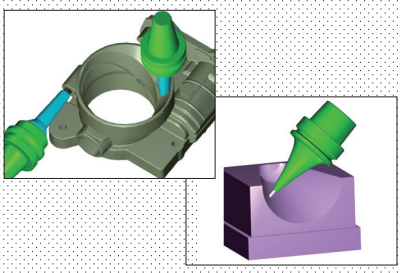
Technical support

At MST, we provide long-term support of your safe use and maintaining high accuracy of our products for your machining.

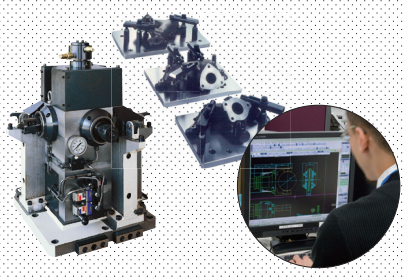
1 Pre-sales

Provide wide-ranging technical support.

Tool selection



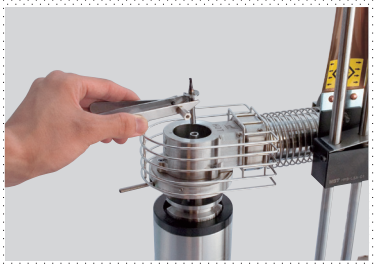
Interference check with 3D drawings



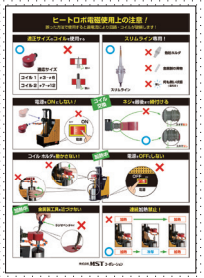
Designing jig fixtures

2 On delivery

You will receive instructions.



Instructions for a heater



Maintenance instruction

3 Post-sales

Our Tool Clinic experts can visit your factory to demonstrate the correct usage, maintenance and seminar.

Seminar

Evaluation

Consulting

Substantial peripheral equipment

Work table
6S DESK
P. 247

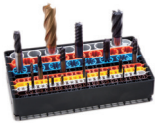
Holder,
Tool washing machine
CLEAN BOX
P. 247

Tool protection cover
TOOL CAP
P. 248

Tool tightening stand
Tool set up station
P. 249

For machine spindle maintenance
Test bar CHECKMATE
P. 251

Tool holder storage cabinet
P. 252



Cutter protection box
ENDMILL HOUSE
P. 253

Cleaning tool
P. 14

Instructions for use

To ensure optimum, trouble-free performance, please read this instructions carefully before using products.
Please contact us if your holder is damaged. We are ready to help you.

Instructions for using SLIMLINE

Pay attention to scratches and dust.

Before using, be sure to remove anti-rust oil on the holder. Scratches and dust can reduce performance and accuracy.
Please keep your holders clean with rags.
Our CLEAN BOX is available for your cleaning needs.

CLEAN BOX
➔P.247

Tool holder shank

If you insert holder shanks with scratches and dust into machine spindles, the acuracy of the spindle is reduced and the spindle can be damaged.
For shank maintenance, use an oil grinding stone or sandpaper to remove scratches and rust.
We can not re-grind shanks since it changes the position of gauge line, so we recommend you to purchase new holders.

Storage

Please use tool protection covers if you store holders with cutters.
Cutting edges may be damaged by coming in contact with each other, and you may get injured by sharp cutting edges.

TOOL CAP
➔P.248

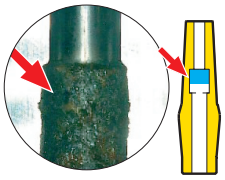
Daily maintenance.

Why does rust form?

- Water in air adheres to SLIMLINE holders. This water reacts with the metal and then rust forms. Since the SLIMLINE is heated, the oil on its surface is liable to evaporate and this makes rusting more likely to occur.
- Rust formed on the metal surface gradually corrodes deeper over time.

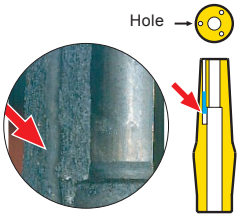
Coolant-through-spindle

In particular, when coolant is passed through a holder or a collet in the spindle-through system, it remains deep inside the holder and induces rusting.



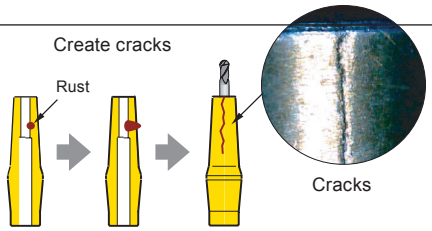
Flush type

Special care must be taken for the flush type SLIMLINE, because coolant is more likely to remain in its small holes.

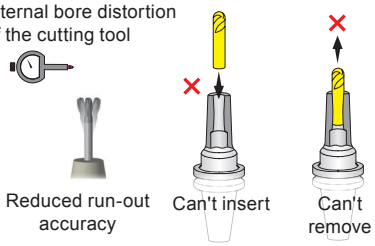


What happens after rusting?

- If a tool is chucked in this state, the tool cannot be inserted into the holder. If the tool is forced, then the stress resulting from the shrink-fit will focus on the corroded part and it causes the holder to crack.
- The clamping force is reduced, resulting in cutter slippage and loss of acuracy.



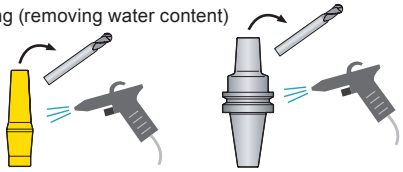
Internal bore distortion of the cutting tool



What should be done to prevent rusting?

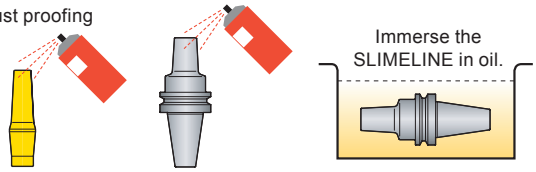
Iron rusting occurs if there are water content and air (oxygen). It can be prevented by removing water content by rustproofing or by ensuring that the metal is not directly exposed to air (oxygen).

❶ Cleaning (removing water content)



- After use, blow off any clinging water content with compressed air. Sufficiently blow air, in particular, into the deep ends of holes, small holes in the flush-type SLIMLINE, etc. After SLIMLINE has been cleaned with cleaning oil or a washing machine, blowing the holder with compressed air is effective.

❷ Rust proofing



- After cleaning, spray with rustproofing oil or immerse your SLIMLINE in rustproofing oil.
- Prior to shrink-fitting, sufficiently remove the rustproofing oil remaining on the SLIMLINE. To remove the oil, a cleaner spray or solvent is useful.

If it's getting hard to insert the cutting tool ?

If oxidation has occurred, or grease or dust has burned onto the internal bores, remove with “cleaning tool rubber grinding stone”.

Cleaning tool
Rubber grinding stone type
➔P. 14

Precautions for shrink-fitting

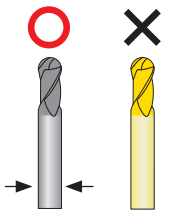
Cleaning before shrink-fitting

You must clean the cutter shank and internal bore of holder before you shrink-fit it. Please use our brush-type cleaning tool to clean out dust and dirt inside before you shrink-fit.

Cleaning tool
Brush type P. 14

Usable tools

- Please use only carbide cutters. No shrink release is possible for any tool using high-speed steel.
- A tool exceeding its tolerance can cause breakage or slippage.
- Sometimes melted particles such as tiny cutting chips on cutter shanks get stuck in clamping holes, and cutters can't be removed. DO NOT remove or insert the cutting tool forcedly, when you cannot remove it, please reheat again.



Carbide
ϕ3～ 5:h6
ϕ6～32:h7

High speed steel

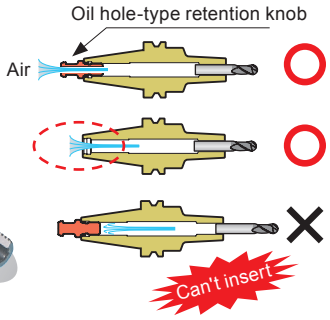
Using heat-resistant gloves

Use these gloves to protect from burns during operation.

Heat-resistant gloves
P. 13

Retention knob with hole (BT)

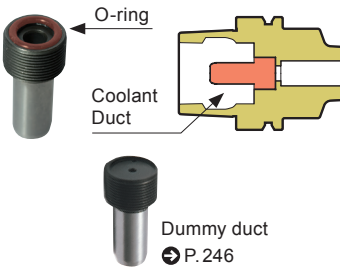
Use a retention knob that has a through hole, or remove the retention knob and heat it. The typical retention knob has no vent to release air which prevents tools from being inserted.



Through hole-type retention knob

Coolant Duct (HSK-A)

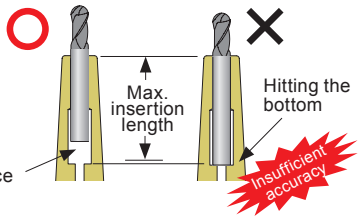
When you use hot air heater, remove the coolant duct before heating the holder. If you heat the holder with the coolant duct attached, the O-ring will be damaged.
A dummy duct is available, If you don't use the coolant-through feature and don't want to remove the duct every time.



P. 246

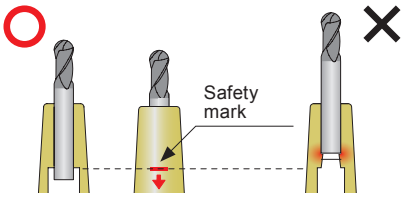
Max. insertion length

Inserting the cutter all the way to the bottom of the holder may result in insufficient accuracy. Please ensure the insertion length.



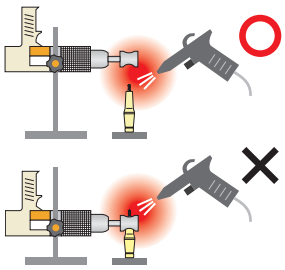
Min. holding length

A short insertion length may cause the holder to be damaged when the cutter is inserted. Always insert the cutter shank beyond the safety mark.



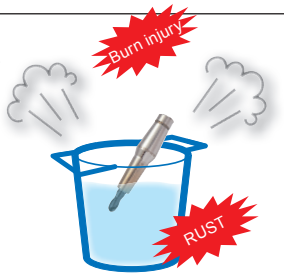
Cooling by outside air

Do not directly apply air to the shrink-fitting heater when cooling the HRB-01, 02S and 03S using air from the outside. The fan in the heater will melt, resulting in a breakdown



Precautions for water-cooling

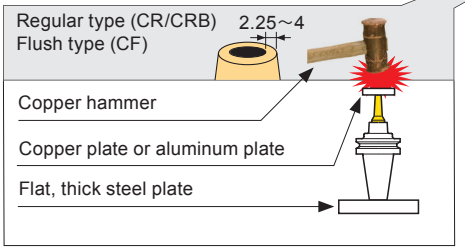
Water-cooling immediately after shrink fitting may ressult in burns due to the large quantity of steam generated.
Be sure to set the shrink-fitting heater setting to COOL and cool the holder for at least one minute before water-cooling.
Moisture left on the holder may lead to rust formation and damage to the holder, so be sure to completely remove all moisture.

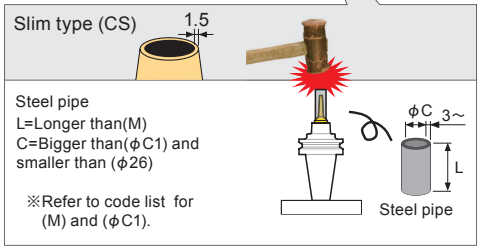


2 PIECE type : When the SLIMLINE collet can't be removed from the master holder.

Tap the collet. You can remove the collet after loosening the stuck screw.

1. Remove the tool using a shrink-fit heating device.
2. Apply force once using the dedicated wrench in the eject direction.
3. Tap it.
4. Eject.
5. Apply oil to the thread.





The reason it cannot be loosened.
In most cases, there is not adequate lubrication on the thread.

Low oil content

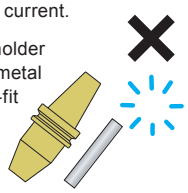
Please contact MST if you cannot remove a collet using the method above.

Cautions when using the HEAT ROBO DENJI! (HRD-01S, HRD-02S)

Only for use with SLIMLINE holders

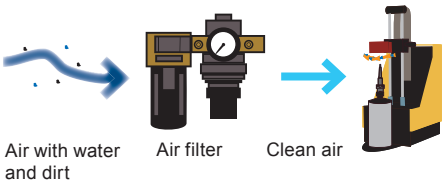
Use of the following items will lead to damage to the heater from excessive current.

- Other brand's shrink-fit holder
- Foreign matter made of metal
- Heating without a shrink-fit holder (blank heating)



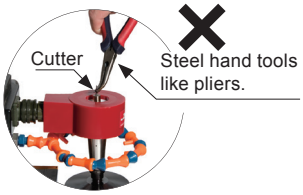
Attaching an air filter

For air-cooling, use filtered air. Air with a lot of water, or hot air, can break air component parts.

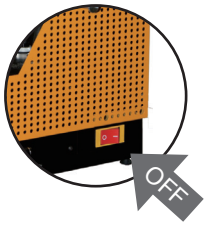


Do not use steel hand tools

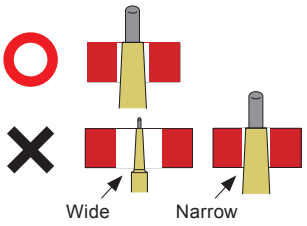
Wear heat-resistant gloves and use a cutter stopper.



Changing coils…
Be sure to turn off the power

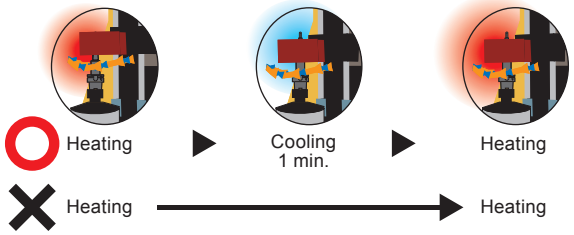


Use the appropriate coil size

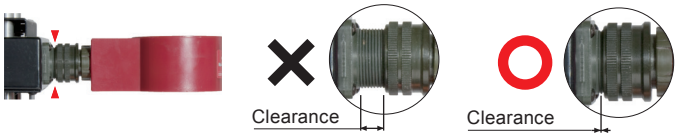


Do not repeat heating

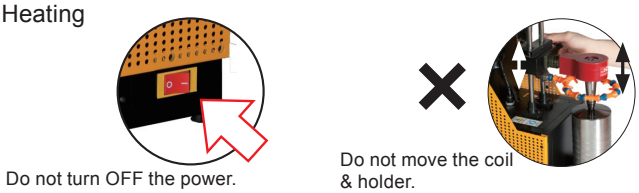
Always conduct a cooling operation for at least one minute after a heating operation, as continuous heating may damage the unit.



When you attach a coil, tighten the threaded connector all the way.

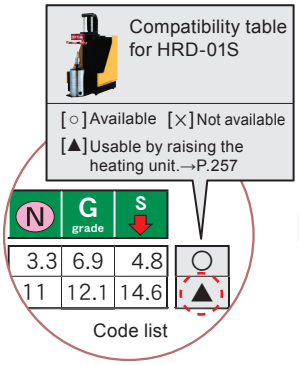


Heating



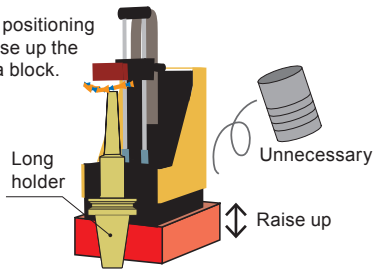
The HEAT ROBO DENJI 1200S (HRD-01S) is unable to shrink certain holders

For the MONO series and STRAIGHT ARBOR, please check for compatibility on item code table before using your holders.
For those marked with 「▲」 on the table, please follow the procedure to the right.



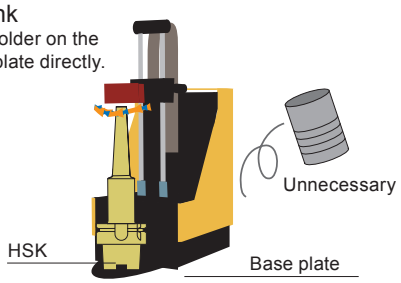
BT shank

Remove the positioning plate and raise up the heater with a block.



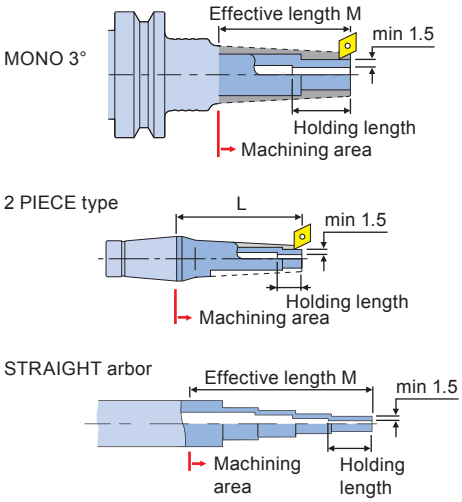
HSK shank

Set up the holder on the positioning plate directly.



User customization (Additional processing)

- Do not change the overall length (tool clamping length).
- Ensure that a thickness of at least 1.5mm is maintained.
- The custom machining area must be above the 「➡」mark. Please check details on the code tables.
- You can not do custom machining with the STRAIGHT ARBOR Carbide Shank type.
- When customizing flush-type (CF, SLFA and SLFB) holders, pay particular attention to the coolant-through holes.
- On request, we also supply drawings as CAD data (DXF format), which are useful for additional processing. These drawings may also be used to carry out interference checks with the work-piece and fixtures.
- The rigidity of the holder decreases after custom-machining. Reduce cutting conditions when using it.



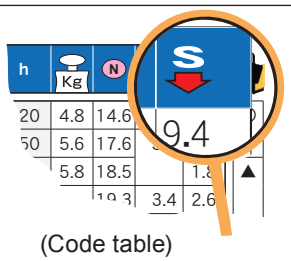
About custom-machining (turning)

- Perform light cutting using a shallow cutting depth (0.1 to 0.2mm).
- During cutting, use water-soluble coolant and do not allow the temperature of the object being cut to rise.
- Use a stainless-use tool or positive tip tool.
- The following machining conditions are recommended:
  - ○Cutting speed ···30～50m/min
  - ○Feed rate ···0.1～0.2mm/rev
  - ○Cutting depth ···0.1～0.2mm

Rigidity of SLIMLINE

Relationship between SLIMLINE rigidity S and L/D

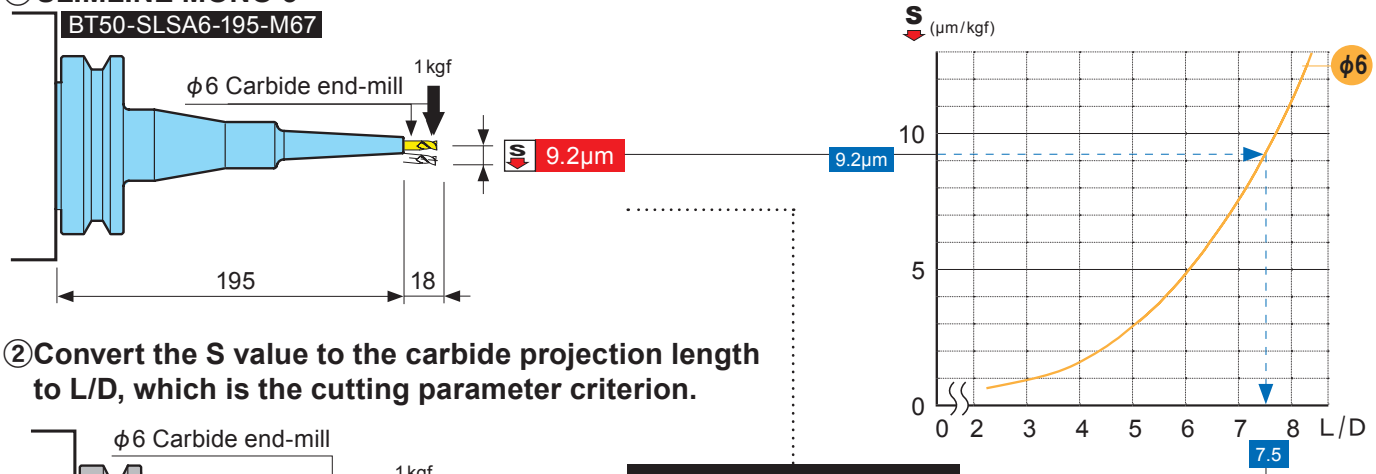
SLIMLINE has a very slim design. Your cutting results may vary significantly, depending on the holder design and the cutting tool projection length.
Rigidity Value S in the dimension tables can be used as a reference mark when selecting holders.
Please refer to the example below to learn more about this.



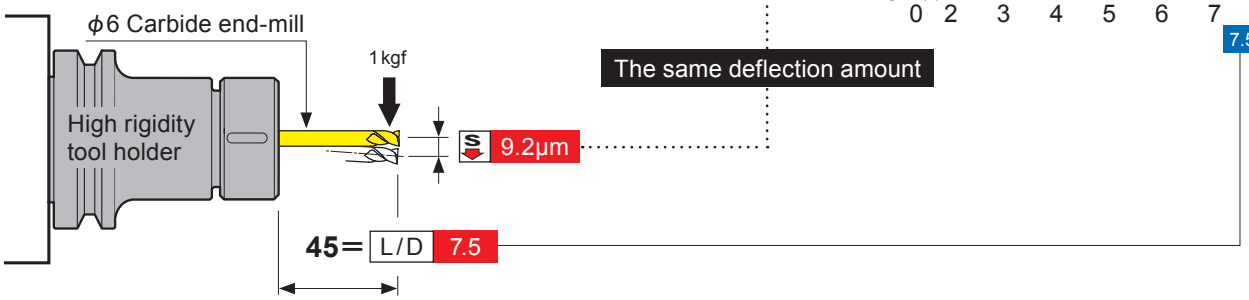
(Code table)

Rigidity Value S is the deflection amount of a holder with a 3D cutter projection length.

①SLIMLINE MONO 3°



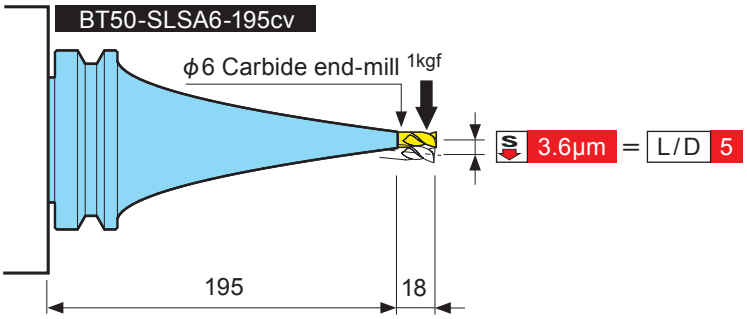
②Convert the S value to the carbide projection length to L/D, which is the cutting parameter criterion.



The rigidity value S = 9.2μm for BT50-SLSA6-195-M67 (18mm cutter projection) is equivalent to L/D = 7.5 = 45mm of carbide cutter projection.

③Even if the holder lengths are the same, the rigidity can vary greatly due to differences in the holder design.

Selecting the same length MONO Curve BT50-SLSA6-195cv holder will give a rigidity value of S = 3. 6μm, L/D = 5, enabling more stable machining.



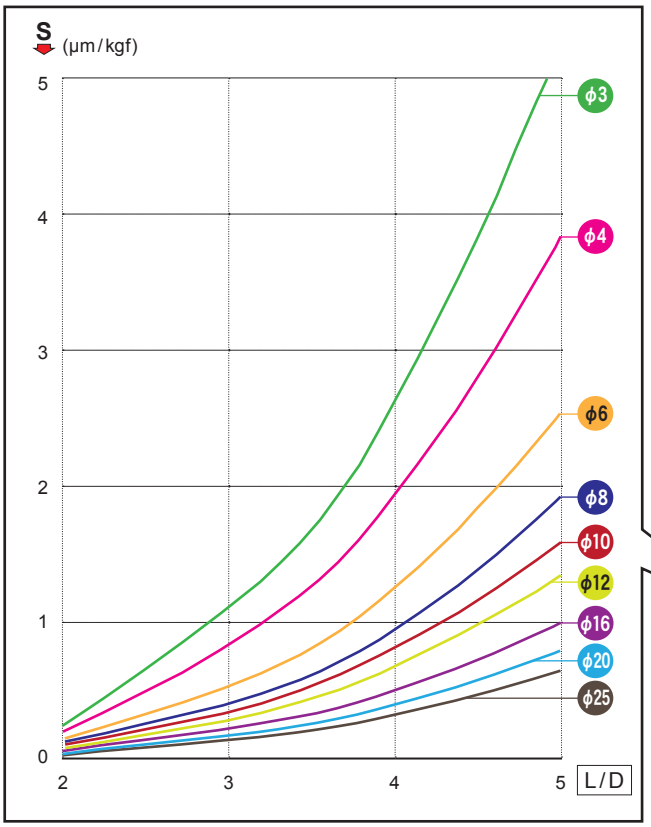
SLIMLINE rigidity calculation software

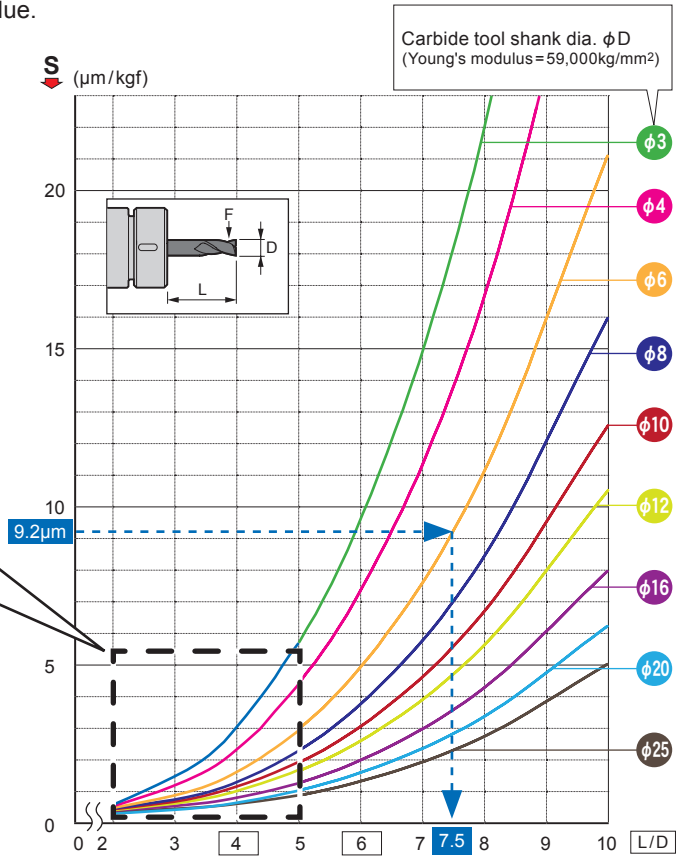
Please use our SLIMLINE rigidity calculation software for different cutter lengths (excluding 3D) and stepped/tapered cutters. It will calculate the rigidity according to your machining conditions.

P. 260

The graph of relationship between rigidity S and L/D

The values of L/D can be determined based on the rigidity S value.





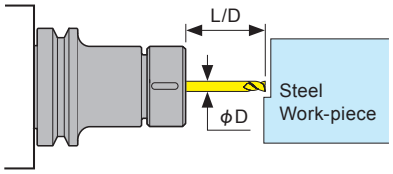
The formula to determine rigidity S (deflection)

$$S = \frac{6.8 \times F \times L^3}{E \times D^4}$$

D : Tool shank dia.
L : Overhang length of cutter
F : Load
E : Young's modulus

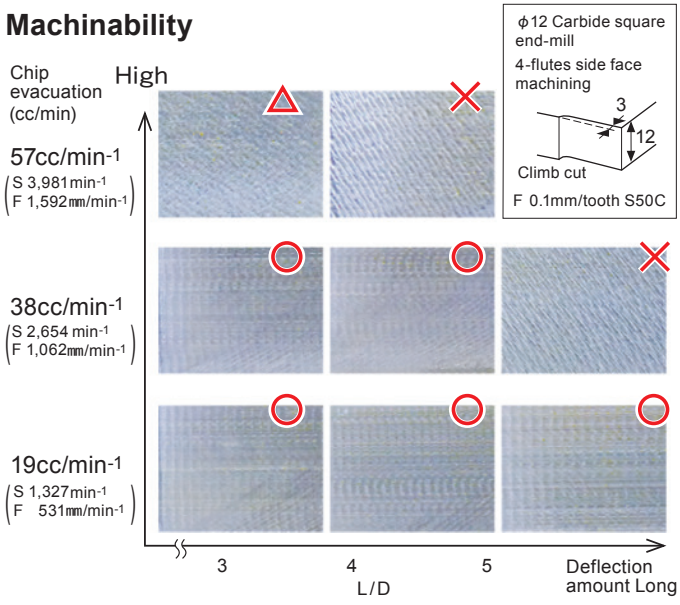
Cutting condition indication

	Cutting condition	
	Standard	Need to conside
Square end-mill Corner radius end-mill	L/D=4 Less than	L/D=4 Over
Ball end-mill	L/D=6 Less than	L/D=6 Over

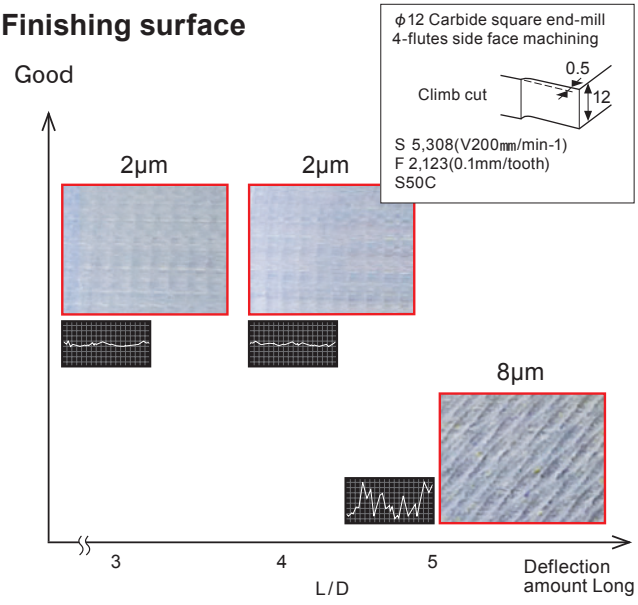


Tool life, surface finishing quality, and productivity comparison by different carbide cutter lengths (L/D)

Machinability



Finishing surface



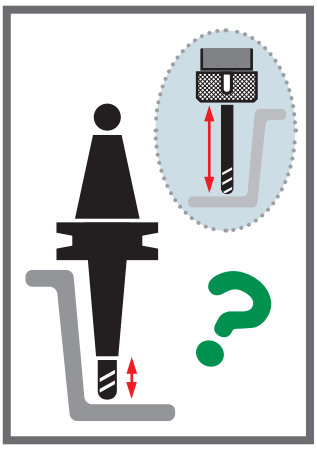
SLIMLINE
Rigidity calculation software

Free of charge

Indispensable for CAM operators!

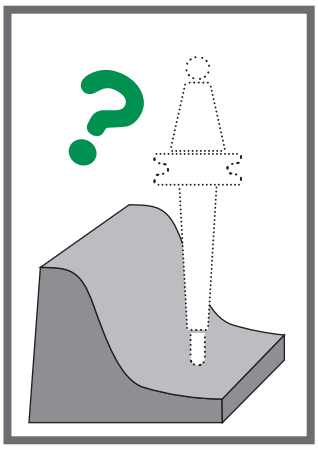
PAT.

Do you have similar problems?

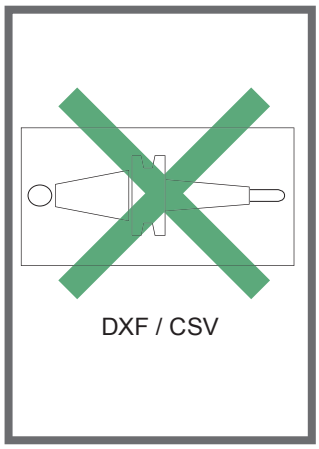


How much more rigidity is there in SLIMLINE compared to con-ventional holders?

We are looking for SLIM-LINE products (4,000 Variations) that can be used at even higher cutting conditions.



We want a holder that perfectly matches our cutting conditions and the shape of our workpiece.



There is no drawing data, which makes it troublesome for us to carry out an interference check using CAM.

Solution

Use SLIMLINE Rigidity Calculation Software to easily check SLIMLINE rigidity with cutter and work-piece interference. You can select the optimum holder with stronger rigidity and less interference.

You can readily improve your machining efficiency and quality.

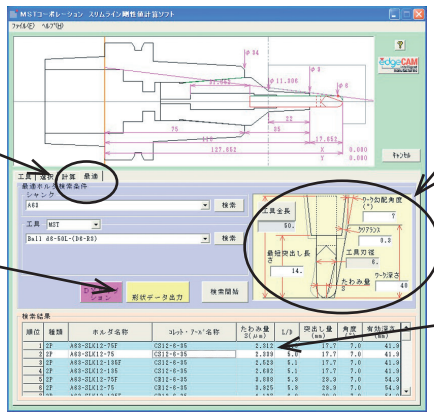
- The most suitable SLIMLINE
  +
- Cutter
  +
- Cutter projection

④Displaying the main dimensions

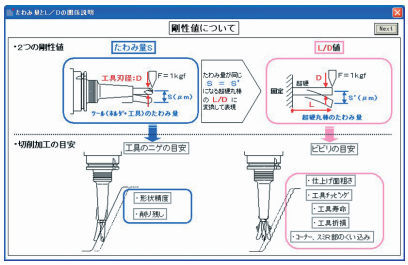
③The most suitable SLIMLINE holder with the highest rigidity for the shape of the work piece is automatically selected.

⑤"Selected SLIMLINE holder"with optimized "projection" of "cutter" can be output in DXF/CSV.

②Holders are listed in order of rigidity.



①Input a work-piece geometry. Input clearance information (between a work-piece and tool/ holder), and tool overhang limitation (min. value).



●The CAM simulators listed below come with SLIMLINE configured data as a standard.

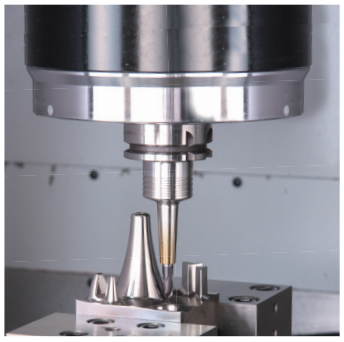
CAM-TOOL	edgecam	worknc	hyperMILL 5AXIS	JBM	GENETEC	SIEMENS
CAM-TOOL	EDGECAM	WORK NC	HYPER MILL	JBM	GENETEC	Siemens PLM Software
FF/cam	tebis	Delcam PowerMILL	CADmeister	VISI	VERICUT	
FF/cam	TEBIS	PowerMill	CAD meister	VISI	VERICUT	

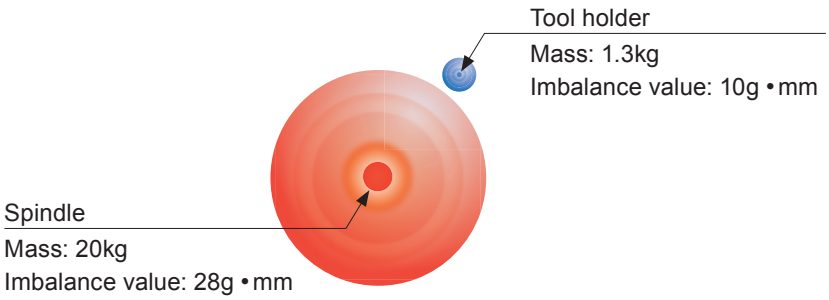
CAUTION : ※Each set of geometry data is handled differently, so please ask each CAM manufacturer for help.

For high-speed spindle rotation

Imbalance value of a machine tool spindle and a tool holder

A tool holder imbalance value (G grade) focuses at high-speed spindle rotation of a machining center. However, it is important to consider the entire rotation body, including the spindle, holder and cutter to determine the high-speed spindle rotation. This is because the holder and cutter weight is much lighter than the spindle weight (less than approx. 1/20th), and thus the effect of a tool holder on the spindle rotating equipment (spindle, tool holder and cutter) becomes significantly smaller.





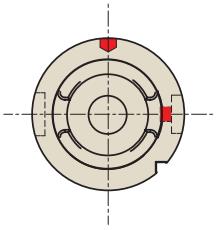
Points to keep in mind at high-speed rotation.

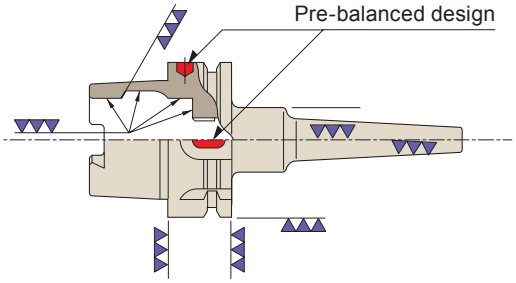
- Minimal length of a tool holder and cutting tool as short as possible.
- Using high accuracy and compact design tool holders.
- Optimizing cutting condition(rpm, feed and depth of cut).

Spending time and money on balance corrections to the holder alone will not result in significant improvement.

PRE-BALANCED DESIGN

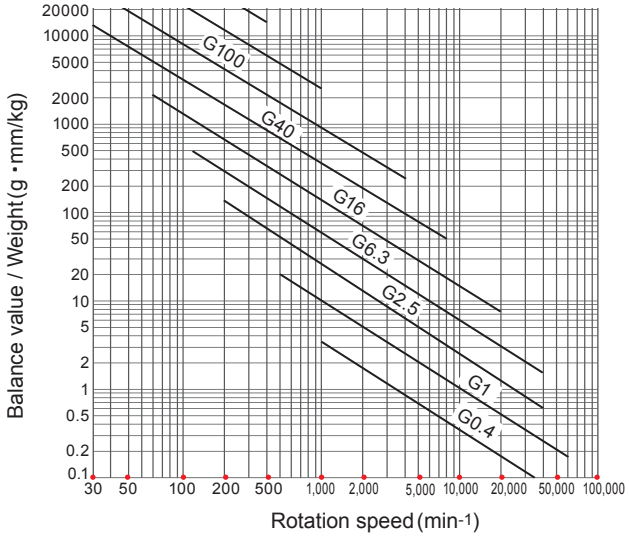
MST has applied our original pre-balancing to make our tool holders applicable for high-speed spindle rotation. Balancing corrections for our products is not required.





- Counter-balancing at imbalanced design areas.
- O.D finish grinding after heat treatment

Unbalancing in terms of tolerable residual ration against the balancing grade (G grade value)

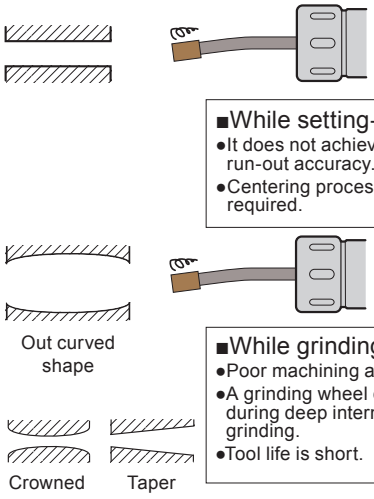


Application examples using SLIMLINE

The shrink fit quill for an internal grinder

A SLIMLINE holder has a slim design. It minimizes interference with grinding wheel. It holds the shorter portion of the tool for grinding. Grinding can be performed with high accuracy and high rigidity. It reduces tool costs and contributes to cost reduction.

Current method of chucking with a collet



■While setting-up
- It does not achieve good run-out accuracy.
- Centering process is required.

■While grinding
- Poor machining accuracy
- A grinding wheel deflects during deep internal bore grinding.
- Tool life is short.

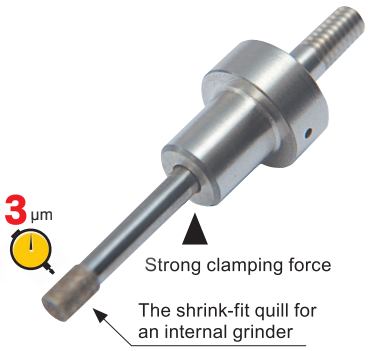
Problem resolution

Ideal for internal grinding.

Specialized brochure available

Comparison data

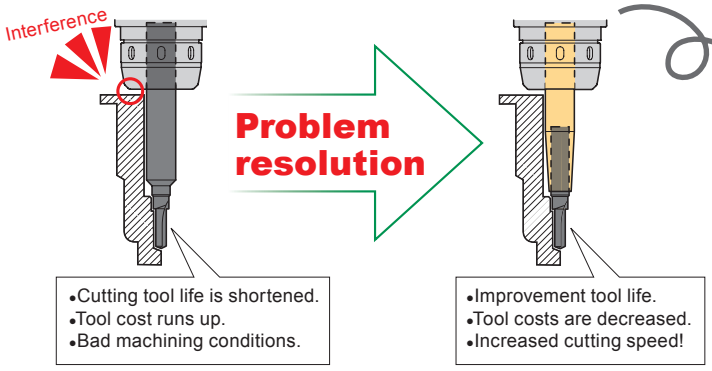
Measurements	SLIMLINE	COLLET HOLDER
Roundness	0.3 µm	0.6 µm
Surface roughness(Ry)	1.38 µm	2.7 µm

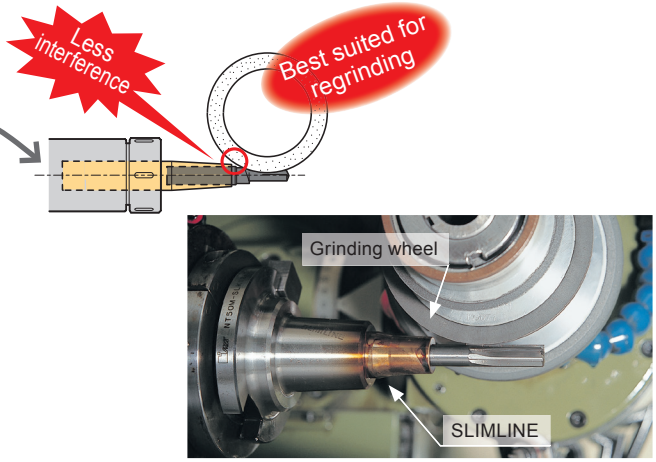


Tool grinding applications

The chucking accuracy of a grinding wheel largely influences grinding accuracy (roundness and surface roughness, etc.).
A shrink-fit quill SLIMLINE holder further enhances processing accuracy.

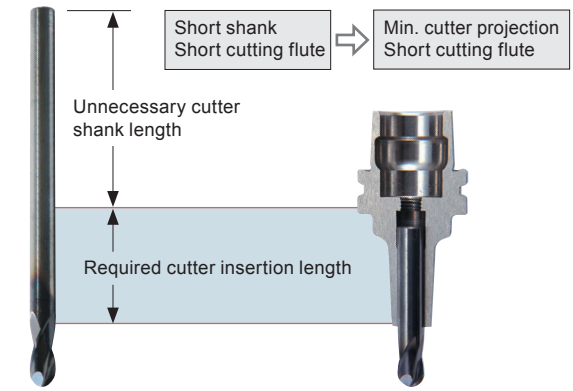
Examples of improvements





Short-overall length carbide endmill for shrink-fit holders.

With a SLIMLINE, the maximum insertion length is short, so a normal length tool is not necessary.



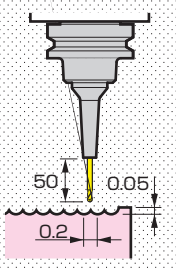
DIJET Super short ball end mill DZ-SSB	MITSUBISHI MATERIALS Impact miracle ball end mill VF-2SSB	MOLDINO Shrink master ball FSHB-TH
NS TOOL Short shank ball end mill MSB230SF	OSG Short over all length type WXL end mill WXL-HS-EBD WXL-HS-LN-EBD	UNION TOOL High-efficiency short shank ball HFB-S

Cutting data

BT40-SLK12-45 CF12-3-55

N : 20000 min^{-1}
F : 2000 mm
V : 25 m
f : 0.05 mm/flute
R0.2 Carbide ball endmill 2flutes

User's voice
Cutter life was extended almost double, because chucking accuracy was improved. Finishing surface of workpiece was improved.

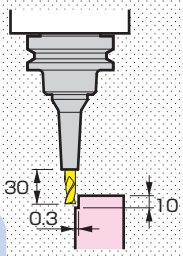


SKD61(HRC50°)

BT40-SLK12-45 CR12-6-55

N : 15000 min^{-1}
F : 2400 mm
V : 188 m
f : 0.04 mm/flute
φ6 Carbide endmill 2flutes

Cutter life was extended almost double against a collet holder. Scratch on the cutting surface with up-cut operation has been disappeared due to increasing rigidity of a cutting tool, because of reducing cutter projection when using SLIMLINE.

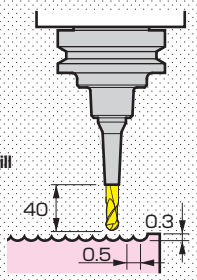


Sintering

BT50-SLK12-75 CS12-10-55

N : 6000 min^{-1}
F : 6000 mm
V : 188 m
f : 0.5 mm/flute
R5 Carbide ball endmill 2flutes

We achieved sufficient cutting surface.
Cutter life was extended about 3 times against using a collet holder.

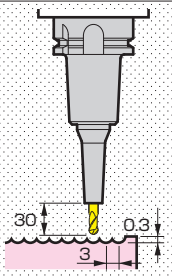


SKD11(HRC40°)

A63-SLK12-75 CF12-6-55

N : 16000 min^{-1}
F : 3200 mm
V : 301 m
f : 0.1 mm/flute
R3 Carbide ball endmill 2flutes

Cutter life was extended about 3 times due to superior chucking accuracy. SLIMLINE provides us great cutting surface, therefore, we could reduce hand-polishing time.

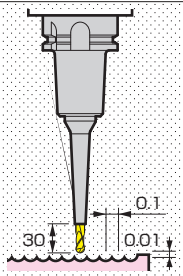


S55C(HRC28°)

A63-SLK12-75 CS12-6-80

N : 20000 min^{-1}
F : 4000 mm
V : 377 m
f : 0.1 mm/flute
R3 Carbide ball endmill 2flutes

No necessity long time for checking interference. Spindle rotation and feed rate were increased 1.5 times. Cutter life was extended due to superior chucking accuracy.

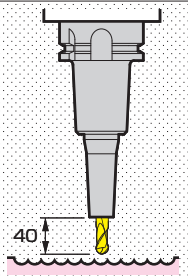


A7075

A63-SLK12-75 CF12-10-55

N : 20000 min^{-1}
F : 6000 mm
V : 628 m
f : 0.15 mm/flute
R4 Carbide ball endmill 2flutes

SLIMLINE provides constant run-out accuracy. We achieved sufficient cutting surface, because of vibration free machining due to high rigidity for cross feed. Cutter life was extended 1.5 ～ 2 times against a collet holder.

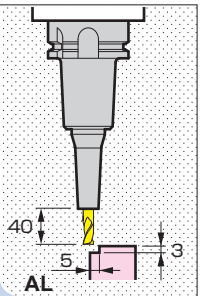


SKD11(HRC50°)

A63-SLK12-75 CR12-10-55

N : 20000 min^{-1}
F : 6000 mm
V : 628 m
f : 0.15 mm/flute
φ10Endmill 2flutes

SLIMLINE achieves noise less running at high speed spindle rotation. No required long projection of cutting tool, because SLIMLINE compact design provides us superior approach to cutting point without interference against work clamping devices.

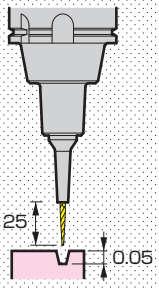


AL

A100-SLK12-105 CR12-4-55

N : 13000 min^{-1}
F : 700 mm
V : 61 m
f : 0.03 mm/flute
φ4 Carbide taper endmill (1°) 2flutes

Cutter life was extended 2 times against a conventional collet holder due to superior chucking accuracy.

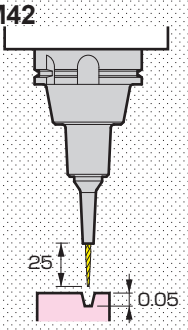


HPM7(HRC32°)

BT40-SLSA6-95-M42

N : 2000 min^{-1}
F : 100 mm
V : 38 m
f : 0.025 mm/flute
φ6 Carbide endmill 2flutes

Cutting surface and holding accuracy improved.

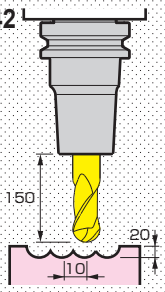


ADC12

BT50-SLRB20-110-M42

N : 4500 min^{-1}
F : 4400 mm
V : 283 m
f : 0.489 mm/flute
R10 Carbide ball endmill 2flutes

We doubled the z feeding compared to conventional holder, but this holder still has enough rigidity.

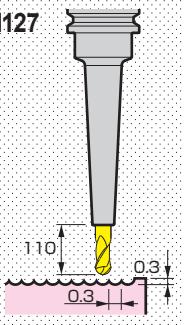


Plastic

BT40-SLSB12-180-M127

N : 2500 min^{-1}
F : 500 mm
V : 94 m
f : 0.1 mm/flute
R6 Carbide ball endmill 2flutes

During the cutting process the vibration reduced, and the cutting surface was improved.

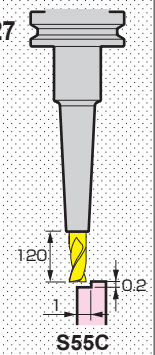


Gr

BT50-SLSB16-225-M127

N : 5600 min^{-1}
F : 2000 mm
V : 281 m
f : 0.179 mm/flute
φ16 Carbide endmill 2flutes

Holding accuracy was stabilized. Cutting surface and cutter life improved 2-3 times.

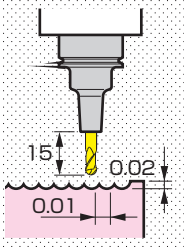


S55C

E40-SLRA6-50

N : 20000 min^{-1}
F : 1500 mm
V : 377 m
f : 0.038 mm/flute
R3 Carbide ball endmill 2 flutes

With conventional holder we could not have good surface finish. However with SLIMLINE we could have great surface finish.

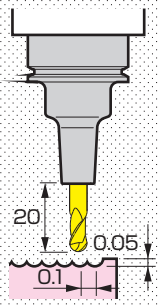


SKD11(HRC60°)

F63-SLSA4-75-M22

N : 16000 min^{-1}
F : 1200 mm
V : 100 m
f : 0.038 mm/flute
R1 Carbide ball endmill 2flutes

The cutter life extended because of great accuracy.

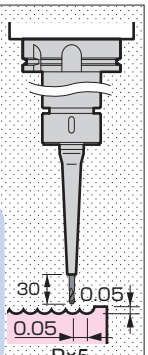


SKD61(HRC55°)

A100−CTH25−195 ST25−SLSA6−320

N : 5000 min^{-1}
F : 150 mm
V : 94 m
f : 0.015 mm/flute
Carbide coated endmill 2flutes

The rigidity and accuracy of the SLIMLINE system has been improved so that it only requires two components (maste holder and collet) for chucking a cutting tool while conventional systems require three different holders connected in series. The machining time has been reduced to 300 minutes from 360 minutes.



P×5

HSK Shank

MST uses DIN-HSK standard shanks, which are widely used in Japan and other countries as "2-face contact tooling" for high-speed, high-efficiency machining.

■The close contact of the end faces (2-face contact) of the HSK shank results in high rigidity for transverse feed, which minimizes vibrations during machining and improves the operating life of the cutting tool and the finishing surface.
■Even if the spindle expands during high-speed rotations, the tapered hollow portion comes up with that expansion, thereby maintaining high precision.

A type
The most common type in use today.

E type
This type has no drive keyway and is suitable for high-speed machining.

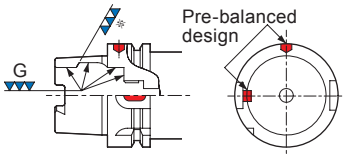
F type
This type uses a combination of different sizes of tapers and flanges.

T type
This type is for turning with turning-mill machines.

PRE-BALANCED DESIGN

The HSK-A-type shank is unbalanced in its standard form, but at MST we have applied our original pre-balancing to make our tool holders applicable for high-speed machining.
In the DIN standard, only the area marked with an asterisk (*) is finished in the hallow. In order to further improve the balance, MST has carried out finish machining after heat treatment.

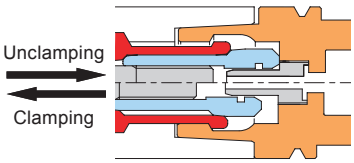
	MST	DIN standard
A 63	15 g·mm	75 g·mm
A100	28 g·mm	170 g·mm



Three times stronger clamping force

HSK uses a clamping mechanism, which utilizes the wedge effect, to provide a tool gripping power 2.5 to 3.0 times greater than in the pull-stud system (BT40 and BT50), thereby increasing rigidity.

	Tensile strength of draw bar	Tool clamping force
BT40	10~15 kN	10~15 kN
A63	5.8 kN	18.4 kN
BT50	20~25 kN	20~25 kN
A100	14.5 kN	45.9 kN

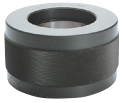


RIGIDITY COMPARISON WITH BT SHANK

The HSK shank is effective when longer overhang or higher transverse feed rigidity is required. The higher rigidity greatly contributes to improving the operating life of the cutting tool and the smoothness of the finished surface

TAPER GAUGE

MST establishes the optimal value within the tolerance in accordance with the DIN standard and manufacturers master gauges for tool shanks and those for spindle tapers accordingly.



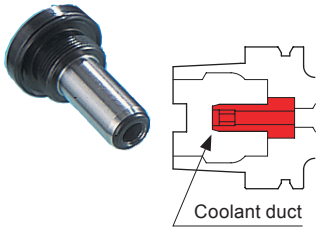
1/10 taper ring gauge

1/10 taper plug gauge

Detection gauge for end face position

COOLANT DUCT

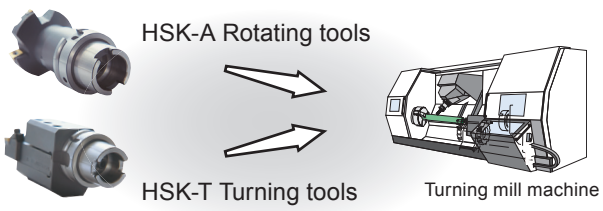
This is a coolant feed part exclusively for the HSK-A type.
MST's HSK-A type holder comes standard with each coolant duct.



For some machines, the use of a coolant duct (Adjustable) is recommended. The existing coolant duct is replaced with an adjustable one at your request only when you have placed an order for the holder. For more information on replacement coolant ducts. ➔ P.246

TOOLING SYSTEMS for HSK-T

Collaborative development with 17 Japanese makers has resulted in an interface for mill-turning machines based on the HSK-A type. With its 2008 ISO accreditation it has become popular standard around the world.

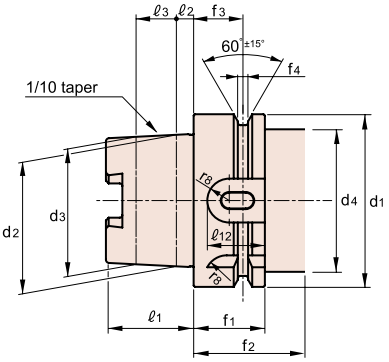


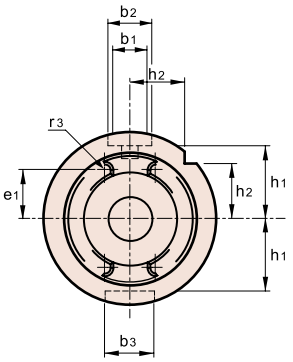
Technical data

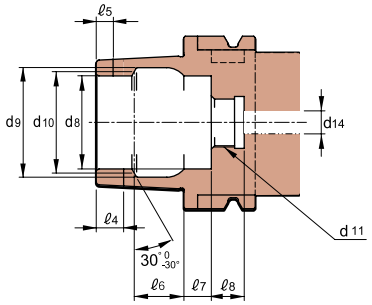
The shank dimensions

HSK-A (Extracts from DIN 69893-1;1993-07)

Shank	A40	A50	A63	A100	A125
b_1 (H10)	8	10.5	12.5	20	25
b_2 (H10)	9	12	16	20	25
b_3 (H10)	11	14	18	22	28
d_1 (h10)	40	50	63	100	125
d_2	30	38	48	75	95
	+0.007 +0.005	+0.009 +0.006	+0.011 +0.007	+0.015 +0.009	+0.018 +0.011
d_3	29.05	36.9	46.53	72.6	91.95
	+0.005 +0.003	+0.006 +0.003	+0.007 +0.003	+0.009 +0.003	+0.011 +0.004
d_4 (max.)	34	42	53	85	105
d_8 (H10)	21	26	34	53	67
d_9 (H11)	25.5	32	40	63	80
d_{10}	23	29	37	58	73
d_{11}	M12 × 1	M16 × 1	M18 × 1	M24 × 1.5	M30 × 1.5
d_{14} (max.)	5	6.8	8.4	12	14
e_1	10.88	13.797	17.862	27.329	35.324
f_1 ($_{-0.1}^{0}$)	20	26	26	29	29
f_2 (min.)	35	42	42	45	45
f_3 (± 0.1)	16	18	18	20	20
f_4 ($^{+0.15}_{0}$)	2	3.75	3.75	3.75	3.75
h_1 ($_{-0.2}^{0}$)	17	21	26.5	44	55.5
h_2 ($_{-0.3}^{0}$)	12	15.5	20	31.5	39.5
ℓ_1 ($_{-0.2}^{0}$)	20	25	32	50	63
ℓ_2	4	5	6.3	10	12.5
ℓ_3	9.5	11	14.7	24	30.5
ℓ_4 ($^{+0.2}_{0}$)	6	7.5	10	15	19
ℓ_5 ($^{+0.2}_{0}$)	3.5	4.5	6	10	12
ℓ_6 (JS10)	11.42	14.13	18.13	28.56	36.27
ℓ_7 ($_{-0.1}^{0}$)	8	10	10	12.5	16
ℓ_8 ($_{-0.3}^{0}$)	8	10	12	16	18
ℓ_{12}	12	19	21	24	24
r_3 ($^{+0.05}_{-0.05}$)	1.88	2.38	2.88	4.88	5.88
r_8	4.5	6	8	10	5

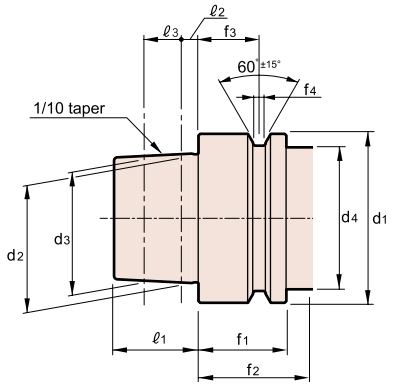


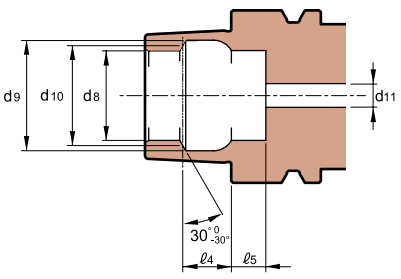




HSK-E (Extracts from DIN V 69893-5;1996-01)

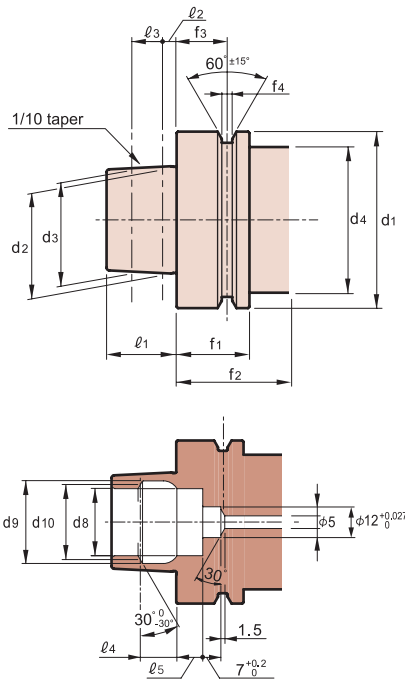
Shank	E25	E32	E40	E50
d_1 (h10)	25	32	40	50
d_2	19	24	30	38
	+0.006 +0.004	+0.007 +0.005	+0.007 +0.005	+0.009 +0.006
d_3	18.15	23.27	29.05	36.90
	+0.004 +0.002	+0.005 +0.003	+0.005 +0.003	+0.006 +0.003
d_4 (max.)	20	26	34	42
d_8 (H10)	14	17	21	26
d_9 (H11)	16.4	21	25.5	32
d_{10}	15	19	23	29
d_{11} (max.)	3	4.2	5	6.8
ℓ_1 ($_{-0.2}^{0}$)	13	16	20	25
ℓ_2	2.5	3.2	4	5
ℓ_3	8.5	7.3	9.5	11
ℓ_4 (JS10)	7.21	8.92	11.42	14.13
ℓ_5 ($_{-0.1}^{0}$)	6	8	8	10
f_1 ($_{-0.1}^{0}$)	10	20	20	26
f_2 (min.)	20	35	35	42
f_3 (± 0.1)	4.5	16	16	18
f_4 ($^{+0.15}_{0}$)	2	2	2	3.75





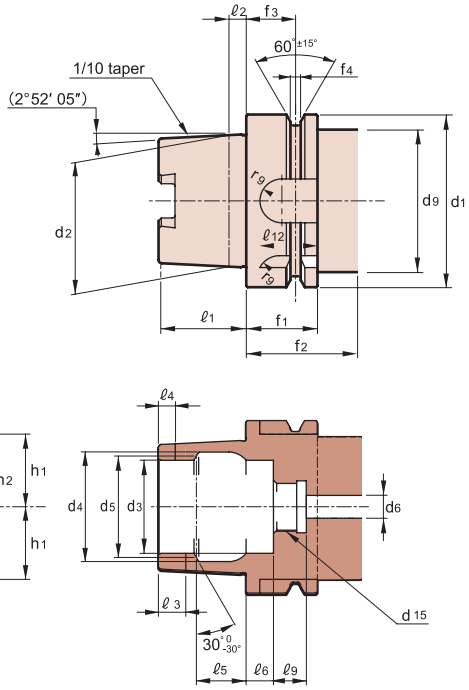
HSK-F (Extracts from DIN V 69893-6;1996-01)

Shank	F63	F80
d_1 (h10)	63	80
d_2	38	48
	+0.009 +0.006	+0.011 +0.007
d_3	36.9	46.53
	+0.006 +0.003	+0.007 +0.003
d_4 (max.)	53	67
d_8 (H10)	26	34
d_9 (H11)	32	40
d_{10}	29	37
f_1 ($^{0}_{-0.1}$)	26	26
f_2 (min.)	42	42
f_3 (± 0.1)	18	18
f_4 ($^{+0.15}_{0}$)	3.75	3.75
ℓ_1 ($^{0}_{-0.2}$)	25	32
ℓ_2	5	6.3
ℓ_3	11	14.7
ℓ_4 (Js10)	14.13	18.13
ℓ_5 ($^{0}_{-0.1}$)	10	10
f_1 ($^{0}_{-0.1}$)	26	26
f_2 (min.)	42	42
f_3 (± 0.1)	18	18
f_4 ($^{+0.15}_{0}$)	3.75	3.75



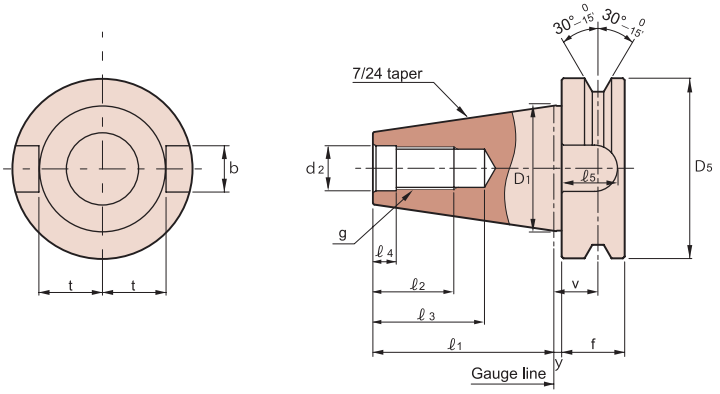
HSK-T (Extracts from ISO 12164-3;2008) For turning with turning mill machines

Shank	T40	T50	T63	T100	T125
b_1 ($^{+0.04}_{-0.04}$)	8.05	10.54	12.54	20.02	25.02
b_2 (H10)	9	12	16	20	25
b_3 (H10)	11	14	18	22	28
b_5	7.932	10.425	12.425	19.91	24.915
	+0.03 0	+0.035 0			+0.04 0
d_1 (h10)	40	50	63	100	125
d_2	30.007	38.009	48.010	75.013	95.016
d_3 (H10)	21	26	34	53	67
d_4 (H11)	25.5	32	40	63	80
d_5	23	29	37	58	73
d_6 (max.)	5	6.8	8.4	12	14
d_9 (max.)	39	49	62	99	124
d_{15}	M12 × 1	M16 × 1	M18 × 1	M24 × 1.5	M30 × 1.5
e_1	11	13.88	17.99	27.37	35.37
f_1 ($^{0}_{-0.1}$)	20	26	26	29	29
f_2 (min.)	23	30	30	34	34
f_3 (± 0.1)	16	18	18	20	20
f_4 ($^{+0.15}_{0}$)	2	3.75	3.75	3.75	3.75
h_1 ($^{0}_{-0.2}$)	17	21	26.5	44	55.5
h_2 ($^{0}_{-0.3}$)	12	15.5	20	31.5	39.5
ℓ_1 ($^{0}_{-0.2}$)	20	25	32	50	63
ℓ_2	4	5	6.3	10	12.5
ℓ_3 ($^{+0.2}_{0}$)	6	7.5	10	15	19
ℓ_4 ($^{+0.2}_{0}$)	3.5	4.5	6	10	12
ℓ_5 (JS10)	11.42	14.13	18.13	28.56	36.27
ℓ_6 ($^{0}_{-0.1}$)	8	10	10	12.5	16
ℓ_9 ($^{0}_{-0.2}$)	8	10	12	16	18
ℓ_{12}	12	19	21	24	24
r_3 ($^{+0.05}_{-0.05}$)	1.88	2.38	2.88	4.88	5.88
r_9	4.5	6	8	10	5



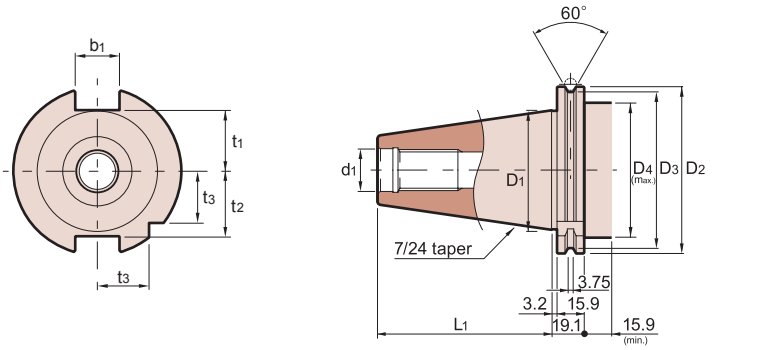
BT (Extracts from MAS 403)

Shank	BT30	BT40	BT50
D_1	31.75	44.45	69.85
ℓ_1 (±0.15)	48.4	65.4	101.8
d_2 (H8)	12.5	17	25
g (6H)	M12	M16	M24
ℓ_2 (min.)	24	30	45
ℓ_3 (min.)	34	43	62
ℓ_4	7	9	13
b (H12)	16.1	16.1	25.7
ℓ_5 (min.)	17	21	31
t ($^{0}_{-0.2}$)	16.3	22.6	35.4
D_5 (h8)	46	63	100
f	20	25	35
v (±0.1)	13.6	16.6	23.2
y (±0.4)	2	2	3



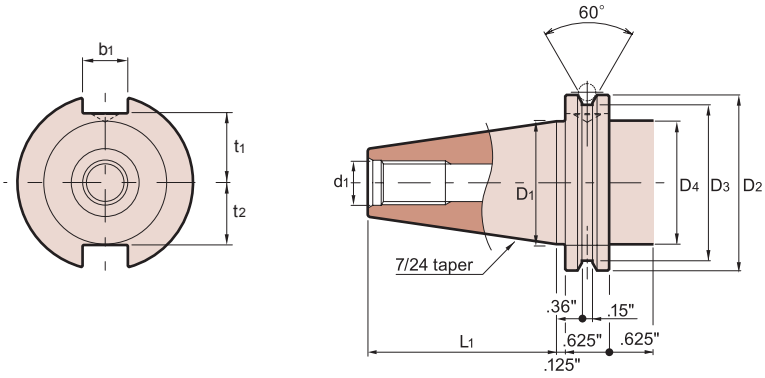
DIN (DIN69871-1)

Shank	DN40	DN50
D_1	44.45	69.85
D_2	63.55	97.5
D_3	56.25	91.25
D_4	50	80
L_1	68.4	101.75
L_3	3.75	6.495
b_1	16.1	25.7
d_1	17	25
t_1	22.8	35.5
t_2	25	37.7
t_3	18.5	30



CAT.

Shank	CT40	CT50
D_1	1.75”	2.75”
D_2	2.5”	3.88”
D_3	2.22”	3.59”
D_4	1.75”	2.75”
L_1	2.69”	4”
b_1	.65”	1.06”
d_1	.64”	1.03”
t_1	.99”	1.49”
t_2	.84”	1.39”



Dimensional tolerance of typically used mating

The class of dimension(mm)		The tolerance of the hole dimension(μm)						The tolerance of the shaft dimension(μm)					
More than	Less than	H4	H5	H6	H7	H8	H9	h4	h5	h6	h7	h8	h9
–	3	+3 0	+4 0	+6 0	+10 0	+14 0	+25 0	0 -3	0 -4	0 -6	0 -10	0 -14	0 -25
3	6	+4 0	+5 0	+8 0	+12 0	+18 0	+30 0	0 -4	0 -5	0 -8	0 -12	0 -18	0 -30
6	10	+4 0	+6 0	+9 0	+15 0	+22 0	+36 0	0 -4	0 -6	0 -9	0 -15	0 -22	0 -36
10	18	+5 0	+8 0	+11 0	+18 0	+27 0	+43 0	0 -5	0 -8	0 -11	0 -18	0 -27	0 -43
18	30	+6 0	+9 0	+13 0	+21 0	+33 0	+52 0	0 -6	0 -9	0 -13	0 -21	0 -33	0 -52
30	50	+7 0	+11 0	+16 0	+25 0	+39 0	+62 0	0 -7	0 -11	0 -16	0 -25	0 -39	0 -62

Conversion table for International System of Units

Force

N	kgf
1	1.01972^{-1}
9.80665	1

Pressure

Pa	kgf/cm²
1	1.0197×10^{-5}
9.80665×10^{4}	1

Stress

Pa	kgf/mm²
1	1.0197×10^{-7}
9.80665×10^{6}	1