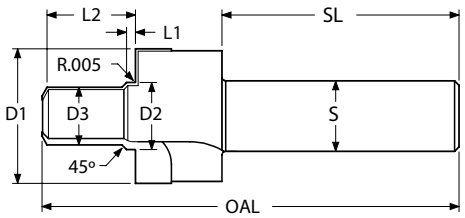
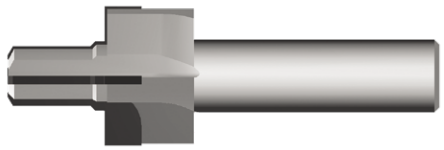
MS33651 (AND10071) - PORT TOOL - CARBIDE TIPPED



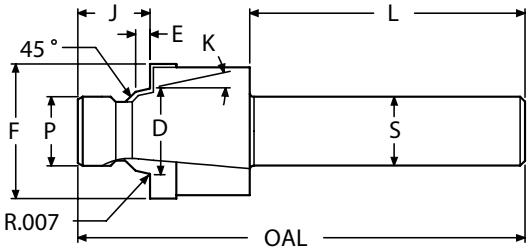


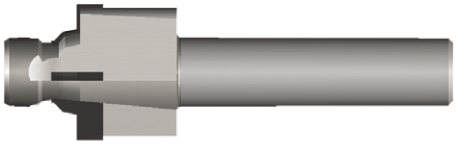
- Polished flute face for optimum performance
- ALTiN+ coating for improved surface finish

D1	D2	D3	L1	L2	S	SL	OAL	FLUTES	THREAD	ORDER #		EDP #	
										UNCOATED	ALTiN+	UNCOATED	ALTiN+
1.050	0.523	0.450	0.070	0.690	0.500	1.88	3.25	4	0.500-20 UNF-3B	MS33651	MS33651A	401001	401010

Thread mills are available. See pages 8-18

MS16142 (SAEJ1926/1) (SAEJ514) O-RING BOSS
SOLID PILOT - CARBIDE TIPPED





- Ideal for non-standard minor diameter lengths
- Often called ORB (followed by port size number)
- Meets the requirements of SAEJ1926/1
- Polished flute face for optimum performance
- ALTiN+ coating for improved surface finish
- Meets the requirements of SAEJ514

K	D	E	F	P	J	L	S	OAL	FLUTES	TUBE	THREAD	SAE#	ORDER #		EDP #	
													UNCOATED	ALTiN+	UNCOATED	ALTiN+
12°	0.3605	0.082	0.682	0.270	0.365	2.00	0.500	3.00	3	0.125	0.3125-24 UNF-2B	SAE#2	MS16142-2S	MS16142-2SA	401119	401219
12°	0.4235	0.082	0.760	0.331	0.415	2.00	0.500	3.00	3	0.188	0.3750-24 UNF-2B	SAE#3	MS16142-3S	MS16142-3SA	401125	401225
12°	0.4895	0.101	0.838	0.385	0.445	2.00	0.500	3.12	3	0.250	0.4375-20 UNF-2B	SAE#4	MS16142-4S	MS16142-4SA	401128	401228
12°	0.5525	0.101	0.916	0.448	0.465	2.00	0.500	3.12	4	0.312	0.5000-20 UNF-2B	SAE#5	MS16142-5S	MS16142-5SA	401131	401231
12°	0.6185	0.105	0.990	0.504	0.495	2.00	0.500	3.25	4	0.375	0.5625-18 UNF-2B	SAE#6	MS16142-6S	MS16142-6SA	401134	401234
15°	0.8135	0.108	1.198	0.685	0.560	2.12	0.750	3.57	4	0.500	0.7500-16 UNF-2B	SAE#8	MS16142-8S	MS16142-8SA	401137	401237
15°	0.9445	0.108	1.354	0.801	0.610	2.12	0.750	3.66	4	0.625	0.8750-14 UNF-2B	SAE#10	MS16142-10S	MS16142-10SA	401101	401201
15°	1.1505	0.138	1.635	0.975	0.640	2.12	0.750	3.75	4	0.750	1.0625-12 UN-2B	SAE#12	MS16142-12S	MS16142-12SA	401104	401204
15°	1.2755	0.138	1.775	1.101	0.710	2.25	1.000	4.00	4	0.875	1.1875-12 UN-2B	SAE#14	MS16142-14S	MS16142-14SA	401107	401207
15°	1.4005	0.138	1.935	1.225	0.710	2.25	1.000	4.05	4	1.000	1.3125-12 UN-2B	SAE#16	MS16142-16S	MS16142-16SA	401110	401210
15°	1.7155	0.140	2.290	1.537	0.750	2.25	1.000	4.20	4	1.250	1.6250-12 UN-2B	SAE#20	MS16142-20S	MS16142-20SA	401113	401213
15°	1.9645	0.140	2.570	1.787	0.750	2.25	1.000	4.20	4	1.500	1.8750-12 UN-2B	SAE#24	MS16142-24S	MS16142-24SA	401116	401216
15°	2.5895	0.140	3.490	2.412	0.800	2.50	1.250	4.60	4	2.000	2.5000-12 UN-2B	SAE#32	MS16142-32S	MS16142-32SA	401122	401222

Thread mills are available. See pages 8-18.

PORT & CAVITY TECHNICAL INFORMATION

MATERIAL	HB/Rc	SPEED (SFM)		CUTTING CONDITIONS	
		UNCOATED	ALTiN+	INFEED PER FLUTE REAM	INFEED PER FLUTE SPOT FACE
CAST IRON	130 HB	75-210	200-450	.001-.0025	.0008-.0020
CARBON STEEL	18 Rc	125-190	190-400	.001-.0030	.001-.0020
ALLOY STEEL	20 Rc	70-135	130-350	.001-.0030	.0008-.0020
TOOL STEEL	25 Rc	75-100	100-220	.001-.0025	.0005-.0020
300 STAINLESS STEEL	150 HB	90-100	100-230	.001-.0020	.0007-.0015
400 STAINLESS STEEL	195 HB	90-135	135-300	.001-.0020	.0005-.0015
HIGH TEMP ALLOY (NICKEL & COBALT BASE)	20 Rc	30-125	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.

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	**Select Tool**
S2916 M03	**SFM = 300 ; RPM = 300 x 3.82 / Reamer Diameter**
G00 G90 G54 X0. Y0.	**RPM = 300 X 3.82 / 0.393**
G43 H51 Z0.1 M08	**RPM = 2916**
G01 Z-0.6 F23.3	**Feed Rate = RPM x 0.002 x 4 (Number of Flutes)**
S1290 M03	**RPM = 300 x 3.82 / 0.888 (Spot Face Diameter)**
G04 P1.	**Dwell to slow down spindle**
G01 Z-.73 F10.3	**Feed rate = RPM x 0.002 x 4 (Number of Flutes)**
G00 Z5. M09	