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JET SPINDLE

Case Study Summaries



Coolant-driven high speed Jet Spindle in comparison to CNC machine spindle for various applications and industrial sectors.



TJS-CS01-07-2017 STRANOICREATE



WELCOME TO THE WORLD OF HIGH-SPEED INNOVATION

Established in 2003, Colibri Spindles Ltd. has taken a leading position as a global high-speed spindle solutions provider, with the patented coolant-driven HSM Jet Spindle technology.

In order to address market needs for reductions in production times within demanding industries such as automotive, aerospace, die & mold, energy and others, machine tool manufacturers must be geared up to provide more productivity-based and efficiency-based solutions.

The introduction of the enhanced speed and feed capabilities of the unique coolant-driven HSM Jet Spindle, has helped to satisfy ever-growing demands for increased tool life, higher production rates and lower costs.

Colibri's R&D team is continuously developing new and upgraded Jet Spindle models, tools and accessories; representing very real technical advancements for a wide variety of applications. Colibri's products and processes are stridently tested and validated.

THE HSM JET SPINDLE TEST CASE SUMMARIES represent key industries such as Automotive, Aerospace, Die & Mold, Energy and many others, that have greatly benefited from utilizing this innovative coolant-driven high speed spindle for numerous high speed machining applications.



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DIE & MOLD

TEST SUMMARY – PROFILE MILLING

The customer needed to increase productivity and save time.
Colibri's TJS 20K-DIN69871-40 Jet Spindle model



Cutting Time/Part (hrs)

Machine Spindle



HSM Jet Spindle



56.9%

Cost Savings Per Part

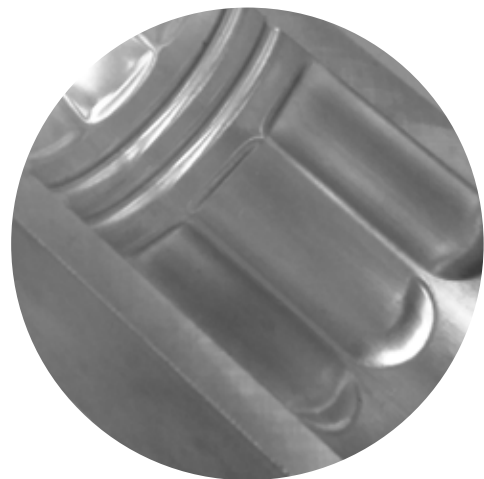
POSITIVE RESULTS:

Productivity savings of 44%

Cost per-part savings 56.9%

Test Date	2015
Country	Australia
Industry	Die & Mold
Application	Profile Milling
Material Group	21 - Aluminum wrought alloy

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	EC 020-B07-2C03 IC08	
Diameter (mm)	2	2
No. of Flutes	2	2
Cutting Speed (m/min)	94	220
Spindle Speed (rpm)	14,961	35,014
Depth of Cut (mm)	0.5	0.5
Width of Cut (mm)	0.8	0.8
Feed Per Tooth (mm/t)	0.0167	0.0167
Table Feed (mm/min)	500	1,169
Parts Per Cutter	300	300
Avg. Chip Thickness	0.01	0.01
Surface Quality	Excellent	Excellent
Metal Removal Rate	0.2	0.47



DIE & MOLD

TEST REPORT SUMMARY – ENGRAVING

The customer needed to improve poor tool performance and speed up machining time.
Colibri's TJS 30K-ER32 Jet Spindle model

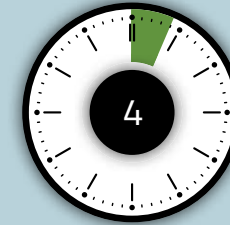


Cutting Time/Part (min)

Machine Spindle



HSM Jet Spindle



12 Times Faster

Productivity of Cycle Time

POSITIVE RESULTS:

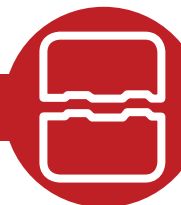
Machining time savings 98%

Tool-life extended 3 times

Test Date	2014
Country	India
Industry	Die & Mold
Application	Engraving – Logo Punch
Material Group	Hardened Steel 65 HRC
Material No.	H13 65HRC

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	ECD-S2 040/90C04-50 TT9030 (90 Deg. Chamfering)	
Diameter (mm)	4	4
No. of Flutes	2	2
Cutting Speed (m/min)	17	66
Spindle Speed (rpm)	8,000	30,000
Depth of Cut (mm)	0.35	0.35
Width of Cut (mm)	0.70	0.70
Feed per Tooth (mm/t)	0.005	0.005
Table Feed (mm/min)	80	300
Surface Quality	Poor	Good
Metal Removal Rate (cm3/min)	0.66	1.44
Metal Removal Rate	0.2	0.47





TEST SUMMARY – MILLING (3 TESTS)

The customer wanted to stop tool breakage, improve surface quality and cut machining time.

Colibri's TJS 30K-ER32-R Jet Spindle model



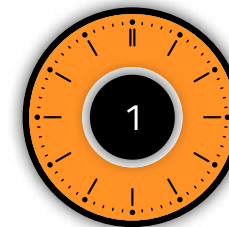
Test Date	October 2014
Country	Czech Rep.
Industry	Automotive
Application	Milling
Material Group	Headlight Mold
Material No.	1.2343, 46HRC

Solid Carbide End Mill	Cutting Conditions	Machine Spindle	HSM Jet Spindle
EB-A2-020-030/04C4M45 IC903	Cutting speed:	56	188 m/min
	Revolutions:	9,000 RPM	30,000 RPM
	Depth of cut:	0,1 mm	0,1 mm
	Width of cut:	0,1 mm	0,1 mm
	Feed per tooth:	0,02 mm/tooth	0,02 mm/tooth
	Table feed:	360 mm/min	1 200 mm/min
	Overhang:	4 x D	4 x D
EB-A2-010-015/03C4M45 IC903	Time machining:	175 min	55 min
	Cutting speed:	28	125 -140
	Revolutions:	9,000 RPM	40,000 – 45,000
	Depth of cut:	0,05	0,05
	Width of cut:	0,05	0,05
	Feed per tooth:	0.014	0.014
	Table feed:	252	1,120 -1,260
EB-A2-005-007/02C4M45 IC903	Overhang:	3 x D	3 x D
	Time machining:	1,670	350
	Cutting speed:	14	75
	Revolutions:	9,000 RPM	48,000
	Depth of cut:	0,02	0,02
	Width of cut:	0,02	0,02
	Feed per tooth:	0.008	0.008
	Table feed:	144	768
	Overhang: 4 x D	4 x D	4 x D
	Time machining:	1,110	210

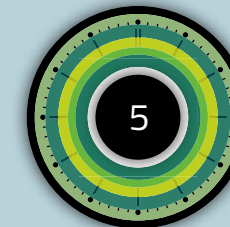


Cutting Time/Part (hrs)

Machine Spindle



HSM Jet Spindle



5 Times

Productivity Increase

POSITIVE RESULTS:

ROI after two machined molds | Productivity increased 5 times

Results (3 tests)

- All three end mills endured complete machining without any problems.
- In this case there is no load of the spindle and milling tool can work at optimized conditions.
- The customer can use only 9,000 RPM during current machining.
- The cutting speed is reduced to only 56 to 14 m/min at diameter 0,5 mm.
- The result is, that time machining is 5 times longer than with using of JET SPINDLE device.
- Not using the JET SPINDLE lead to worse surface quality and low extreme conditions for tools. The broken tools also contribute to poor conditions.

Estimated saved time is together about 39 hours per one mold. ROI after 2 machined molds. Other saving occurred in the consumption of tools thanks to the optimized cutting conditions.



DIE & MOLD

TEST SUMMARY – PROFILE MILLING – 2 OPERATIONS

The customer needed to save time machining electrodes.
Colibri's TJS 30K-ST20 Jet Spindle model



Total Machining Time (min) per part

Machine Spindle



HSM Jet Spindle



57.4%

Time savings per part

POSITIVE RESULTS:

Time savings per part 57.4%

Test Date	2013
Country	Israel
Industry	Die & Mold
Application	Profile Milling
Material Group	Copper C11000ASTMB 152/2009

Operation Test Data	Semi Finishing		Finishing	
	Machine Spindle	Jet Spindle	Machine Spindle	Jet Spindle
Cutting Tool	Ball Nose		Ball Nose	
Diameter (mm)	2.0		1.0	
No. of Teeth	2		2	
Spindle Speed (rpm)	10,000	29,000	11,000	30,000
Cutting Speed (VC M/min)	63	183	35	95
Depth of Cut (mm)	0.08		0.04	
Width of Cut (mm)	0.08		0.04	
Run Out (micron)	7	5	6	4
Feed Per Tooth fz (mm/t)	0.05	0.045	0.027	0.025
Table Feed f (mm/min)	1,000	2,600	600	1,500
Machining Time (min) per part	17	10	30	10
Total Machining Time (min) per part	47		20	



AUTOMOTIVE

TEST SUMMARY – SLOT MILLING

The customer needed to increase tool life and save time machining complex tire molds.
Colibri's TJS 30K-HSK-A63 Jet Spindle model



Cutting Time/Part (min)

Machine Spindle



HSM Jet Spindle



40%

Cutting time Savings Per Part

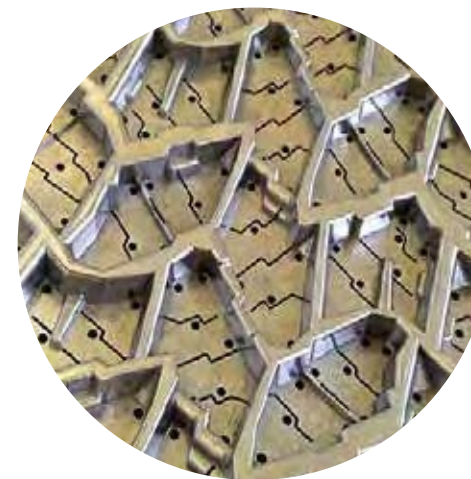
POSITIVE RESULTS:

Tool life increased 66%

Cutting time savings 40% (3 hours per part)

Test Date	2017
Country	Slovakia
Industry	Automotive
Application	Slot Milling
Material Group	Alu AW5083 or ST 52-3 20-15 HRC

Operation Test Data	Rough / Finish	
	Machine Spindle	Jet Spindle
Cutting Tool (D mm)	0.5	0.5
Tool Overhang	35	35
No. of Teeth	2	2
Spindle Speed (rpm)	12,000	57,000
Cutting Speed (VC M/min)	63	183
Depth of Cut (mm)	0.2	0.2
Width of Cut (mm)	0.5	0.5
Tool Cutting Diameter (D mm)	0.5-0.8	0.5-0.8
Run Out (micron)	7	4
Feed Per Tooth fz (mm/t)	0.007	0.007
Feed Revolution fn (mm/r)	0.013	0.013
Table Feed f (mm/min)	350	750
Surface Finish	Good	Good
Results	Machine Spindle	Jet Spindle
Tool Life (per cavity)	3	1
Cutting Time (min)	450	270





AUTOMOTIVE

TEST SUMMARY - COPY MILLING

The customer wanted to increase productivity and save machining time.
Colibri's TJS 30K ST20R Jet Spindle model



Cutting Time/Part (sec)

Machine Spindle



HSM Jet Spindle



27.1%

Cost Savings Per Part

POSITIVE RESULTS:
Cutting time savings 28%
Cost per-part savings 27.1%

Test Date	Mar, 2016
Country	Germany
Industry	Automotive
Application	Copy Milling with Ball nose tool
Material Group	Non-alloy steel and cast steel, free-cutting steel
Material No.	DIN ST 52-3

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	M5782140 R1D2.0	
Diameter (mm)	2	2
No. of Flutes	2	2
Overhang (mm)	100	120
Cutting Speed (m/min)	69	188
Spindle Speed (rpm)	10.982	29.921
Depth of Cut (mm)	0.2	0.2
Width of Cut (mm)	0.5	0.5
Feed per Tooth (mm/t)	0.0818	0.0417
Table Feed (mm/min)	1.797	2.495
Surface Quality	Good	Good
Avg. Chip Thickness (mm)	0.04	0.02
Metal Removal Rate (cm3/min)	0.18	0.25



AEROSPACE

TEST SUMMARY – SHOULDER MILLING

The customer wanted to increase productivity and improve surface quality of the part.
Colibri's TJS 30K-HSK-A63 Jet Spindle model



Cutting Time (hrs.)

Machine Spindle



HSM Jet Spindle



45%

Cost Savings Per Part

POSITIVE RESULTS:
Customer satisfaction
Cutting time savings 45%

Test Date	March, 2015
Country	Germany
Industry	Aerospace
Application	Shoulder Milling
Material Group	DIN Aluminum

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	VHM D1mm	
Diameter (mm)	1	1
No. of Flutes	3	3
Overhang	100	100
Cutting Speed (m/min)	57	126
Spindle Speed (rpm)	18,144	40,107
Depth of Cut (mm)	0.3	0.3
Width of Cut (mm)	0.75	0.75
Feed Per Tooth (mm/t)	0.005	0.005
Table Feed (mm/min)	272	602
No. of Passes	107	107
Chip Type	Fragments	Fragments
Surface Quality	Good	Good
Metal removal Rate	0.06	0.14





ENERGY

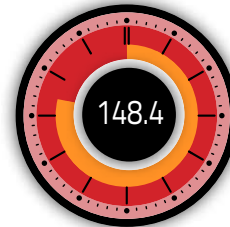
TEST SUMMARY – FACE MILLING

The customer needed to save machining time and to produce a better finish.
Colibri's TJS 30K-ST20-R Jet Spindle model



Cutting Time (hrs.)

Machine Spindle



HSM Jet Spindle



89.5%

Cost Savings Per Part

POSITIVE RESULTS:

Cost per-part savings 89.5%

Productivity savings 69%

Test Date	Oct, 2015
Country	Australia
Industry	Energy Sector
Application	Face Milling
Material Group	Low alloy steel and cast steel
Material No.	AISI/SAE 1045

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	Iscar: EB040A07-2C04	
Diameter (mm)	4	4
No. of Flutes	2	2
Overhang (mm)	20	20
Cutting Speed (m/min)	38	440
Spindle Speed (rpm)	3,024	35,014
Depth of Cut (mm)	0.1	0.1
Width of Cut (mm)	0.5	0.5
Feed Per Tooth (mm/t)	0.033	0.0286
Table Feed (mm/min)	200	2,003
Parts Per Cutter	12	12
Surface Quality	Good	Good
Metal removal Rate	0.01	0.1



ENERGY

TEST SUMMARY – GROOVE MILLING

The customer needed shorter cycle time, prolonged tool life and better surface quality.
Colibri's TJS20K-ER32-R Jet Spindle model



Cutting Time (hrs.)

Machine Spindle



HSM Jet Spindle



68%

Cost Savings Per Part

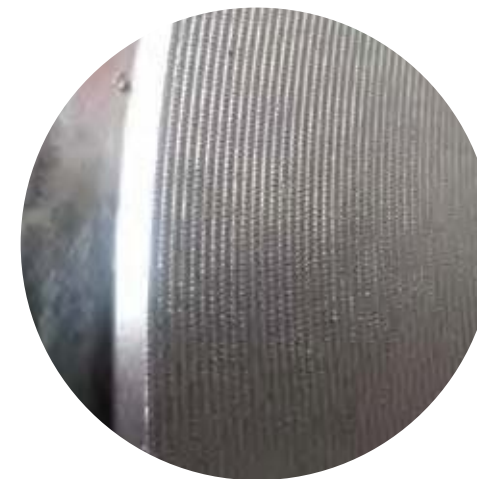
POSITIVE RESULTS:

Customer satisfaction

Cost per-part savings 68%

Test Date	DEC-2015
Country	France
Industry	Energy Sector
Application	Groove Milling: Pump casing flange
Material Group	CI + Chrome, Duplex SS
Material No.	HRC < 45HRC

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	Ball Nose End Mill	
Diameter (mm)	3	3
Cutting Speed (m/min)	33 (108 sfm)	188 (617 sfm)
Spindle Speed (rpm)	3,500	20,000
Feed Per Tooth (mm/t)	0.26 (0.01 ipt)	0.15 (0.006 ipt)
Table Feed (mm/min)	1,820 (71.65 ipm)	6,000 (232.22 ipm)





TEST SUMMARY

SLOTTING & SHOULDER MILLING – 6 OPERATIONS

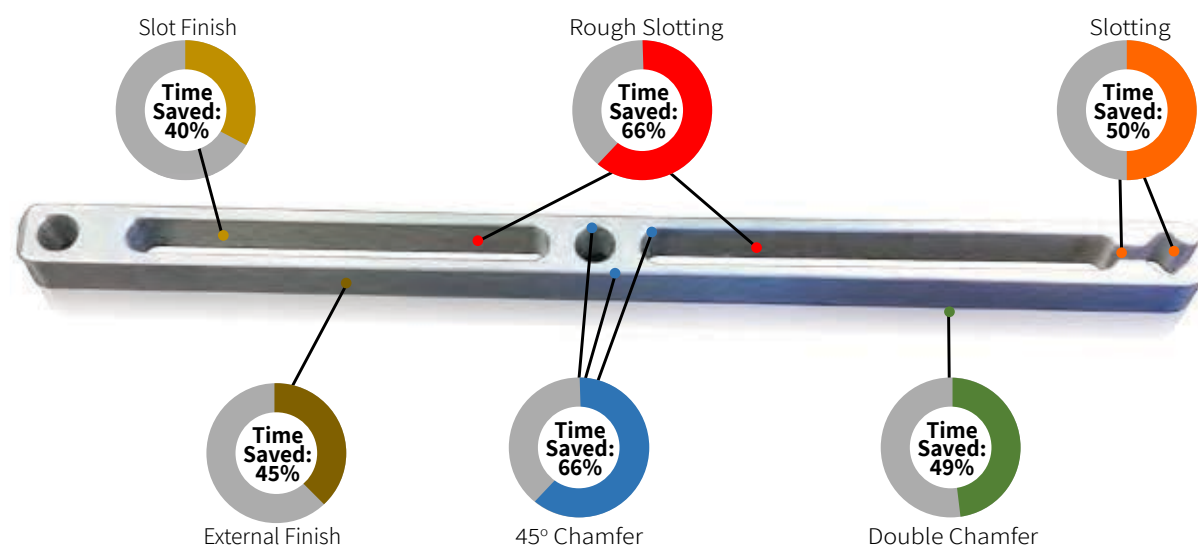
The customer needed to save time machining a precision dental implant placement tool. Colibri's TJS-HPC (High Pressure) and TJS 20K, 30K, 40K-ER32 Jet Spindle models



Test Date	2017
Country	Israel
Industry	Medical Device
Application	Slotting/Shouldering
Material Group	Aluminum 7075 15-20HRC



Operation	1. Rough Slotting		2. Slotting	
Test Data	Machine Spindle	HPC Jet Spindle	Machine Spindle	Jet Spindle 30K
Cutting Tool [mm]	End-Mill 2.5		End-Mill 1.2	
Overhang	30		15	
Run-out [μm]	5	3	5	3
No. of teeth - Z	3		2	
Depth of cut - ap [mm]	0.43		0.43	
Cutting width - ae [mm]	2.5		1.2	
Spindle RPM - n [in material]	10,000	30,000	10,000	48,000
Cutting Speed - Vc [M/min]	1,230	3,690	560	2,688
Feed per tooth - fz [mm/tooth]	0.041		0.028	
Feed / Revolution - fn [mm/rev]	0.123		0.056	
Feed - F [mm/min]	500	2,500	800	2,700
Parts (pcs)	600		600	
Operation	Rough / Finish		Rough / Finish	
Surface Finish	Good		Good	
Results	Machine Spindle	Jet Spindle	Machine Spindle	Jet Spindle
Cutting Time (sec)	180	60	420	210
Cutting Time Reduced (%)		66%		50%



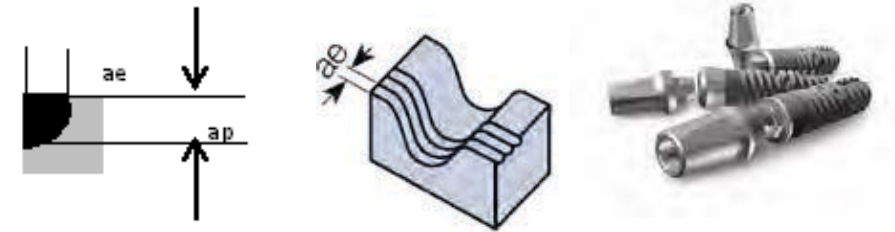


MEDICAL

TEST SUMMARY – PROFILE MILLING – 2 OPERATIONS

The customer needed to save time and increase tool life for semi-finishing and finishing of dental implants.

Colibri's TJS 30K-ER32 Jet Spindle model.



POSITIVE RESULTS:

Machining Time Reduction (per part): 66%

Increased Tool Life: 75%

Test Date	2017
Country	Israel
Industry	Medical Device
Application	Profiling
Material Group	Titanium 34HRC

Operation	3. Double Chamfer		4. 45° Chamfer	
Test Data	Machine Spindle	Jet Spindle 40K	Machine Spindle	Jet Spindle 20K
Cutting Tool [mm]	Double Chamfer 3.0		45° Chamfer 6.0	
Overhang	8		15	
Run-out [μm]	5	3	4	2
No. of teeth - Z	3		3	
Depth of cut - ap [mm]	0.2		0.2	
Cutting width - ae [mm]	0.2		0.2	
Spindle RPM - n [in material]	10,000	55,000	10,000	36,000
Cutting Speed - Vc [M/min]	1,200	6,600	1,800	6,480
Feed per tooth - fz [mm/tooth]	0.04		0.06	
Feed / Revolution - fn [mm/rev]	0.12		0.18	
Feed - F [mm/min]	2,000	6,600	2,000	3,600
Parts (pcs)	600		600	
Operation	Rough / Finish		Finish	
Surface Finish	Good		Good	
Results	Machine Spindle	Jet Spindle	Machine Spindle	Jet Spindle
Cutting Time (sec)	240	120	180	60
Cutting Time Reduced (%)		49%		66%

Operation	5. External Finish		6. Slot Finish	
Test Data	Machine Spindle	Jet Spindle 40K	Machine Spindle	Jet Spindle 40K
Cutting Tool	End-Mill 5.0	End-Mill 2.5	End-Mill 2.5	End-Mill 2.5
Overhang	15		15	
Run-out [μm]	5	2	4	2
No. of teeth - Z	3		3	
Depth of cut - ap [mm]	7	7	0.2	7
Cutting width - ae [mm]	0.2	0.1	0.2	0.1
Spindle RPM - n [in material]	8,000	55,000	10,000	55,000
Cutting Speed - Vc [M/min]	1,200	4,620	1,800	4,620
Feed per tooth - fz [mm/tooth]	0.05	0.028	0.06	0.028
Feed / Revolution - fn [mm/rev]	0.15	0.084	0.18	0.084
Feed - F [mm/min]	1,200	2,500	2,000	2,500
Parts (pcs)	600		600	
Operation	Finish		Finish	
Surface Finish	Good		Good	
Results	Machine Spindle	Jet Spindle	Machine Spindle	Jet Spindle
Cutting Time (sec)	100	55	90	54
Cutting Time Reduced (%)		45%		40%

Operation	Semi Finishing		Finishing	
Test Data	Machine Spindle	Jet Spindle	Machine Spindle	Jet Spindle
Cutting Tool [D mm]	Helix Ball Nose 3.0		Helix Ball Nose 3.0	
Overhang	18		18	
Run-out [μm]	7	6	6	5
No. of teeth - Z	2		2	
Depth of cut - ap [mm]	0.03		0.03	
Cutting width - ae [mm]	0.05		0.05	
Spindle RPM - n [in material]	10,000	25,000	10,000	25,000
Cutting Speed - Vc [M/min]	94	236	25	80
Feed per tooth - fz [mm/tooth]	0.03		0.03	
Feed / Revolution - fn [mm/rev]	0.123		0.056	
Feed - F [mm/min]	600	1,700	600	1,700
Parts per tool	72	288	96	384
Machining time [Min] per part	3	1	5	2
Surface Finish	Good		Good	



GENERAL INDUSTRY

TEST SUMMARY - COPY MILLING

The customer wanted to speed up machining processes for a better bottom line.
Colibri's TJS 20K-HSK A63 Jet Spindle model

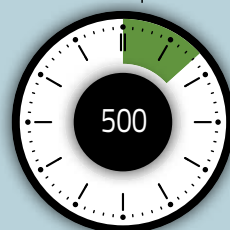


Cutting Time (sec)

Machine Spindle



HSM Jet Spindle



18.8%

Cost Savings Per Part

POSITIVE RESULTS:

Productivity savings of 41%

Cost per-part savings of 18.8%

Test Date	Dec, 2015
Country	Germany
Industry	General machining
Application	Copy milling
Material Group	Aluminum - wrought alloy
Material No.	DIN AlZnMgCu0,5

Test Data	Machine Spindle	HSM Jet Spindle
1084.150018.8	Iscar: EC-A2 020-030/12C4M45903	
Diameter (mm)	2	2
No. of Flutes	2	2
Overhang (mm)	12	12
Cutting Speed (m/min)	107	232
Spindle Speed (rpm)	17,030	36,924
Depth of Cut (mm)	0.5	0.5
Width of Cut (mm)	1.5	1.5
Feed per Tooth (mm/t)	0.026	0.026
Table Feed (mm/min)	886	1,920
Surface Quality	Good	Good
Metal Removal Rate (cm3/min)	0.66	1.44



GENERAL INDUSTRY

TEST SUMMARY – DRILLING

Customer needed to increase productivity for large volume drilling operations.
Colibri's TJS 20K-ER32-R Jet Spindle model

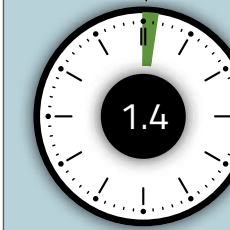


Cutting Time (hrs.)

Machine Spindle



HSM Jet Spindle



22.4%

Cost Savings Per Part

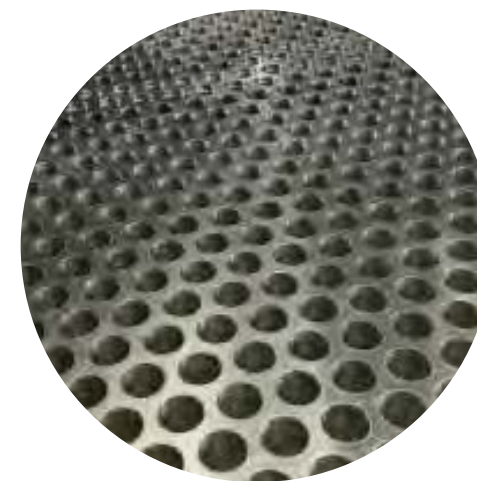
POSITIVE RESULTS:

Excellent ROI

Productivity savings 71%

Test Date	Nov, 2015
Country	France
Industry	General machining
Application	Drilling
Material Group	Low alloy steel and cast steel
Material No.	S300PB

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	Iscar: SCD 010-004-030 AP4 903	
Spindle Type	Machine Spindle	TJS 20K-ER32-R
Hole depth (mm)	1	1
Spindle Speed (rpm)	17,030	36,924
Feed	0.04	0.0789
Table Feed (mm/min)	240	2,998
Holes Per Cutting Edge - New Corner	200	250
Primary Wear	Flank wear	Flank wear
Surface Quality	Good	Good
Chip type	Fragments	Fragments





GENERAL INDUSTRY

TEST SUMMARY – THREAD MILLING

The customer needed to save time and optimize cutting tool performance.
Colibri's TJS 30K-ER32-R Jet Spindle model

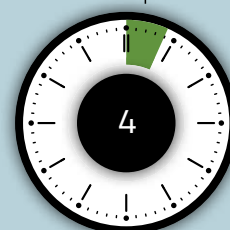


Cutting Time (sec. per hole)

Machine Spindle



HSM Jet Spindle



75%

Cost Savings Per Part

POSITIVE RESULTS:

Machining time savings of 75%
Cutting tool life extended 3 times

Test Date Jan, 2013

Country United Kingdom

Industry General Industry

Application Thread Milling

Material Group Alloy Steel

Material No. SAE 4340

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	D3T06015L062-I0.4 ISO TM VTH Vargus	
Diameter (mm)	1.55	1.55
No. of Teeth	3	3
Cutting Speed (m/min)	32	150
Spindle Speed (rpm)	6,572	32,000 / 30,800
Depth of Cut (mm)	5	5
Feed Per Tooth (mm/t)	0.014	0.014
Table Feed (mm/min)	276	1294
Failure - wear/breakage	Wear	Still good
Tool Life	81	280 (not final)
Surface Finish	Good	Very good



GENERAL INDUSTRY

TEST SUMMARY – PROFILE MILLING

The customer in wanted to save machining time and increase productivity.
Colibri's TJS 20K-DIN69871-40 Jet Spindle model



Cutting Time (hrs.)

Machine Spindle



HSM Jet Spindle



56.7%

Cost Savings Per Part

POSITIVE RESULTS:

Customer satisfaction
Cost per-part savings 56.7%

Test Date Oct, 2015

Country Austria

Industry Mechanical Engineering/Job Shops

Application Profile Milling

Material Group Casting

Material No. DIN GGG-60

Test Data	Machine Spindle	HSM Jet Spindle
Cutting Tool	VHM SONDERFR SER P233	
Diameter (mm)	2.3	2.3
No. of Flutes	2	2
Overhang (mm)	120	120
Cutting Speed (m/min)	123	303
Spindle Speed (rpm)	17,023	41,934
Depth of Cut (mm)	1.3	1.3
Width of Cut (mm)	1.3	1.3
Feed Per Tooth (mm/t)	0.028	0.028
Table Feed (mm/min)	953	2,348
Metal removal Rate	1.61	3.97

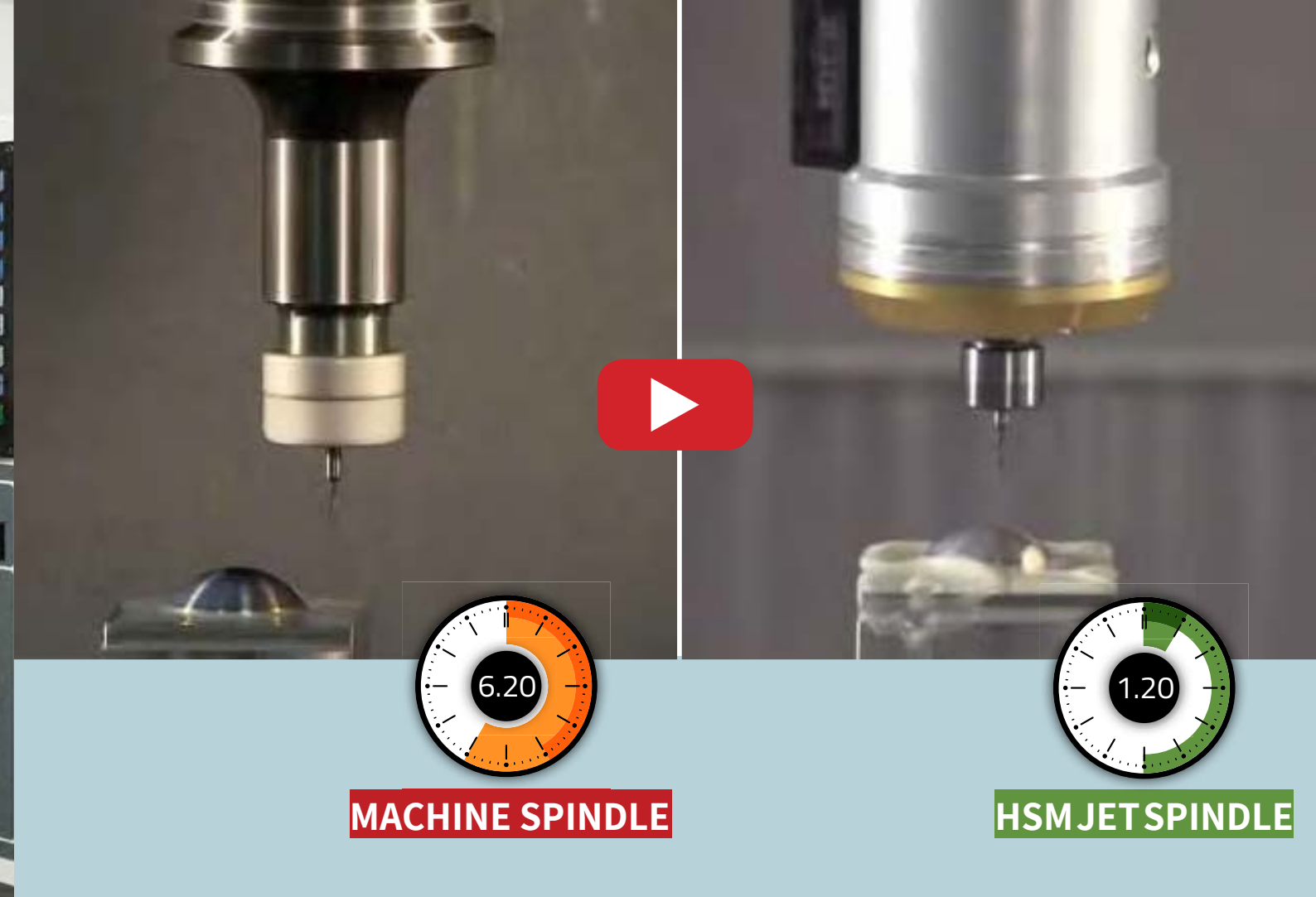


UNDERSTANDING THE DATA

For manufacturers, test data helps them deliver more reliable products and processes for intended applications. For end users, test data helps them verify that they are using the most suitable products and processes for their intended applications.

At Colibri, we're in the high-speed spindle business. Our internal testing for high speed spindle operations expressly takes rigidity into account; checking that vibration and runout are kept to a minimum.

When considering the results of in-the-field tests however, It's important to note that performance data may vary dependent upon CNC machine type and condition, or differences in individual machining environments.



JET SPINDLE COMPARISON VIDEOS

Now you can see various HSM Jet Spindle models in action for a wide range of live machining applications that include; Milling, Profiling, Slot Milling, Drilling, Deburring, Chamfering, Engraving, Internal Thread Milling, Jig Grinding and more.

To view a complete selection of videos featuring the HSM Jet Spindle (trade names SPINJET/Typhoon), visit our website VIDEOS page at:

www.colibrispindles.com/videos/
or check out the video listings on the Colibri Spindles YouTube Channel.