



PREMIUM

A

硬质合金

MEGA MUSCLE 三刃钻头 Vol. ③-1

TRS

TRS-HO-3D TRS-HO-5D TRS-HO-10D

Mega Muscle Drills



欧士机（上海）精密工具有限公司

如果您想追求更高的加工效率，请
尝试此款世界最高速的三刃钻头

Mega Muscle - The World's Fastest and Most Productive
Coolant-Fed Carbide Drill *

* 内部调查数据 Internal Data

~ 3刃钻头有以下优势 ~

在一般2刃钻的1.5 ~ 2倍的高进给条件下实现高寿命

~ Three key concepts that differentiate the Mega Muscle Drill from two fluted drills ~
Feed rates up to 1.5 to 2 times faster than two fluted drills extend tool life.

- ✓ 独特的沟槽形状使其在高进给条件下也能将切屑细小分断！

Unique flute form breaks chips into small manageable pieces for easy ejection even at high feed rates!

- ✓ 采用最适合的边缘负角设计，抑制在贯穿时的崩刃现象

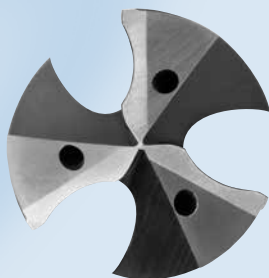
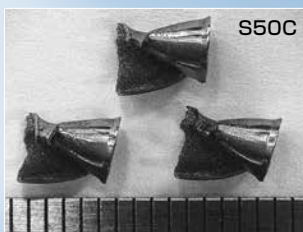
Special negative cutting edges decrease the tendency of chipping at the corners during hole exit.

MEGA
MUSCLE
DRILL

高进给！
High feed rate!

高精度！
High precision!

加工硬化降低！
Reduced work hardening!



- ✓ 120° 等分刃带减轻切削加工中的震动，抑制孔内毛刺的产生

The 120° equal spacing margins allow vibration-free hole processing and better hole tolerance.

- ✓ 减轻每刃进给可以抑制加工硬化，为提高下一个工序的刀具寿命做出贡献

Less loads per flute reduces work hardening, thereby prolongs tool life of secondary operations such as tapping and reaming.



即使高进给加工也能发挥优良耐磨损性的WDI涂层

WDI® Coating, Superior Wear Resistance for High Feed Machining

- ✓ 复合多层构造 Multi-Layered Structure

抑制裂纹传播，实现优良耐崩刃性
Prevents crack propagation and provides greater durability

- ✓ 3,300HV的高硬度涂层 3,300HV Coating Hardness

实现优良的耐磨损性
Superior wear resistance

- ✓ 1,100°C高温氧化开始温度 1,100°C Oxidation Temperature

氧化起始温度高，对应易发热的高速条件
High speed cutting condition achieved by its high oxidation temperature

	涂层构造 Coating Structure	硬度(HV) Surface Hardness	氧化开始温度(°C) Oxidation Temperature
WDI®涂层 WDI® coating	复合多层 Multi-layered	3,300	1,100
TiAlN涂层 TiAlN coating	2层 Dual layer	2,700	800

高进给!

High feed rate!

惊人的高进给

Amazingly High Feed Rates

■极限进给比较

Maximum feed rate Comparison

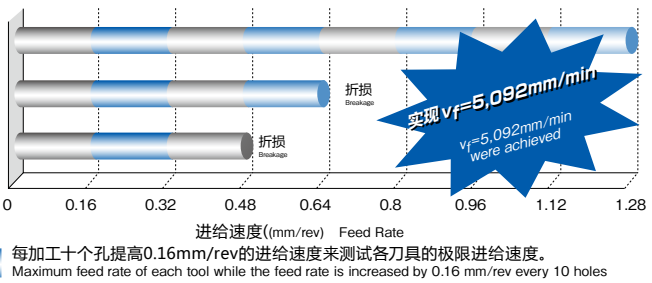
使用工具 Tool	TRS-HO-5D
尺寸 Size	φ8
加工材质 Work Material	FCD600
切削速度 Cutting Speed	100m/min (4,000min ⁻¹)
进给速度 Feed	可变 Variable
孔深度 Depth of Hole	40mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 (外部给油) Water Soluble (External)
使用机械 Machine	卧式加工中心 Horizontal Machining Center

注) 由于其它公司产品没有内冷油孔, 所以这个测试使用外部给油。

Note: Because the competitor's drills are not the coolant-through, coolant had to be fed externally during the test.

极限进给量下 效率比较

Efficiency comparison
during maximum feed



	切削速度 Cutting Speed (m/min)	每转进给量 Feed Rate (mm/rev)	进给速度 Feed (mm/min)
TRS-HO-5D	100	1.28	5,092
其他公司A Competitor A	100	0.64	2,546
其他公司B Competitor B	100	0.48	1,909

当加工材料为铸铁 (FCD600) 时, Mega Muscle 钻头实现了 $F=5,092\text{mm/min}$ 的极限进给量。这是因为新槽形设计带来了更好的刚性, 这个进给率是其它公司产品的 2.0-2.6 倍。但是在这个加工事例的场合, 我们实际的推荐进给量为 0.36mm/rev , 为极限进给量的 28%, 这也是充分考虑到加工的安全性以及稳定性。

When processing cast iron (FCD600) the Mega Muscle Drill achieved a feed rate up to $v_f=5,092\text{mm/min}$. This was achieved by combining the new point and flute design with superior rigidity. This rate is 2.0-2.6 times more productive than competitor's. In this case, the actual recommended feed rate is approximately 0.36mm/rev , which is the 28% of maximum limitation of TRS-HO-5D. However, as illustrated in the test, the Mega Muscle Drill has a large range of achievable feed rates. The priorities in any cutting condition should always be safety and application stability.

高精度!

High precision!

不仅是速度, 更是实现了超群的孔精度。

Amazing Speeds with Excellent Hole Accuracy

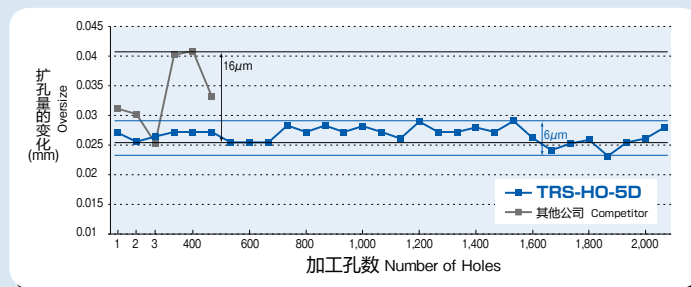
■SCM440 (30HRC) 孔扩大量的比较

Hole oversize comparison in SCM440 (30HRC)

使用工具 Tool	TRS-HO-5D
尺寸 Size	φ10.8
加工材质 Work Material	SCM440 (30HRC)
切削速度 Cutting Speed	70m/min (2,060min ⁻¹)
进给速度 Feed	1,010mm/min (0.49mm/rev)
孔深度 Depth of Hole	50mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

■扩孔量的变化

Changes in amount of hole oversize



对比孔扩大量, TRS 钻头比二刃钻头小。加工中二刃钻的孔扩大大量幅度最大可达到 $16\mu\text{m}$, 而 TRS 钻头则控制在 $6\mu\text{m}$ 显示了超群的稳定加工。这是由于最佳刃带宽度以及三个接触点, 维持了加工时的平衡性, 实现了稳定加工。

When compared to 2 fluted drills, the Mega Muscle Drill always shows a lower amount of hole expansion. The 2 fluted drills were found to have a hole expansion range of approximately $16\mu\text{m}$, while the Mega Muscle Drill only had a $6\mu\text{m}$ variation. The high hole accuracy is possible because the 3-fluted drill has 3 stable points of contact with a hole, when compared to a 2-fluted drill only has 2 points of contact.

加工硬化降低!

Reduced work hardening!

减低了之后加工工序中工具的加工负荷!

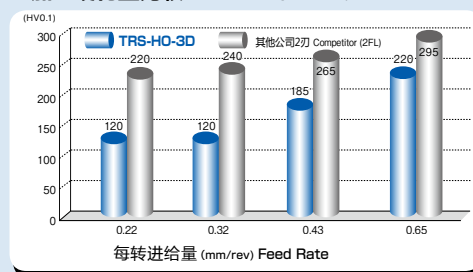
Low risk for the secondary processes

■碳素钢加工中的进给量与加工硬化量的对比

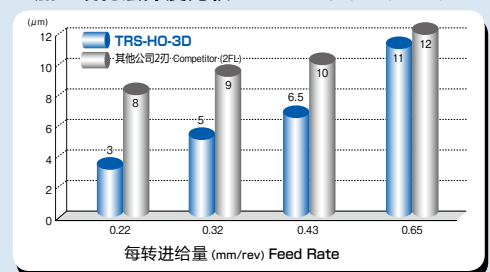
Comparison of the amount of work hardening vs. feed per revolution in carbon steel.

使用工具 Tool	TRS-HO-3D
尺寸 Size	φ10.8
加工材质 Work Material	S50C
切削速度 Cutting Speed	100m/min (2,950min ⁻¹)
进给速度 Feed	可变 Variable
孔深度 Depth of Hole	25mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

●加工硬化量比较 Work hardening rate comparison



●加工硬化层深度比较 Work hardening layer depth comparison

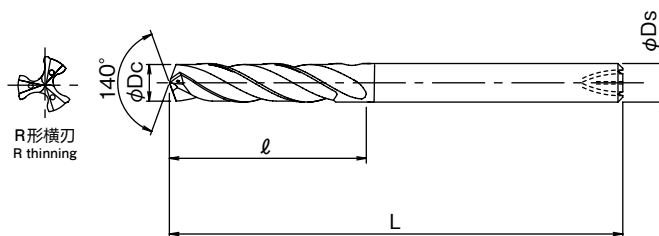


这个表格是碳素钢加工中, 每转进给量从 $0.22 \sim 0.65\text{mm/rev}$ 变化时, 加工硬化量与加工硬化层深度的比较。在不考虑刃数时, 随着进给量的增加, 加工硬化量随之增加, 加工硬化层深度随之上升。但是在相同的进给量下, 三刃钻头与两刃钻头相比, 加工硬化的情况大大减低。在很好的控制了加工硬化的情况下, 之后加工工序中的螺纹加工或较削加工的负荷将会大大减轻, 提高了工具寿命, 并且实现稳定的加工。

The graphs above depict the level and depth of work hardening in carbon steel between the Mega Muscle Drill and a 2-flute drill. Regardless of the number of flutes, work hardening has a tendency to increase along side with feed rate. However, it is important to note that under the same feed rate, 3-flute drills always have a lower work hardening tendency than 2-flute drills. To prolong tool life of secondary operations such as tapping and reaming, it is prominent to keep work hardening to a minimum.



- **材 质** **超微粒子超硬合金**
Tool Material Micro Grain Carbide
- **表面处理** **WDI® 涂层**
Surface Treatment WDI® Coating



为了实现稳定的给油，在柄的底部有一条沟槽。
The grooves are designed at the end of the shank for stable coolant supply.

在少数钻头上的涂层会有色差的情况，但是这不妨碍钻头的性能。
Drills may have some discoloration, but it does not cause any performance problems.

● 3D用 For 3D Operation

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8660500	5	25	80	5	B
8660510	5.1	26	82	6	B
8660520	5.2	26	82	6	B
8660530	5.3	27	82	6	B
8660540	5.4	27	82	6	B
8660550	5.5	28	82	6	B
8660560	5.6	28	82	6	B
8660570	5.7	29	82	6	B
8660580	5.8	29	82	6	B
8660590	5.9	30	82	6	B
8660600	6	30	82	6	B
8660610	6.1	31	88	7	B
8660620	6.2	31	88	7	B
8660630	6.3	32	88	7	B
8660640	6.4	32	88	7	B
8660650	6.5	33	88	7	B
8660660	6.6	33	88	7	B
8660670	6.7	34	88	7	B
8660680	6.8	34	88	7	B
8660690	6.9	35	88	7	B
8660700	7	35	88	7	B
8660710	7.1	36	94	8	B
8660720	7.2	36	94	8	B
8660730	7.3	37	94	8	B
8660740	7.4	37	94	8	B
8660750	7.5	38	94	8	B

单位:mm Unit:mm

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8660760	7.6	38	94	8	B
8660770	7.7	39	94	8	B
8660780	7.8	39	94	8	B
8660790	7.9	40	94	8	B
8660800	8	40	94	8	B
8660810	8.1	41	101	9	B
8660820	8.2	41	101	9	B
8660830	8.3	42	101	9	B
8660840	8.4	42	101	9	B
8660850	8.5	43	101	9	B
8660860	8.6	43	101	9	B
8660870	8.7	44	101	9	B
8660880	8.8	44	101	9	B
8660890	8.9	45	101	9	B
8660900	9	45	101	9	B
8660910	9.1	46	106	10	B
8660920	9.2	46	106	10	B
8660930	9.3	47	106	10	B
8660940	9.4	47	106	10	B
8660950	9.5	48	106	10	B
8660960	9.6	48	106	10	B
8660970	9.7	49	106	10	B
8660980	9.8	49	106	10	B
8660990	9.9	50	106	10	B
8661000	10	50	106	10	B
8661010	10.1	51	113	11	B

B = 标准库存品 B = Standard stock item



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商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8661020	10.2	51	113	11	B
8661030	10.3	52	113	11	B
8661040	10.4	52	113	11	B
8661050	10.5	53	113	11	B
8661060	10.6	53	113	11	B
8661070	10.7	54	113	11	B
8661080	10.8	54	113	11	B
8661090	10.9	55	113	11	B
8661100	11	55	113	11	B
8661110	11.1	56	120	12	B
8661120	11.2	56	120	12	B
8661130	11.3	57	120	12	B
8661140	11.4	57	120	12	B
8661150	11.5	58	120	12	B
8661160	11.6	58	120	12	B
8661170	11.7	59	120	12	B
8661180	11.8	59	120	12	B
8661190	11.9	60	120	12	B
8661200	12	60	120	12	B
8661210	12.1	61	128	13	B
8661220	12.2	61	128	13	B
8661230	12.3	62	128	13	B
8661240	12.4	62	128	13	B
8661250	12.5	63	128	13	B
8661260	12.6	63	128	13	B
8661270	12.7	64	128	13	B
8661280	12.8	64	128	13	B
8661290	12.9	65	128	13	B
8661300	13	65	128	13	B
8661310	13.1	66	134	14	B
8661320	13.2	66	134	14	B
8661330	13.3	67	134	14	B
8661340	13.4	67	134	14	B
8661350	13.5	68	134	14	B

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8661360	13.6	68	134	14	B
8661370	13.7	69	134	14	B
8661380	13.8	69	134	14	B
8661390	13.9	70	134	14	B
8661400	14	70	134	14	B
8661410	14.1	71	140	15	B
8661420	14.2	71	140	15	B
8661430	14.3	72	140	15	B
8661440	14.4	72	140	15	B
8661450	14.5	73	140	15	B
8661460	14.6	73	140	15	B
8661470	14.7	74	140	15	B
8661480	14.8	74	140	15	B
8661490	14.9	75	140	15	B
8661500	15	75	140	15	B
8661510	15.1	76	145	16	B
8661520	15.2	76	145	16	B
8661530	15.3	77	145	16	B
8661540	15.4	77	145	16	B
8661550	15.5	78	145	16	B
8661560	15.6	78	145	16	B
8661570	15.7	79	145	16	B
8661580	15.8	79	145	16	B
8661590	15.9	80	145	16	B
8661600	16	80	145	16	B
8661650	16.5	83	150	17	B
8661700	17	85	150	17	B
8661750	17.5	88	155	18	B
8661800	18	90	155	18	B
8661850	18.5	93	160	19	B
8661900	19	95	160	19	B
8661950	19.5	98	165	20	B
8662000	20	100	165	20	B

B = 标准库存品 B = Standard stock item

更多信息，请咨询营业人员。

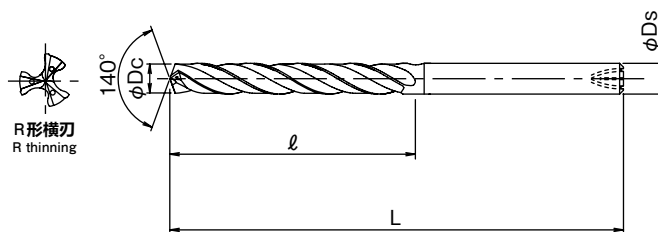
Please contact our sales staff for more information.

可以制作不同径・长度的非标品。
其他铝合金式样的非标品也能制作。

Specialized drills with other diameters, lengths and for aluminum alloy are available upon request.



- **材 质** **超微粒子超硬合金**
Tool Material Micro Grain Carbide
- **表面处理** **WDI® 涂层**
Surface Treatment WDI® Coating



为了实现稳定的给油，在柄的底部有一条沟槽。
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●5D用 For 5D Operation

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8662500	5	45	95	5	B
8662510	5.1	41	100	6	B
8662520	5.2	42	100	6	B
8662530	5.3	43	100	6	B
8662540	5.4	44	100	6	B
8662550	5.5	44	100	6	B
8662560	5.6	45	100	6	B
8662570	5.7	46	100	6	B
8662580	5.8	47	100	6	B
8662590	5.9	48	100	6	B
8662600	6	48	100	6	B
8662610	6.1	49	109	7	B
8662620	6.2	50	109	7	B
8662630	6.3	51	109	7	B
8662640	6.4	52	109	7	B
8662650	6.5	52	109	7	B
8662660	6.6	53	109	7	B
8662670	6.7	54	109	7	B
8662680	6.8	55	109	7	B
8662690	6.9	56	109	7	B
8662700	7	56	109	7	B
8662710	7.1	57	118	8	B
8662720	7.2	58	118	8	B
8662730	7.3	59	118	8	B
8662740	7.4	60	118	8	B
8662750	7.5	60	118	8	B
8662760	7.6	61	118	8	B
8662770	7.7	62	118	8	B

单位:mm Unit:mm

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8662780	7.8	63	118	8	B
8662790	7.9	64	118	8	B
8662800	8	64	118	8	B
8662810	8.1	65	128	9	B
8662820	8.2	66	128	9	B
8662830	8.3	67	128	9	B
8662840	8.4	68	128	9	B
8662850	8.5	68	128	9	B
8662860	8.6	69	128	9	B
8662870	8.7	70	128	9	B
8662880	8.8	71	128	9	B
8662890	8.9	72	128	9	B
8662900	9	72	128	9	B
8662910	9.1	73	136	10	B
8662920	9.2	74	136	10	B
8662930	9.3	75	136	10	B
8662940	9.4	76	136	10	B
8662950	9.5	76	136	10	B
8662960	9.6	77	136	10	B
8662970	9.7	78	136	10	B
8662980	9.8	79	136	10	B
8662990	9.9	80	136	10	B
8663000	10	80	136	10	B
8663010	10.1	81	146	11	B
8663020	10.2	82	146	11	B
8663030	10.3	83	146	11	B
8663040	10.4	84	146	11	B
8663050	10.5	84	146	11	B

B = 标准库存品 B = Standard stock item



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商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8663060	10.6	85	146	11	B
8663070	10.7	86	146	11	B
8663080	10.8	87	146	11	B
8663090	10.9	88	146	11	B
8663100	11	88	146	11	B
8663110	11.1	89	156	12	B
8663120	11.2	90	156	12	B
8663130	11.3	91	156	12	B
8663140	11.4	92	156	12	B
8663150	11.5	92	156	12	B
8663160	11.6	93	156	12	B
8663170	11.7	94	156	12	B
8663180	11.8	95	156	12	B
8663190	11.9	96	156	12	B
8663200	12	96	156	12	B
8663210	12.1	97	167	13	B
8663220	12.2	98	167	13	B
8663230	12.3	99	167	13	B
8663240	12.4	100	167	13	B
8663250	12.5	100	167	13	B
8663260	12.6	101	167	13	B
8663270	12.7	102	167	13	B
8663280	12.8	103	167	13	B
8663290	12.9	104	167	13	B
8663300	13	104	167	13	B
8663310	13.1	105	176	14	B
8663320	13.2	106	176	14	B
8663330	13.3	107	176	14	B
8663340	13.4	108	176	14	B
8663350	13.5	108	176	14	B
8663360	13.6	109	176	14	B
8663370	13.7	110	176	14	B

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8663380	13.8	111	176	14	B
8663390	13.9	112	176	14	B
8663400	14	112	176	14	B
8663410	14.1	113	185	15	B
8663420	14.2	114	185	15	B
8663430	14.3	115	185	15	B
8663440	14.4	116	185	15	B
8663450	14.5	116	185	15	B
8663460	14.6	117	185	15	B
8663470	14.7	118	185	15	B
8663480	14.8	119	185	15	B
8663490	14.9	120	185	15	B
8663500	15	120	185	15	B
8663510	15.1	121	193	16	B
8663520	15.2	122	193	16	B
8663530	15.3	123	193	16	B
8663540	15.4	124	193	16	B
8663550	15.5	124	193	16	B
8663560	15.6	125	193	16	B
8663570	15.7	126	193	16	B
8663580	15.8	127	193	16	B
8663590	15.9	128	193	16	B
8663600	16	128	193	16	B
8663650	16.5	132	201	17	B
8663700	17	136	201	17	B
8663750	17.5	140	209	18	B
8663800	18	144	209	18	B
8663850	18.5	148	217	19	B
8663900	19	152	217	19	B
8663950	19.5	156	225	20	B
8664000	20	160	225	20	B

B = 标准库存品 B = Standard stock item

更多信息，请咨询营业人员。

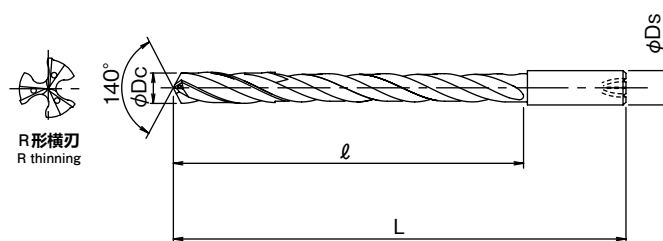
Please contact our sales staff for more information.

可以制作不同径・长度的非标品。
其他铝合金式样的非标品也能制作。

Specialized drills with other diameters, lengths and for aluminum alloy are available upon request.



- **材 质**
Tool Material **超微粒子超硬合金**
Micro Grain Carbide
- **表面处理**
Surface Treatment **WDI® 涂层**
WDI® Coating



为了实现稳定的给油，在柄的底部有一条沟槽。
The grooves are designed at the end of the shank for stable coolant supply.

在少数钻头上的涂层会有色差的情况，但是这不妨碍钻头的性能。
Drills may have some discoloration, but it does not cause any performance problems.

● 10D用 For 10D Operation

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8664050	5	65	115	5	B
8664055	5.5	78	128	6	B
8664060	6	78	128	6	B
8664065	6.5	87	140	7	B
8664070	7	90	140	7	B
8664075	7.5	100	155	8	B
8664080	8	105	155	8	B
8664085	8.5	110	165	9	B

单位:mm Unit:mm

商品记号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	库存 Stock
8664090	9	115	165	9	B
8664095	9.5	125	190	10	B
8664100	10	130	190	10	B
8664105	10.5	140	205	11	B
8664110	11	145	205	11	B
8664115	11.5	155	215	12	B
8664120	12	155	215	12	B

B = 标准库存品 B = Standard stock item

更多信息，请咨询营业人员。
Please contact our sales staff for more information.

可以制作不同径・长度的非标品。
其他铝合金式样的非标品也能制作。

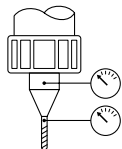
Specialized drills with other diameters, lengths and for aluminum alloy are available upon request.

■ TRS-HO-3D, TRS-HO-5D

加工材料 Work Material	软钢·低炭素钢 Mild Steel·Low Carbon Steel SS400, S10C ~150HB ~500N/mm ²		炭素钢 Carbon Steel S35C, S50C ~210HB ~710N/mm ²		合金钢 Alloy Steel SCM, SCr, SNCM 16~28HRC 710~900N/mm ²	
切削速度 Cutting Speed	80~120m/min		80~120m/min		60~90m/min	
外径 Drill Dia. (mm)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)
5	6,400	0.18 ~ 0.25	6,400	0.18 ~ 0.25	4,800	0.18 ~ 0.25
6	5,300	0.21 ~ 0.3	5,300	0.21 ~ 0.3	4,000	0.21 ~ 0.3
7	4,500	0.25 ~ 0.35	4,500	0.25 ~ 0.35	3,400	0.25 ~ 0.35
8	4,000	0.28 ~ 0.4	4,000	0.28 ~ 0.4	3,000	0.28 ~ 0.4
9	3,500	0.32 ~ 0.45	3,500	0.32 ~ 0.45	2,700	0.32 ~ 0.45
10	3,200	0.35 ~ 0.5	3,200	0.35 ~ 0.5	2,400	0.35 ~ 0.5
11	2,900	0.39 ~ 0.55	2,900	0.39 ~ 0.55	2,200	0.39 ~ 0.5
12	2,700	0.42 ~ 0.6	2,700	0.42 ~ 0.6	2,000	0.42 ~ 0.54
13	2,400	0.46 ~ 0.65	2,400	0.46 ~ 0.65	1,800	0.46 ~ 0.59
14	2,300	0.49 ~ 0.7	2,300	0.49 ~ 0.7	1,700	0.49 ~ 0.63
15	2,100	0.45 ~ 0.68	2,100	0.45 ~ 0.68	1,600	0.45 ~ 0.6
16	2,000	0.48 ~ 0.72	2,000	0.48 ~ 0.72	1,500	0.48 ~ 0.64
17	1,900	0.51 ~ 0.77	1,900	0.51 ~ 0.77	1,400	0.51 ~ 0.68
18	1,800	0.54 ~ 0.81	1,800	0.54 ~ 0.81	1,300	0.54 ~ 0.72
19	1,700	0.57 ~ 0.86	1,700	0.57 ~ 0.86	1,300	0.57 ~ 0.76
20	1,600	0.60 ~ 0.9	1,600	0.60 ~ 0.90	1,200	0.6 ~ 0.8

加工材料 Work Material	合金钢 Alloy Steel SCM, SCr, SNCM 28~35HRC 900~1,100N/mm ²		铸铁 Cast Iron FC250 ~350N/mm ²		球墨铸铁 Ductile Cast Iron FCD450, FCD600 400~600N/mm ²	
切削速度 Cutting Speed	60~90m/min		80~120m/min		60~100m/min	
外径 Drill Dia. (mm)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)	转速 SPEED (min ⁻¹)	进给速度 FEED (mm/rev)
5	4,800	0.18 ~ 0.25	6,400	0.18 ~ 0.3	5,100	0.18 ~ 0.25
6	4,000	0.21 ~ 0.3	5,300	0.21 ~ 0.36	4,200	0.21 ~ 0.3
7	3,400	0.25 ~ 0.35	4,500	0.25 ~ 0.42	3,600	0.25 ~ 0.35
8	3,000	0.28 ~ 0.4	4,000	0.28 ~ 0.48	3,200	0.28 ~ 0.4
9	2,700	0.32 ~ 0.45	3,500	0.32 ~ 0.54	2,800	0.32 ~ 0.45
10	2,400	0.35 ~ 0.5	3,200	0.35 ~ 0.6	2,500	0.35 ~ 0.5
11	2,200	0.39 ~ 0.5	2,900	0.39 ~ 0.66	2,300	0.39 ~ 0.55
12	2,000	0.42 ~ 0.54	2,700	0.42 ~ 0.72	2,100	0.42 ~ 0.6
13	1,800	0.46 ~ 0.59	2,400	0.46 ~ 0.78	2,000	0.46 ~ 0.65
14	1,700	0.49 ~ 0.63	2,300	0.49 ~ 0.84	1,800	0.49 ~ 0.7
15	1,600	0.45 ~ 0.6	2,100	0.53 ~ 0.75	1,700	0.45 ~ 0.68
16	1,500	0.48 ~ 0.64	2,000	0.56 ~ 0.8	1,600	0.48 ~ 0.72
17	1,400	0.51 ~ 0.68	1,900	0.60 ~ 0.85	1,500	0.51 ~ 0.77
18	1,300	0.54 ~ 0.72	1,800	0.63 ~ 0.9	1,400	0.54 ~ 0.81
19	1,300	0.57 ~ 0.76	1,700	0.67 ~ 0.95	1,300	0.57 ~ 0.86
20	1,200	0.6 ~ 0.8	1,600	0.7 ~ 1	1,300	0.6 ~ 0.9

1. 此切削条件基础表适用于水溶性切削油剂冷却加工。
2. 请使用稀释20倍以下的优质水溶性切削油。
3. 使用油性切削油剂或者稀释倍率超过20倍时，切削速度请下调30%。
4. 装夹钻头时，请使用无损伤，无油污的弹簧夹头，并将径向跳动控制在0.02mm以下。
5. 工件夹持必须做到无变形，无振动。
6. 油污堵塞会造成折损，因此供油装置请务必安装过滤网。



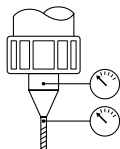
1. The indicated speeds and feeds are for drilling with water-soluble oil.
2. Suitable cutting fluid is water-emulsifiable high density oil (less than 20 times dilution).
3. When using non-water soluble oil or water-emulsifiable (over 20 times dilution), reduce drilling speed by 30%.
4. When inserting a drill into the machine, use a collet that does not have any scratches or dust located within internal bore. Also, minimize runout to under 0.02mm.
5. Fasten the work material to reduce the possibility of work deformation, deflection of machined surface, or vibration.
6. A clogged oil hole can lead to breakage. Make sure that a filter is attached to the oil feeder.

■ TRS-HO-10D

加工材料 Work Material	软钢·低炭素钢 Mild Steel·Low Carbon Steel SS400, S10C ~150HB ~500N/mm ²		炭素钢 Carbon Steel S35C, S50C ~210HB ~710N/mm ²		合金钢 Alloy Steel SCM, SCr, SNCM 16~28HRC 710~900N/mm ²	
切削速度 Cutting Speed	80~120m/min		80~120m/min		60~120m/min	
外径 Drill Dia. (mm)	转速 Speed (min ⁻¹)	进给速度 Feed (mm/rev)	转速 Speed (min ⁻¹)	进给速度 Feed (mm/rev)	转速 Speed (min ⁻¹)	进给速度 Feed (mm/rev)
5	6,400	0.18 ~ 0.25	6,400	0.18 ~ 0.25	5,700	0.18 ~ 0.25
6	5,300	0.21 ~ 0.3	5,300	0.21 ~ 0.3	4,800	0.21 ~ 0.3
7	4,500	0.25 ~ 0.35	4,500	0.25 ~ 0.35	4,100	0.25 ~ 0.35
8	4,000	0.28 ~ 0.4	4,000	0.28 ~ 0.4	3,600	0.28 ~ 0.4
9	3,500	0.32 ~ 0.45	3,500	0.32 ~ 0.45	3,200	0.32 ~ 0.45
10	3,200	0.35 ~ 0.5	3,200	0.35 ~ 0.5	2,900	0.35 ~ 0.5
11	2,900	0.39 ~ 0.55	2,900	0.39 ~ 0.55	2,600	0.39 ~ 0.55
12	2,700	0.42 ~ 0.6	2,700	0.42 ~ 0.6	2,400	0.42 ~ 0.6

加工材料 Work Material	铸铁 Cast Iron FC250 ~350N/mm ²		球墨铸铁 Ductile Cast Iron FCD450, FCD600 400~600N/mm ²	
切削速度 Cutting Speed	80~120m/min		60~100m/min	
外径 Drill Dia. (mm)	转速 Speed (min ⁻¹)	进给速度 Feed (mm/rev)	转速 Speed (min ⁻¹)	进给速度 Feed (mm/rev)
5	6,400	0.18 ~ 0.3	5,100	0.18 ~ 0.25
6	5,300	0.21 ~ 0.36	4,200	0.21 ~ 0.3
7	4,500	0.25 ~ 0.42	3,600	0.25 ~ 0.35
8	4,000	0.28 ~ 0.48	3,200	0.28 ~ 0.4
9	3,500	0.32 ~ 0.54	2,800	0.32 ~ 0.45
10	3,200	0.35 ~ 0.6	2,500	0.35 ~ 0.5
11	2,900	0.39 ~ 0.66	2,300	0.39 ~ 0.55
12	2,700	0.42 ~ 0.72	2,100	0.42 ~ 0.6

1. 这张切削条件表是使用水溶性切削油以及50ml/h程度的MQL。
2. 请使用稀释20倍以下的优质水溶性切削油。
3. 使用油性切削油剂或者稀释倍率超过20倍时，切削速度请下调30%。
4. 装夹钻头时，请使用无损伤，无油污的弹簧夹头，并将径向跳动控制在0.02mm以下。
5. 工件夹持必须做到无变形，无振动。
6. 油污堵塞会造成折损，因此供油装置请务必安装过滤网。
7. 请参照《TRS-HO-10D的推荐加工方法》进行导向孔加工。



1. The indicated speeds and feeds are for drilling with water-soluble oil or MQL (approx. 50ml/hour).
2. Suitable cutting fluid is water-soluble high density oil (less than 20 times dilution).
3. When using non-water soluble oil or water-emulsifiable (over 20 times dilution), reduce drilling speed by 30%.
4. When inserting a drill into the machine, use a collet that does not have any scratches or dust located within internal bore. Also, minimize runout to under 0.02mm.
5. Fasten the work material to reduce the possibility of work deformation, deflection of machined surface, or vibration.
6. A clogged oil hole can lead to breakage. Make sure that a filter is attached to the oil feeder.
7. Make a guide hole before using TRS-HO-10D in accordance with "Tips for using TRS-HO-10D" (p. 10).

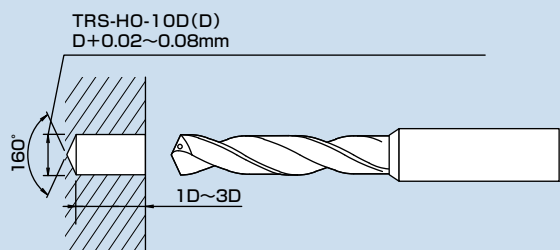
TRS-HO-10D 的推荐加工方法 Tips for using TRS-HO-10D

① WDO-PLT, WDO-3D, TRS-HO-3D 导向孔加工

Make a pilot hole with WDO-PLT, WDO-3D or TRS-HO-3D

- 导向孔加工用工具请选择比 TRS-HO-10D 的直径 (D)+0.02~0.08mm 的钻头, 推荐在加工时在导向孔尽量加深。

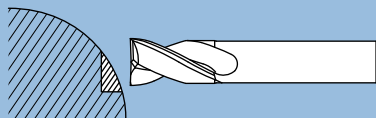
The size of the drill for pilot hole should be 0.02-0.08mm larger than TRS-HO-10D.



若 WDO-PLT 标准品没有适合的尺寸, 也可使用同样直径的 TRS-HO-3D 钻头或者是 WDO-3D 的钻头。

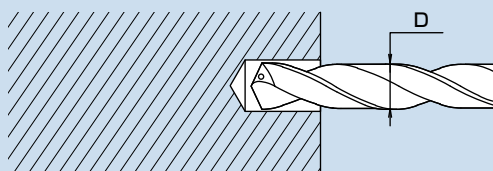
If the suitable size of WDO-PLT is not available among the recommended drills, the same diameter drill of WDO-3D or TRS-HO-3D is recommended.

- ★ 弯曲部加工时, 在定位孔加工前请先用 FX-ZDS 沉孔加工铣刀进行如图所示的沉孔加工。
When working on a curved surface, use the FX-ZDS (end mill for counterboring) to counterbore a pilot hole.



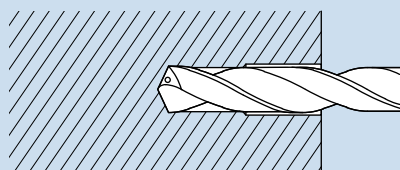
② 以静止或低转速将深孔钻插入

Insert the extra long drill into a pilot hole with zero or low revolution.



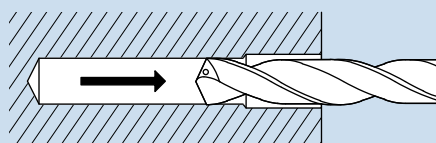
③ 加速至规定转速后开始加工

Increase the revolution to the designated speed and start drilling.



④ 加工后, 拔出钻头时, 在钻头离开孔底后, 请降低转速将其拔出

When pulling the drill out from the hole, reduce the speed after releasing the drill from the bottom of the hole.



※ 加工时请务必使用内冷。

Internal coolant supply must be used during the process.

对 TRS-HO-10D 导向孔加工推荐钻 Recommended pilot hole drills for TRS-HO-10D

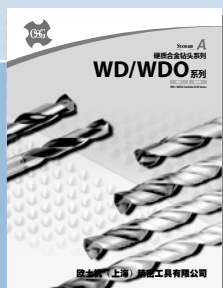
WDO-PLT



WDO-3D



TRS-HO-3D



WDO-PLT, WDO-3D 的详细情况请翻阅
《WDI 涂层硬质合金内冷 WDO 钻头系列》。

Please refer to the "WDI Carbide Drill Series" catalog for additional information.

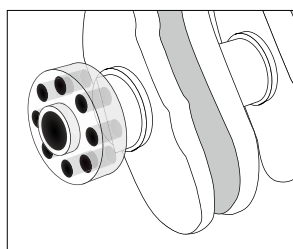
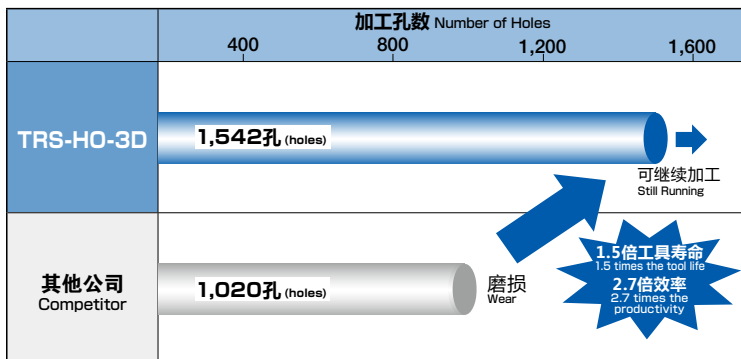
■曲轴（碳素钢）加工中，法兰盘油孔底孔加工

Machining process of mounting holes on a crankshaft flywheel (carbon steel)

使用工具 Tool	TRS-HO-3D	其他公司 Competitor
尺寸 Size	$\phi 10.8$	
加工材质 Work Material	S50C	
切削速度 Cutting Speed	100m/min (2,950min ⁻¹)	
进给速度 Feed Rate	1,480mm/min (0.5mm/rev)	560mm/min (0.19mm/rev)
孔深度 Depth of Hole	24mm(盲孔) (Blind)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	卧式加工中心 Horizontal Machining Center	

其他公司产品相比，耐久达到1.5倍以上，实现约2.7倍的高效率加工。抑制加工硬化，后序加工如螺纹加工使用的刀具寿命也能得到延长。大幅降低每个工件加工所需的成本。

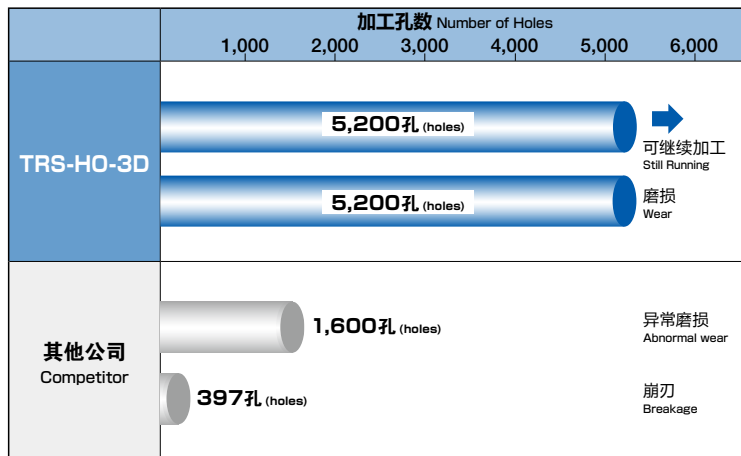
With the ability to control work hardening, the Mega Muscle Drill was able to achieve 1.5 times the tool life and 1.7 times the productivity versus the competition. Moreover, it was able to extend tool life for secondary process of tapping, thus reducing the overall tooling and cost per unit.



■碳素钢的高速加工

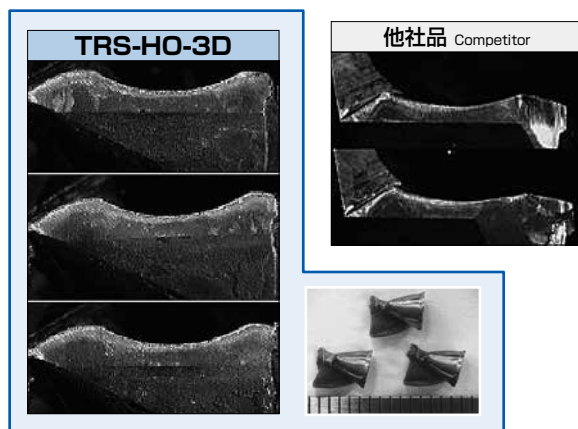
High feed machining in carbon steel

使用工具 Tool	TRS-HO-3D
尺寸 Size	$\phi 10.3$
加工材质 Work Material	S50C
切削速度 Cutting Speed	100m/min (3,090min ⁻¹)
进给速度 Feed Rate	1,480mm/min(0.48mm/rev)
孔深度 Depth of Hole	32mm(通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center



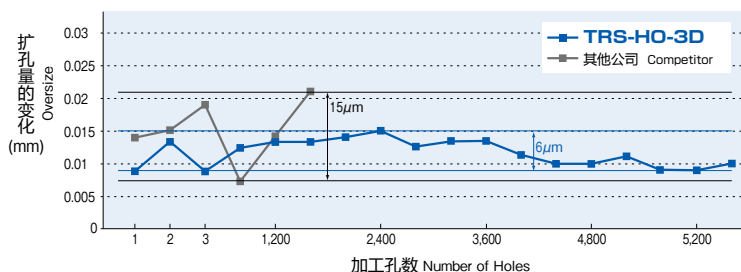
■工具磨损比较

Tool wear comparison



■扩孔量的变化

Changes in amount of hole oversize



在0.48mm/rev的高进给量下，其他公司产品耐久十分不稳定。但TRS钻头能够稳定加工5,200孔（切削长166m）。孔扩大量与其他公司15μm相比，TRS钻头可以实现6μm的稳定加工。

Because of the high feed rate of 0.48mm/rev, the competitor's drill showed a large variation in hole size. However, the Mega Muscle Drill was able to achieve 5,200 holes (cutting length of 166m) with stable hole sizes. The competitor's hole expansion ranged up to 15μm, while the Mega Muscle Drill achieved 6μm.

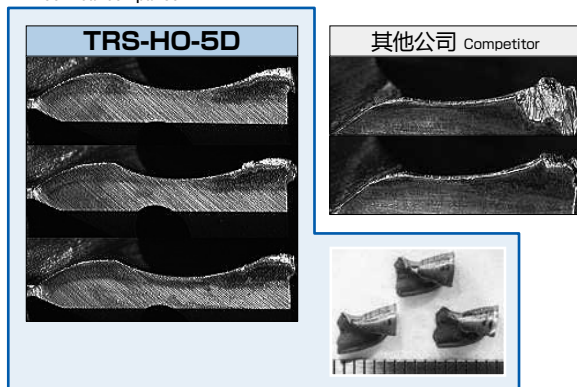
合金钢的高进给加工

High feed operation in alloy steel

使用工具 Tool	TRS-HO-5D
尺寸 Size	φ 10.5
加工材质 Work Material	SCM440生材
切削速度 Cutting Speed	80m/min (2,430min ⁻¹)
进给速度 Feed Rate	1,140mm/min(0.47mm/rev)
孔深度 Depth of Hole	50mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

工具磨损比较

Tool wear comparison

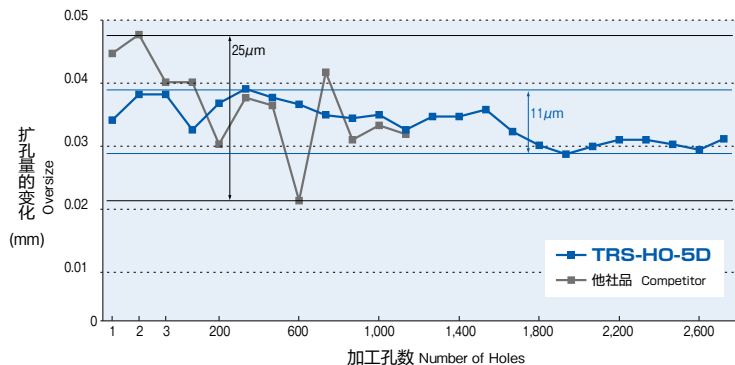


0.47mm/rev 的高进给加工下, 其他公司贯穿时发生崩刃。但是 TRS 在加工 2200 孔(切削长110m)时正常磨损。使得每台零部件刀具费用稳定。孔扩大量作比较, 其他公司产品的25μm, 而 TRS 钻头可以实现11μm 稳定的孔精度。

	加工孔数 Number of Holes					
	500	1,000	1,500	2,000	2,500	3,000
TRS-HO-5D	2,600 孔 (holes)					
	2,200 孔 (holes)					
其他公司 Competitor	1,075 孔 (holes)					
	1,000 孔 (holes)					

扩孔量的变化

Changes in amount of hole oversize



At a high feed drilling rate of 0.47mm/rev, the competitor's drill suffered unstable hole accuracy as well as poor tool life. In contrast, the Mega Muscle Drill exceeded 2,200 holes (cutting length of 110m) with normal wear, thus capable of reducing the overall cost per unit. In terms of hole expansion, the competitor tool was found to have a large variation of up to 25μm, while the Mega Muscle Drill had only up to 11μm.

30HRC合金钢的高进给加工

High feed machining in 30HRC alloy steel

使用工具 Tool	TRS-HO-5D
尺寸 Size	φ 10.8
加工材质 Work Material	SCM440(30HRC)
切削速度 Cutting Speed	70m/min (2,060min ⁻¹)
进给速度 Feed Rate	1,010mm/min(0.49mm/rev)
孔深度 Depth of Hole	50mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

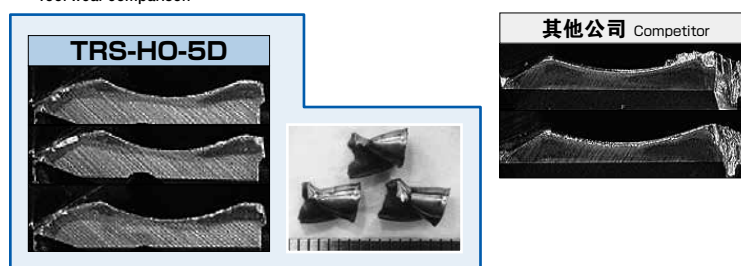
进给在0.49mm/rev 的条件下, 其他公司产品早期异常磨损折损。相对的, TRS 钻头可稳定加工 1700 孔(切削长85m)后正常磨损, 并且确保在研磨次数及研磨费用, 使每台零部件的道具费用相对稳定。

At a high feed drilling rate of 0.49mm/rev, the competitor drill displayed abnormal wear and early breakage. In contrast, the Mega Muscle Drill experienced normal wear after drilling 1,700 holes, thus allowing more regrinds and tool life per drill, thereby reducing overall manufacturing cost.

	加工孔数 Number of Holes					
	500	1,000	1,500	2,000	2,500	3,000
TRS-HO-5D	2,000 孔 (holes)					
	1,700 孔 (holes)					
其他公司 Competitor	174 孔 (holes)					
	300 孔 (holes)					

工具磨损比较

Tool wear comparison



■30HRC合金钢的高耐久·高效率·高精度加工

Machining of high durability, precision and long tool life in 30HRC alloy steel

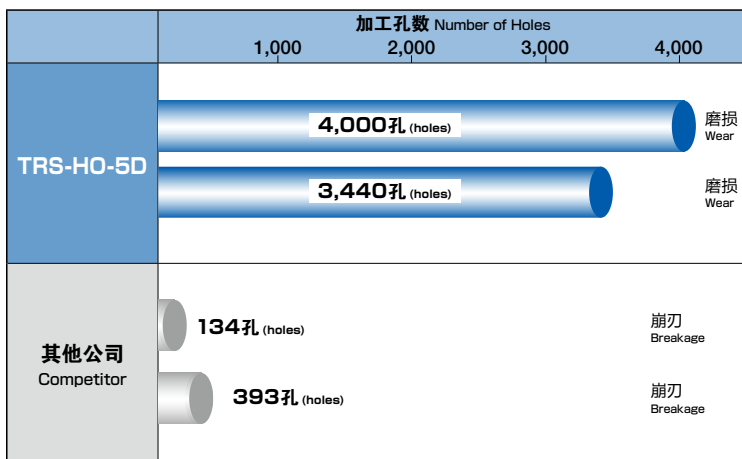
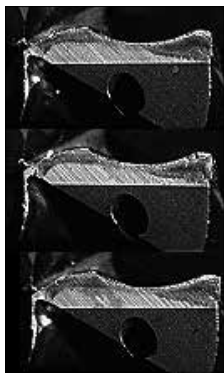
使用工具 Tool	TRS-HO-5D
尺寸 Size	φ6.8
加工材质 Work Material	SCM440(30HRC)
切削速度 Cutting Speed	70m/min (3,280min ⁻¹)
进给速度 Feed Rate	1,120mm/min(0.34mm/rev)
孔深度 Depth of Hole	34mm (盲孔) (Blind)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

0.24mm/rev 的高进给条件下, 其他公司产品的刃尖刚性不足, 两把都折损了。相对的, TRS 钻头加工了3440孔(切削长117m)且正常磨损。孔扩大量控制在5μm 以内。

At a high feed drilling rate of 0.34mm/rev, the competitor's 2-flute drill failed with early tool breakage. The Mega Muscle Drill, on the other hand, was able to machine 3,440 holes (cutting length of 117m) with normal wear.

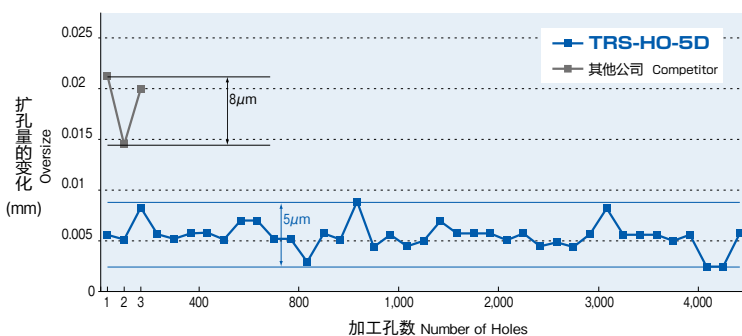
■工具磨损比较

Tool wear comparison



■扩孔量的变化

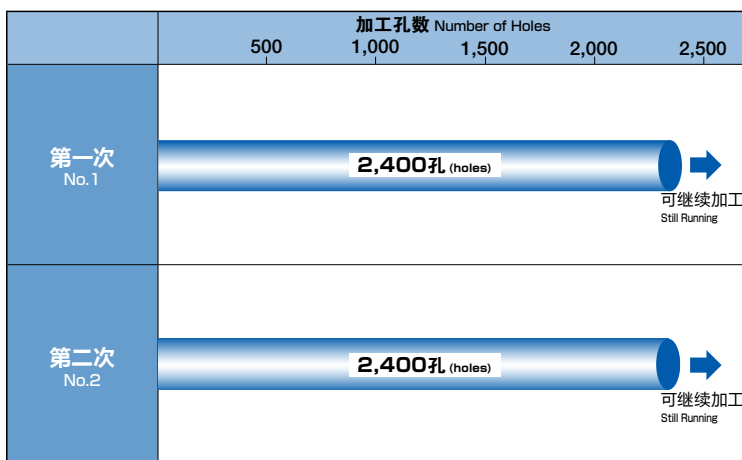
Changes in amount of hole oversize



■软钢的稳定加工

Stable operation in mild steel

使用工具 Tool	TRS-HO-5D
尺寸 Size	φ10.5
加工材质 Work Material	SS400
切削速度 Cutting Speed	100m/min (3,030min ⁻¹)
进给速度 Feed Rate	1,430mm/min(0.47mm/rev)
孔深度 Depth of Hole	50mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center



每转进给即使0.47mm/rev, TRS 钻头也能稳定加工2400孔(切削长120m)以上。一般用钢考虑到切屑断屑性不同请适当调整切削速度。

The Mega Muscle Drill achieved over 2,400 holes (cutting length of 120m), at a feed rate of 0.47mm/rev. It is recommended to adjust the cutting speed accordingly in order to form proper chip shape.

■加工2400孔时刃尖磨损照片

Wear after 2,400 holes



■无中心定位的加工 (特殊品)

Machining operation without centering (Special)

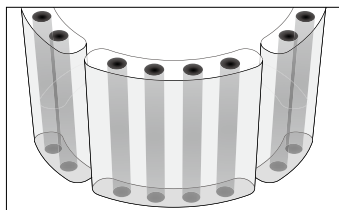
使用工具 Tool	TRS-HO-8D(特殊品) (Special) 无90°中心定位 No Centering	其他公司 Competitor 有90°中心定位 Centering	
尺寸 Size	φ 16		
加工材质 Work Material	FC250		
加工工程 Process	钻削加工 Drilling	钻削加工 Drilling	中心定位加工 Centering
切削速度 Cutting Speed	80m/min (1,590min ⁻¹)	90m/min (1,790min ⁻¹)	80m/min (2,120min ⁻¹)
进给速度 Feed Rate	1,020mm/min (0.64mm/rev)	540mm/min (0.3mm/rev)	630mm/min (0.3mm/rev)
孔深度 Depth of Hole	105mm (通孔) (Through)		6mm
每个部件上的孔数 Holes per Part	15孔 (Holes)		
切削油剂 Coolant	水溶性切削油剂 Water Soluble		
使用机械 Machine	卧式加工中心 Horizontal Machining Center		
每个部件需要的加工时间 Cycle Time per Part	92秒 (sec)	175秒 (sec)	8.5秒 (sec)
		183.5秒 (sec)	
寿命 (孔) Tool Life	1,080孔 (Holes)	1,080孔 (Holes)	

※钻削加工 (112m) 需要的时间

*Drilling time until fixed cutting distance (112m)

以往的加工, 为了防止孔偏移而是先用中心钻定位。TRS 钻头可以再未定位的情况下直接加工。削减了工序的同时, 将进给速度提高到1.88倍。加工效率与工序削减结合起来, 提高了1.98倍。另外, 钻头的耐久性较以往换刀时间(1080孔)可继续加工。

Center drilling with a 2-flute drill is a common machining practice for securing higher hole accuracy. With the introduction of the Mega Muscle Drill, center drilling can be eliminated. Moreover, the Mega Muscle Drill has almost doubled the feed rate and overall productivity.



	加工孔数 Number of Holes					
	200	400	600	800	1,000	1,200
TRS-HO-8D (非标品) (Special)	1,080孔 (holes)					
其他公司 Competitor	1,080孔 (holes)					

效率
Efficiency Ratio
1.98倍以上
more than 1.98 times

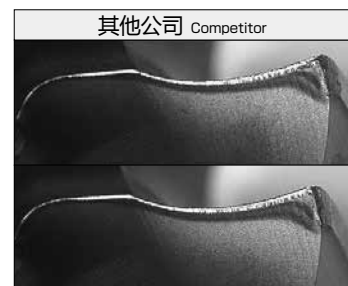
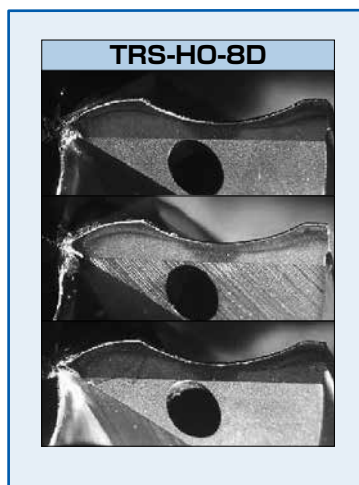
可继续加工
Still Running

磨损
Wear

	进给速度 Feed					
	200	400	600	800	1,000	1,200
TRS-HO-8D (非标品) (Special)	1,020mm/min					
其他公司 Competitor	540mm/min					

■1,080孔加工后的刃尖磨损比较

Wear after drilling 1,080 holes



■气缸盖 缸盖螺栓的铸铁加工

Hole processing of bolt holes on a cylinder head

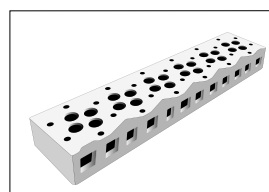
使用工具 Tool	TRS-HO-5D	其他公司 Competitor
尺寸 Size	φ 14	
加工材质 Work Material	FC250	
切削速度 Cutting Speed	80m/min (1,820min ⁻¹)	100m/min (2,270min ⁻¹)
进给速度 Feed Rate	1,270mm/min (0.7mm/rev)	570mm/min (0.25mm/rev)
孔深度 Depth of Hole	105mm (通孔) (Through)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	卧式加工中心 Horizontal Machining Center	

	加工孔数 Number of Holes				
	100	200	300	400	500
TRS-HO-5D	486孔 (holes)				
其他公司 Competitor	346孔 (holes)				

效率比
Efficiency Ratio
2.2倍
2.2 times

可继续加工
Still Running

磨损
Wear



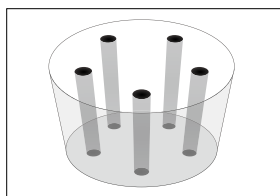
以延长寿命为目的降低切削速度, 设定每转进给量为其他公司产品的2.8倍。其结果是其他公司产品的2.2倍效率及寿命, 并实现加工时间缩减一半。

The machining parameters have been adjusted to extend tool life. Although the cutting speed has been reduced in comparison to the competitor tool, the cutting feed had been increased by 2.8 times. As a result, the Mega Muscle Drill's overall tool life was increased by 2.2 times while cycle time was reduced by half.

球墨铸铁建筑零部件加工

Processing construction machining part in ductile cast iron

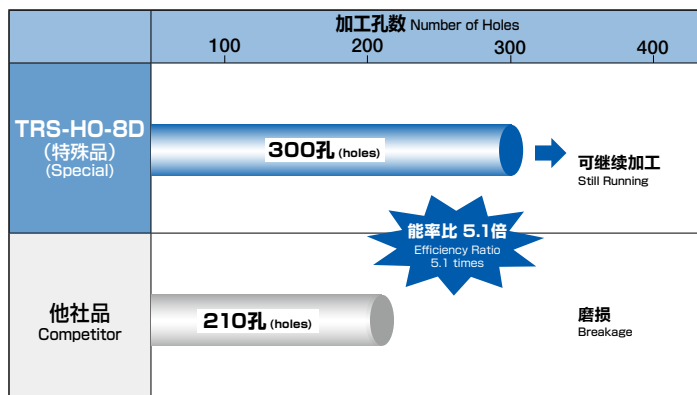
使用工具 Tool	TRS-HO-8D (特殊品) (Special)	其他公司 Competitor
尺寸 Size	φ18	
加工材质 Work Material	FCD450	
切削速度 Cutting Speed	80m/min (1,410min ⁻¹)	56m/min (990min ⁻¹)
进给速度 Feed Rate	1,020mm/min (0.72mm/rev)	200mm/min (0.2mm/rev)
孔深度 Depth of Hole	120mm (通孔) (Through)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	立式加工中心 Vertical Machining Center	



其他公司产品相比切削速度约1.4倍，每转进给3.6倍的条件加工，结果寿命是其他公司A产品的1.4倍以上，综合效率为5.1倍，每个工件加工时间缩短2分40秒。

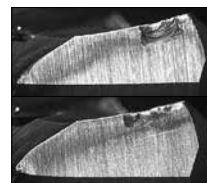
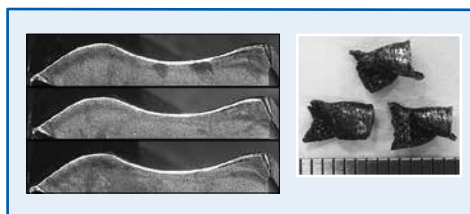
The Mega Muscle Drill was machining at 1.4 times the cutting speed and 3.6 times the feed rate versus the competitor tool. It was able to achieve 1.4 times the tool life while increasing productivity by 5.1 times. Cycle time per part had been reduced by 2 minutes and 40 seconds.

3.6 times the feed rate versus the competitor tool. It was able to achieve 1.4 times the tool life while increasing productivity by 5.1 times. Cycle time per part had been reduced by 2 minutes and 40 seconds.



刃尖磨损比较照片

Wear



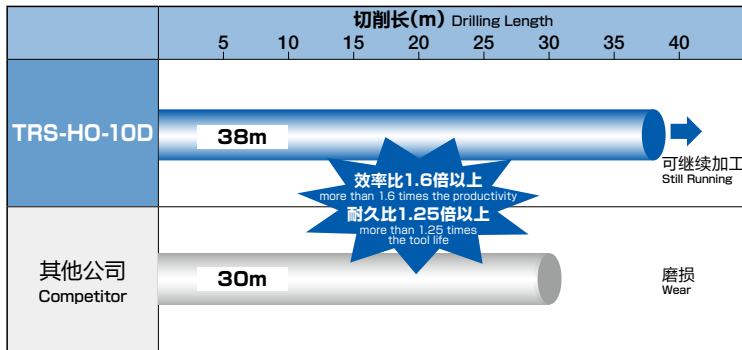
机械部件加工 (SS400) 寿命及效率得到大幅提升!

Excellent durability and efficiency in SS400 drilling

使用工具 Tool	TRS-HO-10D	其他公司 Competitor
尺寸 Size	φ9.5	
加工材质 Work Material	SS400	
切削速度 Cutting Speed	100m/min (3,350min ⁻¹)	75m/min (2,510min ⁻¹)
进给速度 Feed Rate	1,500mm/min (0.45mm/rev)	900mm/min (0.36mm/rev)
孔深度 Depth of Hole	100mm (通孔) (Through)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	卧式加工中心 Horizontal Machining Center	

其他公司二刃钻头相比效率提高了1.6倍以上，耐久提高了1.25倍以上。针对易发生切屑阻塞的软钢材料效果非常理想。一般用钢加工时，因其切屑分断型不同，请适当调节切削速度。

In comparison to the competitor's 2-flute drill, the Mega Muscle Drill was able to achieve more than 1.6 times the efficiency and 1.25 the tool life. When machining materials that are prone to creating bellow-shaped chips, please adjust the cutting speed accordingly in order to maintain proper chip shape.



切屑的情况 Chips





■软钢多孔加工资源·成本削减

Tool Consumption and Energy Cost Reduction in High Efficiency Drilling of Mild Steel

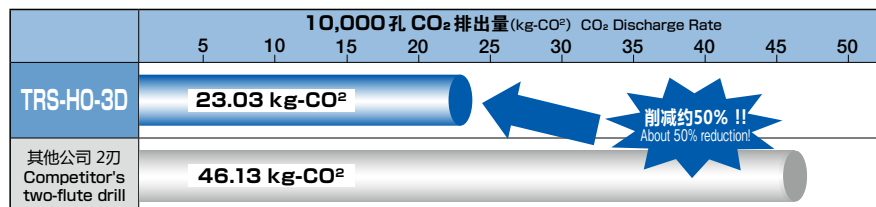
■环境评价 Environmental evaluation

使用工具 Tool	TRS-HO-3D	其他公司2刃 Competitor (2FL)
尺寸 Size	φ8.5	
加工材质 Work Material	S50C	
切削速度 Cutting Speed	100m/min (3,750min ⁻¹)	
进给速度 Feed Rate	1,420mm/min (0.38mm/rev)	710mm/min (0.19mm/rev)
孔深度 Depth of Hole	25mm (通孔) (Through)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	卧式加工中心 (BT40) Horizontal Machining Center	

Mega Muscle 钻头高效率加工的设计, 能够节约1/2的电力, 并且这可以有效的大幅降低二氧化碳的排放量。

*相较于其他二刃钻头

Due to its highly efficient design, the Mega Muscle Drill consumes one-half of the electrical power versus two-flute drills and significantly reduces the discharge of carbon dioxide! (* Compared to the competitor's two-flute drills)



*我司实绩 *Internal data

■生产成本比较例 Productivity Cost Comparison

工件名: 变速箱 加工材料: FC300
Item Name: Transmission case Work Material

2009年实绩 As of 2009

品名	其他公司 Competitor	TRS-HO-5D	以往比 Ratio	品名	其他公司 Competitor	TRS-HO-5D	以往比 Ratio
直径 Drill Diameter	φ8.5	φ8.5	100%	可再研磨数 Number of Regrinds	8 回(Times)	8 回(Times)	100%
切深量 Depth of Hole	34mm	34mm	100%	每月加工孔数 Number of Holes (Monthly)	300,000孔(Hole)	300,000孔(Hole)	100%
切削速度 Cutting Speed	120m/min	120m/min	100%	每月使用量(新+在研磨) Monthly Usage (New + Regrind)	60根(pc.)	40根(pc.)	67%
回转速度 Revolutions per Minute	4,500min ⁻¹	4,500min ⁻¹	100%	每月新品必要数 Monthly Usage (New)	7.5根(pc.)	5根(pc.)	67%
进给速度 Feed Rate	945mm/min	2,160mm/min	229%	每孔的加工时间 Cycle Time (per hole)	2.16秒(sec.)	0.94秒(sec.)	44%
钻头寿命 Tool Life	5,000孔(Hole)	7,500孔(Hole)	150%	每月孔加工时间 Total Time (Monthly)	10,794分(min)	4,722分(min)	44%

实现进给速度2.3倍, 耐久1.5倍及高效率长寿命。
高效率长寿命为削减成本贡献较大。

In this example, the cutting speed was increased by 1.5 times; while tool life and efficiency were increased by 2.3 times. The total cost savings totaled to approximately 118 million yen per year (calculated by standard drill list price).

削减效果

Reduction effect

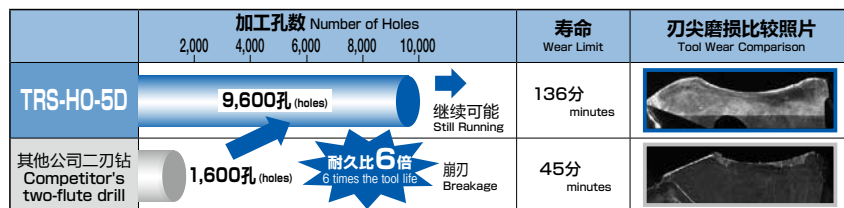
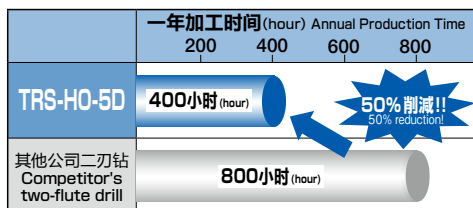
加工小时/年=400小时/年
Reduced electric power consumption 400 hours/year

长寿命削减刀具使用量

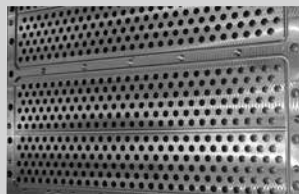
Long life reduces the number of tools used

工具寿命=6倍
Tool life = 6 times

工具使用削减量=180根 (与其他公司二刃钻相比)
Reduction in tool usage = 180 pieces (Competitor's two-flute drill)



使用工具 Tool	TRS-HO-5D	其他公司 Competitor
尺寸 Size	φ10.8	
加工材质 Work Material	SS400相当	
切削速度 Cutting Speed	100m/min (2,950min ⁻¹)	
进给速度 Feed Rate	1,770mm/min (0.6mm/rev)	885mm/min (0.3mm/rev)
孔深度 Depth of Hole	25mm (通孔) (Through)	
切削油剂 Coolant	水溶性切削油剂 Water Soluble	
使用机械 Machine	卧式加工中心 Horizontal Machining Center	



其他公司产品加工1600孔后发生崩刃, TRS 钻头可以以再该公司产品的2倍效率下, 加工9600孔(切削长241m)近6倍效率。刃尖磨损轻微, 可以继续加工。孔数较多的加工下, 约每年缩短加工时间400小时。一年刀具使用量从215把削减到35把, 约削减了180把。TRS 钻头是一款可以大幅削减刀具及电力费用的产品。

In this example, the Mega Muscle Drill processed at feed rates twice as fast as the competition. The competitor's drill broke after machining 1,600 holes. The Mega Muscle Drill, on the other hand, was able to complete 9,600 holes (cutting length of 241m) with only normal wear, which is 6 times the tool life versus the competitor. This resulted in an annual savings of approximately 400 production hours, which is equivalent to an annual savings of 5.6 million yen for the customer. It also resulted in an annual tool consumption decrease of 180 drills per year, from a total of 215 drills to just 35 drills per year. The Mega Muscle Drill is an environmentally friendly drill that is capable of reducing tool consumption and electrical power.

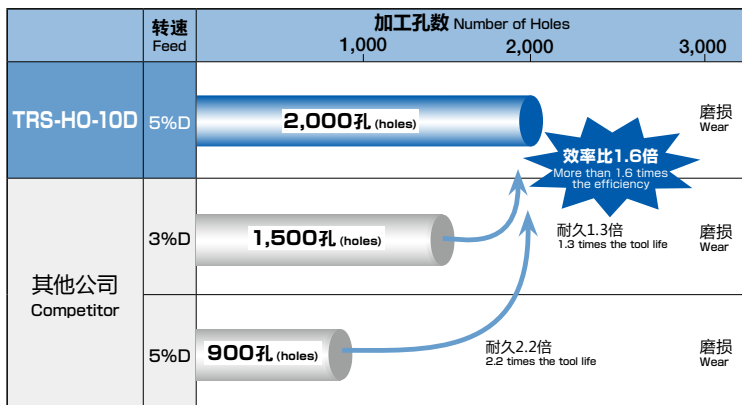
■FCD600的高进给加工

High feed drilling in FCD600

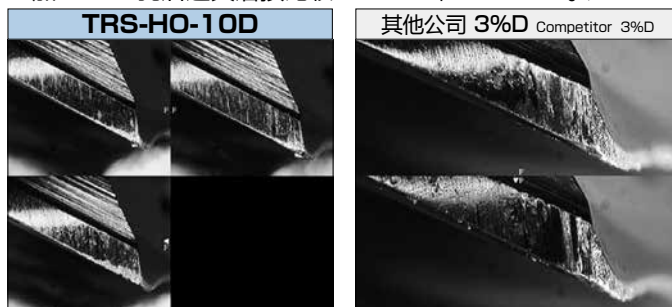
使用工具 Tool	TRS-HO-10D		其他公司 Competitor	
尺寸 Size	φ5			
加工材质 Work Material	FCD600			
切削速度 Cutting Speed	100m/min (6,370min ⁻¹)			
进给速度 Feed Rate	1,590mm/min (0.25mm/rev 5%D)	955mm/min (0.15mm/rev 3%D)	1,590mm/min (0.25mm/rev 5%D)	
孔深度 Depth of Hole	50mm (通孔) (Through)			
切削油剂 Coolant	水溶性切削油剂 Water Soluble			
使用机械 Machine	卧式加工中心 Horizontal Machining Center			

其他公司二刀钻相比,每转进给从0.15提高到0.25mm/rev,效率为1.6倍,耐久为1.3倍。另外,在高进给条件下,耐久可以实现2.2倍,高效率条件下可以发挥该产品性能。

By increasing the feed rate to 0.25mm/rev, the Mega Muscle Drill was able to achieve 1.6 times the efficiency and 1.3 times the durability versus the competitors' 2 flute drills, which ran at 0.15mm/rev. When machining under the feed rate of 0.25mm/rev, the Mega Muscle Drill was able to achieve 2.2 times the tool life versus the competition.



■加工1500孔后刀具磨损比较 Tool wear comparison after drilling 1,500 holes



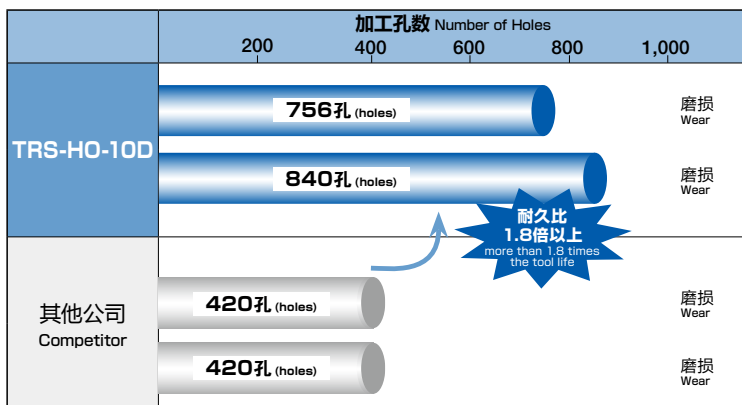
■FCD600的深孔加工

Deep hole drilling in ductile cast iron

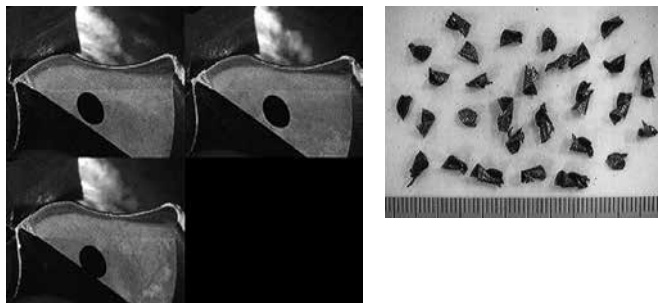
使用工具 Tool	TRS-HO-10D
尺寸 Size	φ10
加工材质 Work Material	FCD600
切削速度 Cutting Speed	80m/min (2,550min ⁻¹)
进给速度 Feed Rate	1,150mm/min (0.45mm/rev)
孔深度 Depth of Hole	100mm (通孔) (Through)
切削油剂 Coolant	水溶性切削油剂 Water Soluble
使用机械 Machine	卧式加工中心 Horizontal Machining Center

球墨铸铁深孔加工, 实现进给超过1000mm/min 高效率条件与其他公司二刀钻相比, 实现耐久1.8倍以上。调节切削速度可进一步提高寿命。

The Mega Muscle drill was able to achieve stable high feed deep-hole drilling in ductile cast iron at 1,150mm/min with 1.8 times the tool life versus the competitor's 2-flute drill. Tool life can be further improved by adjusting the cutting speed.



■加工756孔后刀尖磨损照片 Wear after drilling 756 holes



■S50C的MQL加工

S50C drilling with MQL

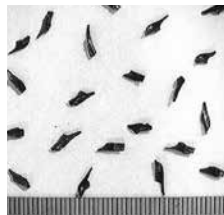
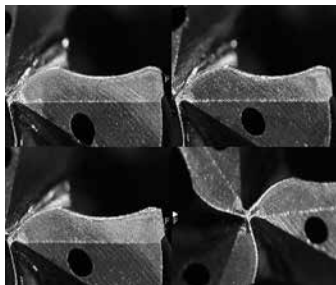
使用工具 Tool	TRS-HO-10D
尺寸 Size	φ5
加工材质 Work Material	S50C
切削速度 Cutting Speed	100m/min (6,370min ⁻¹)
进给速度 Feed Rate	1,590mm/min (0.25mm/rev)
孔深度 Depth of Hole	50mm (通孔) (Through)
切削油剂 Coolant	MQL
使用机械 Machine	卧式加工中心 Horizontal Machining Center

实现进给速度为1590mm/min，切削长超过130m 的高效率加工。
与其他公司产品相比可以抑制横刃磨损，研磨费用相对稳定，可以削减整体成本。

In comparison with other competitor tools, the Mega Muscle Drill suffered minimal wear after machining 130m of materials at a high feed rate of 1,590mm/min. With stable performance and little margin wear, the Mega Muscle Drill is able to achieve long tool life and reduce overall tooling cost.

■加工2600孔后刀尖磨损照片

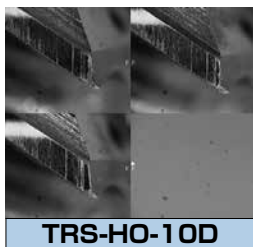
Wear after drilling 2,600 holes



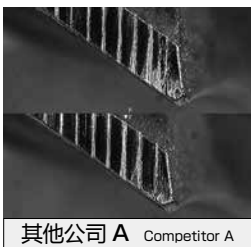
可继续加工 Still Running

	加工孔数 Number of Holes		
	1,000	2,000	3,000
TRS-HO-10D	2,600孔 (holes)	2,600孔 (holes)	可继续加工 Still Running
其他公司 A Competitor A	1,800孔 (holes)	1,400孔 (holes)	崩刃 Chipping 火花 Spark
其他公司 B Competitor B	1,800孔 (holes)	1,400孔 (holes)	磨损 Wear 磨损 Wear
其他公司 C Competitor C	759孔 (holes)	1,181孔 (holes)	磨损 Wear 磨损 Wear

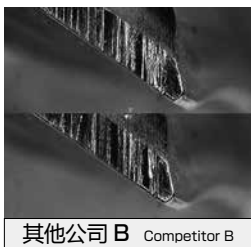
■加工1000孔时刃带部 Margin wear after drilling 1,000 holes



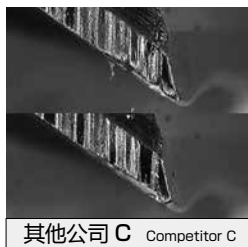
TRS-HO-10D



其他公司 A Competitor A



其他公司 B Competitor B



其他公司 C Competitor C



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