

JULY 2024



COLIBRI
SPINDLES

HIGH-SPEED MACHINING

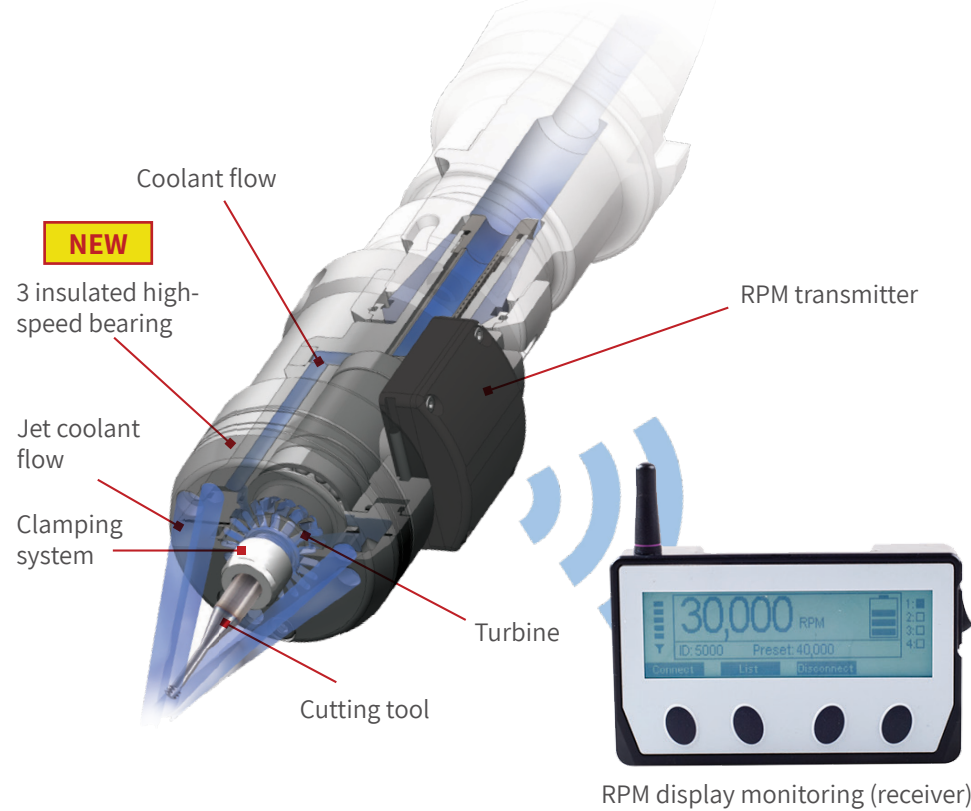


FAMILY OF HSM JET SPINDLE



Ultra precision high-speed Jet Spindles for a variety of milling and drilling processes with small tools. Cuts machining time up to 70%.

COOLANT DRIVEN HIGH-SPEED SPINDLES



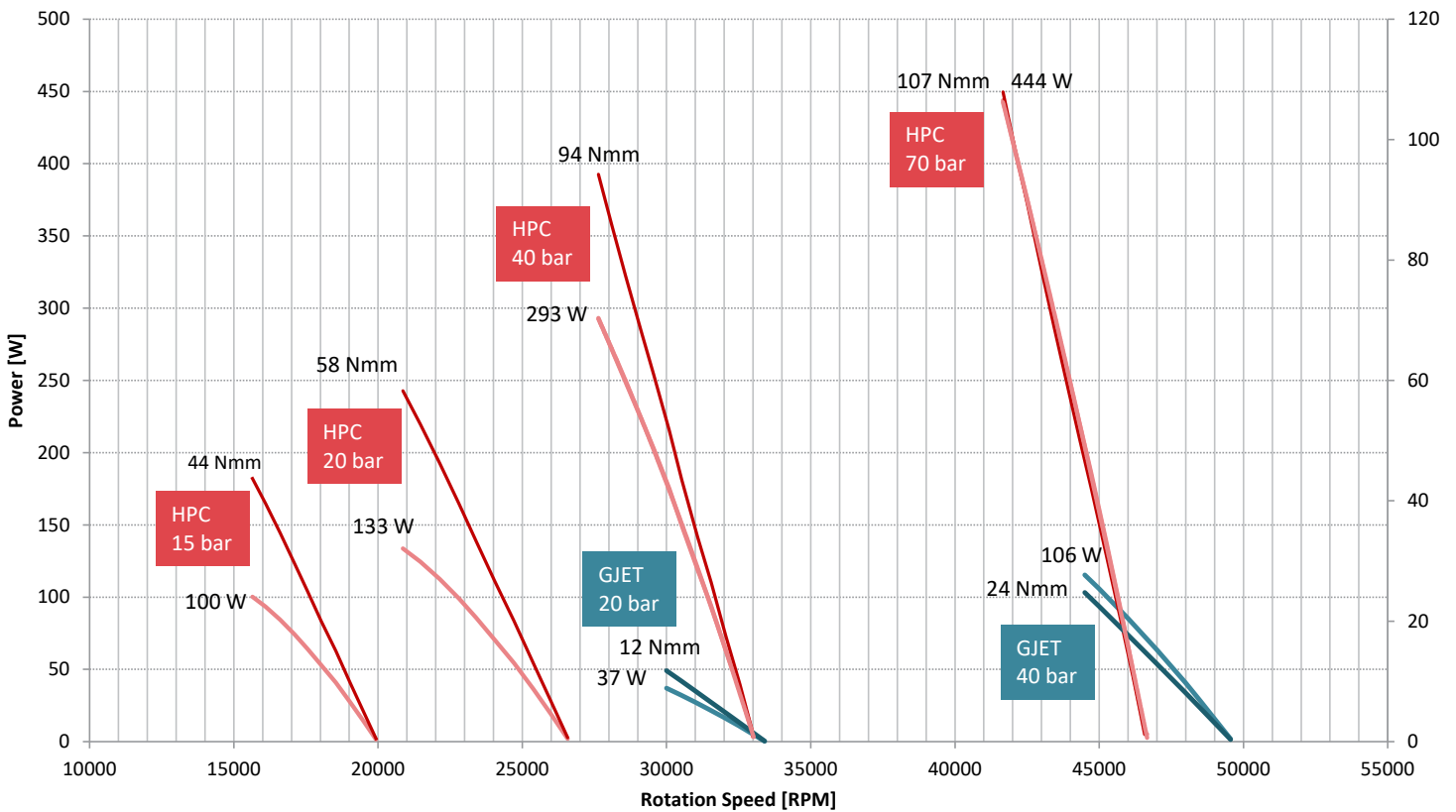
FEATURES

The revolutionary modular high-speed Jet Spindle, meticulously designed, engineered, manufactured and assembled with ultra precision industry collets and nuts, offers maximum flexibility for a wide range of small tool applications.

BENEFITS

- ✓ Quick and easy installation
- ✓ Free energy source
- ✓ Good chip evacuation
- ✓ Coolant at the cutting edge
- ✓ Used in tool changer
- ✓ Compact design

Recommended Working Zone for TJS HPC vs GJET



HPC JET - ideal for all small tools, both versatile and powerful and as accurate as the GJET.

GJET - ideal for applications requiring micro tools and very high speeds at 20 to 40 bar.

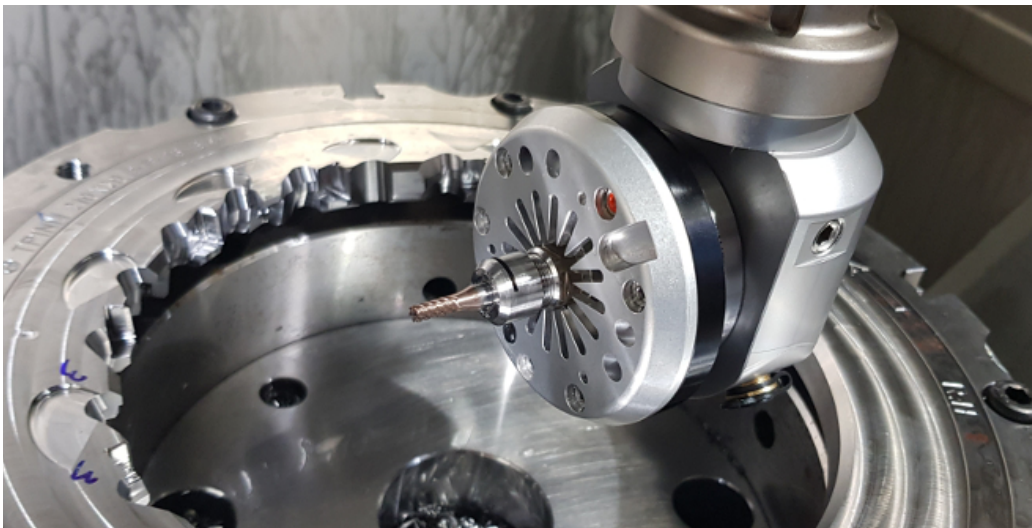


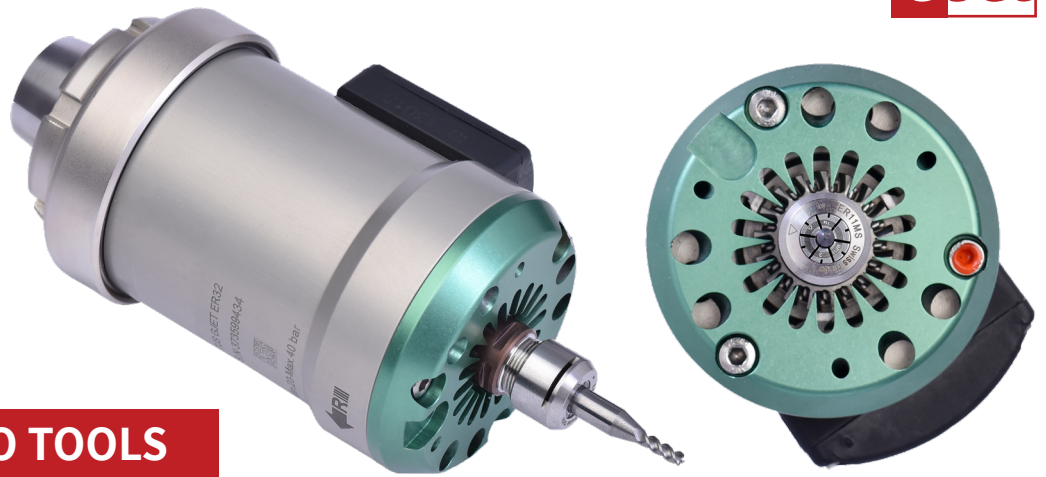
POWER & EFFICIENCY

JET SPINDLE OPERATING PARAMETERS					HPC JET	
High Pressure Coolant (BAR)	15	20	40	70	Terms of Use	
Min Coolant Inlet Diameter	6 mm				Collet	ER11 AA/UP
Min Flow Rate (L/min)	10	12	16	22	Runout	3 micron
Idle Speed (RPM)	20,000	27,000	33,000	47,000		
Max Power (W) / Torque (Nmm)	53 / 20	71 / 27	188 / 57	409 / 93	SMALL TOOL EXPERTISE REQUIRED	
Application	Cutting Tool [mm]	P	M	N	S	
Drilling		0.5 - 2.0		0.5 - 3.0		
Milling	Single / 2 / 4 Flute Helical, Corner Radii	0.3 - 4.0		0.3 - 6.0		
Profiling	Ball-Nose [1]	0.3 - 6.0		0.3 - 6.0		
Chamfering		0.1 - 4.0		1.0 - 6.0		
Deburring	Lollipop [1]	0.1 - 4.0		1.0 - 6.0		
Profiling	Barrel	0.5 - 4.0		0.5 - 6.0		
Engraving (45-60°)		0.2 - 5.0		0.2 - 6.0		
FILES AVAILABLE FOR DOWNLOAD IN ONLINE CATALOGUE: https://colibrispindles.com/catalog/						
ADAPTER	C5/6	CAT 40/50	SK30/40	BT30/40	HSK-A40/A63	ER32/ST20

[1] Effective DC (DCap) - Cutting diameter at cutting depth ap

MORE SPEED / MORE TORQUE / MORE FLEXIBILITY

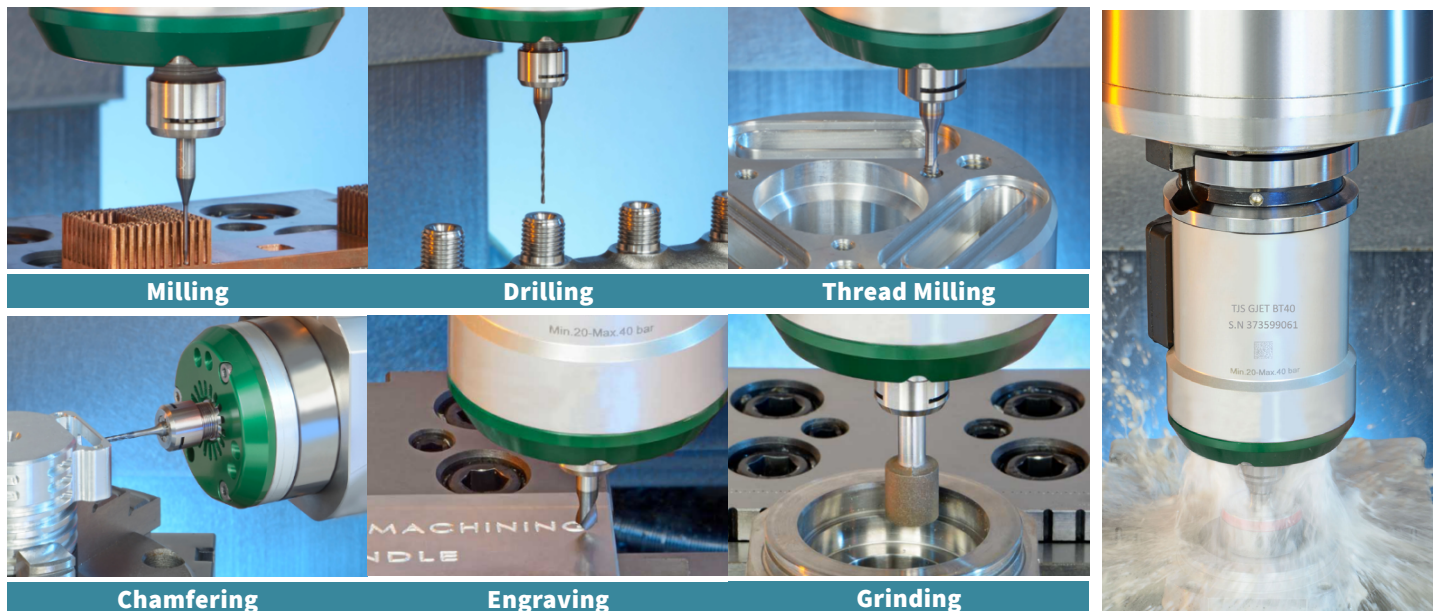


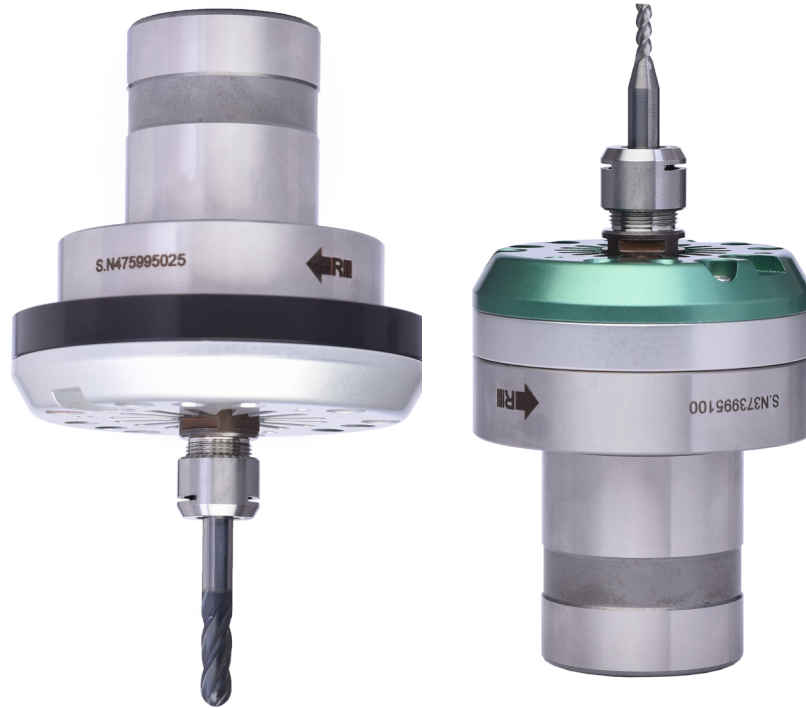


SPEED FOR MICRO TOOLS

JET SPINDLE OPERATING PARAMETERS					GJET	
High Pressure Coolant (BAR)	20	40	Terms of Use			
Min Coolant Inlet Diameter	6 mm		Collet	ER11	AA/UP	
Min Flow Rate (L/min)	10	20	Runout	3 micron	At length of 3D	
Idle Speed (RPM)	33,000	50,000				
Max Power (W) / Torque (Nmm)	37 / 12	115 / 25	SMALL TOOL EXPERTISE REQUIRED			
Application	Cutting tool [mm]	P	M	N	S	
Drilling		0.1 - 1.0		0.1 - 2.0		
Milling	Single / 2 / 4 Flute Helical, Corner Radii	0.1 - 2.0		0.1 - 3.0		
Profiling	Ball-Nose [1]	0.1 - 2.0		0.1 - 3.0		
Chamfering		0.1 - 2.0		0.1 - 3.0		
Lollipop	Lollipop [1]	0.2 - 2.0		0.2 - 3.0		
Profiling	Barrel	0.5 - 2.0		0.5 - 3.0		
Engraving		0.2 - 2.0		0.2 - 3.0		
FILES AVAILABLE FOR DOWNLOAD IN ONLINE CATALOGUE: https://colibrispindles.com/catalog/						
ADAPTER	C5/6	CAT40	SK30/40	ER32/ST20	HSK-A40/A63	BT30/40

[1] Effective DC (DCap) - Cutting diameter at cutting depth ap

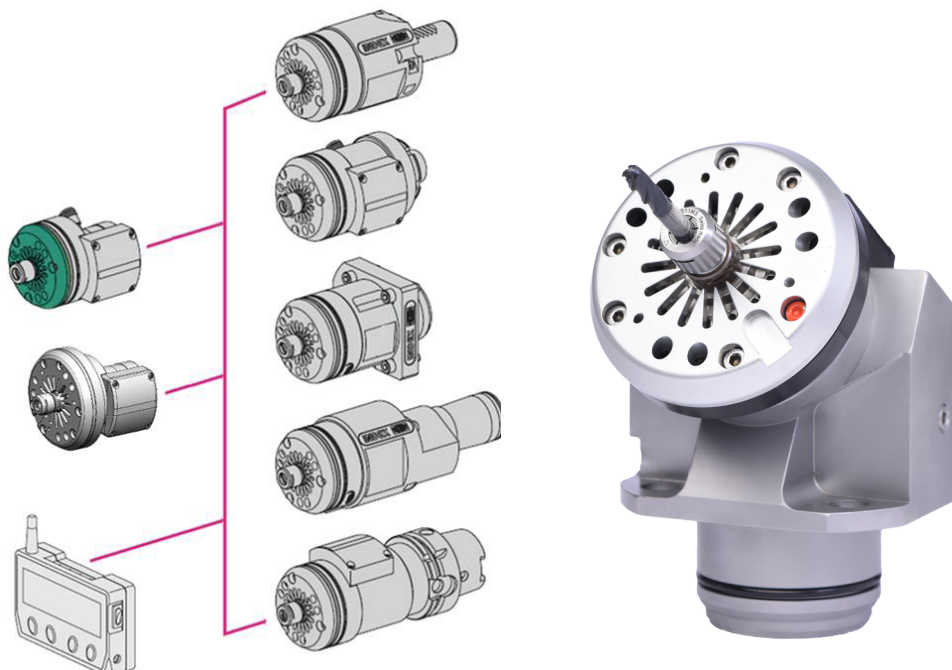




JET GENERIC INTERFACE FOR NEW ASSEMBLIES

Spindle Operating Data	TR G-JET	TR HPC-JET
Operating range of coolant pressure [bar]	20 - 40	15 - 70
Minimum coolant flow rate [l/min]	10	10
Rotational spindle speed [Krpm]	35 - 55	21 - 45
Rotational direction	Right	
Optimum cutting tool diameter [mm] for Nonferrous Alloys	Drilling 0.1 - 2.0	Drilling 0.5 - 3.0
	Milling 0.1 - 3.0	Milling 0.2 - 6.0
Maximum tool shank diameter [mm]	6.0	6.0
Compatible adapter models	Rear and Front Clamping	

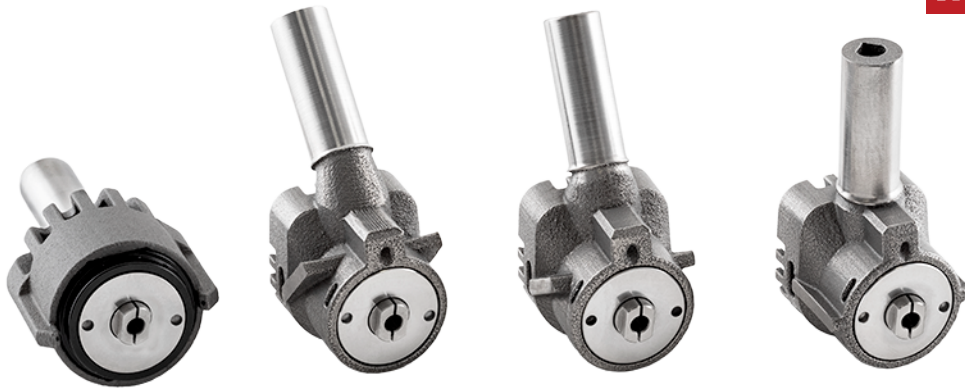
NEW



JET SPINDLES

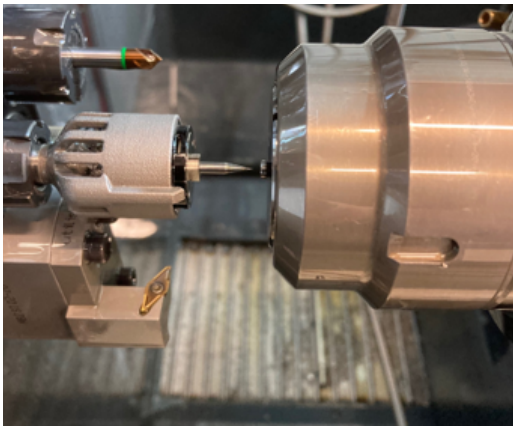
MICRO Jet

NEW



SWISS TYPE MICRO JET SPINDLE

JET SPINDLE OPERATING PARAMETERS				MICRO JET
High Pressure Coolant (BAR)	20	40	Terms of Use	
Min Tube Diameter	4 mm		Collect	1.6, 2.0, 3.0, 3.175 mm
Min Flow Rate (L/min)	10	20	Accessories	ST 20X100 ER16 / ER16 SEAL 10 AA
Idle Speed (RPM)	35,000	53,000	Warranty	SMALL TOOL EXPERTISE REQUIRED
Cutter [mm]	P	M	N	S
Drilling	0.1 - 2.0			
Ball-Nose	0.1 - 3.0			
Chamfering	0.1 - 3.0			
Lollipop	0.1 - 3.0			
Barrel	0.5 - 3.0			
Helical			0.1 - 2.0	
Engraving	0.1 - 3.0			
FILES AVAILABLE FOR DOWNLOAD IN ONLINE CATALOGUE: https://colibrispindles.com/catalog/micro-90/				
MICRO LINE	00°	30°	45°	90°



HIGH SPEED MACHINED PARTS



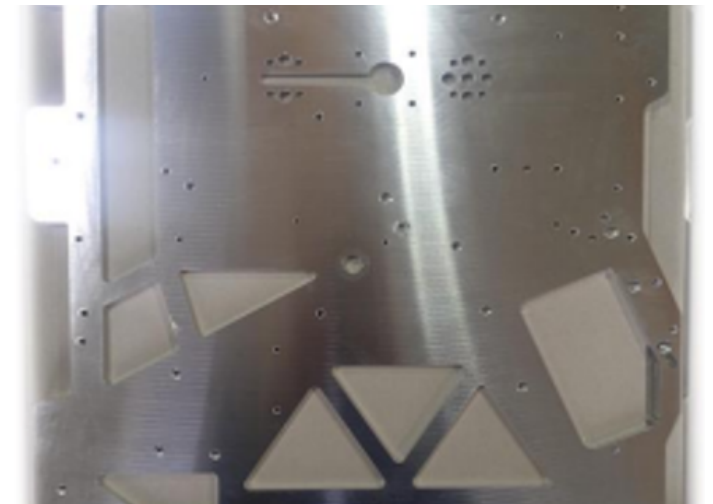
HPC Engraving & Chamfering



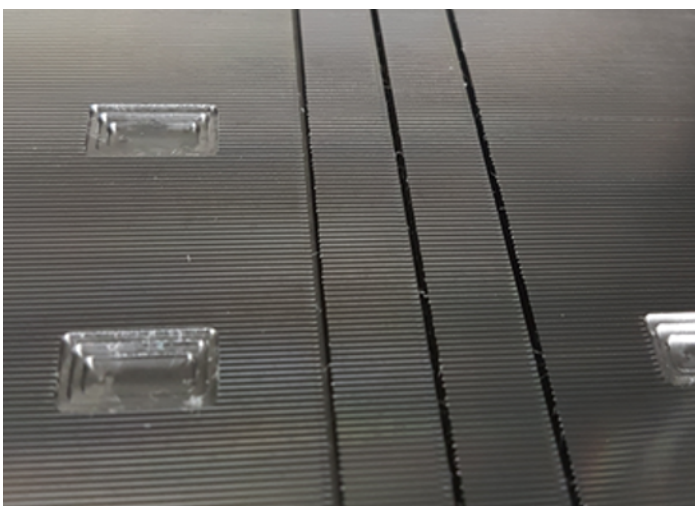
GJET Engraving



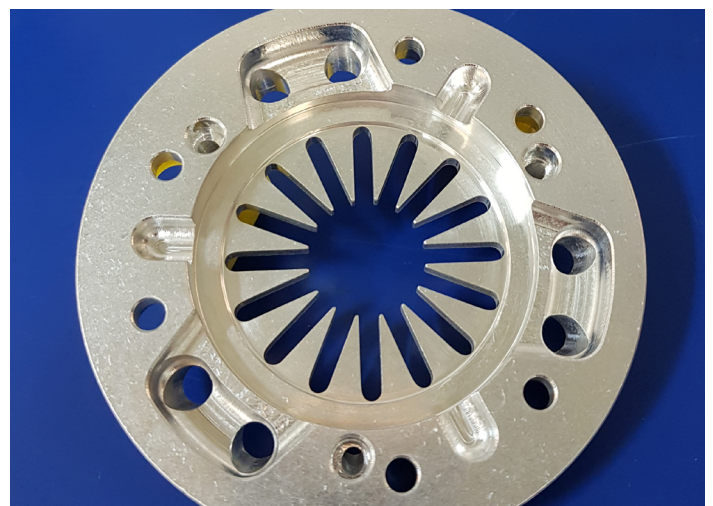
HPC Profiling



GJET Slot Milling & Drilling



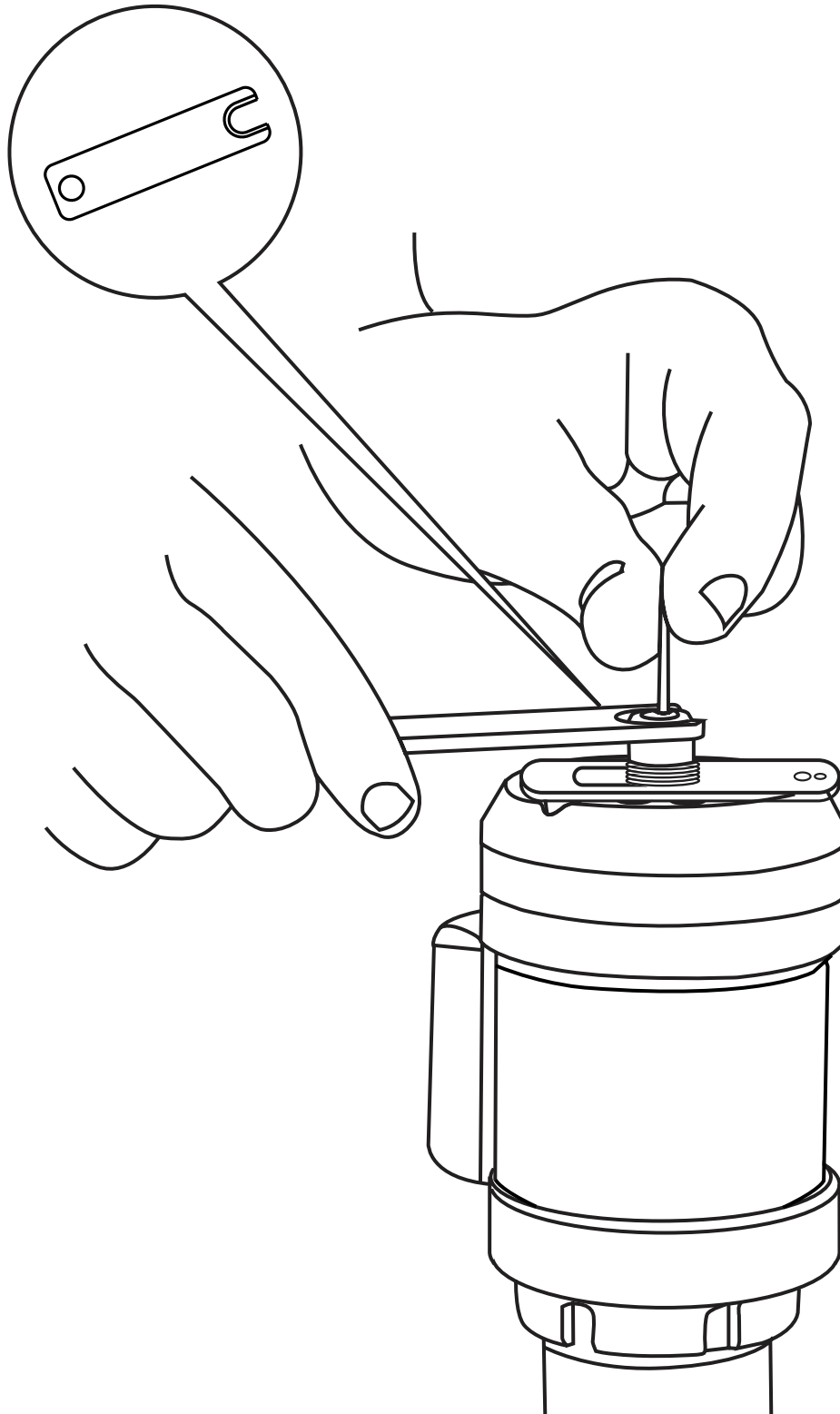
HPC Pocket, Slot & Plan Milling



HPC Slot & Helical Milling

HSM Jet Spindle

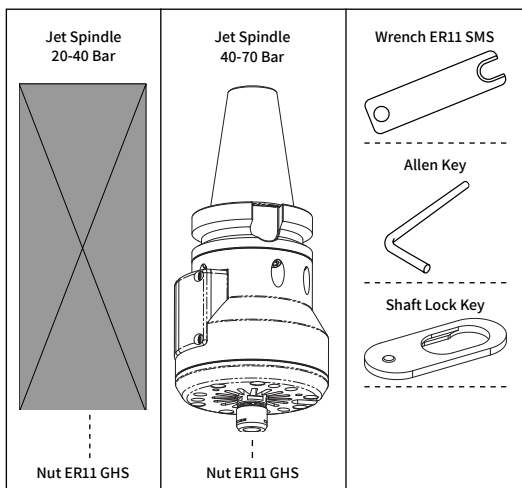
Quick Start - Technical Guide



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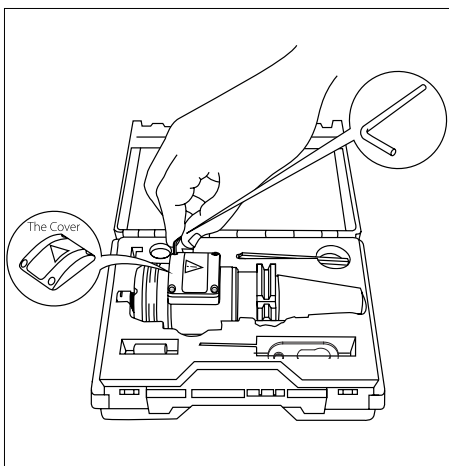
HSM Jet Spindle | Quick Start

Box Contents

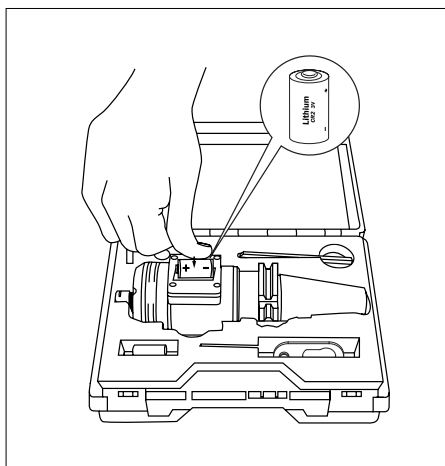


1. Insert Battery

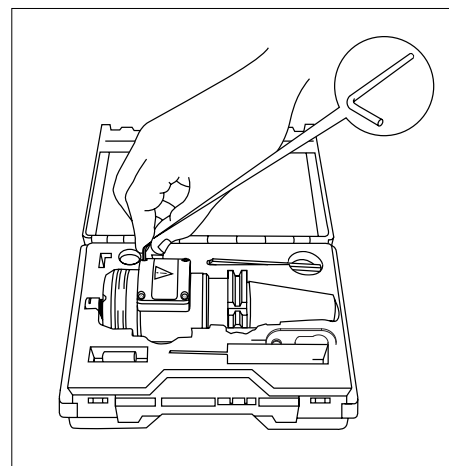
1.A. Open battery compartment by removing the 4 screws with the supplied allen key.



1.B. Use moderate pressure to insert the lithium CR2 3V battery.



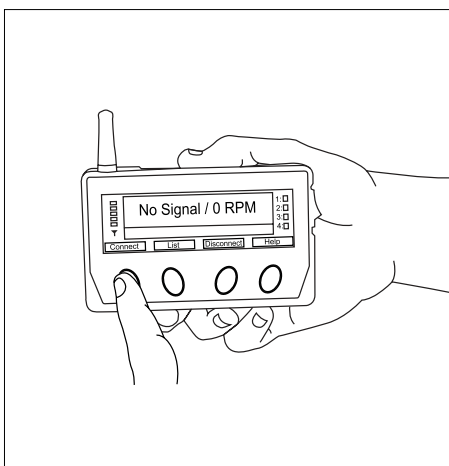
1.C. Replace screws to close the battery compartment.



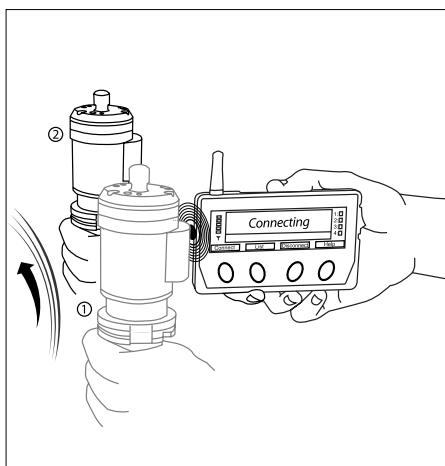
*Immediately connect to the display in order to save the battery.

2. Connecting the Display

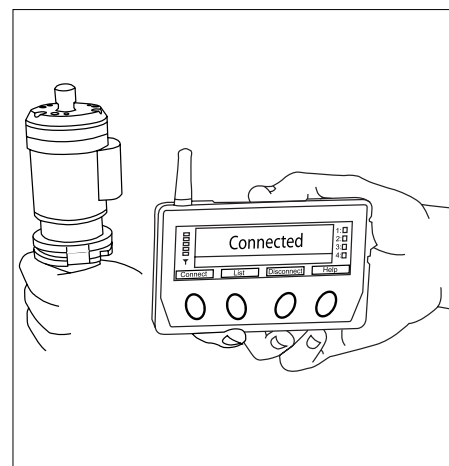
2.A. Connect the display to the external power and switch ON, then press the CONNECT button on the left.



2.B. First press the CONNECT button, then slide the transmitter across the left side of the display from point 1 to point 2.



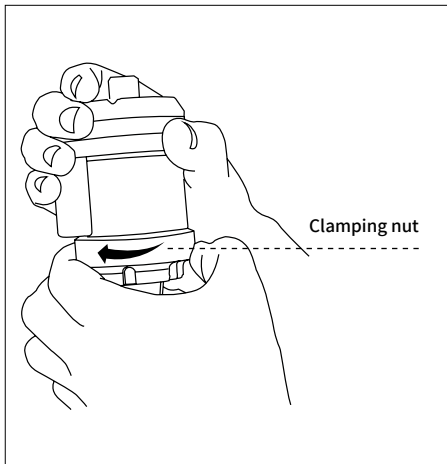
2.C. "Connected" indication will appear after successful connection to the spindle.



*If side magnet does not make a connection, use magnets on the back of the display unit.

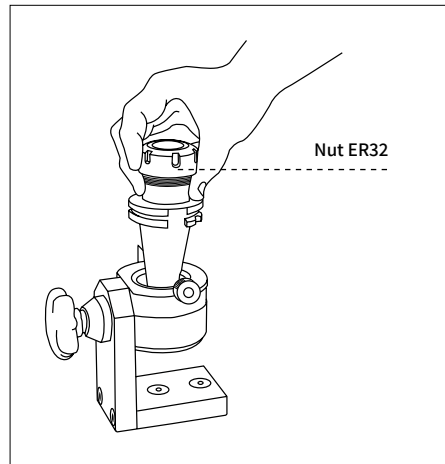
3. Clamping the Cutting Tool

3.A. If using an ER32 built-in adaptor, loosen the clamping nut on the adaptor and turn 1.5 rotations counter clockwise.

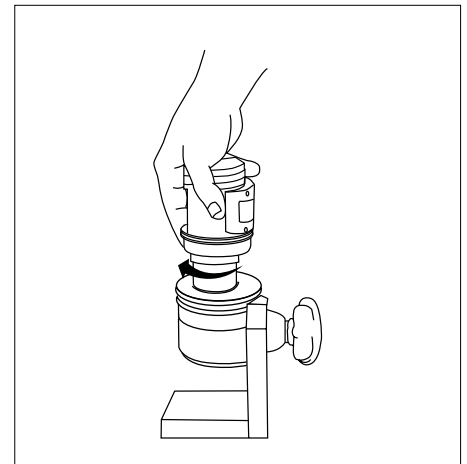


*For specific instructions for different adaptations, see the HSM Jet Spindle user manual.

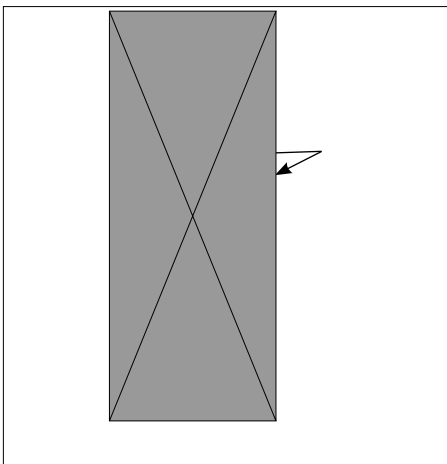
3.B. Place a specific tool adaptor with ER32 collet chuck into the tool clamping device and release the original ER32 Nut.



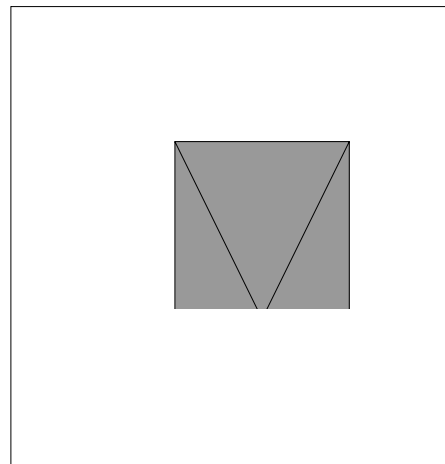
3.C. Set the ER32 built-in adaptor into the tool holder collet chuck and fasten the clamping nut.



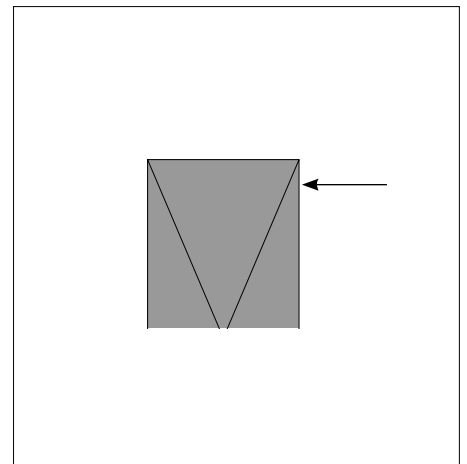
3.D. First assemble the ER 11 AA collet and tool. Insert nut for tightening. Align flat sides of the shaft with the positioning slot on the spindle cover.



3.E. Position shaft lock key over the nut. Raised button fits into the positioning slot underneath.

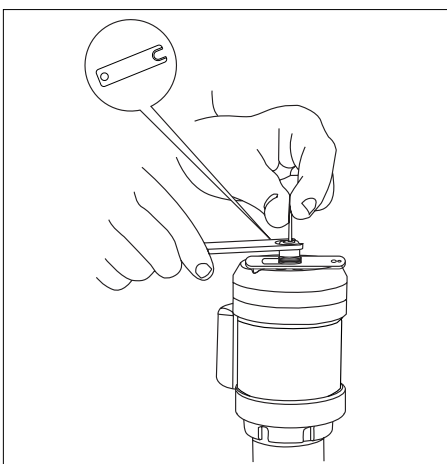


3.F. Slide shaft lock key to secure it in place.

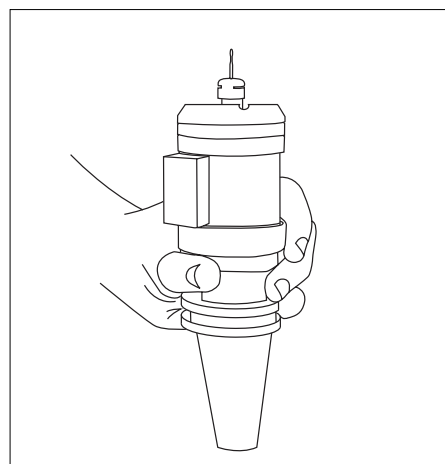


3. Clamping the Cutting Tool (continued)

3.G. Insert ER11 wrench into the grooves on the Nut. Turn ER11 wrench clockwise to tighten.



3.H. The Jet Spindle is now ready to mount on the machine, the same as any other standard tool.



To Remove a Tool:

- Slide the shaft lock flat key to unlock.
- Insert the wrench and turn counterclockwise to loosen the nut (this may take a few turns).
- Keep the shaft lock in the secure position if you wish to insert a new tool.

* Don't forget to lock the main machine spindle during Jet Spindle operation.

Milling & Drilling with Jet Spindles

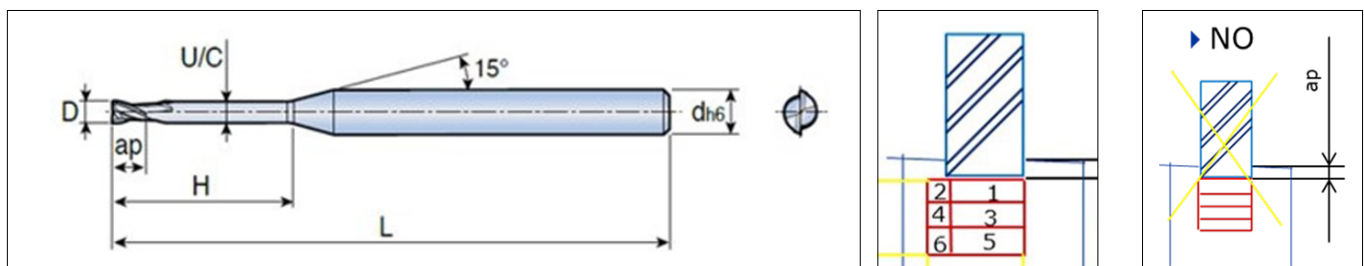
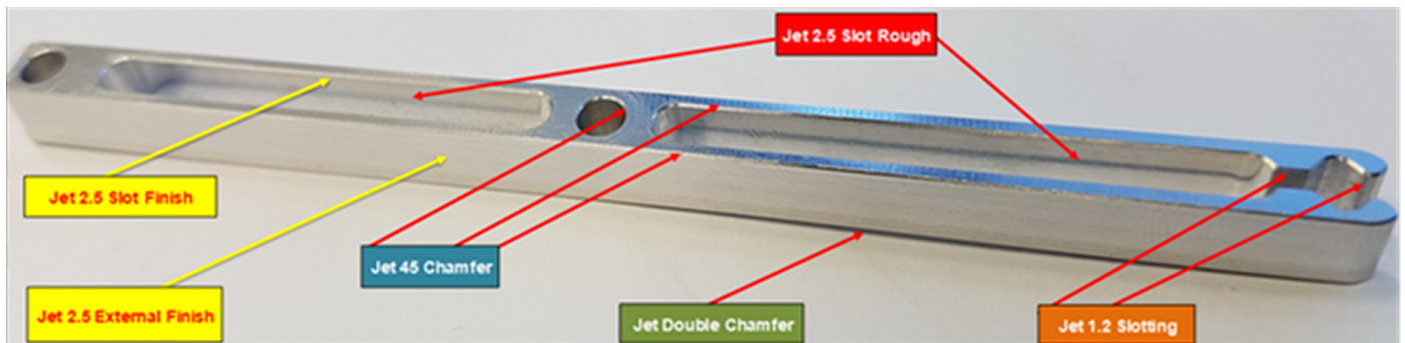
Slot Milling Formula

Use a High Speed Slot/Shoulder Milling Strategy as follows:

First step – slot mill with an Ae of 60% of the final slot diameter and an Ap of 30% of end-mill diameter

Second Step – shoulder mill with an Ae of the remaining 40% of final slot diameter and a equivalent Ap of 30% of the end-mill diameter. Repeat first and second step until you complete the slot.

F(z) according to the "Jet Spindles Cutting Conditions Table", classified by: Tool diameter, Material, Speed



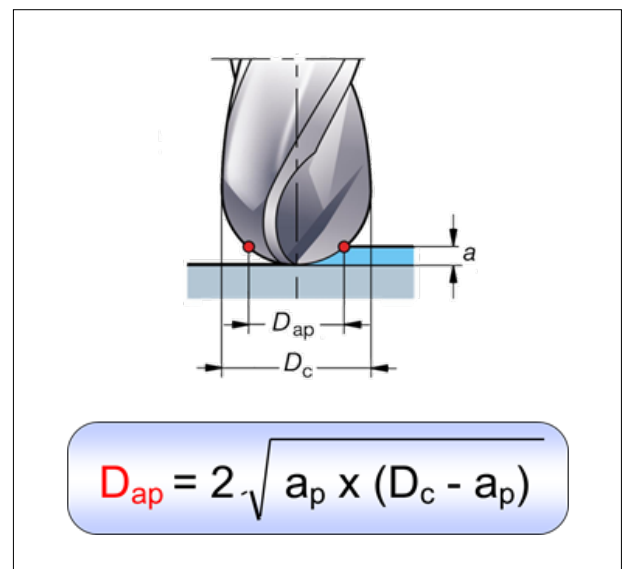
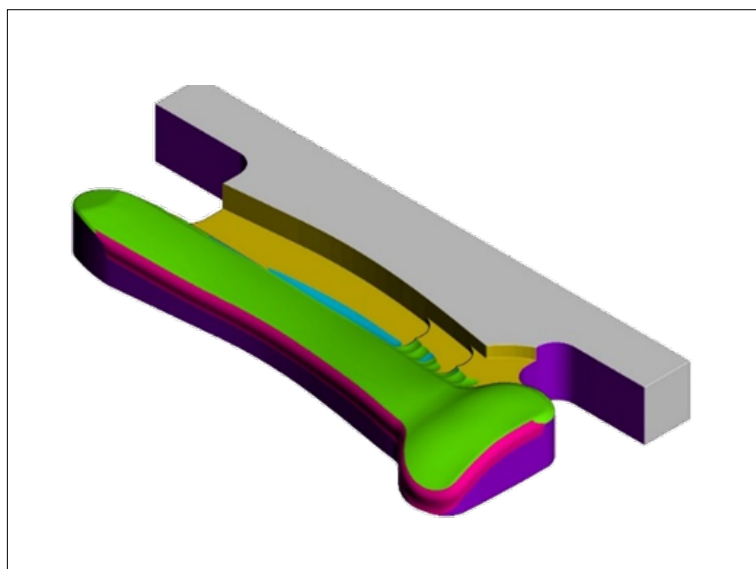
Profile Milling Formula

Ball nose geometry and Ap values determined the effective Dap – see equation

Finishing steps cutting conditions are usually correlated:

Ap or Dap = Ae

To achieve better Surface-finish, Ae should be minimum, and Feed will be according to the F(z) "Jet Spindles Cutting Conditions Table" recommendations – Material, Speed, Diameter



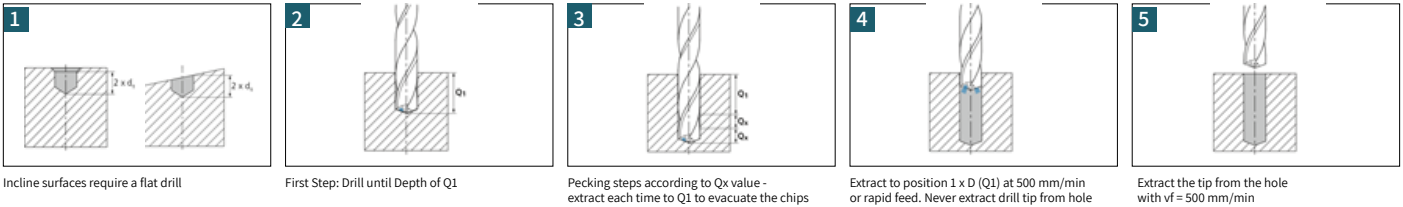
Drilling Formula

High Speed drill non-ferrous materials with a highly polished spiral tool.

First step – on inclined surfaces preparation with a flat drill or end-mill is mandatory.

Second step – drill until $Q1=D$ according to the $F(z)$ from the "Jet Spindles Operating Data" tables, classified by: Tool diameter, Material, Speed.

Third step - peck drill with $Qx = Ap$ values from the Cutting conditions table. After each peck drill extract to position $Q1$ for chip evacuation.



10% Speed Drop Rule

As the cutting tool enters the work piece, RPMs decrease due to load.

The Jet Spindle RPM value when working should not drop more than 10% of the RPM value registered at 'idle speed'.

TO REGISTER IDLE SPEED:

1. Mount Jet Spindle on the machine with cutting tool inserted.
2. Turn on fluid pressure and note RPM on the display monitor.



In the EXAMPLE, following the 10% rule: If idle speed is 40,000 RPM then during machining the jet spindle speed should decrease to a minimum of 36,000 RPM. If however, spindle speed decreases to less than 36,000 RPM, then both depth of cut (Ap) and feed (Fz) need to be reduced. Refer to Operating Data tables below.

30% Feed Rate Rule

Q: How to start with a good setup?

A: Implement the 30% feed rate Rule

After updating the CNC Program with the recommended Ae , Ap , and Feed rate values:

- First step** – operate the Jet spindle coolant and record the idle speed value.
- Second step** – change the Feed Dial (F) on the control panel to 30% value.
- Third step** – start operation with Jet spindle and record spindle speed value.
- Fourth step** – spindle speed drop should be a reduction of 3% from Idle speed.
- Fifth step** – if the spindle speed drop is correct, add 20% on the Feed Dial (F), i.e. proceed to 50% feed rate and record the new speed value
- Six step** – if the spindle speed drop is 5%, then proceed with adding an additional 20% on the Feed Dial (F) reaching 70% feed rate and record the new jet spindle speed value
- Seven step** – if the spindle speed drop is 7%, then proceed with adding an additional 30% on the Feed Dial (F) reaching 100% of the recommended feed value which should coincide with a maximum spindle speed drop of 10%.
- Once the spindle speed drop is a maximum of 10%, save these values in the CNC program.
- Eight step** – If you face a major speed drop, while adding Feed, you better immediately reduce Ap value by 20% in the CNC Program and refer to Operating Data tables before running the setup again.



HPCJET Operating Data

Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)		
N	Al-Si 9%	Drilling	Drill	0.3	80-160 HB	15	22,000	0.30	0.025	0.002	
				0.3		20	25,000	0.30	0.027	0.002	
				0.3		40	35,000	0.30	0.027	0.002	
				0.3		70	45,000	0.30	0.027	0.002	
				0.5		15	22,000	0.50	0.050	0.003	
				0.5		20	25,000	0.50	0.050	0.003	
				0.5		40	35,000	0.50	0.070	0.003	
				0.5		70	45,000	0.30	0.100	0.003	
				0.8		15	22,000	0.80	0.100	0.003	
				0.8		20	25,000	0.80	0.150	0.003	
				0.8		40	35,000	0.80	0.150	0.003	
				0.8		70	45,000	0.80	0.150	0.003	
				1		15	22,000	1.00	0.300	0.008	
				1		20	25,000	1.00	0.300	0.008	
				1		40	35,000	1.00	0.300	0.008	
				1		70	45,000	1.00	0.350	0.008	
				1.5		15	22,000	1.50	0.150	0.008	
				1.5		20	25,000	1.50	0.200	0.008	
				1.5		40	35,000	1.50	0.250	0.008	
				1.5		70	45,000	1.50	0.350	0.008	
				2		15	22,000	2.00	0.200	0.008	
				2		20	25,000	2.00	0.250	0.008	
				2		40	35,000	2.00	0.300	0.008	
				2		70	45,000	2.00	0.380	0.008	
				3		15	22,000	3.00	0.250	0.008	
				3		20	25,000	3.00	0.300	0.008	
				3		40	35,000	3.00	0.350	0.008	
				3		70	45,000	3.00	0.400	0.008	
				4		15	22,000	4.00	0.200	0.008	
				4		20	25,000	4.00	0.250	0.010	
				4		40	35,000	4.00	0.250	0.010	
				4		70	45,000	4.00	0.300	0.010	
				5		15	22,000	5.00	0.175	0.008	
				5		20	25,000	5.00	0.200	0.010	
				5		40	35,000	5.00	0.200	0.010	
				5		70	45,000	5.00	0.350	0.010	
		6	15	22,000	6.00	0.300	0.008				
		6	20	25,000	6.00	0.300	0.010				
		6	40	35,000	6.00	0.350	0.010				
		6	70	45,000	6.00	0.400	0.010				
		0.5	Profile Milling	Ball Nose	0.5	80-160 HB	15	22,000	0.06	0.05	0.008
		0.5			20		25,000	0.06	0.05	0.010	
		0.5			40		35,000	0.07	0.13	0.012	
		0.5			70		45,000	0.07	0.13	0.012	
		0.8			15		22,000	0.06	0.05	0.008	
		0.8			20		25,000	0.06	0.05	0.010	
		0.8			40		35,000	0.07	0.13	0.012	
		0.8			70		45,000	0.07	0.13	0.012	
		1			15		22,000	0.10	0.08	0.004	
		1			20		25,000	0.10	0.08	0.004	
		1			40		35,000	0.11	0.15	0.004	
		1			70		45,000	0.07	0.15	0.012	
		1.5			15		22,000	0.12	0.08	0.006	
		1.5			20		25,000	0.13	0.09	0.006	
		1.5			40		35,000	0.15	0.15	0.006	
		1.5			70		45,000	0.07	0.15	0.012	
		2			15		22,000	0.15	0.050	0.003	
		2			20		25,000	0.16	0.050	0.003	
		2			40		35,000	0.20	0.120	0.003	
		2			70		45,000	0.07	0.130	0.004	
		2.5			15		22,000	0.15	0.050	0.003	
		2.5			20		25,000	0.16	0.050	0.003	
		2.5			40		35,000	0.25	0.130	0.003	
		2.5			70		45,000	0.07	0.130	0.005	
		3			15		22,000	0.22	0.075	0.004	
		3			20		25,000	0.25	0.075	0.004	
		3			40		35,000	0.25	0.100	0.004	
		3			70		45,000	0.07	0.130	0.005	
		4			15		22,000	0.20	0.080	0.006	
		4			20		25,000	0.25	0.090	0.006	
		4			40		35,000	0.27	0.100	0.006	
		4			70		45,000	0.07	0.130	0.007	
		5			15		22,000	0.25	0.070	0.004	
		5			20		25,000	0.26	0.075	0.004	
		5			40		35,000	0.28	0.120	0.004	
		5			70		45,000	0.07	0.130	0.006	
		6	15	22,000	0.23	0.085	0.006				
		6	20	25,000	0.25	0.090	0.006				
		6	40	35,000	0.25	0.120	0.006				
		6	70	45,000	0.07	0.130	0.008				
		0.5	Slot Milling	End-Mill	0.5	80-160 HB	15	22,000	0.50	0.100	0.008
		0.5			20		25,000	0.50	0.100	0.008	
		0.5			40		35,000	0.50	0.100	0.008	
		0.5			70		45,000	0.50	0.100	0.008	
		0.8			15		22,000	0.80	0.160	0.008	
		0.8			20		25,000	0.80	0.160	0.008	
		0.8			40		35,000	0.80	0.160	0.008	
		0.8			70		45,000	0.80	0.160	0.008	
		1			15		22,000	1.00	0.200	0.020	
		1			20		25,000	1.00	0.200	0.020	
		1			40		35,000	1.00	0.200	0.020	
		1			70		45,000	1.00	0.200	0.007	
		1.5			15		22,000	1.50	0.300	0.020	
		1.5			20		25,000	1.50	0.300	0.020	
		1.5			40		35,000	1.50	0.300	0.020	
		1.5			70		45,000	1.50	0.300	0.007	
		2			15		22,000	2.00	0.400	0.022	
		2			20		25,000	2.00	0.400	0.022	
		2			40		35,000	2.00	0.400	0.022	
		2			70		45,000	2.00	0.400	0.007	
2.5	15	22,000			2.50		0.500	0.025			
2.5	20	25,000			2.50		0.500	0.025			
2.5	40	35,000			2.50		0.500	0.025			
2.5	70	45,000			2.50		0.500	0.007			
3	15	22,000			3.00		0.600	0.025			
3	20	25,000			3.00		0.600	0.025			
3	40	35,000			3.00		0.600	0.025			
3	70	45,000			3.00		0.600	0.007			
3.5	15	22,000			3.50		0.700	0.025			
3.5	20	25,000			3.50		0.700	0.025			
3.5	40	35,000			3.50		0.700	0.025			
3.5	70	45,000			3.50		0.700	0.007			
4	15	22,000			4.00		0.800	0.025			
4	20	25,000			4.00		0.800	0.025			
4	40	35,000			4.00		0.800	0.025			
4	70	45,000			4.00		0.800	0.007			
4.5	15	22,000	4.50	0.900	0.025						

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)		
N	Al-Si 9%	Slot Milling		4.5	80-160 HB	20	25,000	4.50	0.900	0.025		
				4.5		40	35,000	4.50	0.900	0.025		
				4.5		70	45,000	4.50	0.900	0.007		
				5		15	22,000	5.00	1.000	0.022		
				5		20	25,000	5.00	1.000	0.022		
				5		40	35,000	5.00	1.000	0.022		
				5		70	45,000	5.00	1.000	0.007		
				5.5		15	22,000	5.50	1.100	0.022		
				5.5		20	25,000	5.50	1.100	0.022		
				5.5		40	35,000	5.50	1.100	0.022		
				5.5		70	45,000	5.50	1.100	0.007		
				6		15	22,000	6.00	1.200	0.022		
				6		20	25,000	6.00	1.200	0.022		
				6		40	35,000	6.00	1.200	0.022		
				6		70	45,000	6.00	1.200	0.007		
				1		15	22,000	0.20	0.100	0.015		
				1		20	25,000	0.20	0.150	0.017		
				1		40	35,000	0.20	0.150	0.017		
		1	70	45,000		0.20	0.150	0.017				
		2	15	22,000		0.40	0.100	0.015				
		2	20	25,000		0.40	0.100	0.015				
		2	40	35,000		0.40	0.100	0.018				
		2	70	45,000		0.40	0.150	0.017				
		3	15	22,000		0.60	0.100	0.020				
		3	20	25,000		0.60	0.150	0.020				
		3	40	35,000		0.60	0.250	0.025				
		3	70	45,000		0.60	0.150	0.017				
		4	15	22,000		0.80	0.100	0.015				
		4	20	25,000		0.80	0.100	0.015				
		4	40	35,000		0.80	0.100	0.015				
		4	70	45,000		0.80	0.150	0.017				
		5	15	22,000		1.00	0.100	0.020				
		5	20	25,000		1.00	0.130	0.020				
		5	40	35,000		1.00	0.150	0.025				
		5	70	45,000		1.00	0.150	0.017				
		6	15	22,000		1.20	0.100	0.020				
		6	20	25,000		0.80	0.100	0.020				
		6	40	35,000		1.20	0.100	0.020				
		6	70	45,000		1.20	0.150	0.017				
				Shoulder Mill		End-Mill	1	15	22,000	0.20	0.100	0.015
							1	20	25,000	0.20	0.150	0.017
							1	40	35,000	0.20	0.150	0.017
		1	70		45,000		0.20	0.150	0.017			
		2	15		22,000		0.40	0.100	0.015			
		2	20		25,000		0.40	0.100	0.015			
		2	40		35,000		0.40	0.100	0.018			
		2	70		45,000		0.40	0.150	0.017			
		3	15		22,000		0.60	0.100	0.020			
		3	20		25,000		0.60	0.150	0.020			
		3	40		35,000		0.60	0.250	0.025			
		3	70		45,000		0.60	0.150	0.017			
		4	15		22,000		0.80	0.100	0.015			
		4	20		25,000		0.80	0.100	0.015			
		4	40		35,000		0.80	0.100	0.015			
		4	70		45,000		0.80	0.150	0.017			
		5	15		22,000		1.00	0.100	0.020			
		5	20		25,000		1.00	0.130	0.020			
		5	40	35,000	1.00	0.150	0.025					
		5	70	45,000	1.00	0.150	0.017					
		6	15	22,000	1.20	0.100	0.020					
		6	20	25,000	0.80	0.100	0.020					
		6	40	35,000	1.20	0.100	0.020					
		6	70	45,000	1.20	0.150	0.017					

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
H	SAE 1.2316	Drilling	Drill	0.3	35 HRC	15	22000	0.30	0.07	0.002
				0.3		20	25000	0.30	0.07	0.002
				0.3		40	35000	0.30	0.07	0.002
				0.3		70	45000	0.30	0.07	0.003
				0.5		15	22000	0.50	0.10	0.004
				0.5		20	25000	0.50	0.10	0.004
				0.5		40	35000	0.50	0.10	0.004
				0.5		70	45000	0.50	0.07	0.004
				0.8		15	22000	0.80	0.10	0.006
				0.8		20	25000	0.80	0.10	0.006
				0.8		40	35000	0.80	0.10	0.006
				0.8		70	45000	0.80	0.07	0.006
				1		15	22000	1.00	0.10	0.006
				1		20	25000	1.00	0.10	0.006
				1		40	35000	1.00	0.10	0.006
				1		70	45000	1.00	0.10	0.006
				1.5		15	22000	1.50	0.10	0.006
				1.5		20	25000	1.50	0.10	0.006
				1.5		40	35000	1.50	0.10	0.006
				1.5		70	45000	1.50	0.10	0.006
				2		15	22000	2.00	0.10	0.008
				2		20	25000	2.00	0.10	0.008
				2		40	35000	2.00	0.10	0.008
				2		70	45000	2.00	0.10	0.008
				2.5		15	22000	2.50	0.10	0.008
				2.5		20	25000	2.50	0.10	0.008
				2.5		40	35000	2.50	0.10	0.008
				2.5		70	45000	2.50	0.10	0.008
				3		15	22000	3.00	0.10	0.008
				3		20	25000	3.00	0.10	0.008
				3		40	35000	3.00	0.10	0.008
				3		70	45000	3.00	0.07	0.008
				3.5		15	22000	3.50	0.10	0.008
				3.5		20	25000	3.50	0.10	0.008
				3.5		40	35000	3.50	0.10	0.008
				3.5		70	45000	3.50	0.10	0.008
				0.3		15	22000	0.03	0.02	0.005
				0.3		20	25000	0.03	0.02	0.005
				0.3		40	35000	0.03	0.02	0.005
				0.3		70	35000	0.03	0.02	0.005
				0.5		15	22000	0.05	0.03	0.007
				0.5		20	25000	0.05	0.03	0.007
				0.5		40	35000	0.05	0.03	0.007
				0.5		70	45000	0.05	0.03	0.007
				1		15	22000	0.10	0.06	0.012
				1		20	25000	0.10	0.06	0.012
				1		40	35000	0.10	0.06	0.012
				1		70	45000	0.10	0.06	0.012
				1.5		15	22000	0.15	0.09	0.012
				1.5		20	25000	0.15	0.09	0.012
		1.5	40	35000		0.15	0.09	0.012		
		1.5	70	45000		0.15	0.09	0.012		
		2	15	22000		0.20	0.12	0.012		
		2	20	25000		0.20	0.12	0.012		
		2	40	35000		0.20	0.12	0.012		
		2	70	45000		0.20	0.12	0.012		
		2.5	15	22000		0.25	0.15	0.012		
		2.5	20	25000		0.25	0.15	0.012		
		2.5	40	35000		0.25	0.15	0.012		
		2.5	70	45000		0.25	0.15	0.012		
		3	15	22000		0.30	0.18	0.006		
		3	20	25000		0.30	0.18	0.006		
		3	40	35000		0.30	0.18	0.006		
		3	70	45000		0.30	0.18	0.006		
		4	15	22000		0.40	0.20	0.006		
		4	20	25000		0.40	0.20	0.006		
		4	40	35000		0.40	0.20	0.006		
		4	70	45000		0.40	0.20	0.006		
		5	15	22000		0.50	0.25	0.006		
		5	20	25000		0.50	0.25	0.006		
		5	40	35000		0.50	0.25	0.006		
		5	70	45000		0.50	0.25	0.006		

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
H	SAE 1.2316	Profile Milling	Ball Nose	5	35 HRC	70	45,000	0.50	0.30	0.006
				6		15	22,000	0.10	0.10	0.006
				6		20	25,000	0.10	0.10	0.006
				6		40	35,000	0.10	0.10	0.006
				6		70	45,000	0.60	0.36	0.006
				0.3		15	22,000	0.30	0.10	0.004
		0.3	20	25,000		0.30	0.10	0.004		
		0.3	40	35,000		0.30	0.15	0.004		
		0.3	70	45,000		0.30	0.15	0.004		
		0.5	15	22,000		0.50	0.10	0.007		
		0.5	20	25,000		0.50	0.10	0.007		
		0.5	40	35,000		0.50	0.15	0.007		
		0.5	70	45,000		0.50	0.15	0.007		
		0.8	15	22,000		0.80	0.12	0.010		
		0.8	20	25,000		0.80	0.14	0.010		
		0.8	40	35,000		0.80	0.14	0.010		
		0.8	70	45,000		0.80	0.15	0.010		
		1	15	22,000		1.00	0.12	0.010		
		1	20	25,000		1.00	0.12	0.010		
		1	40	35,000		1.00	0.15	0.010		
		1	70	45,000		1.00	0.15	0.010		
		1.5	15	22,000		1.50	0.15	0.020		
		1.5	20	25,000		1.50	0.15	0.020		
		1.5	40	35,000		1.50	0.15	0.020		
		1.5	70	45,000		1.50	0.15	0.020		
		2	15	22,000		2.00	0.15	0.020		
		2	20	25,000		2.00	0.15	0.020		
		2	40	35,000		2.00	0.15	0.020		
		2	70	45,000		2.00	0.15	0.020		
		2.5	15	22,000		2.50	0.10	0.024		
		2.5	20	25,000		2.50	0.10	0.024		
		2.5	40	35,000		2.50	0.10	0.024		
		2.5	70	45,000		2.50	0.10	0.024		
		3	15	22,000		3.00	0.10	0.025		
		3	20	25,000		3.00	0.10	0.025		
		3	40	35,000		3.00	0.10	0.025		
		3	70	45,000		3.00	0.10	0.025		
		4	15	22,000		4.00	0.10	0.025		
		4	20	25,000		4.00	0.10	0.025		
		4	40	35,000		4.00	0.10	0.025		
		4	70	45,000		4.00	0.10	0.025		
		4.5	15	22,000		4.50	0.10	0.026		
		4.5	20	25,000		4.50	0.10	0.026		
		4.5	40	35,000		4.50	0.10	0.026		
		5	15	22,000		5.00	0.10	0.025		
		5	20	25,000		5.00	0.10	0.025		
		5	40	35,000		5.00	0.10	0.025		
		5	70	45,000		5.00	0.10	0.025		
		6	15	22,000		6.00	0.10	0.025		
		6	20	25,000		6.00	0.10	0.025		
		6	40	35,000		6.00	0.10	0.025		
		6	70	45,000		6.00	0.10	0.025		
		0.5	15	22,000		0.18	0.10	0.009		
		0.5	20	25,000		0.20	0.10	0.009		
		0.5	40	35,000		0.20	0.10	0.010		
		0.5	70	45,000		0.20	0.10	0.010		
		1	15	22,000		0.50	0.25	0.010		
		1	20	25,000		0.50	0.25	0.010		
		1	40	35,000		0.50	0.25	0.010		
		1	70	45,000		0.50	0.25	0.010		
2	15	22,000	0.75	0.08	0.009					
2	20	25,000	0.75	0.08	0.009					
2	40	35,000	0.75	0.09	0.009					
2	70	45,000	0.75	0.16	0.009					
3	15	22,000	0.50	0.50	0.010					
3	20	25,000	0.50	0.50	0.010					
3	40	35,000	0.50	0.50	0.010					
3	70	45,000	0.50	0.50	0.010					
4	15	22,000	0.50	0.08	0.010					
4	20	25,000	0.50	0.08	0.010					
4	40	35,000	0.50	0.09	0.010					
4	70	45,000	0.50	0.10	0.010					
5	15	22,000	3.20	0.08	0.009					
5	20	25,000	3.20	0.08	0.009					
5	40	35,000	3.20	0.09	0.009					
5	70	45,000	3.20	0.10	0.010					
6	15	22,000	3.80	0.10	0.015					
6	20	25,000	3.80	0.10	0.017					
6	40	35,000	3.80	0.10	0.018					
6	70	45,000	3.80	0.10	0.020					
M	SS 316	Drilling	Drill	0.5	180-250 HB	15	22,000	0.50	0.10	0.002
				0.5		20	25,000	0.50	0.10	0.002
				0.5		40	35,000	0.50	0.10	0.002
				0.5		70	45,000	0.50	0.10	0.002
				0.8		15	22,000	0.80	0.10	0.004
				0.8		20	25,000	0.80	0.10	0.004
				0.8		40	35,000	0.80	0.10	0.004
				0.8		70	45,000	0.80	0.10	0.004
				1		15	22,000	1.00	0.10	0.004
				1		20	25,000	1.00	0.10	0.004
				1		40	35,000	1.00	0.10	0.004
				1		70	45,000	1.00	0.10	0.004
				1.5		15	22,000	1.50	0.10	0.006
				1.5		20	25,000	1.50	0.10	0.006
				1.5		40	35,000	1.50	0.10	0.010
				1.5		70	45,000	1.50	0.10	0.010
				2		15	22,000	2.00	0.10	0.010
				2		20	25,000	2.00	0.10	0.010
				2		40	35,000	2.00	0.10	0.010
				2		70	45,000	2.00	0.10	0.010
				2.5		15	22,000	2.50	0.10	0.010
				2.5		20	25,000	2.50	0.10	0.010
				2.5		40	35,000	2.50	0.10	0.010
				2.5		70	45,000	2.50	0.10	0.010
				3		15	22,000	3.00	0.10	0.010
				3		20	25,000	3.00	0.10	0.010
				3		40	35,000	3.00	0.10	0.010
				3		70	45,000	3.00	0.10	0.010
				3.5		15	22,000	3.50	0.10	0.010

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
M	SS 316	Drilling	Drill	0.5	180-250 HB	15	22,000	0.50	0.10	0.002
				0.5		20	25,000	0.50	0.10	0.002
				0.5		40	35,000	0.50	0.10	0.002
				0.5		70	45,000	0.50	0.10	0.002
				0.8		15	22,000	0.80	0.10	0.004
				0.8		20	25,000	0.80	0.10	0.004
				0.8		40	35,000	0.80	0.10	0.004
				0.8		70	45,000	0.80	0.10	0.004
				1		15	22,000	1.00	0.10	0.004
				1		20	25,000	1.00	0.10	0.004
				1		40	35,000	1.00	0.10	0.004
				1		70	45,000	1.00	0.10	0.004
				1.5		15	22,000	1.50	0.10	0.006
				1.5		20	25,000	1.50	0.10	0.006
				1.5		40	35,000	1.50	0.10	0.010
				1.5		70	45,000	1.50	0.10	0.010
				2		15	22,000	2.00	0.10	0.010
				2		20	25,000	2.00	0.10	0.010
				2		40	35,000	2.00	0.10	0.010
				2		70	45,000	2.00	0.10	0.010
				2.5		15	22,000	2.50	0.10	0.010
				2.5		20	25,000	2.50	0.10	0.010
				2.5		40	35,000	2.50	0.10	0.010
				2.5		70	45,000	2.50	0.10	0.010
				3		15	22,000	3.00	0.10	0.010
				3		20	25,000	3.00	0.10	0.010
				3		40	35,000	3.00	0.10	0.010
				3		70	45,000	3.00	0.10	0.010
				3.5		15	22,000	3.50	0.10	0.010

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
M	SS 316	Drilling	Drill	3.5	180-250 HB	20	25,000	3.50	0.10	0.010
				3.5		40	35,000	3.50	0.10	0.010
				3.5		70	45,000	3.50	0.10	0.010
				0.5		15	22,000	0.10	0.10	0.006
				0.5		20	25,000	0.10	0.10	0.006
				0.5		40	35,000	0.10	0.10	0.006
				0.5		70	45,000	0.10	0.10	0.006
				1		15	22,000	0.10	0.10	0.006
				1		20	25,000	0.10	0.10	0.006
				1		40	35,000	0.10	0.10	0.006
		1	70	45,000		0.10	0.10	0.006		
		1.5	15	22,000		0.10	0.10	0.006		
		1.5	20	25,000		0.10	0.10	0.006		
		1.5	40	35,000		0.10	0.10	0.006		
		1.5	70	45,000		0.10	0.10	0.006		
		2	15	22,000		0.10	0.10	0.006		
		2	20	25,000		0.10	0.10	0.006		
		2	40	35,000		0.10	0.10	0.006		
		2	70	45,000		0.10	0.10	0.006		
		2.5	15	22,000		0.10	0.10	0.006		
		2.5	20	25,000		0.10	0.10	0.006		
		2.5	40	35,000		0.10	0.10	0.006		
		2.5	70	45,000		0.10	0.10	0.006		
		3	15	22,000		0.10	0.10	0.006		
		3	20	25,000		0.10	0.10	0.006		
		3	40	35,000		0.10	0.10	0.006		
		3	70	45,000		0.10	0.10	0.006		
		4	15	22,000		0.10	0.10	0.006		
		4	20	25,000		0.10	0.10	0.006		
		4	40	35,000		0.10	0.10	0.006		
		4	70	45,000		0.10	0.10	0.006		
		5	15	22,000		0.10	0.10	0.006		
		5	20	25,000		0.10	0.10	0.006		
		5	40	35,000		0.10	0.10	0.006		
		5	70	45,000		0.10	0.10	0.006		
		6	15	22,000		0.10	0.10	0.006		
		6	20	25,000		0.10	0.10	0.006		
		6	40	35,000		0.10	0.10	0.006		
		6	70	45,000		0.10	0.10	0.006		
		0.5	15	22,000		0.50	0.10	0.008		
		0.5	20	25,000		0.50	0.10	0.008		
		0.5	40	35,000		0.50	0.15	0.009		
		0.5	70	45,000		0.50	0.15	0.009		
		0.8	15	22,000		0.80	0.12	0.010		
		0.8	20	25,000		0.80	0.14	0.010		
		0.8	40	35,000		0.80	0.14	0.010		
		0.8	70	45,000		0.80	0.15	0.009		
		1	15	22,000		1.00	0.12	0.010		
		1	20	25,000		1.00	0.12	0.010		
		1	40	35,000		1.00	0.15	0.010		
		1	70	45,000		1.00	0.15	0.009		
		1.5	15	22,000		1.50	0.15	0.012		
		1.5	20	25,000		1.50	0.15	0.017		
		1.5	40	35,000		1.50	0.15	0.018		
		1.5	70	45,000		1.50	0.15	0.020		
		2	15	22,000		2.00	0.08	0.009		
		2	20	25,000		2.00	0.08	0.009		
		2	40	35,000		2.00	0.09	0.009		
		2	70	45,000		2.00	0.10	0.009		
		2.5	15	22,000		2.50	0.10	0.015		
		2.5	20	25,000		2.50	0.10	0.015		
		2.5	40	35,000		2.50	0.15	0.016		
		2.5	70	45,000		2.50	0.15	0.016		
		3	15	22,000		3.00	0.12	0.010		
		3	20	25,000		3.00	0.12	0.010		
		3	40	35,000		3.00	0.12	0.010		
		3	70	45,000		3.00	0.12	0.010		
		4	15	22,000		4.00	0.12	0.010		
		4	20	25,000		4.00	0.12	0.010		
		4	40	35,000		4.00	0.12	0.010		
		4	70	45,000		4.00	0.12	0.010		
		4.5	15	22,000		4.50	0.12	0.010		
		4.5	20	25,000		4.50	0.12	0.010		
		4.5	40	35,000		4.50	0.12	0.010		
		4.5	70	45,000		4.50	0.12	0.010		
		5	15	22,000		5.00	0.10	0.009		
		5	20	25,000		5.00	0.10	0.009		
		5	40	35,000		5.00	0.10	0.009		
		5	70	45,000		5.00	0.10	0.009		
		6	15	22,000		6.00	0.08	0.009		
		6	20	25,000		6.00	0.08	0.009		
		6	40	35,000		6.00	0.08	0.009		
		6	70	45,000		6.00	0.08	0.009		
		1	15	22,000		0.50	0.50	0.014		
		1	20	25,000		0.50	0.50	0.014		
		1	40	35,000		0.50	0.50	0.014		
		1	70	45,000		0.50	0.50	0.014		
		2	15	22,000		0.50	0.08	0.009		
		2	20	25,000		0.50	0.08	0.009		
		2	40	35,000		0.50	0.09	0.009		
		2	70	45,000		0.50	0.08	0.012		
		3	15	22,000		0.50	0.08	0.010		
		3	20	25,000		0.50	0.08	0.017		
		3	40	35,000		0.50	0.08	0.018		
		3	70	45,000		0.50	0.08	0.018		
		4	15	22,000		0.50	0.08	0.015		
		4	20	25,000		0.50	0.08	0.015		
		4	40	35,000		0.50	0.09	0.015		
		4	70	45,000		0.50	0.09	0.015		
		5	15	22,000		0.50	0.08	0.015		
5	20	25,000	0.50	0.08	0.015					
5	40	35,000	0.50	0.09	0.015					
5	70	45,000	0.50	0.09	0.015					
6	15	22,000	0.50	0.15	0.015					
6	20	25,000	0.50	0.15	0.015					
6	40	35,000	0.50	0.15	0.015					
6	70	45,000	0.50	0.15	0.015					

GJET Operating Data

Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)	
N	Al-Si 9%	Drilling	Drill	0.3	80-160 HB	20	33000	0.30	0.025	0.002
				0.3		30	44000	0.30	0.027	0.002
				0.3		40	55000	0.30	0.027	0.002
				0.5		20	33000	0.50	0.03	0.002
				0.5		30	44000	0.50	0.03	0.002
				0.5		40	55000	0.50	0.03	0.002
				0.8		20	33000	0.80	0.05	0.002
				0.8		30	44000	0.80	0.05	0.002
				0.8		40	55000	0.80	0.05	0.002
				1		20	33000	1.00	0.07	0.003
				1		30	44000	1.00	0.07	0.003
				1		40	55000	1.00	0.07	0.003
				1.5		20	33000	1.50	0.08	0.004
				1.5		30	44000	1.50	0.08	0.004
				1.5		40	55000	1.50	0.08	0.004
				2		20	33000	2.00	0.10	0.004
				2		30	44000	2.00	0.10	0.004
				2		40	55000	2.00	0.10	0.004
				3		20	33000	3.00	0.10	0.004
				3		30	44000	3.00	0.10	0.004
				3		40	55000	3.00	0.10	0.004
				4		20	33000	4.00	0.12	0.005
				4		30	44000	4.00	0.12	0.005
				4		40	55000	4.00	0.12	0.005
				5		20	33000	5.00	0.13	0.005
				5		30	44000	5.00	0.13	0.005
				5		40	55000	5.00	0.13	0.005
				6		20	33000	6.00	0.15	0.005
				6		30	44000	6.00	0.15	0.006
				6		40	55000	6.00	0.15	0.006
		0.5	Profile Milling	Ball Nose	0.5	20	33000	0.06	0.05	0.008
		0.5			30	44000	0.06	0.05	0.008	
		0.5			40	55000	0.07	0.10	0.008	
		0.8			20	33000	0.06	0.05	0.008	
		0.8			30	44000	0.06	0.05	0.008	
		0.8			40	55000	0.07	0.13	0.008	
		1			20	33000	0.10	0.08	0.004	
		1			30	44000	0.10	0.09	0.004	
		1			40	55000	0.11	0.15	0.004	
		1.5			20	33000	0.12	0.09	0.006	
		1.5			30	44000	0.13	0.09	0.006	
		1.5			40	55000	0.15	0.10	0.006	
		2			20	33000	0.13	0.05	0.008	
		2			30	44000	0.13	0.05	0.008	
		2			40	55000	0.17	0.13	0.008	
		2.5			20	33000	0.15	0.10	0.030	
		2.5			30	44000	0.16	0.10	0.030	
		2.5			40	55000	0.25	0.13	0.030	
		3			20	33000	0.22	0.08	0.030	
		3			30	44000	0.25	0.08	0.030	
		3			40	55000	0.25	0.15	0.030	
		4			20	33000	0.20	0.08	0.030	
		4			30	44000	0.25	0.09	0.030	
		4			40	55000	0.27	0.15	0.030	
		5			20	33000	0.25	0.08	0.030	
		5			30	44000	0.26	0.08	0.030	
		5			40	55000	0.28	0.15	0.030	
		6			20	33000	0.23	0.08	0.030	
		6			30	44000	0.25	0.09	0.030	
		6			40	55000	0.25	0.15	0.030	
		0.5	Slot Milling	End-Mill	0.5	20	33000	0.50	0.05	0.007
		0.5			30	44000	0.50	0.05	0.007	
		0.5			40	55000	0.50	0.05	0.007	
		0.8			20	33000	0.80	0.08	0.008	
		0.8			30	44000	0.80	0.08	0.008	
		0.8			40	55000	0.80	0.08	0.008	
		1			20	33000	1.00	0.10	0.018	
		1			30	44000	1.00	0.10	0.018	
		1			40	55000	1.00	0.10	0.018	
		1.5			20	33000	1.50	0.15	0.020	
		1.5			30	44000	1.50	0.15	0.020	
		1.5			40	55000	1.50	0.15	0.020	
		2			20	33000	2.00	0.20	0.022	
		2			30	44000	2.00	0.20	0.022	
		2			40	55000	2.00	0.20	0.022	
		2.5			20	33000	2.50	0.25	0.025	
		2.5			30	44000	2.50	0.25	0.025	
		2.5			40	55000	2.50	0.25	0.025	
		3			20	33000	3.00	0.30	0.025	
		3			30	44000	3.00	0.30	0.025	
		3			40	55000	3.00	0.30	0.025	
		3.5			20	33000	3.50	0.25	0.025	
		3.5			30	44000	3.50	0.25	0.025	
		3.5			40	55000	3.50	0.25	0.025	
		4			20	33000	4.00	0.28	0.025	
		4			30	44000	4.00	0.28	0.025	
		4			40	55000	4.00	0.28	0.025	
		4.5			20	33000	4.50	0.32	0.025	
		4.5			30	44000	4.50	0.32	0.025	
		4.5			40	55000	4.50	0.32	0.025	
		5	20	33000	5.00	0.35	0.022			
		5	30	44000	5.00	0.35	0.022			
		5	40	55000	5.00	0.35	0.022			
		5.5	20	33000	5.50	0.36	0.022			
		5.5	30	44000	5.50	0.36	0.022			
		5	40	55000	5.50	0.36	0.022			
		6	20	33000	6.00	0.36	0.022			
		6	30	44000	6.00	0.36	0.022			
		6	40	55000	6.00	0.36	0.022			
		1	Shoulder Mill	End-Mill	1	20	33000	0.30	0.10	0.015
1	30	44000			0.30	0.15	0.017			
1	40	55000			0.30	0.15	0.017			
2	20	33000			0.60	0.10	0.015			
2	30	44000			0.60	0.10	0.015			
2	40	55000			0.60	0.10	0.018			
3	20	33000			0.90	0.10	0.020			
3	30	44000			0.90	0.10	0.020			
3	40	55000			0.90	0.10	0.025			
4	20	33000			1.20	0.10	0.025			
4	30	44000			1.20	0.10	0.025			
4	40	55000			1.20	0.10	0.025			
5	20	33000			1.50	0.10	0.025			
5	30	44000			1.50	0.10	0.025			
5	40	55000			1.50	0.10	0.025			
6	20	33000			1.80	0.10	0.025			
6	30	44000			1.80	0.10	0.025			
6	40	55000			1.80	0.10	0.025			

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)			
H	SAE 1.2316	Drilling	Drill	0.3	35 HRC	20	33000	0.30	0.07	0.002			
				0.3		30	44000	0.30	0.07	0.002			
				0.3		40	55000	0.30	0.07	0.002			
				0.5		20	33000	0.50	0.10	0.002			
				0.5		30	44000	0.50	0.10	0.002			
				0.5		40	55000	0.50	0.10	0.002			
				0.8		20	33000	0.80	0.10	0.002			
				0.8		30	44000	0.80	0.10	0.002			
				0.8		40	55000	0.80	0.10	0.002			
				1		20	33000	1.00	0.10	0.003			
				1		30	44000	1.00	0.10	0.003			
				1		40	55000	1.00	0.10	0.003			
				1.5		20	33000	1.50	0.10	0.004			
				1.5		30	44000	1.50	0.10	0.004			
				1.5		40	55000	1.50	0.10	0.004			
				2		20	33000	2.00	0.10	0.004			
				2		30	44000	2.00	0.10	0.004			
				2		40	55000	2.00	0.10	0.004			
				2.5		20	33000	2.50	0.10	0.004			
				2.5		30	44000	2.50	0.10	0.004			
				2.5		40	55000	2.50	0.10	0.004			
				3		20	33000	3.00	0.10	0.005			
				3		30	44000	3.00	0.10	0.005			
				3		40	55000	3.00	0.10	0.005			
				3.5		20	33000	3.50	0.10	0.005			
				3.5		30	44000	3.50	0.10	0.005			
				3.5		40	55000	3.50	0.10	0.005			
				0.3		20	Profile Milling	Ball Nose	0.3	33000	0.03	0.02	0.010
				0.3		30			44000	0.03	0.02	0.010	
				0.3		40			55000	0.03	0.02	0.010	
		0.5	20	33000		0.05			0.03	0.012			
		0.5	30	44000		0.05			0.03	0.012			
		0.5	40	55000		0.05			0.03	0.012			
		1	20	33000		0.10			0.06	0.012			
		1	30	44000		0.10			0.06	0.012			
		1	40	55000		0.10			0.06	0.012			
		1.5	20	33000		0.15			0.09	0.012			
		1.5	30	44000		0.15			0.09	0.012			
		1.5	40	55000		0.15			0.09	0.012			
		2	20	33000		0.20			0.12	0.012			
		2	30	44000		0.20			0.12	0.012			
		2	40	55000		0.20			0.12	0.012			
		2.5	20	33000		0.25			0.15	0.012			
		2.5	30	44000		0.25			0.15	0.012			
		2.5	40	55000		0.25			0.15	0.012			
		3	20	33000		0.30			0.15	0.012			
		3	30	44000		0.30			0.15	0.012			
		3	40	55000		0.30			0.15	0.012			
		4	20	33000		0.40			0.10	0.012			
		4	30	44000		0.40			0.10	0.012			
		4	40	55000		0.40			0.10	0.012			
		5	20	33000		0.50			0.10	0.012			
		5	30	44000		0.50			0.10	0.012			
		5	40	55000		0.50			0.10	0.012			
		6	20	33000		0.60			0.10	0.006			
		6	30	44000		0.60			0.10	0.006			
		6	40	55000		0.60			0.10	0.006			
		0.3	20	Slot Milling		End-Mill	0.3	33000	0.30	0.10	0.006		
		0.3	30				44000	0.30	0.10	0.006			
		0.3	40				55000	0.30	0.15	0.006			
		0.5	20				33000	0.50	0.10	0.007			
		0.5	30				44000	0.50	0.10	0.007			
		0.5	40				55000	0.50	0.15	0.007			
		0.8	20				33000	0.80	0.12	0.010			
		0.8	30				44000	0.80	0.14	0.010			
		0.8	40				55000	0.80	0.14	0.010			
		1	20				33000	1.00	0.12	0.010			
		1	30				44000	1.00	0.12	0.010			
		1	40				55000	1.00	0.15	0.010			
		1.5	20				33000	1.50	0.50	0.014			
		1.5	30				44000	1.50	0.50	0.017			
		1.5	40				55000	1.50	0.50	0.018			
		2	20				33000	2.00	0.08	0.009			
		2	30				44000	2.00	0.08	0.009			
		2	40				55000	2.00	0.09	0.009			
		2.5	20				33000	2.50	0.10	0.010			
		2.5	30				44000	2.50	0.10	0.013			
		2.5	40				55000	2.50	0.15	0.013			
		3	20				33000	3.00	0.12	0.010			
		3	30				44000	3.00	0.14	0.010			
		3	40				55000	3.00	0.14	0.010			
		4	20				33000	4.00	0.12	0.010			
		4	30				44000	4.00	0.12	0.010			
		4	40				55000	4.00	0.15	0.010			
		4.5	20				33000	4.50	0.12	0.010			
		4.5	30				44000	4.50	0.12	0.010			
		4.5	40				55000	4.50	0.15	0.010			
		5	20	33000		5.00	0.50	0.012					
		5	30	44000		5.00	0.50	0.017					
		5	40	55000		5.00	0.50	0.018					
		6	20	33000		6.00	0.08	0.009					
		6	30	44000		6.00	0.08	0.009					
		6	40	55000		6.00	0.09	0.009					
		0.5	20	Shoulder Mill			0.5	33000	0.50	0.30	0.009		
		0.5	30				44000	0.50	0.30	0.009			
		0.5	40				55000	0.50	0.35	0.010			
		1	20				33000	1.00	0.50	0.015			
		1	30				44000	1.00	0.50	0.017			
		1	40				55000	1.00	0.50	0.018			
		2	20				33000	2.00	0.08	0.009			
2	30	44000	2.00		0.08		0.009						
2	40	55000	2.00		0.09		0.009						
3	20	33000	3.00		0.50		0.015						
3	30	44000	3.00		0.50		0.017						
3	40	55000	3.00		0.50		0.018						
4	20	33000	4.00		0.08		0.009						
4	30	44000	4.00		0.08		0.009						
4	40	55000	4.00		0.09		0.009						
5	20	33000	5.00		0.08		0.009						
5	30	44000	5.00		0.08		0.009						
5	40	55000	5.00		0.09		0.009						
6	20	33000	6.00		0.10		0.015						
6	30	44000	6.00		0.10		0.017						
6	40	55000	6.00		0.10		0.018						

M

Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)			
SS 316	Drilling	Drill	0.5	180-250 HB	20	33000	0.50	0.10	0.002			
			0.5		30	44000	0.50	0.10	0.002			
			0.5		40	55000	0.50	0.10	0.002			
			0.8		20	33000	0.80	0.10	0.002			
			0.8		30	44000	0.80	0.10	0.002			
			0.8		40	55000	0.80	0.10	0.002			
			1		20	33000	1.00	0.10	0.002			
			1		30	44000	1.00	0.10	0.002			
			1		40	55000	1.00	0.10	0.002			
			1.5		20	33000	1.50	0.10	0.003			
			1.5		30	44000	1.50	0.10	0.003			
			1.5		40	55000	1.50	0.10	0.003			
			2		20	33000	2.00	0.10	0.004			
			2		30	44000	2.00	0.10	0.004			
			2		40	55000	2.00	0.10	0.004			
			2.5		20	33000	2.50	0.10	0.004			
			2.5		30	44000	2.50	0.10	0.004			
			2.5		40	55000	2.50	0.10	0.004			
			3		20	33000	3.00	0.10	0.004			
			3		30	44000	3.00	0.10	0.004			
			3		40	55000	3.00	0.10	0.004			
			3.5		20	33000	3.50	0.10	0.005			
			3.5		30	44000	3.50	0.10	0.005			
			3.5		40	55000	3.50	0.10	0.005			
			0.5		Profile Milling	Ball Nose	0.5	20	33000	0.50	0.10	0.006
			0.5				30	44000	0.50	0.10	0.006	
			0.5				40	55000	0.50	0.10	0.006	
			1				20	33000	1.00	0.10	0.006	
			1				30	44000	1.00	0.10	0.006	
			1				40	55000	1.00	0.10	0.006	
	1.5	20	33000				1.50	0.10	0.006			
	1.5	30	44000				1.50	0.10	0.006			
	1.5	40	55000				1.50	0.10	0.006			
	2	20	33000				2.00	0.10	0.006			
	2	30	44000				2.00	0.10	0.006			
	2	40	55000				2.00	0.10	0.006			
	2.5	20	33000				2.50	0.10	0.006			
	2.5	30	44000				2.50	0.10	0.006			
	2.5	40	55000				2.50	0.10	0.006			
	3	20	33000				3.00	0.10	0.006			
	3	30	44000				3.00	0.10	0.006			
	3	40	55000				3.00	0.10	0.006			
	4	20	33000				4.00	0.10	0.006			
	4	30	44000				4.00	0.10	0.006			
	4	40	55000				4.00	0.10	0.006			
	5	20	33000				5.00	0.10	0.006			
	5	30	44000				5.00	0.10	0.006			
	5	40	55000				5.00	0.10	0.006			
	6	20	33000				6.00	0.10	0.006			
	6	30	44000				6.00	0.10	0.006			
	6	40	55000				6.00	0.10	0.006			
	0.5	Slot Milling	End-Mill				0.5	20	33000	0.50	0.10	0.008
	0.5						30	44000	0.50	0.10	0.008	
	0.5						40	55000	0.50	0.10	0.009	
	0.8				20	33000	0.80	0.10	0.010			
	0.8				30	44000	0.80	0.10	0.010			
	0.8				40	55000	0.80	0.10	0.010			
	1				20	33000	1.00	0.12	0.010			
	1				30	44000	1.00	0.12	0.010			
	1				40	55000	1.00	0.12	0.010			
	1.5				20	33000	1.50	0.15	0.012			
	1.5				30	44000	1.50	0.15	0.017			
	1.5				40	55000	1.50	0.15	0.018			
	2				20	33000	2.00	0.15	0.009			
	2				30	44000	2.00	0.15	0.009			
	2				40	55000	2.00	0.15	0.009			
	2.5				20	33000	2.50	0.10	0.015			
	2.5				30	44000	2.50	0.10	0.015			
	2.5				40	55000	2.50	0.10	0.016			
	3				20	33000	3.00	0.10	0.010			
	3				30	44000	3.00	0.10	0.010			
	3				40	55000	3.00	0.10	0.010			
	4				20	33000	4.00	0.10	0.010			
	4				30	44000	4.00	0.10	0.010			
	4				40	55000	4.00	0.10	0.010			
	4.5				20	33000	4.50	0.10	0.010			
	4.5				30	44000	4.50	0.10	0.010			
	4.5				40	55000	4.50	0.10	0.010			
	5				20	33000	5.00	0.10	0.011			
	5				30	44000	5.00	0.10	0.017			
	5				40	55000	5.00	0.10	0.018			
	6	20	33000		6.00	0.10	0.018					
	6	30	44000		6.00	0.10	0.018					
	6	40	55000		6.00	0.10	0.018					
	1	Shoulder Mill	End-Mill		1	20	33000	0.50	0.10	0.014		
	1				30	44000	0.50	0.10	0.014			
	1				40	55000	0.50	0.10	0.014			
	2				20	33000	1.00	0.10	0.015			
	2				30	44000	1.00	0.10	0.015			
	2				40	55000	1.00	0.10	0.015			
	3				20	33000	1.00	0.10	0.015			
	3				30	44000	1.00	0.10	0.015			
	3				40	55000	1.00	0.10	0.015			
	4				20	33000	0.75	0.10	0.009			
	4				30	44000	0.75	0.10	0.009			
	4				40	55000	0.75	0.10	0.009			
	5				20	33000	4.00	0.10	0.009			
	5				30	44000	4.00	0.10	0.009			
	5				40	55000	4.00	0.10	0.009			
	6				20	33000	0.50	0.10	0.013			
6	30			44000	0.50	0.10	0.017					
6	40			55000	0.50	0.10	0.018					

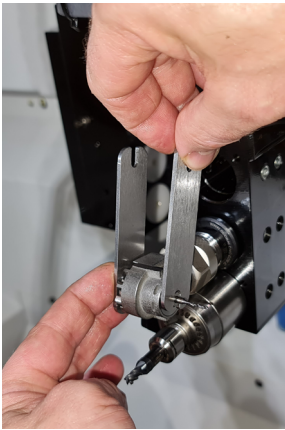
MICRO90 Tool installation



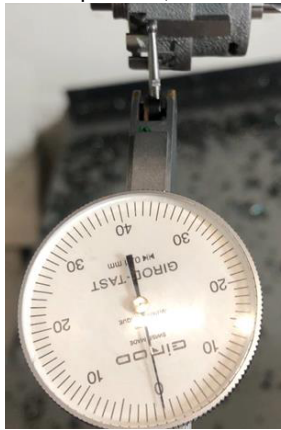
1 Insert the collet into the shaft



2 Lock the shaft using the dedicated key as shown in the picture, and screw the collet in position



3 Insert the cutting tool into the collet then tighten the collet using both keys as shown in the picture



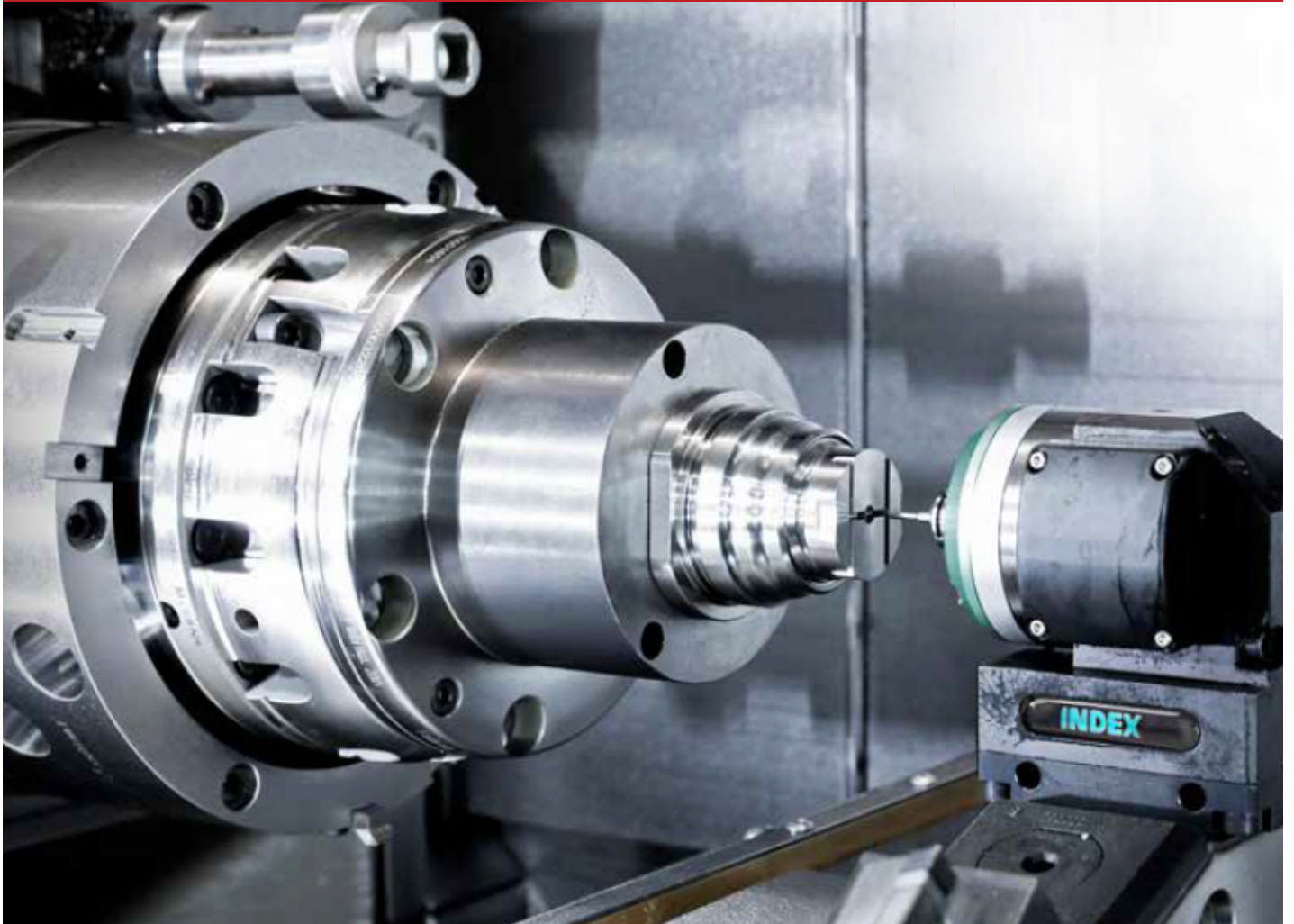
4 Use a dial indicator to align the spindle housing on the ground edge



5 Use ER16 wrench to fasten the ER16 nut on the holder

MICRO90 Operating Data

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)			
N	Al-Si 9%	Drilling	Drill	0.50	80-160 HB	20	35,000	0.50	0.10	0.002			
				0.50		30	44,000	0.50	0.10	0.002			
				0.50		40	53,000	0.50	0.10	0.002			
				1.00		20	35,000	1.00	0.20	0.002			
				1.00		30	44,000	1.00	0.20	0.002			
				1.00		40	53,000	1.00	0.20	0.003			
				2.00		20	35,000	2.00	0.30	0.004			
				2.00		30	44,000	2.00	0.30	0.004			
				2.00		40	53,000	2.00	0.30	0.004			
				1.00		20	35,000	0.06	0.05	0.003			
				1.00		30	44,000	0.06	0.05	0.003			
				1.00		40	53,000	0.07	0.13	0.003			
		2.00	20	35,000		0.07	0.08	0.004					
		2.00	30	44,000		0.07	0.08	0.004					
		2.00	40	53,000		0.08	0.10	0.004					
		3.00	20	35,000		0.08	0.08	0.006					
		3.00	30	44,000		0.09	0.09	0.006					
		3.00	40	53,000		0.10	0.15	0.006					
		0.50	20	35,000		0.50	0.10	0.020					
		0.50	30	44,000		0.50	0.12	0.020					
		0.50	40	53,000		0.50	0.15	0.020					
		1.00	20	35,000		1.00	0.10	0.025					
		1.00	30	44,000		1.00	0.15	0.025					
		1.00	40	53,000		1.00	0.15	0.025					
		2.00	20	35,000		2.00	0.20	0.025					
		2.00	30	44,000		2.00	0.20	0.025					
		2.00	40	53,000		2.00	0.20	0.025					
		2.00	20	35,000		0.50	0.25	0.020					
		2.00	30	44,000		0.50	0.50	0.020					
		2.00	40	53,000		0.50	0.50	0.025					
		2.00	20	35,000		0.20	0.10	0.015					
		2.00	30	44,000		0.20	0.10	0.015					
		2.00	40	53,000		0.20	0.10	0.015					
		H	H13	Profile Milling		Ball Nose	1.00	58 HRC	20	35,000	0.05	0.05	0.005
							1.00		30	44,000	0.05	0.05	0.005
							1.00		40	53,000	0.05	0.05	0.005
							2.00		20	35,000	0.07	0.07	0.006
							2.00		30	44,000	0.08	0.08	0.006
							2.00		40	53,000	0.08	0.08	0.006
							3.00		20	35,000	0.08	0.08	0.006
							3.00		30	44,000	0.09	0.10	0.006
							3.00		40	53,000	0.10	0.10	0.006
							0.50		20	35,000	0.50	0.05	0.002
							0.50		30	44,000	0.50	0.05	0.002
							0.50		40	53,000	0.50	0.05	0.002
			1.00	20		35,000	1.00		0.10	0.003			
			1.00	30		44,000	1.00		0.10	0.003			
			1.00	40		53,000	1.00		0.10	0.003			
2.00	20		35,000	2.00	0.10	0.003							
2.00	30		44,000	2.00	0.10	0.003							
2.00	40		53,000	2.00	0.10	0.003							
1.00	20		35,000	0.05	0.05	0.003							
1.00	30		44,000	0.05	0.05	0.003							
1.00	40		53,000	0.05	0.05	0.003							
2.00	20		35,000	0.08	0.08	0.004							
2.00	30		44,000	0.08	0.08	0.004							
2.00	40		53,000	0.08	0.08	0.004							
3.00	20		35,000	0.10	0.10	0.006							
3.00	30		44,000	0.10	0.10	0.006							
3.00	40		53,000	0.10	0.10	0.006							
0.50	20		35,000	0.50	0.05	0.006							
0.50	30		44,000	0.50	0.05	0.006							
0.50	40		53,000	0.50	0.05	0.006							
1.00	20		35,000	1.00	0.10	0.006							
1.00	30		44,000	1.00	0.10	0.006							
1.00	40		53,000	1.00	0.10	0.006							
2.00	20		35,000	2.00	0.12	0.010							
2.00	30		44,000	2.00	0.14	0.010							
2.00	40		53,000	2.00	0.14	0.010							
3.00	20		35,000	3.00	0.12	0.010							
3.00	30		44,000	3.00	0.12	0.010							
3.00	40		53,000	3.00	0.15	0.010							
2.00	20		35,000	0.50	0.50	0.010							
2.00	30		44,000	0.50	0.50	0.010							
2.00	40		53,000	0.50	0.50	0.010							
2.00	20		35,000	0.50	0.08	0.009							
2.00	30		44,000	0.50	0.08	0.009							
2.00	40		53,000	0.50	0.09	0.009							
M	SS 316		Slot Milling	End-Mill	1.00	180-250 HB	20		35,000	1.00	0.10	0.015	
					1.00		30		44,000	1.00	0.15	0.015	
					1.00		40		53,000	1.00	0.15	0.015	
		2.00			20		35,000	2.00	0.15	0.015			
		2.00			30		44,000	2.00	0.15	0.015			
		2.00			40		53,000	2.00	0.20	0.015			
		0.50	20	35,000	0.50		0.05	0.002					
		0.50	30	44,000	0.50		0.05	0.002					
		0.50	40	53,000	0.50		0.05	0.002					
		1.00	20	35,000	1.00		0.10	0.003					
		1.00	30	44,000	1.00		0.10	0.003					
		1.00	40	53,000	1.00		0.10	0.003					
		2.00	20	35,000	2.00		0.05	0.003					
		2.00	30	44,000	2.00		0.05	0.003					
		2.00	40	53,000	2.00		0.05	0.003					
		2.00	20	35,000	0.35		0.15	0.020					
		2.00	30	44,000	0.40		0.15	0.020					
		2.00	40	53,000	0.50		0.18	0.025					
		2.00	20	35,000	0.50		0.07	0.015					
		2.00	30	44,000	0.50		0.07	0.015					
		2.00	40	53,000	0.50		0.08	0.015					



PARTNERS



COLIBRI
SPINDLES

Colibri Spindles Ltd.
Lavon Industrial Park, 2011800, Israel
Tel +972 4 9089104
Fax +972 4 9589061
marketing@colibrispindles.com
www.colibrispindles.com