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Test Report No. PLB0/17

Crater wear of tips grade S1P, RD176, RD110
and RD184 machining EN9



S U M M A R Y

Tests were carried out with tools of grade S1P, RD184, RD110 and RD176 at 600 fpm cutting speed, 0.010 in/rev. feed and 0.10 in. depth of cut machining EN9 to determine their relative resistance to crater wear. The performance of the grades was in the ratio S1P-100, RD184-85, RD110-56 and RD176-53, although with three out of the four corners tested the performance of RD184 matched that of S1P.

During the tests RD184 was the only grade which had an edge radius and it is suggested that further tests should be carried out to determine whether this has any effect on cratering.

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Test conditions

The following conditions were used during the tests:-

Work material: EN9
Depth of cut: 0.10 in.
Feed: 0.010 in/rev.
Cutting speed: 600 fpm

and the tools used were:-

S1P NT279 (no edge radius)
RD176 NT319 (no edge radius)
RD184 NT328 (edge radius)

Test results

The four corners of each tip were tested to .030 in. flankwear. The flankwear was measured and recorded at intervals of six minutes cutting time and the crater wear was measured by taking a Talysurf trace at approximately 0.010, 0.020 and 0.030 in. flankwear.

The results are given in tables 1 - 16 and the Talysurf traces from which the crater depth was measured are given in figures 1 - 4.

The results can be summarised by constructing a table as shown below giving the rate of crater wear, expressed as minutes/0.001" crater depth, for each of the corners tested.

corner/grade	<u>S1P</u>	<u>RD184</u>	<u>RD110</u>	<u>RD176</u>
1	8.3	10.0	4.4	4.5
2	8.9	8.0	4.3	4.0
3	6.9	6.0	4.0	4.8
4	<u>7.2</u>	<u>2.8</u>	<u>4.8</u>	<u>3.4</u>
mean time to 0.001" crater	7.9	6.7	4.4	4.2 min.

Using the results of this table, if the resistance of S1P to crater wear is taken as 100 then the corresponding relative values for the other grades are: RD184-85, RD110-56 and RD176-53. (As can be seen from the results one corner of the RD184 tip gave a much inferior performance to the other three corners. If this result is ignored and the three best results for each grade are compared, then the relative values of resistance to cratering are S1P-100, RD184-99, RD110-56 and RD176-54).

The tip of RD184 used was edge radiused whereas the other tips had no edge radius. The absence or otherwise of an edge radius may have some effect on the rate of crater wear and this should be checked by further tests.



Conclusions

Under the conditions tested RD184 gave a much better resistance to crater wear than did RD110 or RD176. Except for one result the performance of RD184 matched that of S1P. On an overall basis the relative resistance to crater wear of the four grades was S1P-100, RD184-85, RD110-56 and RD176-53. It is suggested that further tests should be carried out to find out whether an edge radius has any effect on the rate of crater wear.



Table 1

Grade: S1P Depth of cut: .10 in.
 Tip: NT279/1 Speed: 600 fpm
 Feed: .010 in/rev. Material: EN9

Time min.	Flankwear		Fc	Crater depth (max)	Remarks
	Fa	Fb			
6	.006	.006	.0085		
12	.009	.009	.013	.0012	
18	.0125	.0125	.016		
24	.015	.0165	.0165		
30	.017	.020	.0195	.003	
36	.024	.025	.025		
42	.030	.0325	.0295	.005	

Table 2

Grade: S1P Depth of cut: .10 in.
 Tip: NT279/2 Speed: 600 fpm
 Feed: .010 in/rev. Material: EN9

Time min.	Flankwear		Fc	Crater depth (max)	Remarks
	Fa	Fb			
6	.008	.014	.0075	.0006	
12	.011	.0185	.0135	.0015	Slight chip on flank face
18	.015	.0255	.0185		
24	.020	.0315	.020	.0027	

Table 3

Grade: S1P Depth of cut: .10 in.
 Tip: NT279/3 Speed: 600 fpm
 Feed: .010 in/rev. Material: EN9

Time min.	Flankwear		Fb	Crater depth (max)	Remarks
	Fa	Fb			
6	.008	.014	.009	.0005	
12	.0125	.020	.015	.0012	Slight chip on flank face
18	.016	.023	.016		
24	.019	.028	.017	.0035	
30	.0225	.0335	.0225		

Table 4

Grade:	S1P	Depth of cut:	.10 in.
Tip:	NT279/4	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear			Crater depth (max)	Remarks
	Fa	Fb	Fc		
6	.0105	.0175	.007	.0007	
12	.015	.0235	.0135	.001	chip on flank
18	.019	.030	.016	.0025	
24	.023	.039	.021		

Table 5

Grade:	RD176	Depth of cut:	.10 in.
Tip:	NT319/1	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear			Crater depth (max)	Remarks
	Fa	Fb	Fc		
6	.0045	.007	.007		
12	.0075	.0105	.013	.002	
18	.0095	.014	.018		
24	.014	.0185	.0215	.004	
30	.016	.0215	.0285		
36	.018	.026	.034	.008	

Table 6

Grade:	RD176	Depth of cut:	.10 in.
Tip:	NR319/2	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear			Crater depth (max)	Remarks
	Fa	Fb	Fb		
6	.013	.013	.011	.0011	
12	.018	.0195	.0175	.0025	
18	.0245	.0245	.019		
24	.0285	.029	.025	.006	
30	.0345	.0345	.0285		

Table 7

Grade: RD176
 Tip: NT319/3
 Feed: 0.10 in/rev.

Depth of cut: .10 in.
 Speed: 600 fpm
 Material: EN9

Time min	Flankwear		F _c	Crater depth (max)	Remarks
	F _a	F _b			
6	.009	.0095	.007	.001	
12	.0135	.0175	.015	.025	
18	.0155	.025	.018		
24	.019	.0325	.026	.005	

Table 8

Grade: RD176
 Tip: NT319/4
 Feed: .010 in/rev.

Depth of cut: .10 in.
 Speed: 600 fpm
 Material: EN9

Time min.	Flankwear		F _c	Crater depth (max)	Remarks
	F _a	F _b			
6	.012	.0245	.008	.0015	
12	.0145	.020	.0135	.0025	
18	.018	.025	.020		
24	.021	.029	.025	.007	
30	.0235	.032	.0295		

Table 9

Grade: RD110
 Tip: NT299/1
 Feed: .010 in/rev.

Depth of cut: .10 in.
 Speed: 600 fpm
 Material: EN9

Time min.	Flankwear		F _c	Crater depth (max)	Remarks
	F _a	F _b			
6	.012	.0215	.010	.0015	
12	.016	.029	.0185	.0027	chipped on flank
18	.019	.035	.026	.0035	



Table 10

Grade:	RD110	Depth of cut:	.10 in.
Tip:	NT299/2	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear		Fc	Crater depth (max)	Remarks
	Fa	Fb			
6	.015	.0135	.011	.001	
12	.015	.0185	.019	.0027	
18	.017	.022	.0235		
24	.0215	.025	.0265		
30	.0235	.028	.0325	.007	

Table 11

Grade:	RD110	Depth of cut:	.10 in.
Tip:	NT299/3	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear		Fc	Crater depth (max)	Remarks
	Fa	Fb			
6	.012	.012	.0105	.00125	
12	.0155	.0175	.0205	.0025	
18	.0195	.025	.025		
24	.020	.028	.029	.006	
30	.025	.036	.0385		

Table 12

Grade:	RD110	Depth of cut:	.10 in.
Tip:	NT299/4	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear		Fc	Crater depth (max)	Remarks
	Fa	Fb			
6	.012	.013	.011	.001	
12	.0145	.019	.020	.0025	
18	.020	.025	.020		
24	.025	.030	.031	.0062	

Table 16

Grade:	RD184	Depth of cut:	.10 in.
Tip:	NT328/4	Speed:	600 fpm
Feed:	.010 in/rev.	Material:	EN9

Time min.	Flankwear			Crater depth (max)	Remarks
	Fa	Fb	Fc		
6	.009	.0075	.009	.001	
12	.013	.013	.015		
18	.016	.016	.020	.002	
24	.018	.018	.024		
30	.022	.022	.026		
36	.0245	.025	.029	.0045	
42	.027	.027	.033		

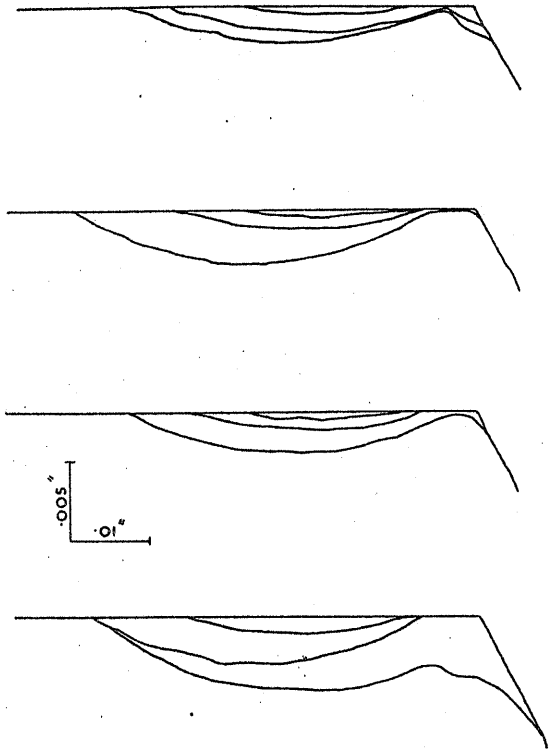


FIG.1. CRATER WEAR OF SIP AT .01 .020 AND .030 IN FLANKWEAR.

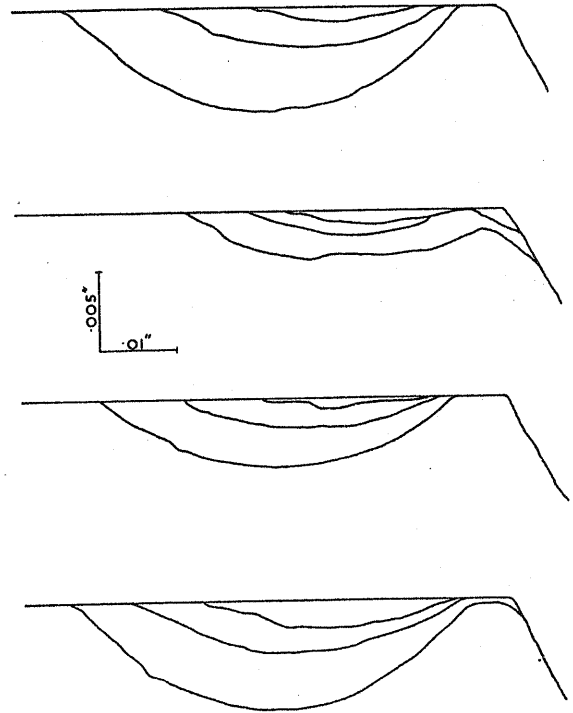


FIG.2. CRATER WEAR OF RD184 AT .01 .02 AND .03 IN FLANKWEAR.

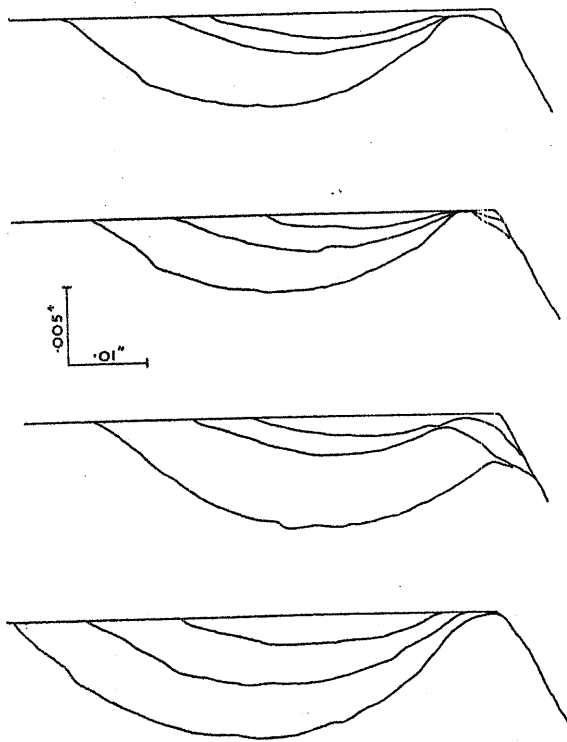


FIG.3. CRATER WEAR OF RD176 AT .01 .02 AND .03 IN FLANKWEAR.

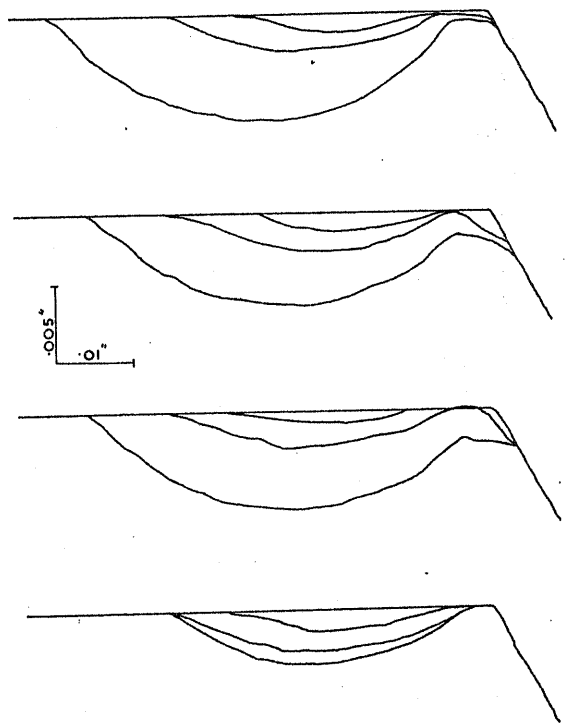


FIG.4. CRATER WEAR OF RD110 AT .01 .02 AND .03 IN FLANKWEAR.

