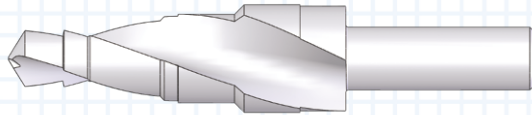
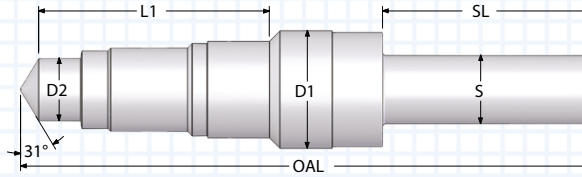


# SUN HYDRAULIC CARTRIDGE VALVE TOOLS HIGH SPEED STEEL ROUGHING STEP DRILLS



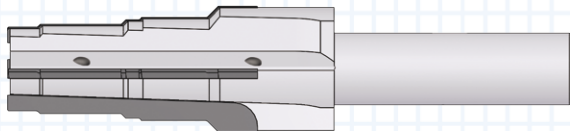
- Precision ground for maximum concentricity
- Prepares cavity for finish tool



This illustration shows the largest and smallest diameter.  
Visit website [www.sct-usa.com](http://www.sct-usa.com) for more details.

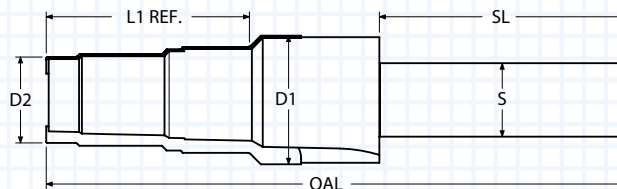
D1	D2	L1	S	SL	OAL	FLUTES	THREAD	ORDER #		EDP #	
								UNCOATED	ALTiN+	UNCOATED	ALTiN+
1.285	0.686	2.517	0.750	2.400	6.40	2	1.0-14UNS-2B	T-2A-DRILL	T-2A-DRILL-A	400701	400741
1.312	0.876	2.382	0.750	2.400	6.40	2	1.0-14UNS-2B	T-3A-DRILL	T-3A-DRILL-A	400704	400744
1.312	0.876	2.147	0.750	2.400	6.40	2	1.0-14UNS-2B	T-5A-DRILL	T-5A-DRILL-A	400707	400747
0.980	0.688	2.018	0.750	2.400	6.40	2	M20X1.5-6H	T-10A-DRILL	T-10A-DRILL-A	400710	400750
0.980	0.688	2.322	0.750	2.400	6.40	2	M20X1.5-6H	T-11A-DRILL	T-11A-DRILL-A	400713	400753
0.980	0.688	1.858	0.750	2.400	6.40	2	M20X1.5-6H	T-13A-DRILL	T-13A-DRILL-A	400716	400756
1.500	1.251	2.377	0.750	2.400	6.50	2	M36X2.0-6H	T-16A-DRILL	T-16A-DRILL-A	400719	400759
0.978	0.529	2.780	0.750	2.400	6.80	2	M20X1.5-6H	T-21A-DRILL	T-21A-DRILL-A	400722	400762
1.125	0.405	1.804	0.750	2.400	6.40	2	M16X1.5-6H	T-162A-DRILL	T-162A-DRILL-A	400725	400765
1.125	0.405	2.143	0.750	2.400	6.40	2	M16X1.5-6H	T-163A-DRILL	T-163A-DRILL-A	400728	400768

# SUN HYDRAULIC CARTRIDGE VALVE TOOLS ROUGHER - CARBIDE TIPPED



Coolant Hole(s) Each Flute

- ALTiN+ coating for higher cutting speed
- Polished flute face for optimum performance
- Precision ground for maximum concentricity

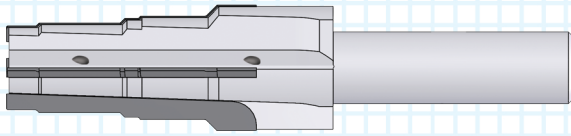


This illustration shows the largest and smallest diameter.  
Visit website [www.sct-usa.com](http://www.sct-usa.com) for more details.

D1	D2	L1	S	SL	OAL	FLUTES	THREAD	ORDER #		EDP #	
								UNCOATED	ALTiN+	UNCOATED	ALTiN+
1.725	1.226	2.697	1.000	2.50	6.50	4	M36X2.0-6H	T-17A-ROUGH-X8	T-17A-ROUGH-X8A	400826	400876
2.038	1.601	3.135	1.000	2.50	6.88	4	M48X2.0-6H	T-18A-ROUGH-X8	T-18A-ROUGH-X8A	400829	400879

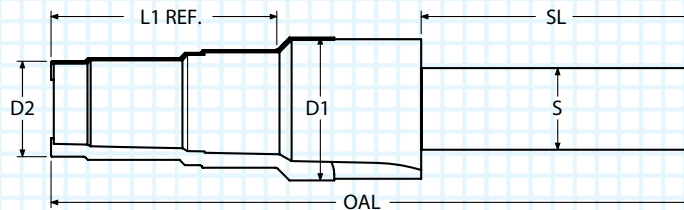
# SUN HYDRAULIC CARTRIDGE VALVE TOOLS

## FINISHER - CARBIDE TIPPED



Coolant Hole(s) Each Flute

- ALTiN+ coating for higher cutting speed
- Polished flute face for optimum performance
- Precision ground for maximum concentricity



This illustration shows the largest and smallest diameter.  
Visit website [www.sct-usa.com](http://www.sct-usa.com) for more details.

D1	D2	L1	S	SL	OAL	FLUTES	THREAD	ORDER #		EDP #	
								UNCOATED	ALTiN+	UNCOATED	ALTiN+
1.312	0.876	2.073	0.750	2.50	5.88	4	1.0-14UNS-2B	T-2A-FINISH-X8	T-2A-FINISH-X8A	400801	400851
1.709	0.876	1.885	0.750	2.25	5.38	4	1.0-14UNS-2B	T-3A-FINISH-X8	T-3A-FINISH-X8A	400804	400854
1.079	0.876	1.635	0.750	2.25	5.13	3	1.0-14UNS-2B	T-5A-FINISH-X6	T-5A-FINISH-X6A	400614	400616
0.704	0.438	0.752	0.500	2.00	4.00	3	M16X1.5-6H	T-8A-FINISH-X3	T-8A-FINISH-X3A	400811	400861
1.000	0.688	1.726	0.750	2.25	5.25	4	M20X1.5-6H	T-10A-FINISH-X8	T-10A-FINISH-X8A	400813	400863
1.000	0.688	2.036	0.750	2.25	5.50	3	M20X1.5-6H	T-11A-FINISH-X6	T-11A-FINISH-X6A	400611	400813
1.000	0.688	1.539	0.750	2.25	5.00	3	M20X1.5-6H	T-13A-FINISH-X6	T-13A-FINISH-X6A	400817	400867
1.563	1.251	2.448	1.000	2.25	6.00	4	M36X2.0-6H	T-16A-FINISH-X8	T-16A-FINISH-X8A	400822	400872
1.750	1.251	2.448	1.000	2.50	6.50	4	M36X2.0-6H	T-17A-FINISH-X8	T-17A-FINISH-X8A	400825	400875
2.063	1.626	3.135	1.000	2.50	6.88	4	M48X2.0-6H	T-18A-FINISH-X8	T-18A-FINISH-X8A	400828	400878
1.000	0.688	2.539	0.750	2.25	6.00	4	M20X1.5-6H	T-21A-FINISH-X8	T-21A-FINISH-X8A	400831	400881
0.938	0.516	1.377	0.750	2.25	4.88	3	M16X1.5-6H	T-162A-FINISH-X6	T-162A-FINISH-X6A	400602	400604
0.938	0.516	1.800	0.750	2.25	5.25	3	M16X1.5-6H	T-163A-FINISH-X6	T-163A-FINISH-X6A	400607	400610

# PORT & CAVITY TECHNICAL INFORMATION

MATERIAL	HB/Rc	SPEED (SFM)		CUTTING CONDITIONS	
		UNCOATED	ALTiN+	INFEEED PER FLUTE REAM	INFEEED PER FLUTE SPOT FACE
CAST IRON	130 HB	75-210	200-450	.001-.0025	.0008-.0020
CARBON STEEL*	18 Rc	125-190 (Not Ideal)	190-400	.001-.0030	.001-.0020
ALLOY STEEL*	20 Rc	70-135 (Not Ideal)	130-350	.001-.0030	.0008-.0020
TOOL STEEL*	25 Rc	75-100 (Not Ideal)	100-220	.001-.0025	.0005-.0020
300 STAINLESS STEEL*	150 HB	90-100 (Not Ideal)	100-230	.001-.0020	.0007-.0015
400 STAINLESS STEEL*	195 HB	90-135 (Not Ideal)	135-300	.001-.0020	.0005-.0015
HIGH TEMP ALLOY* (NICKEL & COBALT BASE)	20 Rc	30-125 (Not Ideal)	100-150	.0008-.0015	.0005-.0010
TITANIUM	25 Rc	50-100	100-140	.001-.0020	.0005-.0010
HEAT TREATED ALLOYS (38-45Rc)	40 Rc	50-75	75-130	.0008-.0015	.0005-.0010
ALUMINUM	100 HB	850-1000	800-1500	.002-.0040	.0010-.0030
BRASS, ZINC	80 HB	750-950	800-1200	.002-.0040	.0010-.0030

SFM = Surface Feet per Minute

RPM = SFM x 3.82 divided by tool diameter

Starting parameters only. Setup and machine rigidity may affect performance.

\*ALTiN+ is highly recommended for steel, stainless steel & high temp alloy.

PROBLEM	CAUSE	SOLUTION
RAPID FLANK WEAR	CUTTING CONDITIONS	Check for excessive speed and feed - see chart.
	TOOL	Select a coated tool.
	PROGRAM	Remove dwell from program at end of cut.
BUILT-UP EDGE	TOOL	Select a coated tool. The coating will resist built-up edges.
	HEAT	Use coolant through port tool. If coolant is not available, use shop air and a coated tool.
SURFACE TORN	TOOL	Use a coated tool. On most carbon steels, an uncoated tool will not produce an acceptable finish.
CHATTER	TOOL	Hone cutting edge of spot face. Use Coated Tool. Increase chip load.
LIGHT CHATTER	PROGRAM	Increase speed by 15-20%. A faster speed reduces forces. A dwell typically will not remove chatter.
POOR TOOL LIFE	AMOUNT OF STOCK	Rough port to 0.97 inch of finish size.
	PART	Make sure prior operation did not work harden the material.

## SAMPLE PROGRAM FOR MAXIMUM PRODUCTIVITY

N51 (Sample Port Tool Program: MS33649-4RA (ALTiN+) cutting Carbon Steel

**T51 M06**

**S2916 M03**

**G00 G90 G54 X0. Y0.**

**G43 H51 Z0.1 M08**

**G01 Z-0.6 F23.3**

**S1290 M03**

**G04 P1.**

**G01 Z-.73 F10.3**

**G00 Z5. M09**

**Select Tool**

**SFM = 300 ; RPM = 300 x 3.82 / Reamer Diameter**

**RPM = 300 X 3.82 / 0.393**

**RPM = 2916**

**Feed Rate = RPM x 0.002 x 4 (Number of Flutes)**

**RPM = 300 x 3.82 / 0.888 (Spot Face Diameter)**

**Dwell to slow down spindle**

**Feed rate = RPM x 0.002 x 4 (Number of Flutes)**