mode : Wet Cutting
Water-soluble Coolant, 2 MPa

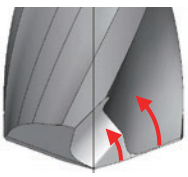
New XR point thinning, reduces cutting load and optimises chip flow.

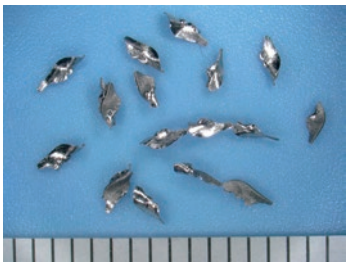
The new point thinning breaks chips into the optimum shape for streamlined flow and achieves a much lower cutting resistance.

DVAS

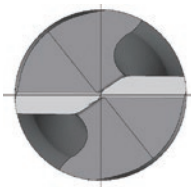


The R shaped space created by the point thinning forms compact chips that aids chip flow.

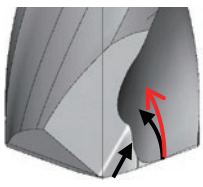


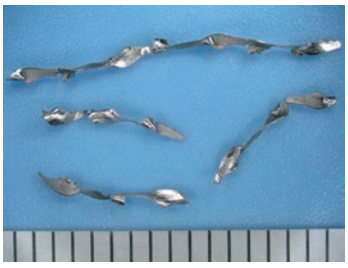


Conventional



Larger chips are created that means a lower rate of chip flow that can cause chip clogging.



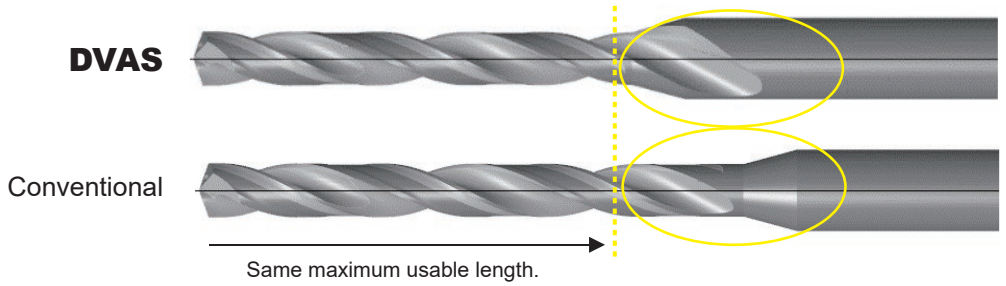


<Cutting Conditions>
Workpiece Material : JIS SCM440
Tool : DC=ø2 mm, L/D=20
Cutting Speed : vc= 50 m/min
Feed per Rev. : fr= 0.06 mm/rev.
Cutting Mode : Wet Cutting
Water-soluble Coolant, 2 MPa

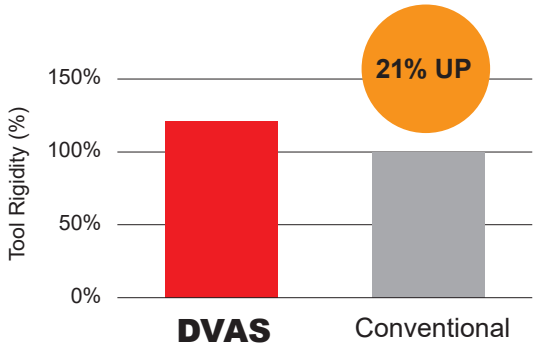
Unique flute form for greater rigidity.

Applies to L/D=2, 7, 12

The short drill is designed for high rigidity and good chip evacuation by minimizing the neck length. A chip discharge area is provided over the tapered section, increasing the tool rigidity by 20% more than the conventional model as well as improving the positional accuracy of the hole.

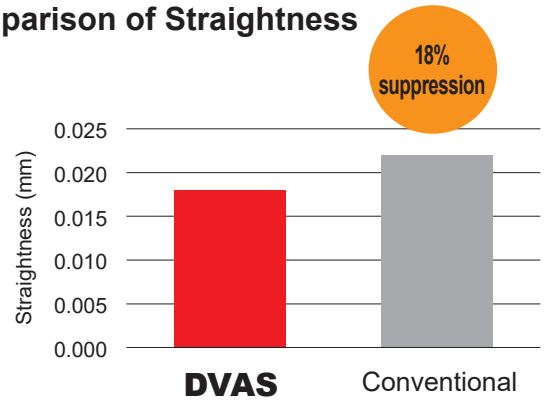


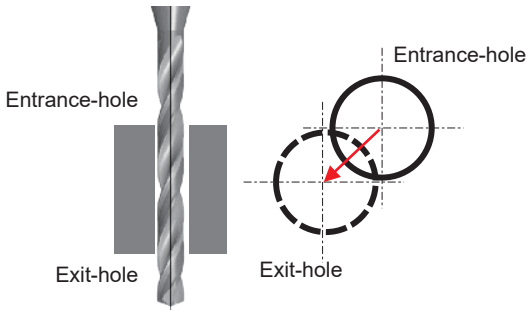
Comparison of Tool Rigidity



<Analysis Conditions>
Analysis Model : DC=ø2 mm, L/D=7
Overall Length : OAL= 60 mm
Constraints : Shank to tip range of 0-30 mm
Load : Distributed load of 140 N in Z axis direction.

Comparison of Straightness





<Cutting Conditions>
Workpiece Material : JIS SCM440
Tool : DC=ø2 mm, L/D=7
Cutting Speed : vc= 70 m/min
Feed per Rev. : fr= 0.08 mm/rev.
Hole Depth :10 mm
Cutting Mode : Wet Cutting, Water-soluble Coolant, 5 MPa
Hydro Chuck
Number of Holes : 100 holes

Please see here for details including item list.

Cutting Example

Comparison of Drilling Efficiency on Automatic Lathe

Drilling efficiency is 10 times higher compared to gun drills.
It provides high efficiency and stability even when machining stainless and alloy steels.

Drilling for SCM435

General Cutting Conditions for Gun Drills

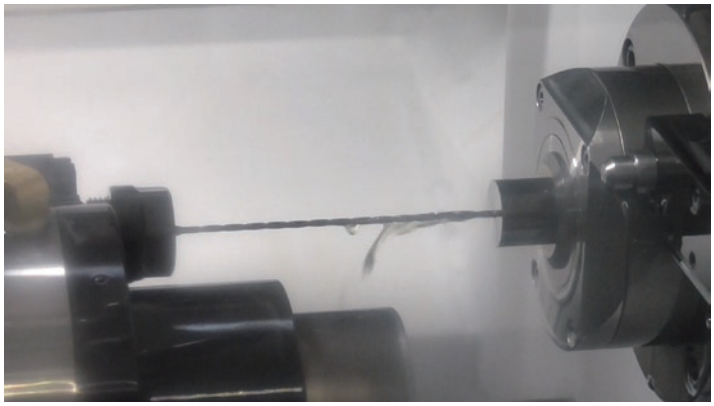
<Cutting Conditions>
Tool : DC=ø2 mm, L/D=50
Cutting Speed : vc= 50 m/min
Feed per Rev. : fr= 0.007 mm/rev.
Hole Depth : 100 mm
Cutting Mode : Wet Cutting, Oil, 15 MPa

DVAS Cutting Conditions

<Cutting Conditions>
Tool : DC=ø2 mm, L/D=50
Cutting Speed : vc= 50 m/min
Feed per Rev. : fr= 0.07 mm/rev.
Hole Depth : 100 mm
Cutting Mode : Wet Cutting, Oil, 15 MPa

Cutting Time 10.8 sec./hole

DVAS Drill



YouTube

Drilling for SUS304

General Cutting Conditions for Gun Drills

<Cutting Conditions>
Tool : DC=ø2 mm, L/D=50
Cutting Speed : vc= 40 m/min
Feed per Rev. : fr= 0.005 mm/rev.
Hole Depth : 100 mm
Cutting Mode : Wet Cutting, Oil, 15 MPa

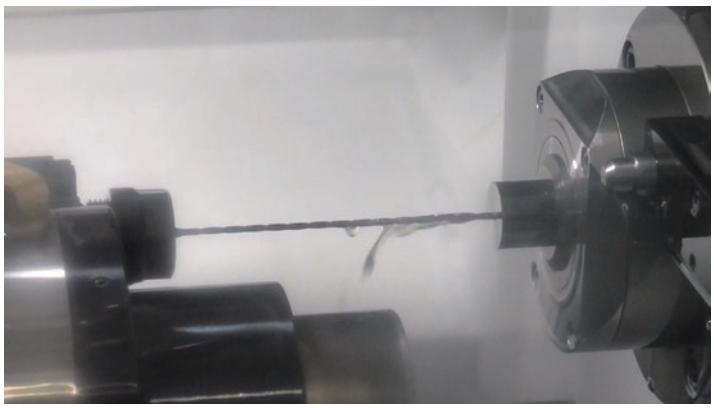
Cutting Time 188.4 sec./hole

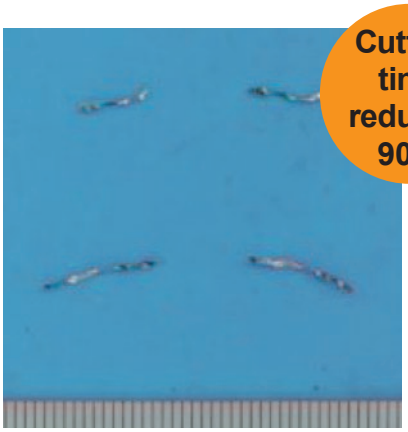
DVAS Cutting Conditions

<Cutting Conditions>
Tool : DC=ø2 mm, L/D=50
Cutting Speed : vc= 40 m/min
Feed per Rev. : fr= 0.05 mm/rev.
Hole Depth : 100 mm
Cutting Mode : Wet Cutting, Oil, 15 MPa

Cutting Time 18.8 sec./hole

DVAS Drill





YouTube

Please see here for details including item list.

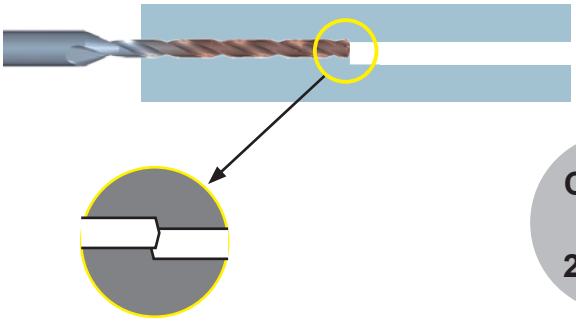
Example of Improved Drilling Efficiency on Automatic Lathes

DVAS significantly reduces cycle times and ensures consistent drilling.

Drilling from both ends method

First step: One side drilled with a blind hole.

Second step: Workpiece is inverted to produce a through hole.



Hole mismatch is likely to occur.

Cutting Time 20 min.

Drilling Process with a **DVAS** drill

First step: Drilling a through hole from one side only.

Cutting Time is Approx 1 Minute

DVAS

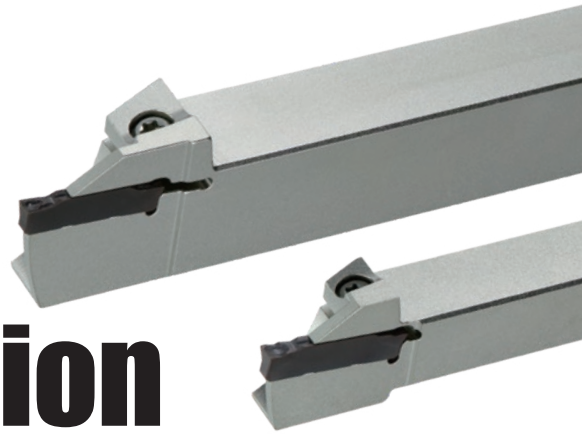
<Cutting Conditions>
Workpiece Material : JIS S45C
Tool : DC=ø2.5 mm, L/D=50
Cutting Speed : vc= 70 m/min
Feed per Rev. : fr= 0.09-0.12 mm/rev.
Hole Depth : 117 mm
Cutting Mode : Wet Cutting, Oil, 7 MPa

Memo

Grooving System

GY Series

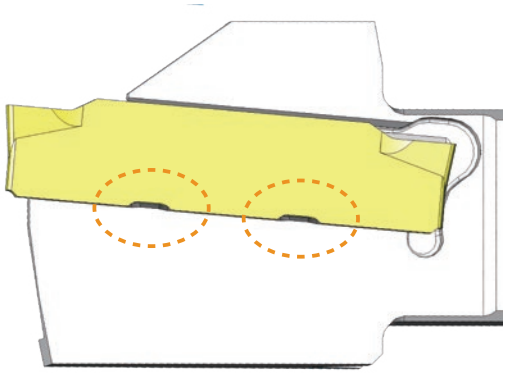
Grooving Revolution



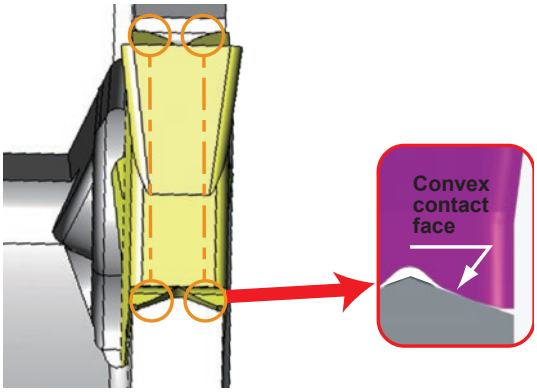
Innovative clamping system ensures reliable grooving.

Highly Reliable Insert Clamp

The safety key locks the insert and prevents movement.



The convex geometry ensures high precision clamping.

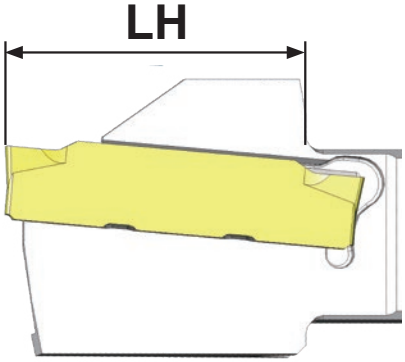


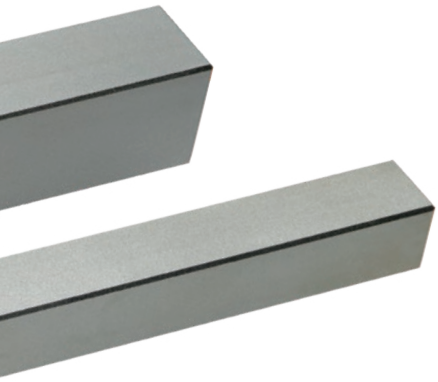
Monoblock Holder for Swiss-Type Automatic Lathes

The new geometry with greatly improved rigidity suppresses vibrations and dimensional changes, thereby solving common cutting off problems.

Overhang Length Compatible with Swiss-Type Automatic Lathes

Head length corresponding to the maximum machining diameter of CNC Swiss-Type automatic lathes and turret machines.





Environmentally Friendly Product

2022-031 JTA ECO PRODUCT

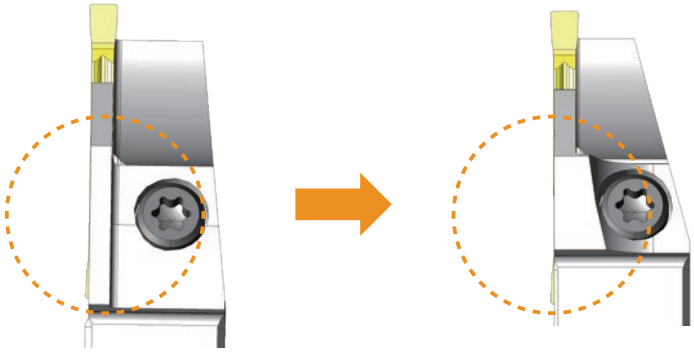
Please see here for details including item list.

Please refer to the page 12 for more information on certified environmentally friendly products.

Features of the High Rigidity Holder

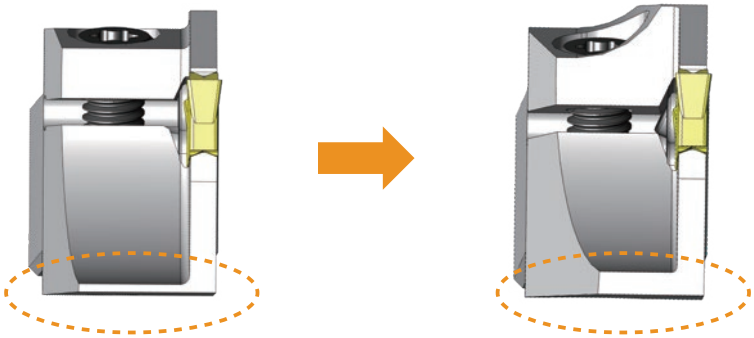
Strong Clamp Bridge

The strong design of the clamp bridge suppresses chatter and vibration.



Thicker Tool Base

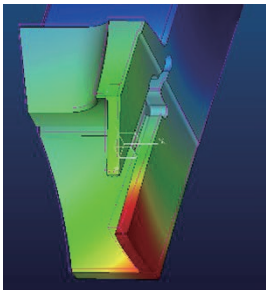
Tool deflection caused by cutting resistance is greatly reduced.



Analysis by Simulation
Deflection Measurement : 0.044

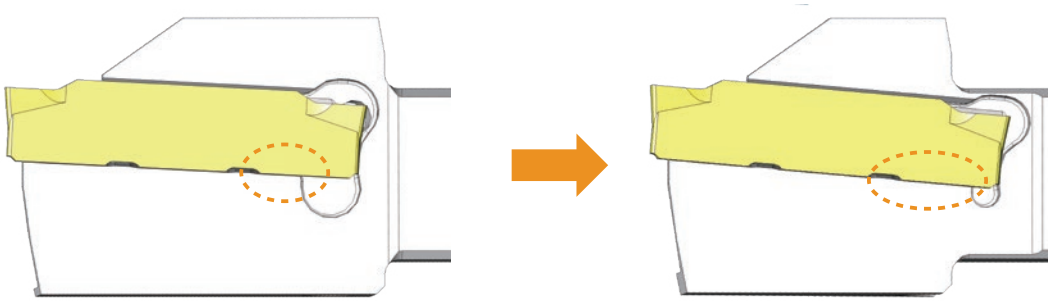
Analysis by Simulation
Deflection Measurement : 0.013

Analysis by Simulation



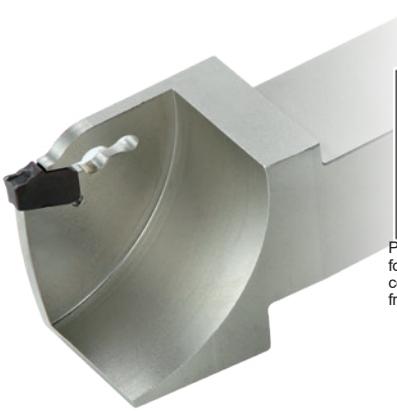
Strengthening of the Insert Clamp

The seating face of the insert becomes wider, reducing the deformation of the workpiece material.



Cutting Off and Grooving System

GW Series

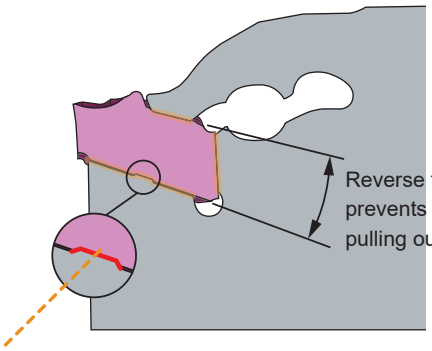


Environmentally Friendly Product

2018-007 JTA ECO PRODUCT

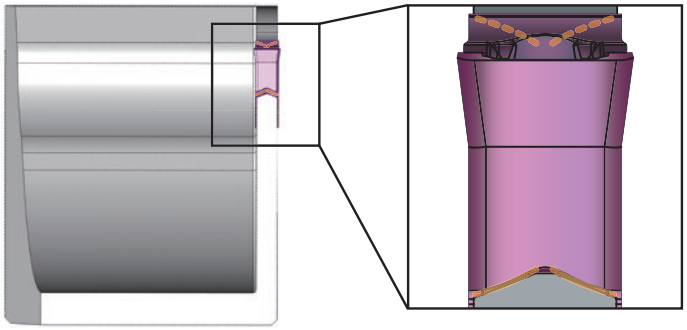
Please refer to the page 12 for more information on certified environmentally friendly products.

Highly Reliable Insert Clamping



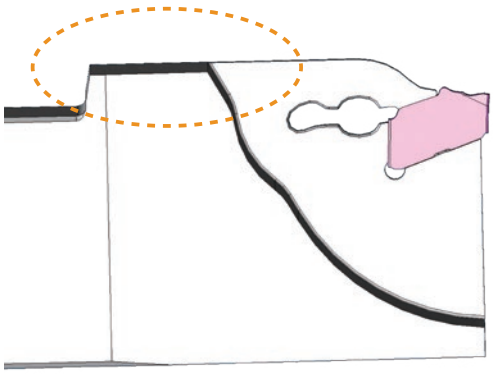
Safety key prevents insert movement.

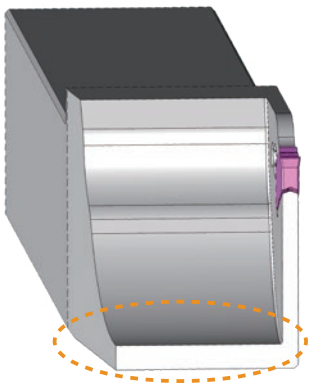
Convex geometry ensures high precision clamping.



High Rigidity Holder

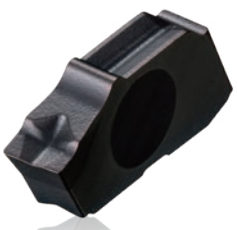
Tool deflection caused by cutting resistance and the remaining material pip in the centre are greatly reduced.



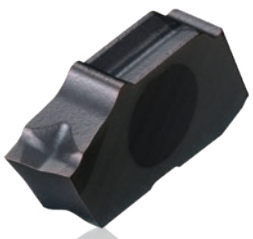


New Low Resistance and High Lead Angle Insert

New inserts with a lead angle of 8º have been added to the range to reduce burrs and the remaining material pip in the centre.



Lead Angle 5°



Lead Angle 8°

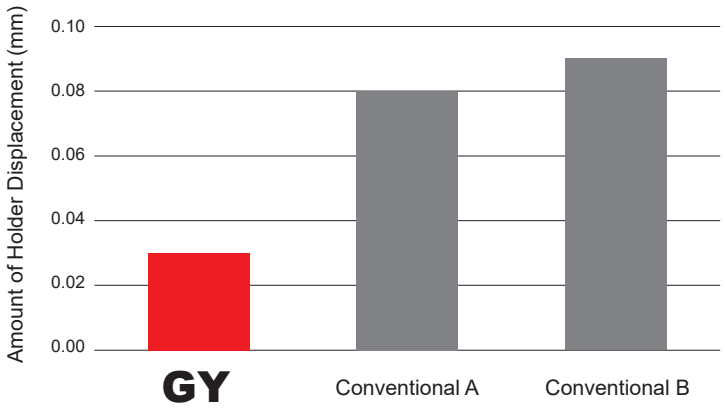
Please see here for details including item list.

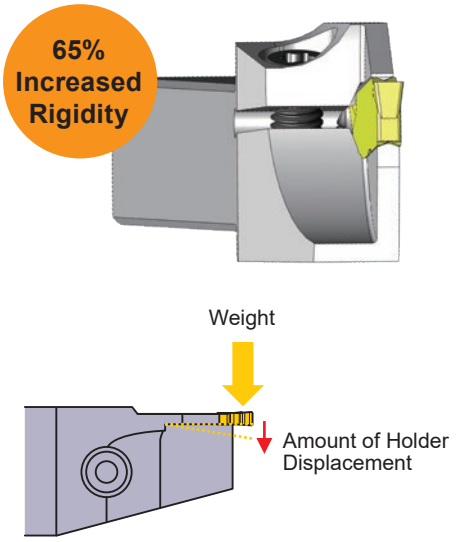
Cutting Performance

Tool Holder Deflection Comparison

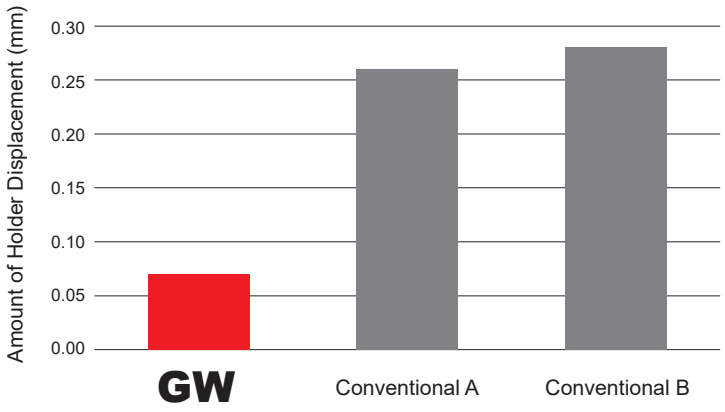
The high rigidity of the tool reduces chatter and vibration thereby improving the component surface finish and also reduces the remaining pip in the centre.

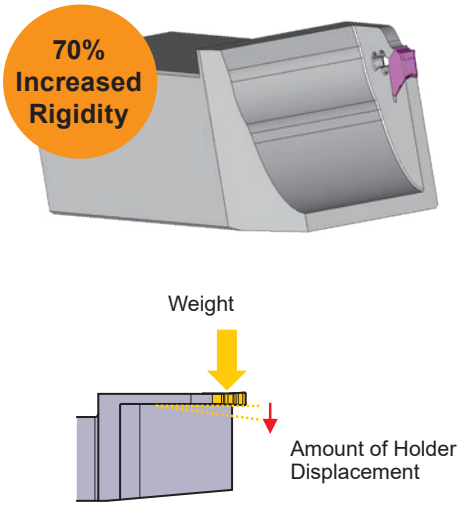
GY Holder





GW Holder





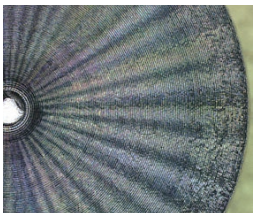
Cutting Performance

Surface Finish Comparison when Cutting Off : JIS SUS304

The high rigidity holder suppresses vibration and tool deflection, improving the finished surface.

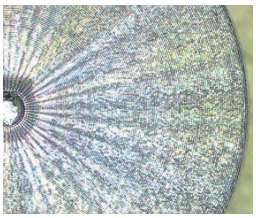
GY Holder

GY



Rz 1.8 µm

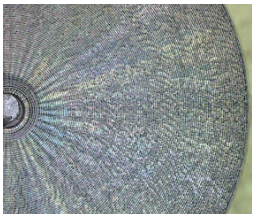
Conventional A



Rz 5.6 µm

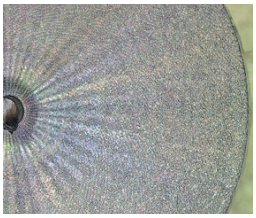
Excellent Surface Finish

Conventional B



Rz 4.1 µm

Conventional C

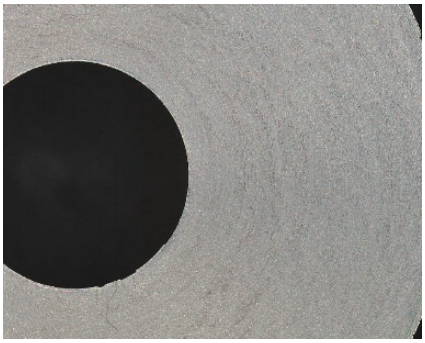


Rz 5.7 µm

<Cutting Conditions>
Workpiece Material : SUS304 ø25 mm
Tool : Cutting Width CW=2 mm
RE=0.2 mm
16×16
Cutting Speed : vc=120 m/min
Feed per Rev. : f=0.10 mm/rev
Cutting Mode : Wet Cutting

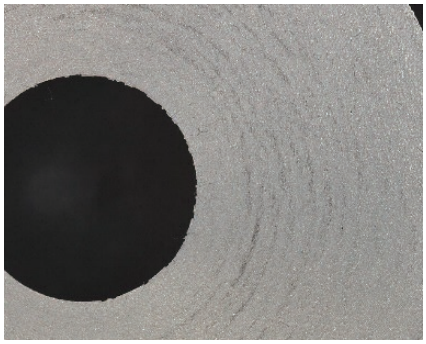
GW Holder

GW Lead Angle 8°



Rz 7.9 µm

Conventional Lead Angle 6°



Rz 11.3 µm

High Lead Angle Effect

<Cutting Conditions>
Workpiece Material : SUS304 ø38 mm
Tool : Cutting Width CW=2 mm
Cutting Speed : vc=120 m/min
Feed per Rev. : f=0.11 mm/rev
Cutting Mode : Wet Cutting

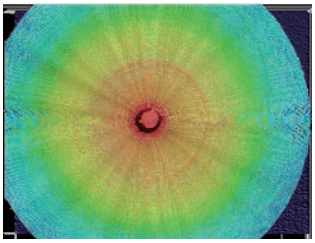
Comparison of the Accuracy of the Workpiece When Cutting Off : JIS SUS304

GY Holder

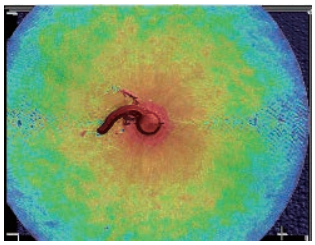
Height Difference Colour

+15 µm
0
-15 µm

GY

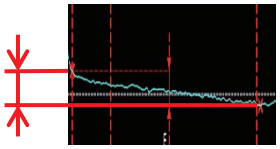


Conventional

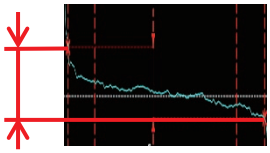


1/2 of Conventional Products

20 µm



40 µm



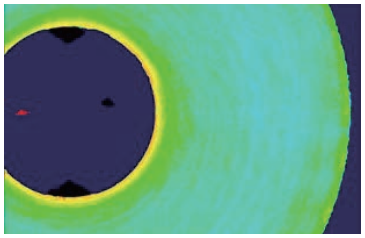
<Cutting Conditions>
Workpiece Material : SUS304 ø25 mm
Tool : Cutting Width CW=2 mm
RE=0.2 mm
16×16
Cutting Speed : vc=120 m/min
Feed per Rev. : f=0.10 mm/rev
Cutting Mode : Wet Cutting

GW Holder

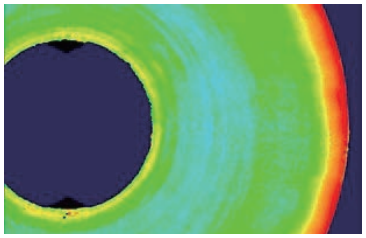
Height Difference Colour

+40 µm
0
-40 µm

GW Lead Angle 8°

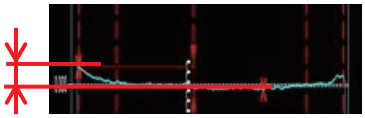


Conventional Lead Angle 8°

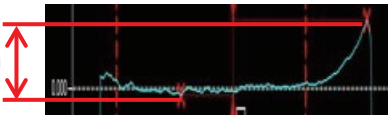


High accuracy with same lead angle

30 µm



70 µm



<Cutting Conditions>
Workpiece Material : SUS304 ø38 mm
Tool : Cutting Width CW=2 mm
Cutting Speed : vc=120 m/min
Feed per Rev. : f=0.11 mm/rev
Cutting Mode : Wet Cutting

Boring Bar for Small Parts Machining

Swiss-Type Automatic Lathe Compatible

Minimum cutting diameter of 5 mm

Coated Cemented Carbide Grade for Carbon Steel

MS6015

Skilled at pure iron, carbon steel and free cutting steel turning and achieving implemented stable finished surfaces and excellent dimensional accuracy.

Environmentally Friendly Product

Please refer to the page 12 for more information on certified environmentally friendly products.

For Swiss-Type Automatic Lathes MS plus End Mill Series

MP2ES/3ES/4EC

Enhanced Burr Reduction and Fracture Resistance to Solve Typical Swiss Lathe Machining Problems

Solid Carbide Drills for Swiss-Type Automatic Lathes WSTAR Drill Series

DWAE

Environmentally Friendly Product

2020-005 JTA ECO PRODUCT

Please refer to the page 12 for more information on certified environmentally friendly products.

Solid Drills for Centering and Chamfering Leading Drill Series

DLE

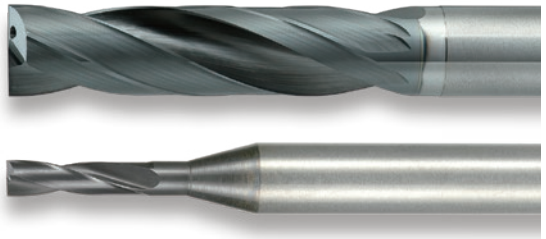
Environmentally Friendly Product

2019-002 JTA ECO PRODUCT

Please refer to the page 12 for more information on certified environmentally friendly products.

Solid Carbide Flat Bottom Drills

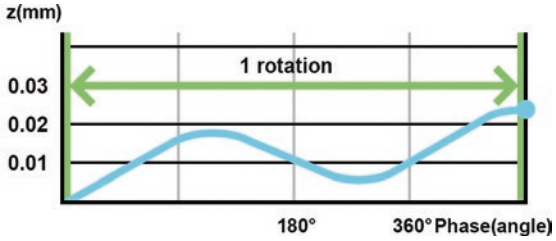
DFAS/MFE



Three Vibration Modes

Mode 1 : When fine swarf fragments are required

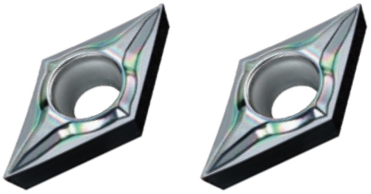
Designate the number of vibrations per workpiece rotation



Competitive products

Conventional machining 100 pieces

LFV 100 pieces



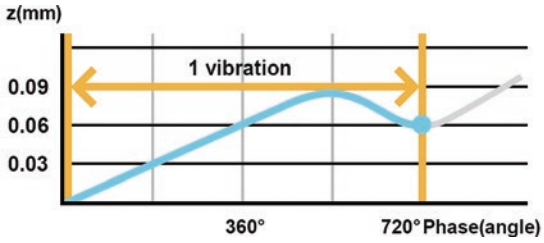
MS9025
LS-P

Conventional machining 100 pieces

LFV 100 pieces

Mode 2 : When high peripheral speed is required for fine machining or deep, small-diameter holes

Designate the amount of workpiece rotation per vibration



SUS304　Drilling

DC=6mm,Hole depth30mm, vc=60m/min, fr=0.05mm/rev

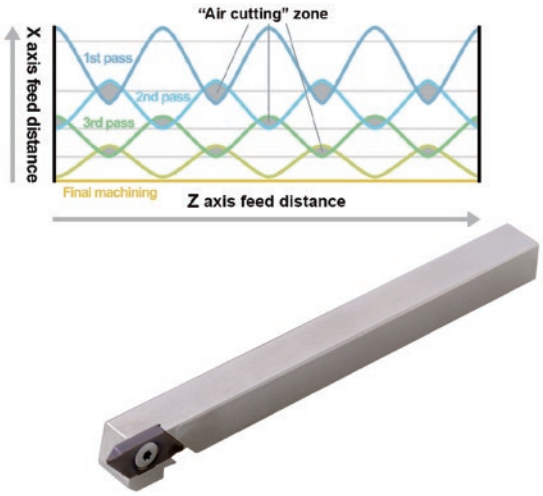
Conventional machining

" LFV " Spindle rotation amount E1.5

*LFV is a registered trademark of Citizen Watch Co., Japan　*Quoted from the website of Citizen Machinery Co., Ltd.

Mode 3 : When breaking up chips during threading processing is desired

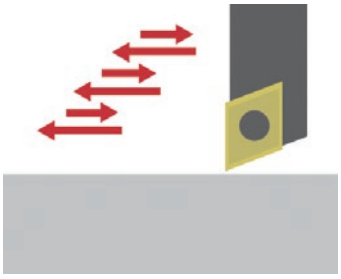
Processing method which alters the vibration timing within the threading pass



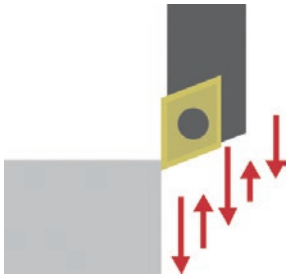
LFV

A Variety of types of machining can be handled

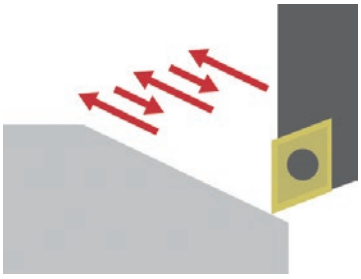
Z axis direction



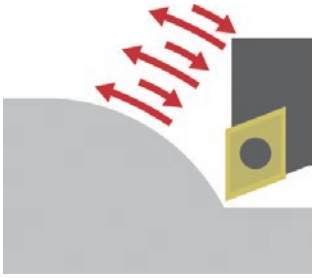
X axis direction



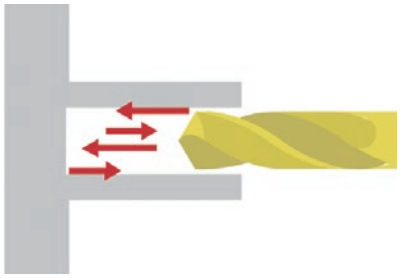
Taper



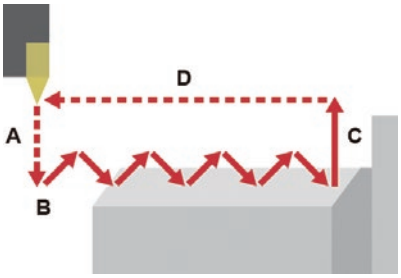
Arc



Drilling



Threading



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(Tool specifications are subject to change without notice.)

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