



## HIGH-SPEED MACHINING

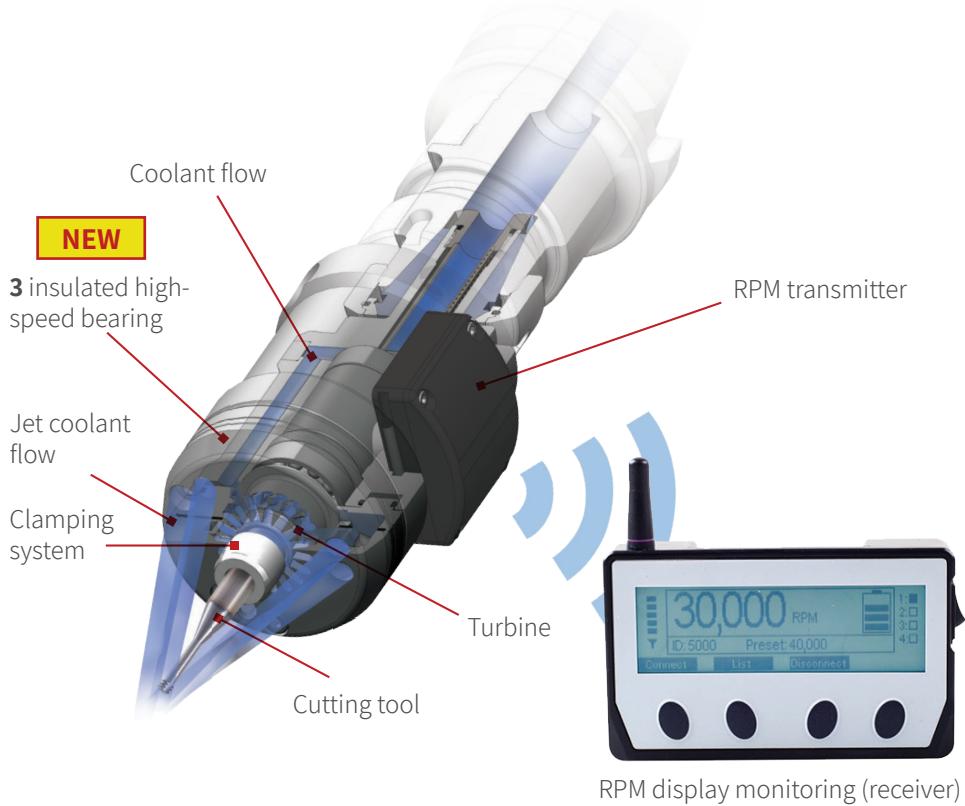


### FAMILY OF HSM JET SPINDLES



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



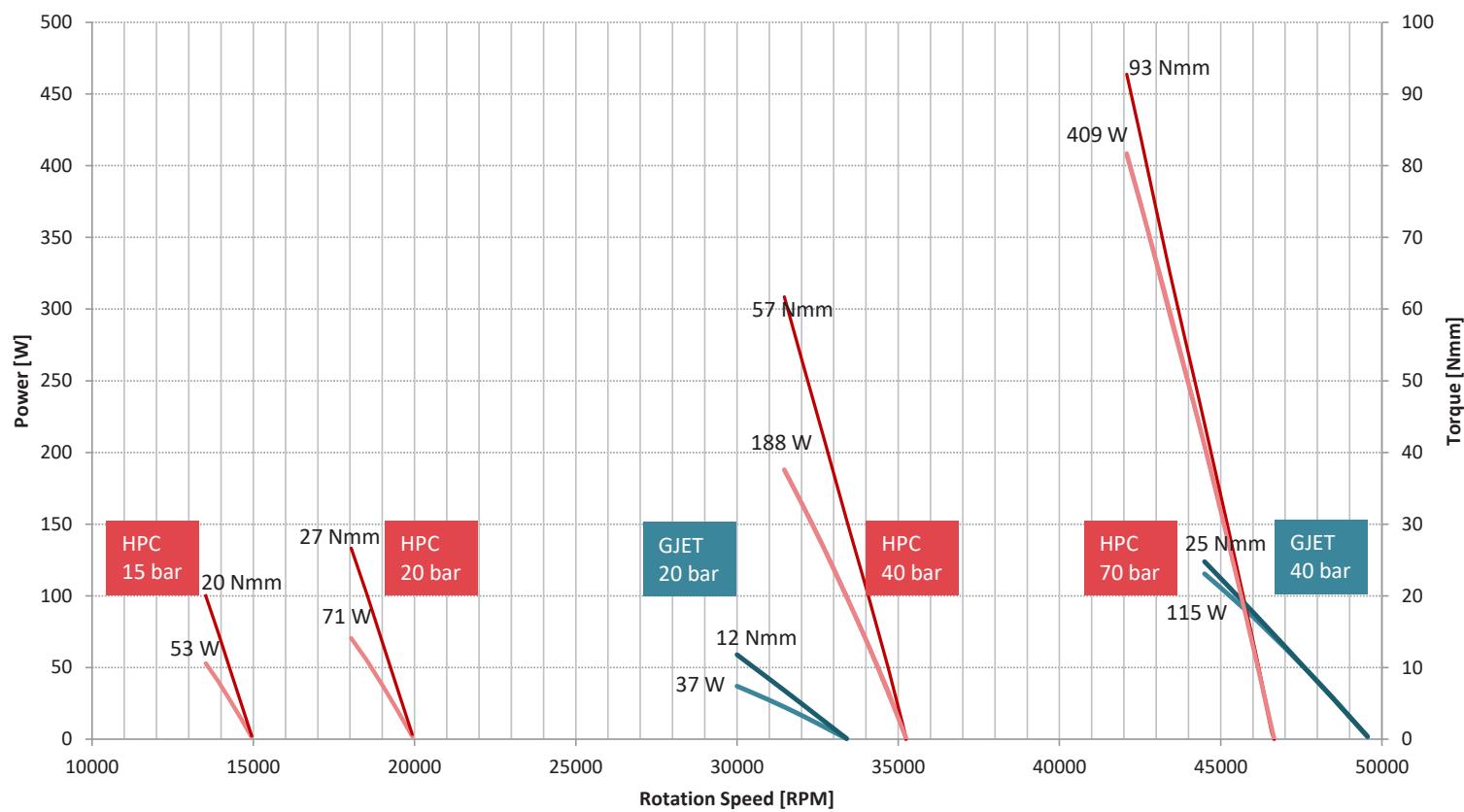
### FEATURES

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

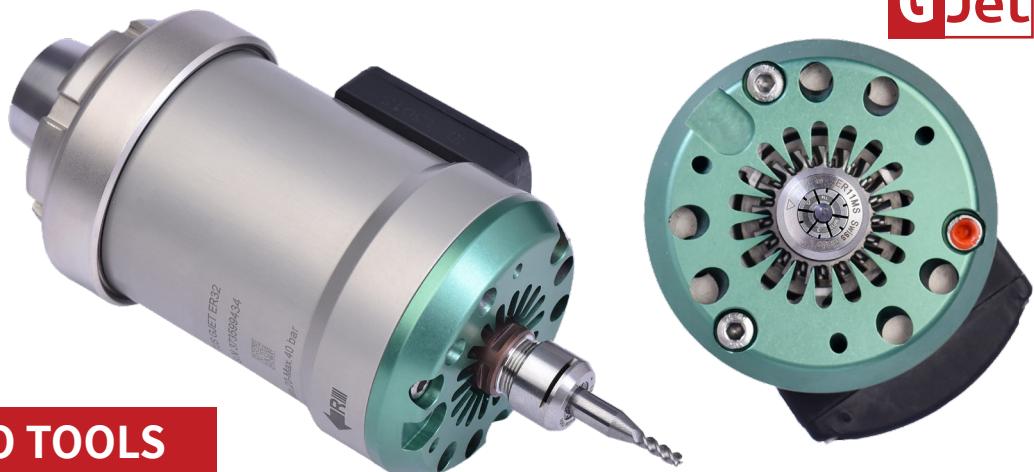
- ✓ Quick and easy installation
- ✓ Free energy source
- ✓ Good chip evacuation
- ✓ Coolant at the cutting edge
- ✓ Used in tool changer
- ✓ Compact design

### Recommended Working Zone for HPC JET vs GJET



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

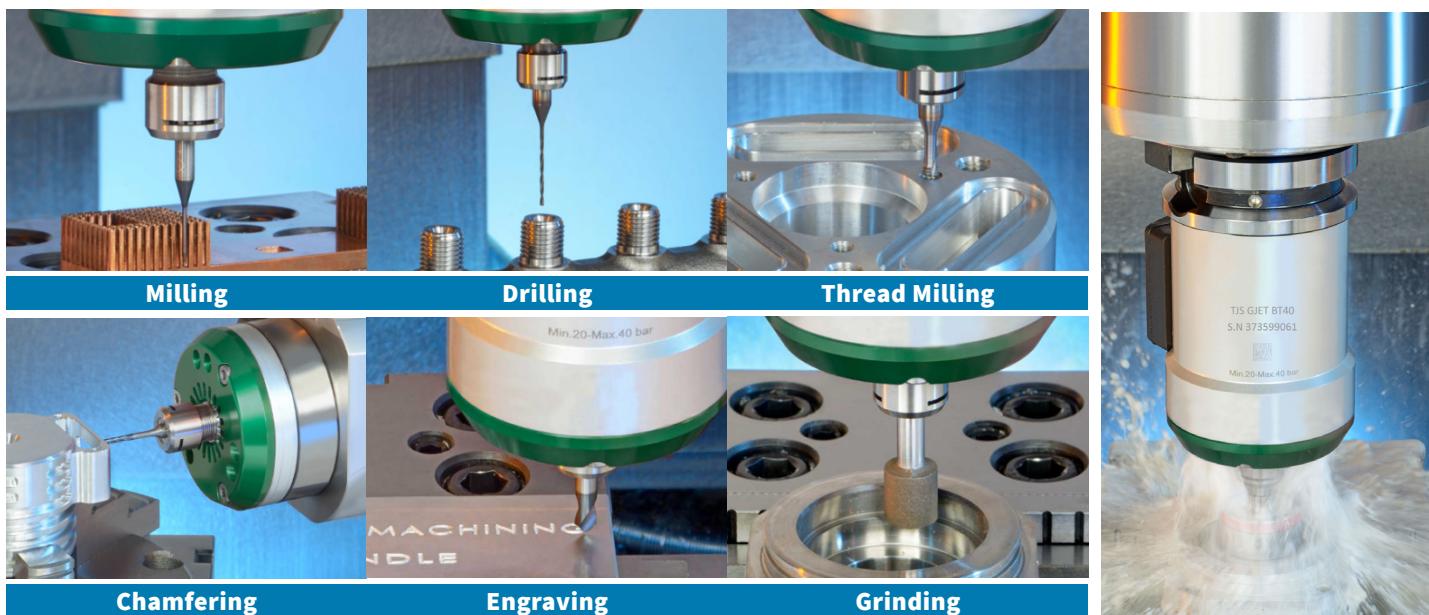
GJET - ideal for applications requiring micro tools and very high speeds at 20 to 40 bar.



### SPEED FOR MICRO TOOLS

JET SPINDLE OPERATING PARAMETERS				GJET		
High Pressure Coolant (BAR)	20	40	Terms of Use			
Min Coolant Inlet Diameter [mm]	6		Collet	ER11	AA/UP	
Min Flow Rate (L/min)	10	20	Runout	3 micron	At length of 3D	
Idle Speed (RPM)	33,000	55,000				
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	1 / 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		
ADAPTER	C5/6	CAT40	SK30/40	ER32/ST20	HSK-A40/A63	BT30/40

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





### POWER & EFFICIENCY

JET SPINDLE OPERATING PARAMETERS					HPC JET
High Pressure Coolant (BAR)	15	20	40	70	Terms of Use
Min Coolant Inlet Diameter [mm]	6 mm			Collet	ER11 AA/UP
Flow Rate (L/min)	10	12	16	22	Runout 3 micron
Idle Speed (RPM)	20,000	25,000	35,000	45,000	
Max Power (W) / Torque (Nmm)	196 / 100	261 / 134	460 / 293	694 / 444	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	
ADAPTER	C6	CAT 40	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

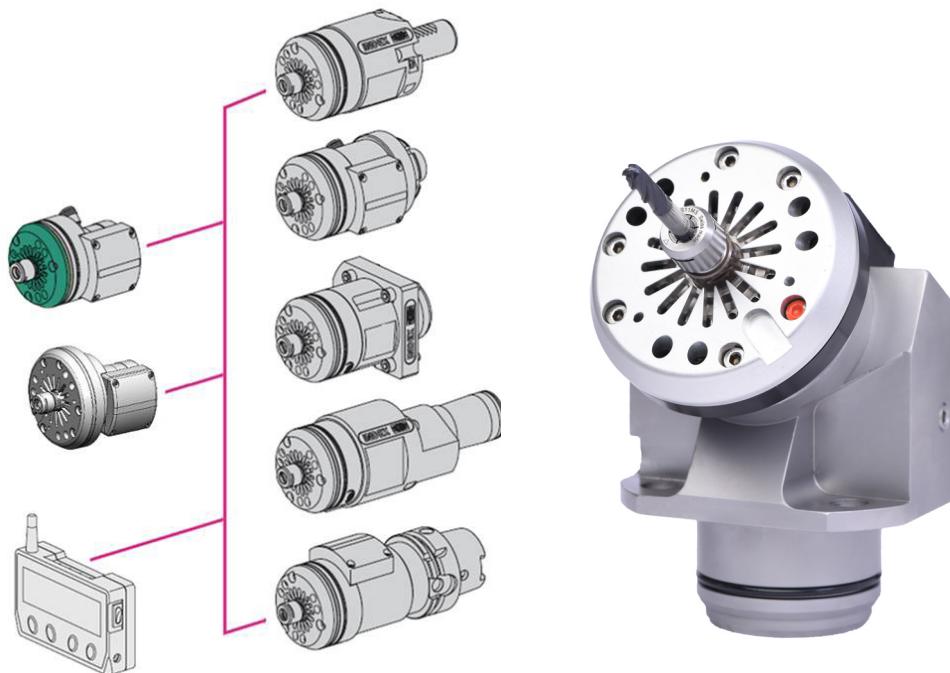




## JET GENERIC INTERFACE FOR NEW ASSEMBLIES

Spindle Operating Data	TR G-JET	TR HPC-JET
Operating range of coolant pressure [bar]	20 - 40	<b>15 - 70</b>
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**





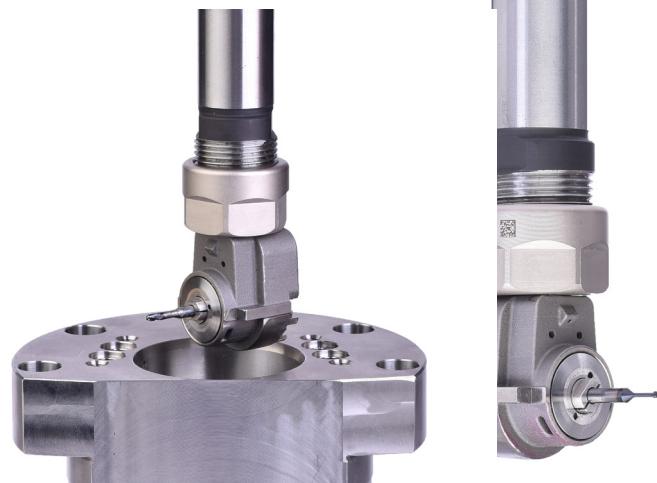
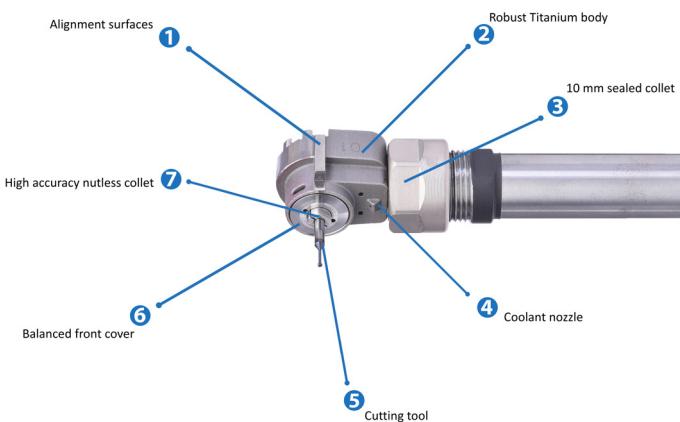
## SWISS TYPE MICRO JET SPINDLE

JET SPINDLE OPERATING PARAMETERS				MICRO90 JET
High Pressure Coolant (BAR)	20	40		Terms of Use
<b>Min Tube Diameter</b>		4 mm	Collect	1.6, 2.0, 3.0, 3.175 mm
<b>Min Flow Rate (L/min)</b>	10	20	Accessories	ST 20X100 ER16 / ER16 SEAL 10 AA
<b>Idle Speed (RPM)</b>	35,000	53,000	Warranty	
				<b>SMALL TOOL EXPERTISE REQUIRED</b>
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	

## APPLICATIONS

- Finishing & semi-finishing processes
- Small tools drilling and milling processes
- Special emphasis on the internal machining of parts
- Ideal for hard to reach places

Example of clamping with ER16

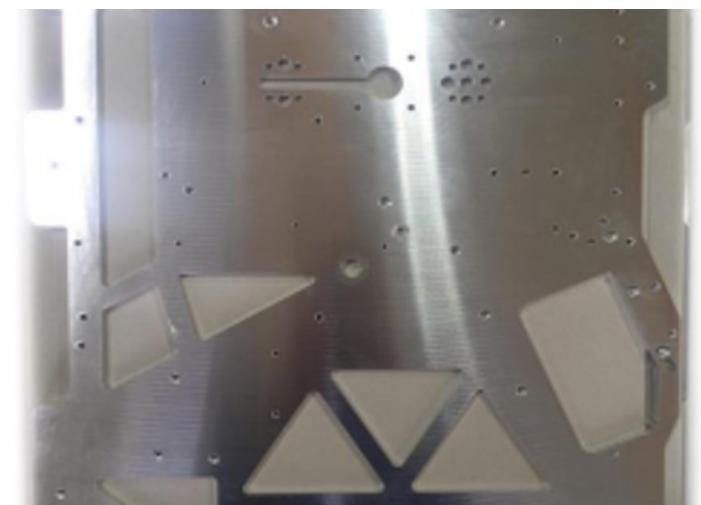


## HIGH SPEED MACHINED PARTS



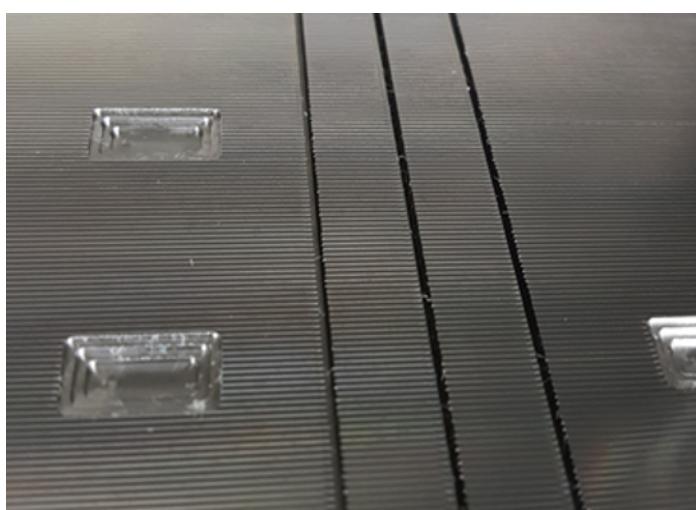
**HPC** Engraving & Chamfering

**GJET** Engraving



**HPC** Profiling

**GJET** Slot Milling & Drilling

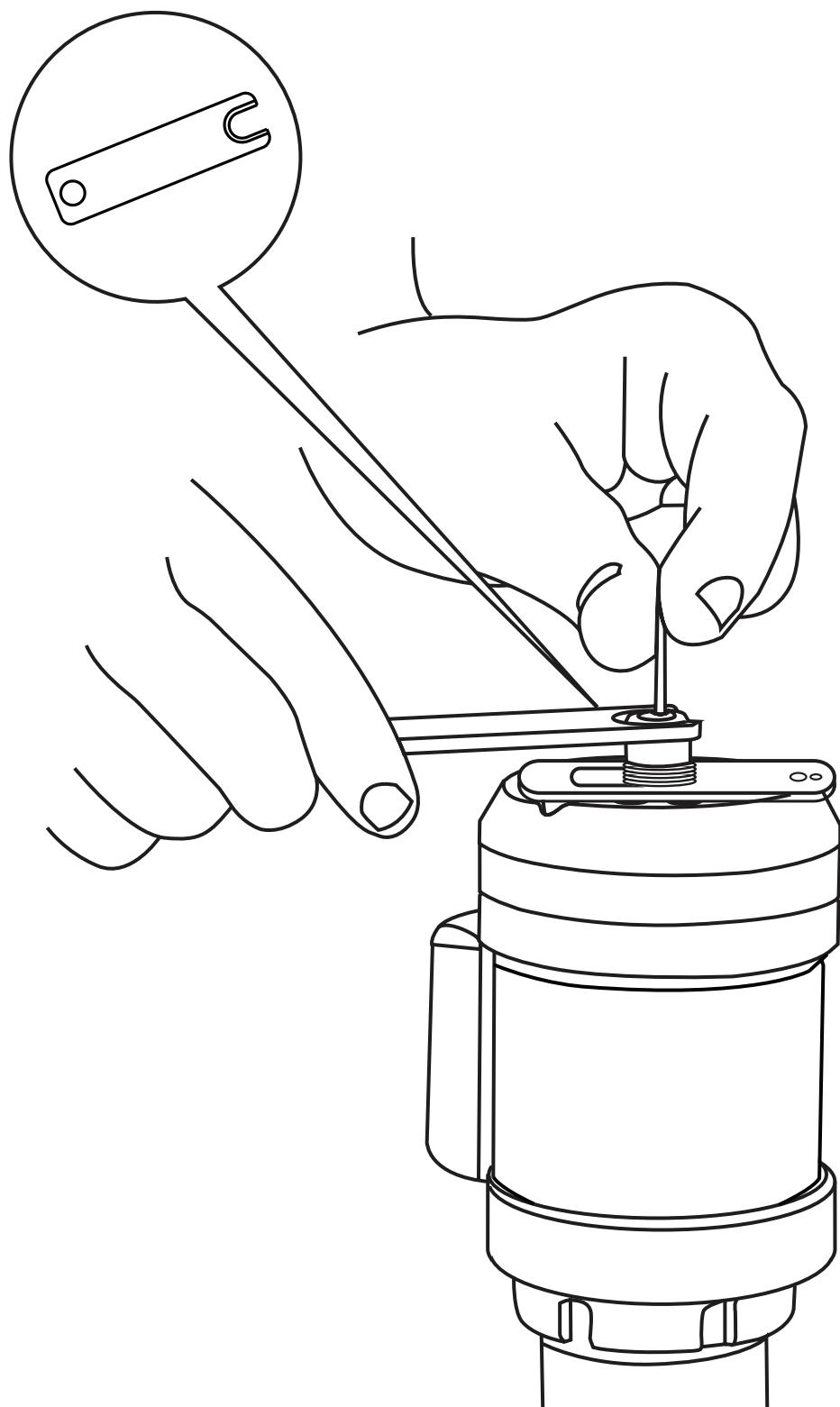


**HPC** Pocket, Slot & Plan Milling

**HPC** Slot & Helical Milling

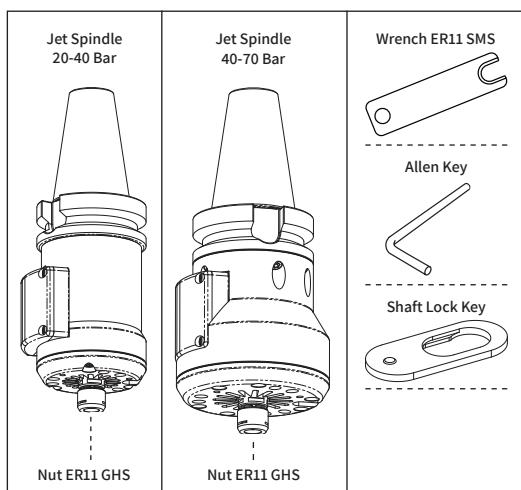
# HSM Jet Spindle

## Quick Start - Technical Guide



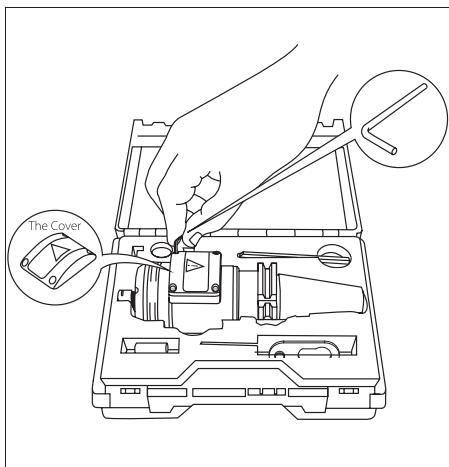
# HSM Jet Spindle | Quick Start

## Box Contents

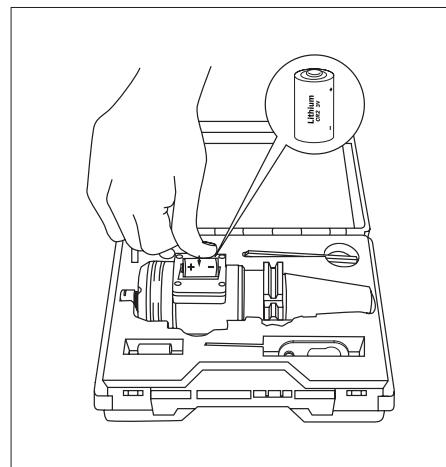


## 1. Insert Battery

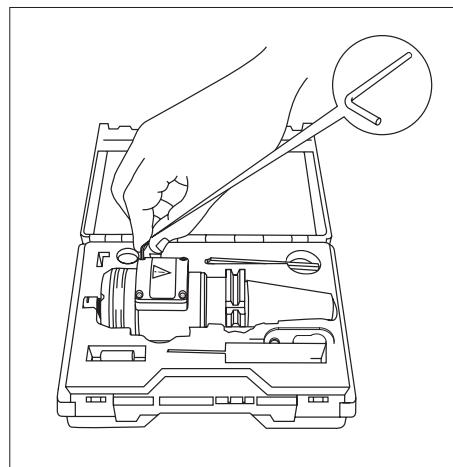
**1.A.** Open battery compartment by removing the 4 screws with the supplied allen key.



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



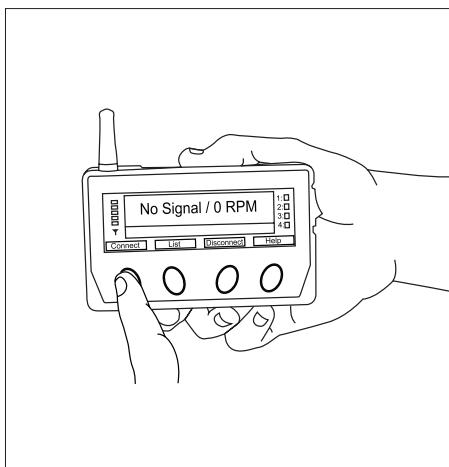
**1.C.** Replace screws to close the battery compartment.



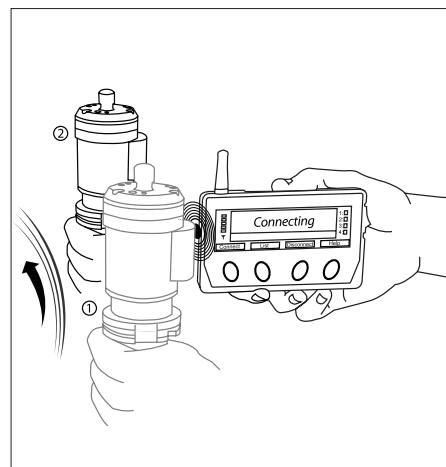
\*Immediately connect to the display in order to save the battery.

## 2. Connecting the Display

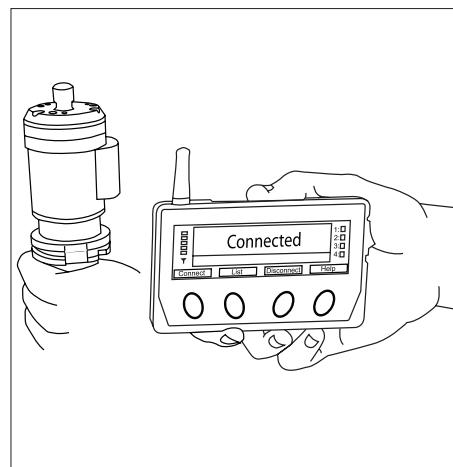
**2.A.** Connect the display to the external power and switch ON, then press the CONNECT button on the left.



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



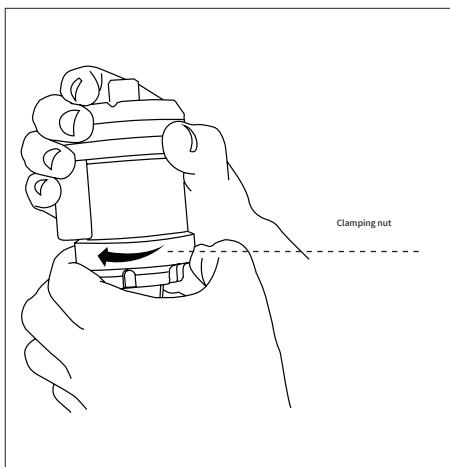
**2.C.** "Connected" indication will appear after successful connection to the spindle.



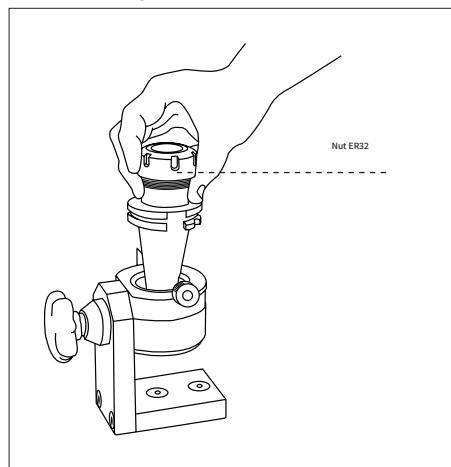
\*If side magnet does not make a connection, use magnets on the back of the display unit.

### **3. Clamping the Cutting Tool**

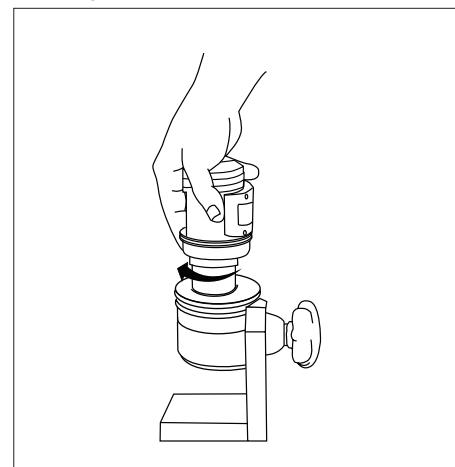
**3.A.** If using an ER32 built-in adaptor, loosen the clamping nut on the adaptor and turn 1.5 rotations counter clockwise.



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



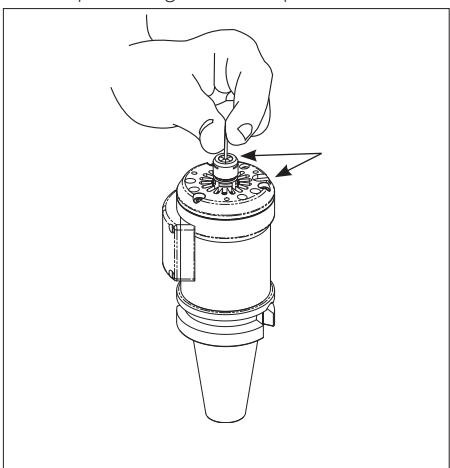
**3.C.** Set the ER32 built-in adaptor into the tool holder collet chuck and fasten the clamping nut.



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

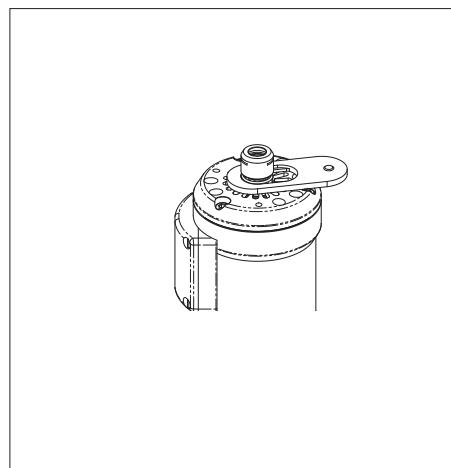
#### **3.D. First assemble the ER 11 AA collet and tool.**

Insert nut for tightening. Align flat sides of the shaft with the positioning slot on the spindle cover.

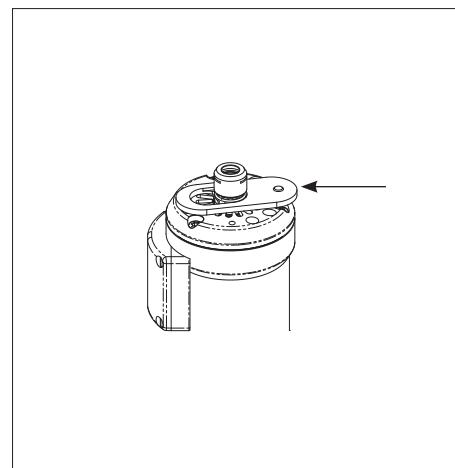


#### **3.E. Position shaft lock key over the nut.**

Raised button fits into the positioning slot underneath.

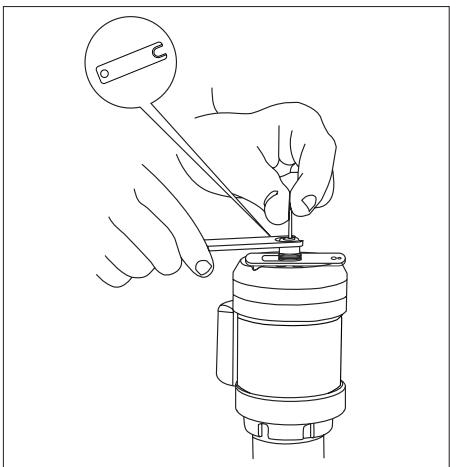


#### **3.F. Slide shaft lock key to secure it in place.**

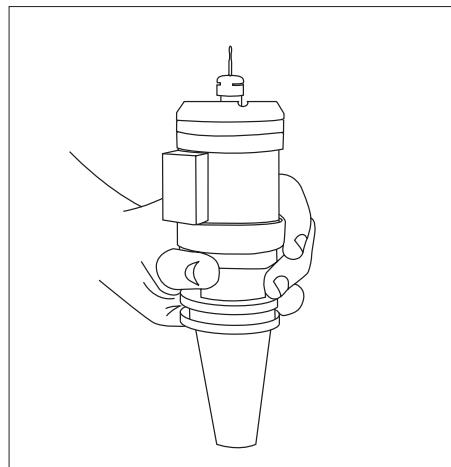


### **3. Clamping the Cutting Tool (continued)**

**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 counter-clockwise 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 with Jet Spindles

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

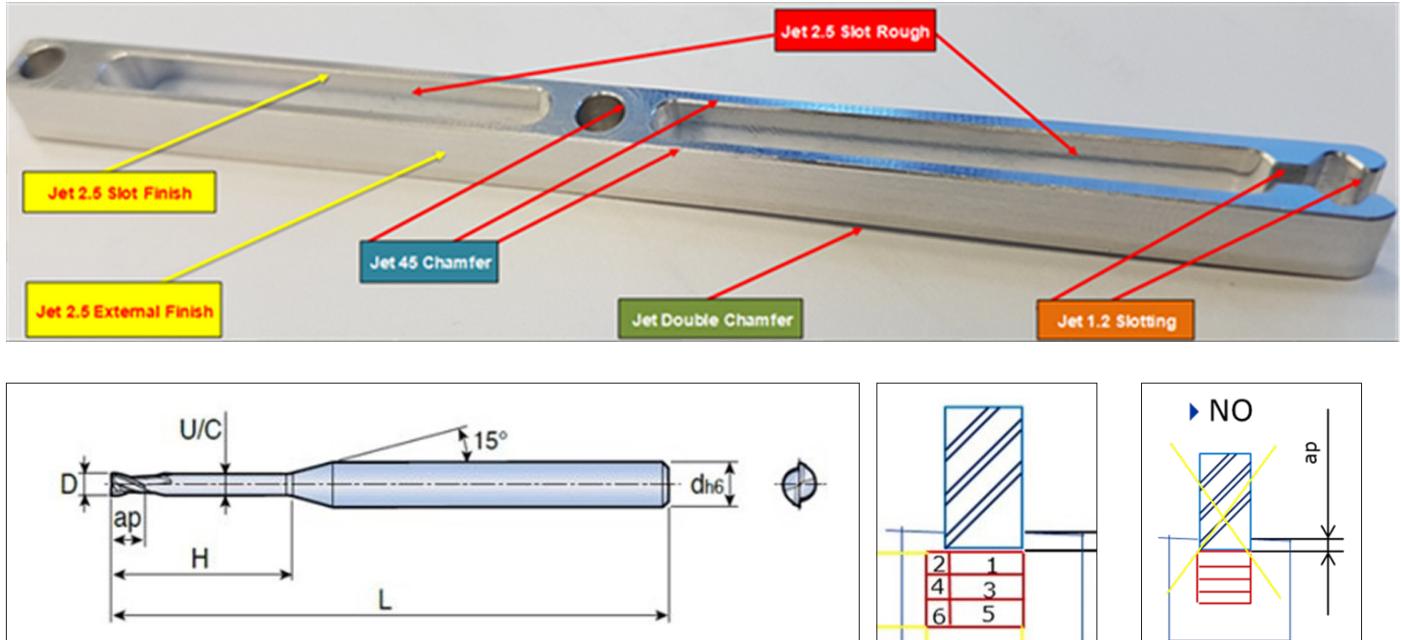
First step – slot mill with an Ae of 60% of the final slot diameter and an Ap of 30% of end-mill diameter

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

## Slot Milling with Jet Spindles – working method



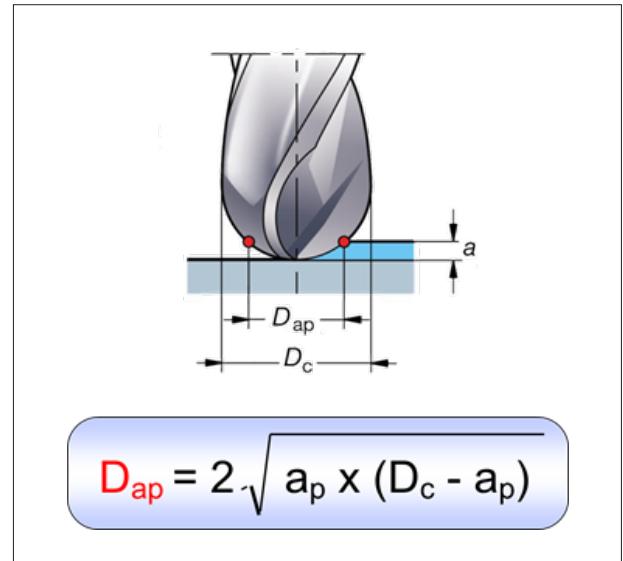
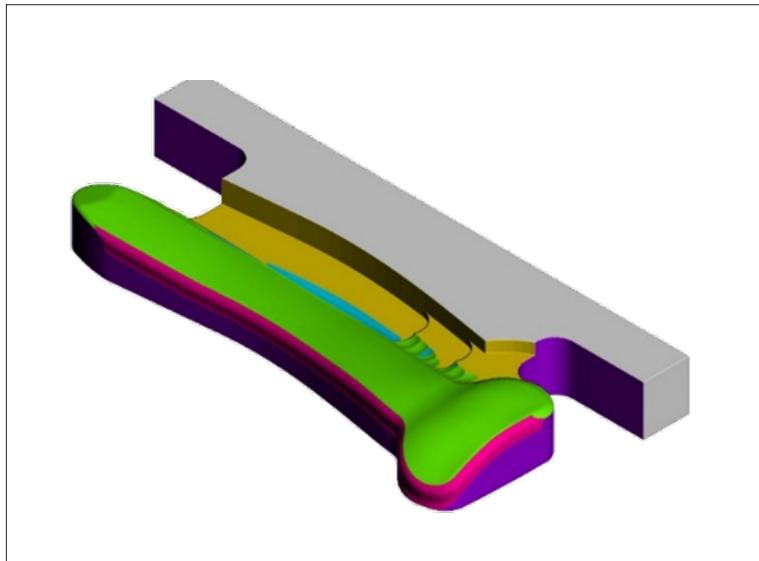
## Profile Milling Formula

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 with Jet Spindles

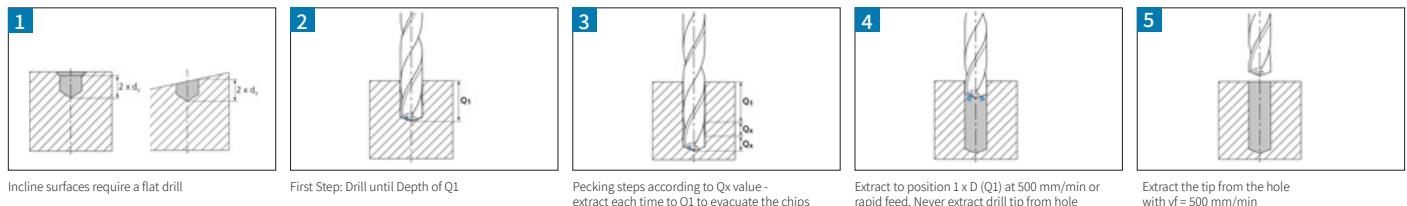
High Speed drill non-ferrous materials with a highly polished spiral tool.

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

Second step – drill until  $Q_1=D$  according to the  $F(z)$  from the "Jet Spindles Operating Data" tables, classified by: Tool diameter, Material, Speed.

Third step - peck drill with  $Q_x = A_p$  values from the Cutting conditions table. After each peck drill extract to position  $Q_1$  for chip evacuation.

### Drilling Process for Small Drills



## 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 ( $A_p$ ) and feed ( $F_z$ ) 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  $A_e$ ,  $A_p$ , 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.

**Forth 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  $A_p$  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)
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	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	0.08	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	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	0.020
			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	0.020
			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	0.022
			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	0.025
			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	0.025
			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	0.025
			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	0.025
			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	End-Mill	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
		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
				1		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
				1.5		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
				2		70	45000	1.50	0.10	0.006
		Profile Milling	Ball Nose	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
				4		15	22000	4.00	0.10	0.012
				4		20	25000	4.00	0.10	0.012
				4		40	35000	4.00	0.10	0.012
				4		70	45000	4.00	0.10	0.012
				4.5		15	22000	4.50	0.10	0.012
				4.5		20	25000	4.50	0.10	0.012
				4.5		40	35000	4.50	0.10	0.012
				4.5		70	45000	4.50	0.10	0.012
				5		15	22000	5.00	0.10	0.012
				5		20	25000	5.00	0.10	0.012
				5		40	35000	5.00	0.10	0.012
				5		70	45000	5.00	0.10	0.012
				6		15	22000	6.00	0.10	0.012
				6		20	25000	6.00	0.10	0.012
				6		40	35000	6.00	0.10	0.012
				6		70	45000	6.00	0.10	0.012

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
H SAE 1.2316	Profile Milling	Ball Nose	35 HRC	5		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
				1.5		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
				4.5		70	45,000	4.00	0.10	0.025
			End-Mill	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
				4.5		70	45,000	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
			Shoulder Mill	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

	Material	Process	Type	Cutting Tool dia.	Hardness	Pressure	Speed (n)	Ae (mm)	Ap (mm)	Fz (mm)
M SS 316	Drilling	Drill	180-250 HB	0.5		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	0.006
				1.5		70	45,000	1.50	0.10	0.006
				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)
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
		Ball Nose	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
		Profile Milling	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
	Slot Milling	End-Mill	3		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
	Shoulder Mill	End-Mill	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
			6		15	22,000	0.50	0.50	0.014
			6		20	25,000	0.50	0.50	0.014
			6		40	35,000	0.50	0.50	0.014
			1		70	45,000	0.50	0.50	0.014
		End-Mill	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
		End-Mill	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
		End-Mill	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
			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
			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)
AI-Si 9%	Drilling	Drill	0.3	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	
	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	
	Slot Milling	End-Mill	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	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	
	Shoulder Mill		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	
			5.5	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	
			6	40	55000	6.00	0.36	0.022	
			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)
SAE 1.2316	Drilling	Drill		0.3		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	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	35 HRC	20	33000	0.30	0.10	0.006
				0.3	35 HRC	30	44000	0.30	0.10	0.006
				0.3	35 HRC	40	55000	0.30	0.15	0.006
				0.5	35 HRC	20	33000	0.50	0.10	0.007
				0.5	35 HRC	30	44000	0.50	0.10	0.007
				0.5	35 HRC	40	55000	0.50	0.15	0.007
				0.8	35 HRC	20	33000	0.80	0.12	0.010
				0.8	35 HRC	30	44000	0.80	0.14	0.010
				0.8	35 HRC	40	55000	0.80	0.14	0.010
				1	35 HRC	20	33000	1.00	0.12	0.010
				1	35 HRC	30	44000	1.00	0.12	0.010
				1	35 HRC	40	55000	1.00	0.15	0.010
				1.5	35 HRC	20	33000	1.50	0.50	0.014
				1.5	35 HRC	30	44000	1.50	0.50	0.017
				1.5	35 HRC	40	55000	1.50	0.50	0.018
				2	35 HRC	20	33000	2.00	0.08	0.009
				2	35 HRC	30	44000	2.00	0.08	0.009
				2	35 HRC	40	55000	2.00	0.08	0.009
				2.5	35 HRC	20	33000	2.50	0.10	0.013
				2.5	35 HRC	30	44000	3.00	0.12	0.010
				2.5	35 HRC	40	55000	3.00	0.14	0.010
				3	35 HRC	20	33000	4.00	0.12	0.010
				3	35 HRC	30	44000	4.00	0.12	0.010
				3	35 HRC	40	55000	4.00	0.15	0.010
				4	35 HRC	20	33000	4.50	0.12	0.010
				4	35 HRC	30	44000	4.50	0.12	0.010
				4	35 HRC	40	55000	4.50	0.15	0.010
				4.5	35 HRC	20	33000	5.00	0.50	0.012
				4.5	35 HRC	30	44000	5.00	0.50	0.017
				4.5	35 HRC	40	55000	5.00	0.50	0.018
				5	35 HRC	20	33000	6.00	0.08	0.009
				5	35 HRC	30	44000	6.00	0.08	0.009
				5	35 HRC	40	55000	6.00	0.09	0.009
				0.5	35 HRC	20	33000	0.50	0.30	0.009
				0.5	35 HRC	30	44000	0.50	0.30	0.009
				0.5	35 HRC	40	55000	0.50	0.30	0.010
				0.5	35 HRC	20	33000	1.00	0.50	0.015
				0.5	35 HRC	30	44000	1.00	0.50	0.017
				0.5	35 HRC	40	55000	1.00	0.50	0.018
				1	35 HRC	20	33000	2.00	0.08	0.009
				1	35 HRC	30	44000	2.00	0.08	0.009
				1	35 HRC	40	55000	2.00	0.08	0.009
				2	35 HRC	20	33000	3.00	0.08	0.009
				2	35 HRC	30	44000	3.00	0.08	0.009
				2	35 HRC	40	55000	3.00	0.08	0.009
				3	35 HRC	20	33000	4.00	0.08	0.009
				3	35 HRC	30	44000	4.00	0.08	0.009
				3	35 HRC	40	55000	4.00	0.08	0.009
				4	35 HRC	20	33000	5.00	0.08	0.009
				4	35 HRC	30	44000	5.00	0.08	0.009
				4	35 HRC	40	55000	5.00	0.08	0.009
				5	35 HRC	20	33000	6.00	0.10	0.015
				5	35 HRC	30	44000	6.00	0.10	0.017
				5	35 HRC	40	55000	6.00	0.10	0.018
				6	35 HRC	20	33000	6.00	0.10	0.018
				6	35 HRC	30	44000	6.00	0.10	0.018
				6	35 HRC	40	55000	6.00	0.10	0

	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	Ball Nose	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
				1.5		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
				6		20	33000	0.50	0.10	0.008
				0.5	Slot Milling	30	44000	0.50	0.10	0.008
				0.5		40	55000	0.50	0.10	0.008
				0.5		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
				2.5		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
				6		20	33000	0.50	0.10	0.014
				1	Shoulder Mill	30	44000	0.50	0.10	0.014
				1		40	55000	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



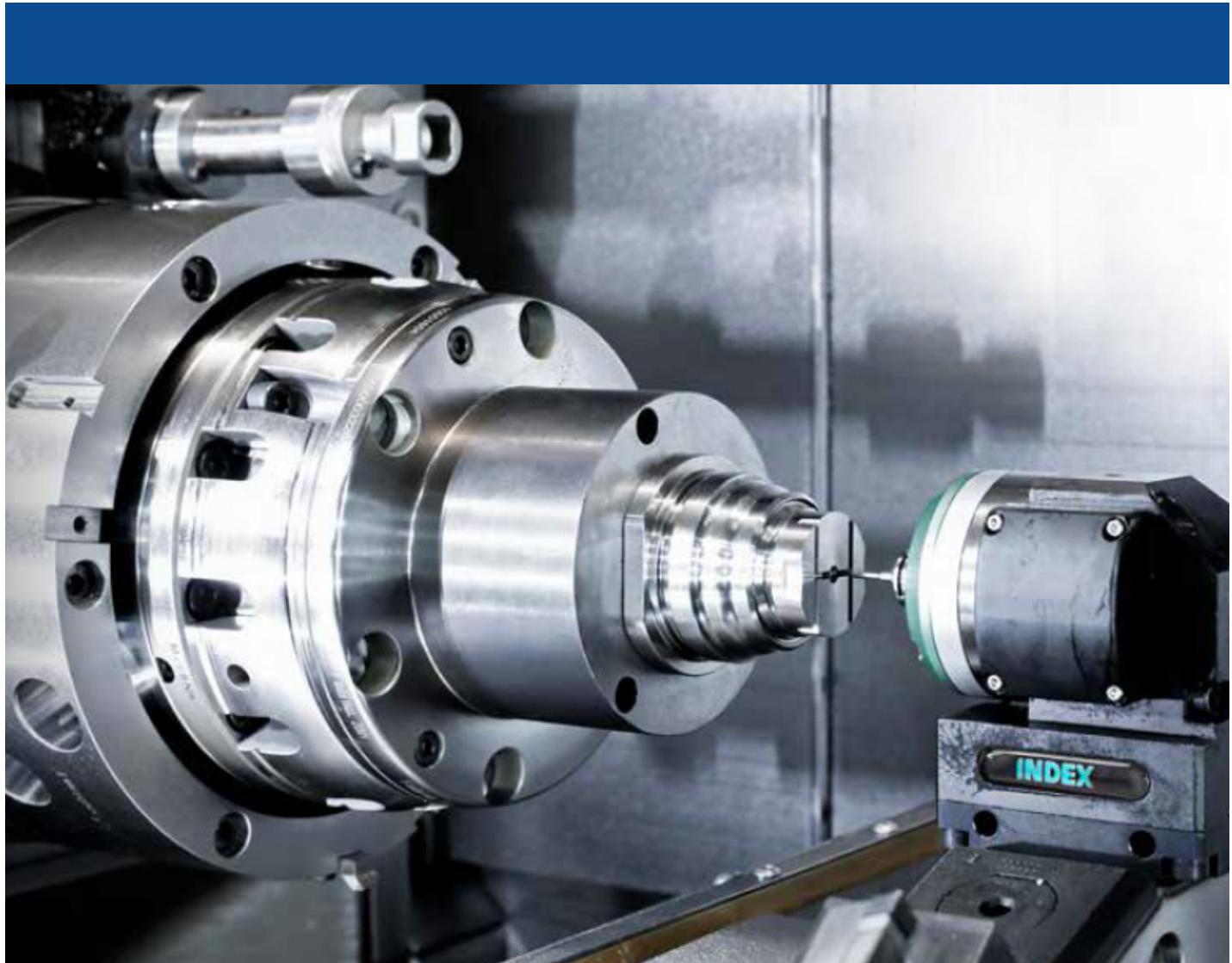
- 4 Use a dial indicator to align the spindle housing on the ground edge



- 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
		Profile Milling	Ball Nose	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	0.08	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
		Slot Milling	Endmill	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
		Shoulder Mill	Endmill	2.00		30	44,000	2.00	0.20	0.025
				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
		Drilling	Drill	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
		Profile Milling	Ball Nose	2.00		20	35,000	0.05	0.05	0.003
				2.00		30	44,000	0.05	0.05	0.003
				2.00		40	53,000	0.05	0.05	0.003
				3.00		20	35,000	0.08	0.08	0.004
				3.00		30	44,000	0.08	0.08	0.004
				3.00		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
M	SS 316	Slot Milling	End-Mill	0.50	35 HRC	20	35,000	0.05	0.05	0.002
				0.50		30	44,000	0.05	0.05	0.002
				0.50		40	53,000	0.05	0.05	0.002
				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	0.15	0.006
				2.00		20	35,000	2.00	0.12	0.010
				2.00		30	44,000	2.00	0.14	0.010
		Slot Milling	End-Mill	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
				3.00		20	35,000	0.50	0.50	0.010
				3.00		30	44,000	0.50	0.50	0.010
				3.00		40	53,000	0.50	0.50	0.010
				2.00		20	35,000	0.50	0.08	0.009
		Shoulder Mill	End-Mill	2.00		30	44,000	0.50	0.08	0.009
				2.00		40	53,000	0.50	0.09	0.009
				1.00		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
		Drilling	Drill	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
		Shoulder Mill	End-Mill	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

