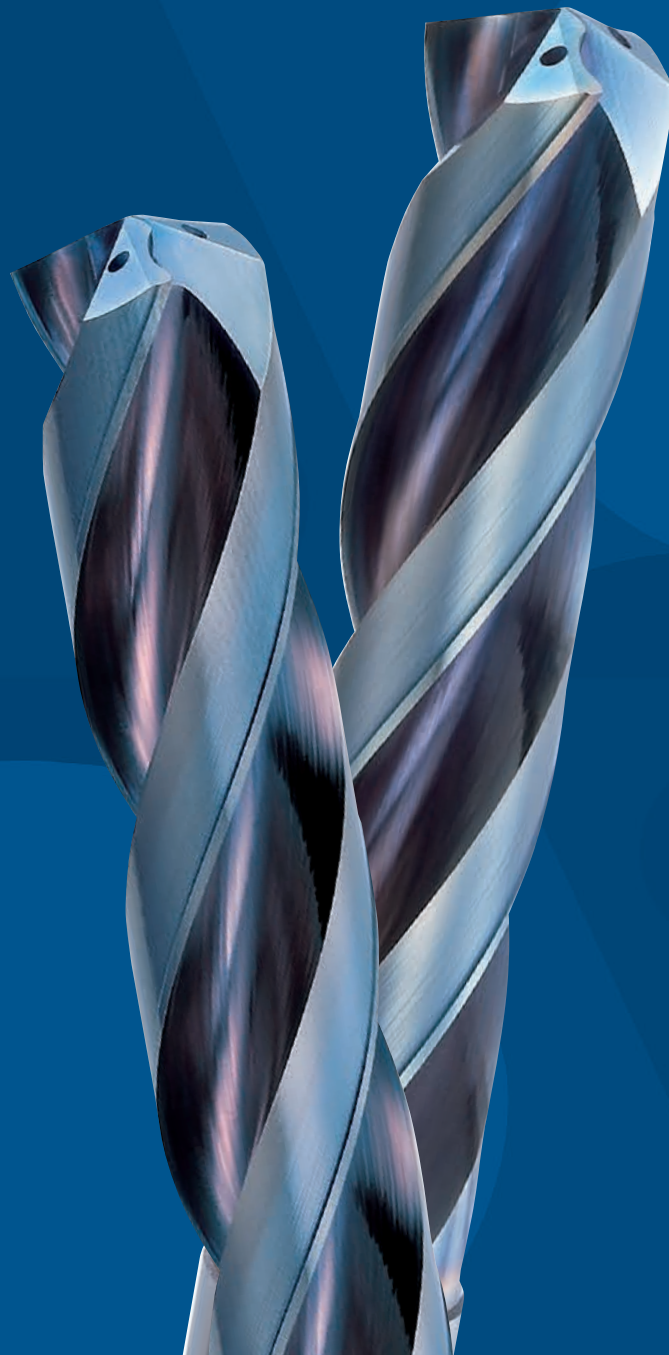




Coolant-Through - Three fluted - Carbide Drills

# TRS SERIES

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





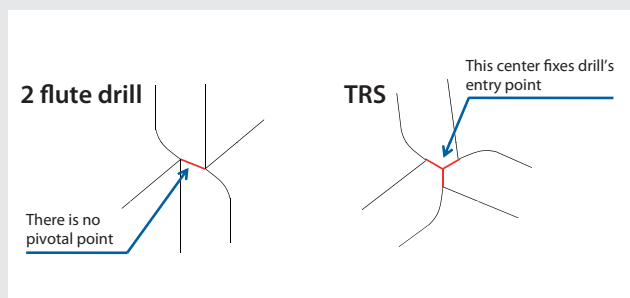
# THREE CONCEPTS DIFFERENTIATE THE TRS SERIES FROM TWO-FLUTES & CONVENTIONAL DRILLS

## 1 Higher Precision

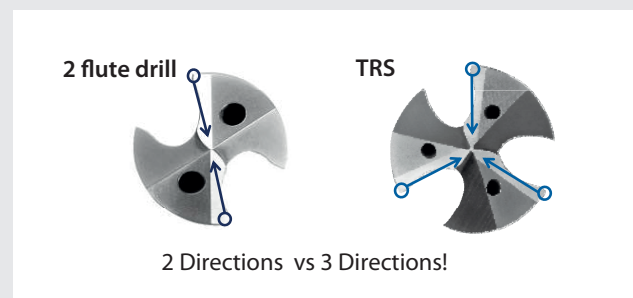
- Better tapping process from improved pilot holes
- Reamer-less drilling can be achieved

There are 2 keys to High Precision Drilling

### 1. Good biting properties to minimize deflection



### 2. Stable guide to keep the drilling process straight

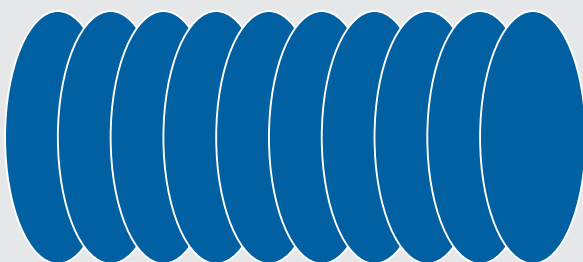


## 2 Improved feed rate

- The higher the feed rate, the more the output
- Reduced cost per unit

If we needed to drill 10mm through hole...

**TRS** will complete the process in 10 revolutions with feed rate of 1mm/rev.



10 revolutions = 10mm

**Conventional Drill**, on the other hand, will require 100 revolutions at 0.1mm/rev feed rate



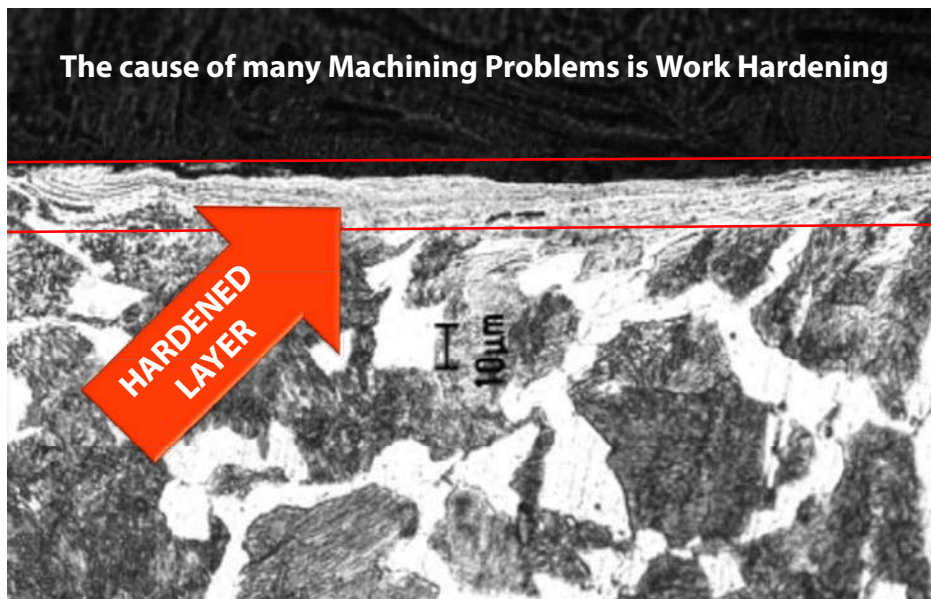
10 revolutions = 1.0mm

# THREE CONCEPTS DIFFERENTIATE THE TRS SERIES FROM TWO-FLUTES & CONVENTIONAL DRILLS

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## 3 Reduced work hardening

- Optimal conditions for thread making
- Improved tool life for succeeding cutting tools



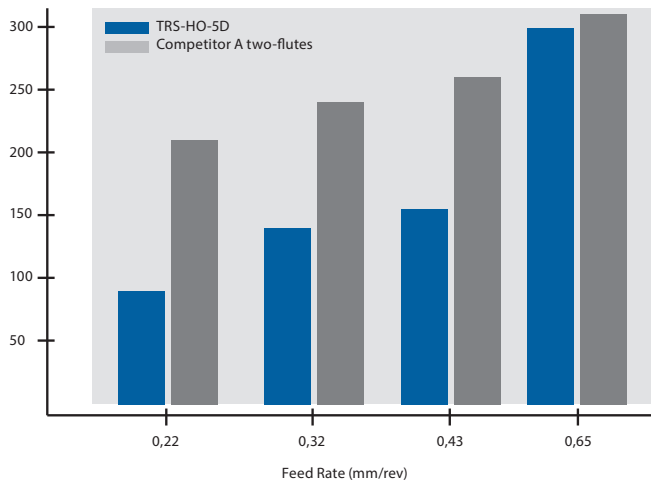
Work Hardening can cause:

1. Unstable tapping quality for both cutting and forming taps
2. Increased machine load that often result in reduced tool life for the drill and succeeding cutting tools.

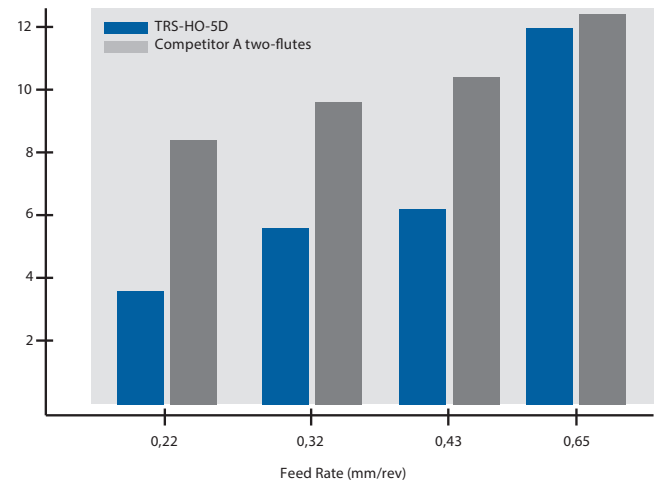
# THE WDI COATING IS EFFECTIVE IN HIGH FEED DRILLING

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

Work hardening rate comparison



Work hardening layer depth comparison



<b>Tool</b>	TRS-HO-5D ø10,8
<b>Work Material</b>	S50c (DIN CK50) (AISI 1050)
<b>Drilling Speed</b>	100m/min (2.950min <sup>-1</sup> )
<b>Feed</b>	Variable (See chart)
<b>Depth of Hole</b>	25mm (Through)
<b>Coolant</b>	Water Soluble
<b>Machine</b>	Horizontal Machining Center

	TRS-HO-5D		Competitor A Two-Flute	
	Work Hardening Level (Hv0,1)	Work Hardening Depth (µm)	Work Hardening Depth (Hv0,1)	Work Hardening Depth (µm)
Feed Rate	(Hv0,1)	(µm)	(Hv0,1)	(µm)
f=0,22mm/rev	120	3	220	8
f=0,32mm/rev	120	5	240	9
f=0,43mm/rev	185	6,5	265	10
f=0,65mm/rev	220	11	295	12

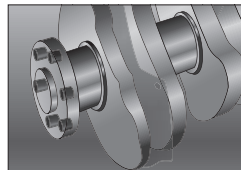
These graphs show the level and depth of work hardening in carbon steel when comparing the Mega Muscle drill versus 2-fluted drills. The amount of feed per revolution ranges from 0.22 to 0.65 mm/rev. Regardless of the number of flutes, work hardening has the tendency to increase with the increase of the feed rate. It can be noted, when the same feed rate is applied to both drills, the 3-fluted type has a much lower work hardening effect. 3-fluted drills always achieve lower work hardening rates when compared to 2-fluted drills. Thus, it is best practice to keep the work hardening as low as possible when secondary operations such as tapping or reaming are required. The Mega Muscle Drill offers this process stability, reducing the burden of the taps and reamers by increasing their tool life.

# UNMATCHED PROCESSING EFFICIENCY

- Feed rates of  $F = 1480\text{mm/min}$  were achieved in this crankshaft application (carbon steel)

Tool	TRS-HO-3D $\varnothing 10,3$	Competitor A
Work Material	S50C (DIN CK50 - AISI 1050)	
Drilling Speed	100m/min (2.950min <sup>-1</sup> )	
Feed	1.480mm/min (0,5mm/rev)	560mm/min 0,19mm/rev
Depth of Hole	24mm (Blind)	
Coolant	Water Soluble	
Machine	Horizontal Machining Center	

Drills	Number of Holes			
	400	800	1.200	1.600
TRS-HO-3D	1.542 (Holes)			
	Continue			
Competitor A	1.020 (Holes) Wear			



**1,5 times the tool life**  
**2,7 times the productivity**

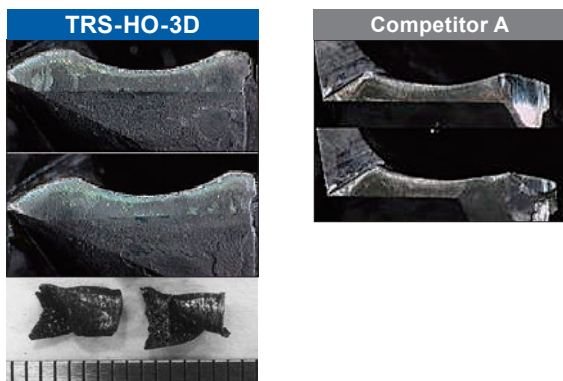
Example of the hole processing for the mounting holes on the crankshaft flywheel. TRS Drill achieved 1.5 times the tool life and 2.7 times the productivity over Competitor A's 2 fluted drill. With the ability to control work hardening, one has the ability to extend tool life on secondary processes such as tapping, thus decreasing overall tooling and part cost per unit. For example, by lowering the cutting speed to 80m/min, tool life of the drill and all secondary process tools can be extended.

- Feed rates of  $F=1.480\text{mm/min}$  were achieved, with overall cutting lengths of 166m.

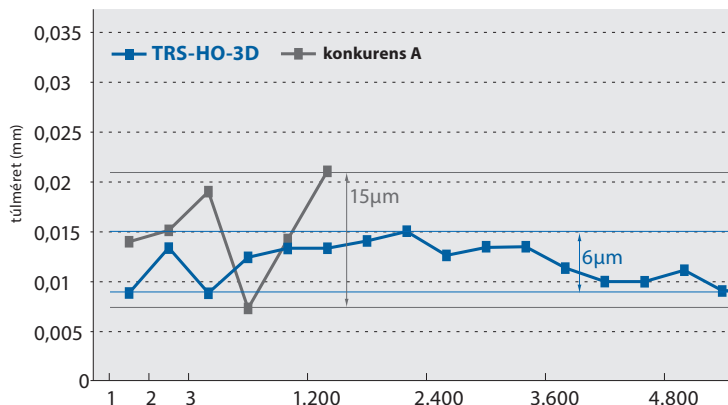
Tool	TRS-HO-3D $\varnothing 10,3$
Work Material	S50C (DIN CK50 - AISI 1050)
Drilling Speed	100m/min (3.090 min <sup>-1</sup> )
Feed	1.480mm/min (0,48mm/rev)
Depth of Hole	32mm (Through)
Coolant	Water Soluble
Machine	Horizontal Machining Center

Drills	Number of Holes					
	1.000	2.000	3.000	4.000	5.000	6.000
TRS-HO-3D	5.200 (Holes)					
	Continue					
	5.200 (Holes) Wear					
Competitor A	1.600 (Holes) Abnormal Wear					
	397 (Holes) Breakage					

- Tool wear comparison



- Changes in amount of hole oversize



Example of carbon steel processing. Because of the high feed rate of 0.48mm/rev, the competitor company's drill showed a large variation in hole expansion as well as low tool life. However, the Mega Muscle Drill was able to achieve 5200 holes (cutting length 166m) with stable hole sizes. The competitor A's hole expansion ranged up to 15µm, while the TRS Drill had only a 6µm variation.



# DRILLING FEEDS EXCEEDING 1.000 MM/MIN

- Feed rates of  $F=1.140\text{mm/min}$  were achieved, with overall cutting lengths of 110m

<b>Tool</b>	TRS-HO-5D $\phi$ 10,5
<b>Work Material</b>	SCM440 (Alloy Steel)
<b>Drilling Speed</b>	80m/min (2.430min <sup>-1</sup> )
<b>Feed</b>	1.140mm/min (0,47mm/rev)
<b>Depth of Hole</b>	50mm (Through)
<b>Coolant</b>	Water Soluble
<b>Machine</b>	Horizontal Machining Center

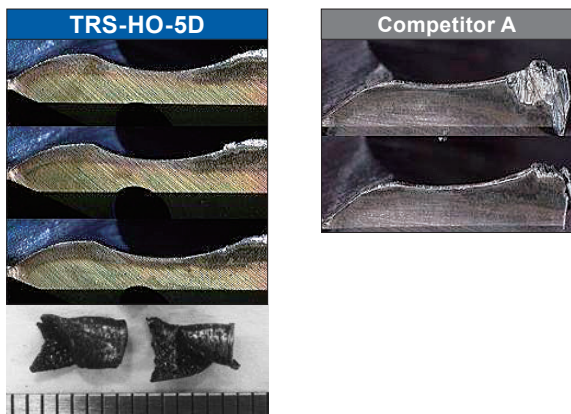
Drills	Number of Holes					
	500	1.000	1.500	2.000	2.500	3.000
TRS-HO-5D	2.600 (Holes) Wear					
	2.200 (Holes) Wear					
Competitor A	1.075 (Holes) Breakage					
	1.000 (Holes) Breakage					

- Feed rates of  $F=1010\text{mm/min}$  were achieved in 30HRC alloy steel.

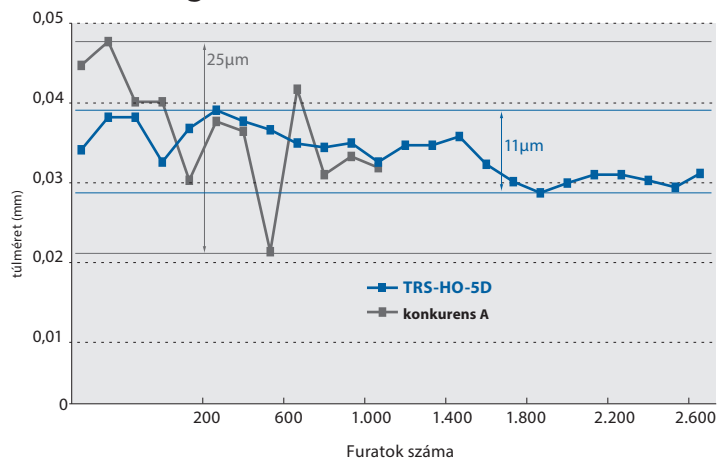
<b>Tool</b>	TRS-HO-5D $\phi$ 10,8
<b>Work Material</b>	SCM440 (30HRC) (Alloy Steel)
<b>Drilling Speed</b>	70m/min (2.060min <sup>-1</sup> )
<b>Feed</b>	1.010mm/min (0,49mm/rev)
<b>Depth of Hole</b>	50mm (Through)
<b>Coolant</b>	Water Soluble
<b>Machine</b>	Horizontal Machining Center

Drills	Number of Holes					
	500	1.000	1.500	2.000	2.500	3.000
TRS-HO-5D	2.000 (Holes) Wear					
	1.700 (Holes) Wear					
Competitor A	174 (Holes) Breakage					
	300 (Holes) Abnormal Wear					

- Tool wear comparison



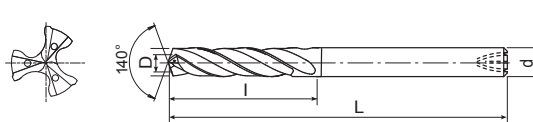
- Changes in amount of hole oversize



Example of hole processing in alloy steel. At high feed machining of 0.47mm/rev, Competitor A's drill was found to be unstable in hole size as well as having low tool life. However, the TRS Drill exceeded 2200 (cutting length 110m) holes of tool life, limited by normal wear, thus decreasing overall tooling and part cost per unit. When comparing the hole expansion values, Competitor A was found to have a large variation of up to 25µm. While the Mega Muscle Drill had up to 11µm.

# TRS-HO-3D

Drilling | Solid carbide | 3xD



- First choice in quality and performance
- 3 flute carbide drill with internal coolant, WDI coating
- Up to 3xD
- Allows high feed 1.000mm/min process in steel and cast iron
- 87 sizes



Drilling | Solid carbide

3xD

EDP	D	L	l	d	Price
48157050	5	80	25	6	
8660510	5,1	82	26	6	
8660520	5,2	82	26	6	
8660530	5,3	82	27	6	
8660540	5,4	82	27	6	
8660550	5,5	82	28	6	
48157555	5,55	82	28	6	
8660560	5,6	82	28	6	
8660570	5,7	82	29	6	
8660580	5,8	82	29	6	
8660590	5,9	82	30	6	
8660600	6	82	30	6	
48157061	6,1	88	31	8	
48157062	6,2	88	31	8	
48157063	6,3	88	32	8	
48157064	6,4	88	32	8	
48157065	6,5	88	33	8	
48157066	6,6	88	33	8	
48157067	6,7	88	34	8	
48157068	6,8	88	34	8	
48157069	6,9	88	35	8	
48157070	7	88	35	8	
8660710	7,1	94	36	8	
8660720	7,2	94	36	8	
8660730	7,3	94	37	8	
8660740	7,4	94	37	8	
8660750	7,5	94	38	8	
48157755	7,55	94	38	8	
8660760	7,6	94	38	8	
8660770	7,7	94	39	8	
8660780	7,8	94	39	8	
8660790	7,9	94	40	8	
8660800	8	94	40	8	
48157081	8,1	101	41	10	
48157082	8,2	101	41	10	
48157083	8,3	101	42	10	
48157084	8,4	101	42	10	
48157085	8,5	101	43	10	
48157086	8,6	101	43	10	

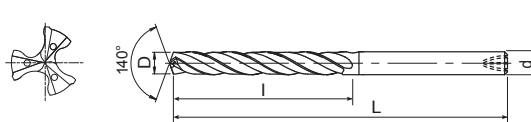
EDP	D	L	l	d	Price
48157087	8,7	101	44	10	
48157088	8,8	101	44	10	
48157089	8,9	101	45	10	
48157090	9	101	45	10	
8660910	9,1	106	46	10	
8660920	9,2	106	46	10	
8660930	9,3	106	47	10	
8660940	9,4	106	47	10	
8660950	9,5	106	48	10	
48157955	9,55	106	48	10	
8660960	9,6	106	48	10	
8660970	9,7	106	49	10	
8660980	9,8	106	49	10	
8660990	9,9	106	50	10	
8661000	10	106	50	10	
48157101	10,1	113	51	12	
48157102	10,2	113	51	12	
48157103	10,3	113	52	12	
48157104	10,4	113	52	12	
48157105	10,5	113	53	12	
48157106	10,6	113	53	12	
48157107	10,7	113	54	12	
48157108	10,8	113	54	12	
48157109	10,9	113	55	12	
48157110	11	113	55	12	
8661110	11,1	120	56	12	
8661120	11,2	120	56	12	
8661130	11,3	120	57	12	
8661140	11,4	120	57	12	
8661150	11,5	120	58	12	
8661160	11,6	120	58	12	
8661170	11,7	120	59	12	
8661180	11,8	120	59	12	
8661190	11,9	120	60	12	
8661200	12	120	60	12	
48157125	12,5	128	63	14	
48157130	13	128	65	14	
8661350	13,5	134	68	14	





# TRS-HO-5D

Drilling | Solid carbide | 5xD



- First choice in quality and performance
- 3 flute carbide drill with internal coolant, WDI coating
- Up to 5xD
- Allows high feed 1.000mm/min process in steel and cast iron
- 95 sizes



Drilling | Solid carbide

5xD

EDP	D	L	l	d	Price
48158050	5	95	45	6	
8662510	5,1	100	41	6	
8662520	5,2	100	42	6	
8662530	5,3	100	43	6	
8662540	5,4	100	44	6	
8662550	5,5	100	44	6	
48158555	5,55	100	45	6	
8662560	5,6	100	45	6	
8662570	5,7	100	46	6	
8662580	5,8	100	47	6	
8662590	5,9	100	48	6	
8662600	6	100	48	6	
48158061	6,1	109	49	8	
48158062	6,2	109	50	8	
48158063	6,3	109	51	8	
48158064	6,4	109	52	8	
48158065	6,5	109	52	8	
48158066	6,6	109	53	8	
48158067	6,7	109	54	8	
48158068	6,8	109	55	8	
48158069	6,9	109	56	8	
48158070	7	109	56	8	
8662710	7,1	118	57	8	
8662720	7,2	118	58	8	
8662730	7,3	118	59	8	
8662740	7,4	118	60	8	
8662750	7,5	118	60	8	
48158755	7,55	118	61	8	
8662760	7,6	118	61	8	
8662770	7,7	118	62	8	
8662780	7,8	118	63	8	
8662790	7,9	118	64	8	
8662800	8	118	64	8	
48158081	8,1	128	65	10	
48158082	8,2	128	66	10	
48158083	8,3	128	67	10	
48158084	8,4	128	68	10	
48158085	8,5	128	68	10	
48158086	8,6	128	69	10	
48158087	8,7	128	70	10	
48158088	8,8	128	71	10	
48158089	8,9	128	72	10	
48158090	9	128	72	10	
8662910	9,1	136	73	10	
8662920	9,2	136	74	10	

EDP	D	L	l	d	Price
8662930	9,3	136	75	10	
8662940	9,4	136	76	10	
8662950	9,5	136	76	10	
48158955	9,55	136	77	10	
8662960	9,6	136	77	10	
8662970	9,7	136	78	10	
8662980	9,8	136	79	10	
8662990	9,9	136	80	10	
8663000	10	136	80	10	
48158101	10,1	146	81	12	
48158102	10,2	146	82	12	
48158103	10,3	146	83	12	
48158104	10,4	146	84	12	
48158105	10,5	146	84	12	
48158106	10,6	146	85	12	
48158107	10,7	146	86	12	
48158108	10,8	146	87	12	
48158109	10,9	146	88	12	
48158110	11	146	88	12	
8663110	11,1	156	89	12	
8663120	11,2	156	90	12	
8663130	11,3	156	91	12	
8663140	11,4	156	92	12	
8663150	11,5	156	92	12	
8663160	11,6	156	93	12	
8663170	11,7	156	94	12	
8663180	11,8	156	95	12	
8663190	11,9	156	96	12	
8663200	12	156	96	12	
48158121	12,1	167	97	14	
48158122	12,2	167	98	14	
48158123	12,3	167	99	14	
48158124	12,4	167	100	14	
48158125	12,5	167	100	14	
48158126	12,6	167	101	14	
48158127	12,7	167	102	14	
48158128	12,8	167	103	14	
48158129	12,9	167	104	14	
48158130	13	167	104	14	
8663350	13,5	176	108	14	
8663400	14	176	112	14	
48158145	14,5	185	116	16	
48158150	15	185	120	16	
8663550	15,5	193	124	16	
8663600	16	193	128	16	





# CUTTING CONDITIONS

Drilling | Solid | Cutting conditions

## TRS-HO-3D/5D/10D

Ø	Mild Steel - Low Carbon Steel St-52 ~150HB ~500 N/mm <sup>2</sup>			Carbon Steel C45 ~210HB ~710 N/mm <sup>2</sup>			Alloys Steel 42CrMo4 16~28HRC 710~900 N/mm <sup>2</sup>			Alloys Steel 42CrMo4 16~28HRC 900~110 N/mm <sup>2</sup>			Cast Iron GG-25 ~350 N/mm <sup>2</sup>			Ductile Cast Iron GGG-60 400~600 N/mm <sup>2</sup>					
	Vc			80 ~ 120 m/min			80 ~ 120 m/min			60 ~ 100 m/min			60 ~ 90 m/min			80 ~ 150 m/min			60 ~ 120 m/min		
	S (min <sup>-1</sup> )		F (mm/rev.)	S (min <sup>-1</sup> )		F (mm/rev.)	S (min <sup>-1</sup> )		F (mm/rev.)	S (min <sup>-1</sup> )		F (mm/rev.)	S (min <sup>-1</sup> )		F (mm/rev.)	S (min <sup>-1</sup> )		F (mm/rev.)			
3D	5D	3D		10D	3D		10D	3D		10D	3D		10D	3D		10D	3D		10D	3D	10D
5	6.400	6.400	0,18 ~ 0,25	6.400	6.400	0,18 ~ 0,25	4.800	4.800	0,18 ~ 0,25	4.800	5.700	0,18 ~ 0,25	6.400	6.400	0,18 ~ 0,30	6.400	6.400	0,18 ~ 0,25			
6	5.300	5.300	0,21 ~ 0,30	5.300	5.300	0,21 ~ 0,30	4.000	4.000	0,21 ~ 0,30	4.000	4.800	0,21 ~ 0,30	5.300	5.300	0,21 ~ 0,36	5.300	5.300	0,21 ~ 0,30			
7	4.500	4.500	0,25 ~ 0,35	4.500	4.500	0,25 ~ 0,35	3.400	3.400	0,25 ~ 0,35	3.400	4.100	0,25 ~ 0,35	4.500	4.500	0,25 ~ 0,42	4.500	4.500	0,25 ~ 0,35			
8	4.000	4.000	0,28 ~ 0,40	4.000	4.000	0,28 ~ 0,40	3.000	3.000	0,28 ~ 0,40	3.000	3.600	0,28 ~ 0,40	4.000	4.000	0,28 ~ 0,48	4.000	4.000	0,28 ~ 0,40			
9	3.500	3.500	0,32 ~ 0,45	3.500	3.500	0,32 ~ 0,45	2.700	2.700	0,32 ~ 0,45	2.700	3.200	0,32 ~ 0,45	3.500	3.500	0,32 ~ 0,54	3.500	3.500	0,32 ~ 0,45			
10	3.200	3.200	0,35 ~ 0,50	3.200	3.200	0,35 ~ 0,50	2.400	2.400	0,35 ~ 0,50	2.400	2.900	0,35 ~ 0,50	3.200	3.200	0,35 ~ 0,60	3.200	3.200	0,35 ~ 0,50			
11	2.900	2.900	0,39 ~ 0,55	2.900	2.900	0,39 ~ 0,55	2.200	2.200	0,39 ~ 0,50	2.200	2.600	0,39 ~ 0,50	2.900	2.900	0,39 ~ 0,66	2.900	2.900	0,39 ~ 0,55			
12	2.700	2.700	0,42 ~ 0,60	2.700	2.700	0,42 ~ 0,60	2.000	2.000	0,42 ~ 0,54	2.000	2.400	0,42 ~ 0,54	2.700	2.700	0,42 ~ 0,72	2.700	2.700	0,42 ~ 0,60			
13	2.400	-	0,46 ~ 0,65	2.400	-	0,46 ~ 0,65	1.800	1.800	0,46 ~ 0,59	1.800	-	0,46 ~ 0,59	2.400	-	0,46 ~ 0,78	2.400	-	0,46 ~ 0,65			
14	2.300	-	0,49 ~ 0,70	2.300	-	0,49 ~ 0,70	1.700	1.700	0,49 ~ 0,63	1.700	-	0,49 ~ 0,63	2.300	-	0,49 ~ 0,84	2.300	-	0,49 ~ 0,70			
16	2.000	-	0,48 ~ 0,72	2.000	-	0,48 ~ 0,72	1.500	1.500	0,48 ~ 0,64	1.500	-	0,48 ~ 0,64	2.000	-	0,56 ~ 0,80	2.000	-	0,48 ~ 0,72			
18	1.800	-	0,54 ~ 0,81	1.800	-	0,54 ~ 0,81	1.300	1.300	0,54 ~ 0,72	1.300	-	0,54 ~ 0,72	1.800	-	0,63 ~ 0,90	1.800	-	0,54 ~ 0,81			

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