

### 3.4 Abrasion Resistance

An abrasion resistance testing technique was specifically developed for Unique Tool and Gauge in an effort to quantify material loss characteristics associated with rubbing contact.

Each sample was machined to a 5" x 1.5" x 0.35" platen, weighed then placed longitudinally on the test platform. A hardened steel abrasion block with a contact width of 0.25" x 0.10" was placed in contact with the test platen and lead vertically to 250g<sub>f</sub>. The test platen was then cycled longitudinally through a length of 3.5 inches at a rate of 30 cycles per minute for a total of 5000 cycles. After cycle completion, the final weight was measured and weight loss determined. The surface topography was then evaluated using the scanning electron microscope. The five platens are illustrated in Figure 2, and the surface characteristics associated with the abrasion are illustrated in Figures 3 through to 7. Results are presented in Table 4.

**Table 4.** Abrasion Resistance Material Loss (g)

	Initial Wt	Final Wt	Wt Loss / 5000 cycles
Aluminum	65.174	65.148	0.026
Alumold	70.840	70.826	0.014
Hokotol	71.325	71.321	0.004
QC-10	71.950	71.928	0.022
P-20	185.234	185.234	0.000



**Figure 2.** Image of the five platens after the linear abrasion test.

### 3.5 Cyclic Compression Testing

Cyclic compression testing was conducted on cylindrical specimens prepared from each alloy in an effort to simulate the nature of contact damage which may be associated with real-life mold closure. Matching cylindrical specimens of 1.0" diameter were prepared from each alloy and surface finished with a 250 grit emery paper. The surfaces were measured for roughness (Ra) using the Mitutoyo Surftest 201 surface roughness tester. Surface texture was also recorded with the JEOL JSM-5600 scanning electron microscope.

The compression test incorporated a servo-hydraulic test frame and a holding jig specifically developed and tested for this cyclic compression test procedure (Figure 8). The test involved the compression of the matching specimens to a stress of 5000psi at a closure rate of 1" per minute, then held at closure for a period of 10 seconds for a total 10000 cycles. Upon completion of testing each sample was then re-measured for surface roughness and examined with the scanning electron microscope. Surface roughness data, test specimens and surface images are presented in Table 5 and Figures 8 to 14 respectively.

**Table 5.** Compression Sample Surface Roughness

	Aluminum	Alumold	Hokotol	QC-10	P-20
Face "A" Before Test	10.7	8.0	6.0	7.0	15.0
Face "A" After Test	10.3	6.6	6.6	6.7	19.0
Face "B" Before Test	9.3	11.6	5.3	6.0	13.7
Face "B" After Test	10.3	7.0	5.7	9.3	15.3



**Figure 8.** Compression frame and test jig fixture employed in the test of the five alloys. The arrows highlight the location of the test specimens.



**Figure 9.** Image of the five alloy sets. This image was taken after the completion of the cyclic compression tests.