

RAPCO,inc.

REPLACEMENT AIRCRAFT PARTS CO.



82-00067 Shear Coupling Force Failure Report

An analysis of shear mode characteristics of the 82-00067 shear coupling after a simulated in flight Vacuum Pump failure.

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Index

Description	Page
Testing Outline	1,2
Testing Summery	2
Pre-Test Pictures	3
Post Test Sample 1 Pictures	4,5
Post Test Sample 2 Pictures	6,7
Post Test Sample 3 Pictures	8,9
Post Test Sample 4 pictures	10,11

Shear Coupler Test Outline

On 8/27/2008 Rapco, Inc. conducted four independent force shear failures of shear coupler Part # 82-00067. The data pertinent to these events has been documented by photo and DVD video. Each testing sequence was conducted as follows:

- 1) Four shear couplers were selected for serviceable vacuum pump cores that were returned to Rapco, Inc. Each shear coupler was inspected to insure that it stated “82-0067” and “FAA-PMA”.
- 2) Each sample shear coupler was labeled with 1, 2, 3 or 4. Both faces of each of the samples were labeled with the appropriate sample number. The face of the shear coupler that would face out of the pump and interface with the exterior drive gear was marked with an additional dot.
- 3) Each sample shear coupler was dimensional measured before testing. (See Table 1 below)

Table 1 Dimensional Inspection

Sample #	Outside Diameter	Shear Section Diameter	Overall Length
1	1.320”	0.775”	0.698”
2	1.315”	0.792”	0.745”
3	1.330”	0.768”	0.694”
4	1.320”	0.795”	0.720”

- 4) An Airborne 212CW vacuum pump was mounted to Rapco, Inc.’s test bench. Four separate vacuum pumps were used, (one for each event). Each pump contained one of the marked shear couplers.
- 5) Each test bench was started and the subject vacuum pump was allowed to run 10-20 seconds. (Please note that the RPM that the 3600-3700 RPM range was chosen because it is representative of what the vacuum pumps actual speed would be during cruise flight on a Cessna 210)
- 6) F.O.D (Foreign Objects and debris) was introduced into the inlet of each vacuum pump.
- 7) All four force shear failures were conducted and recorded.
- 8) After the pump was F.O.D failed and the operational noise from the vacuum pump stopped, the time was noted.

- 9) After the failures each sample was run a specified amount of time (from the failure time that was noted) using the test bench motor in order to simulate what the result would be on the shear coupler should the shear coupler have failed in flight. (See table 2 for post failure run times)

Table 2 Post failure run times

Sample	Post Failure Run Time	Failure /Post Failure Test Bench Motor RPM
1	10 seconds	3600-3700
2	30 seconds	3600-3700
3	1 minute	3600-3700
4	5 minutes	3600-3700

- 10) A post failure inspection of the parts were conducted and recorded.

Summery: Each of the samples shows some melting of the base material after failure. As the run times after failure increase with each different sample the melting of the base material becomes more severe. This is due to the increased exposure to heat.

Note: These tests were conducted in a controlled test lab with an ambient temperature of 74 degrees Fahrenheit. The real world environment which this component would be subjected to is typically between 125 -195 degrees Fahrenheit.

Pre-Test Pictures Sample 1



Sample 1 Front View



Sample 1 Side View



Sample 1 Back View



Sample 1 Installed View



Sample 2 Front View



Sample 2 Side View



Sample 2 Back View



Sample 2 Installed View



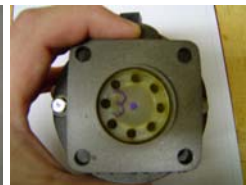
Sample 3 Front View



Sample 3 Side View



Sample 3 Back View



Sample 3 Installed View



Sample 4 Front View



Sample 4 Side View



Sample 4 Back View



Sample 4 Installed View

Post Test Pictures Sample 1 (10 Seconds Run Time After Failure)



Sample 1 Outside External Face View



Sample 1 Inside External Face View



Sample 1 Outside Internal Face View

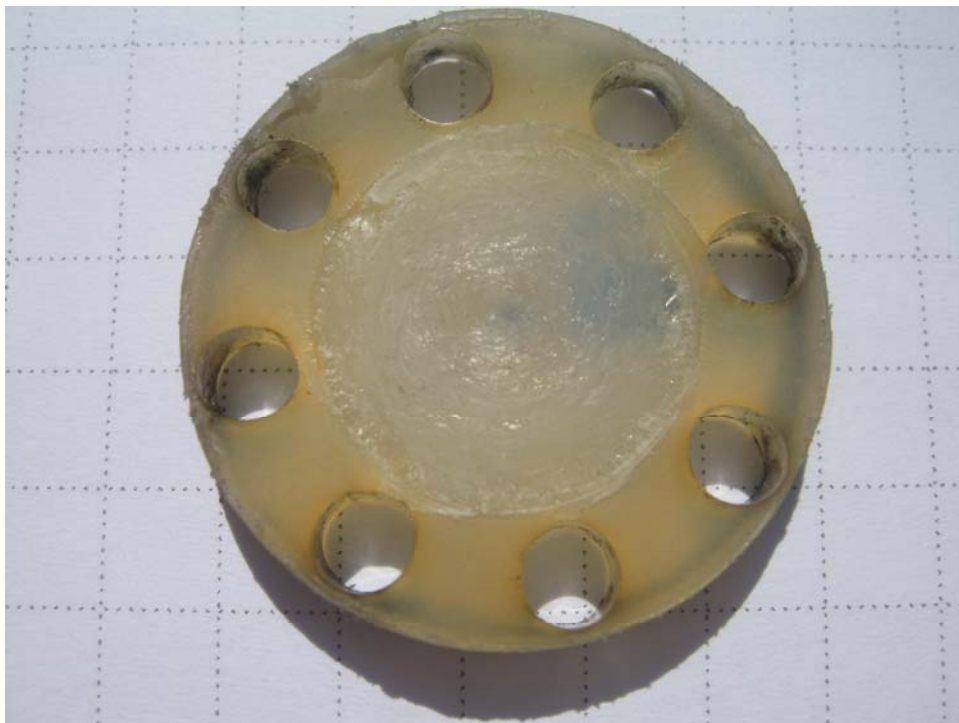


Sample 1 Inside Internal Face View

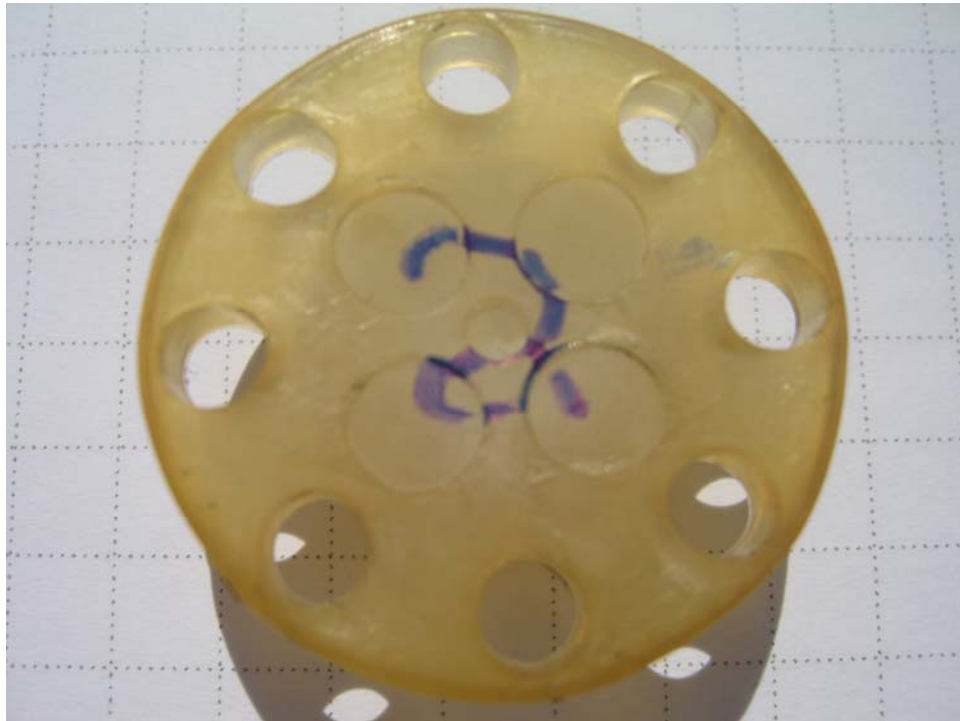
Post Test Pictures Sample 2 (30 Seconds Run Time After Failure)



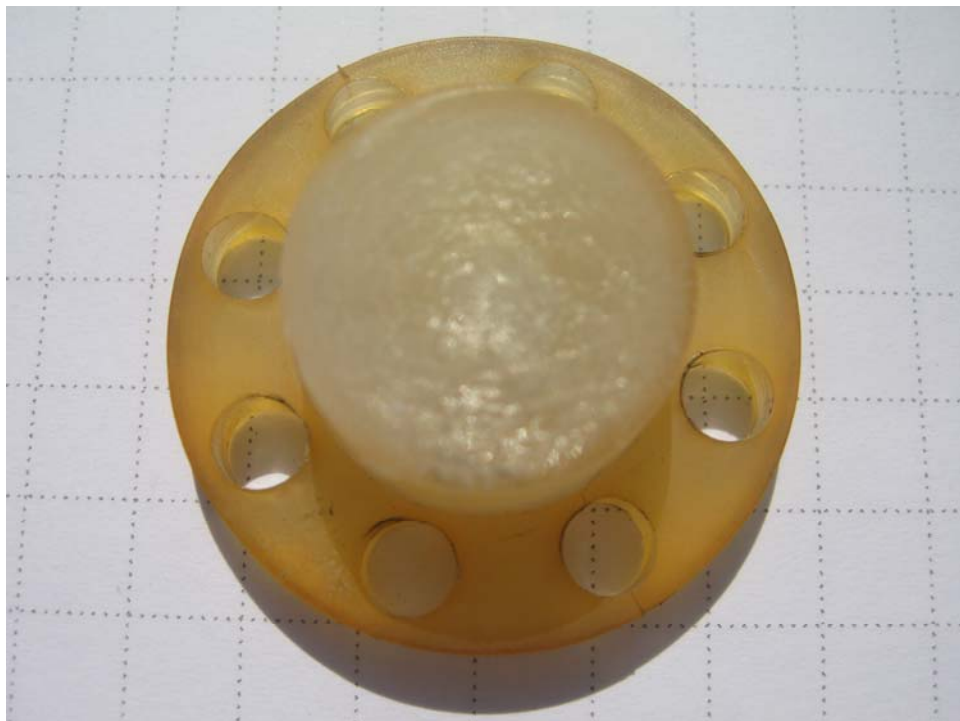
Sample 2 Outside External Face View



Sample 2 Inside External Face View



Sample 2 Outside Internal Face View



Sample 2 inside Internal Face View

Post Test Pictures Sample 3 (1 Minute Run Time After Failure)



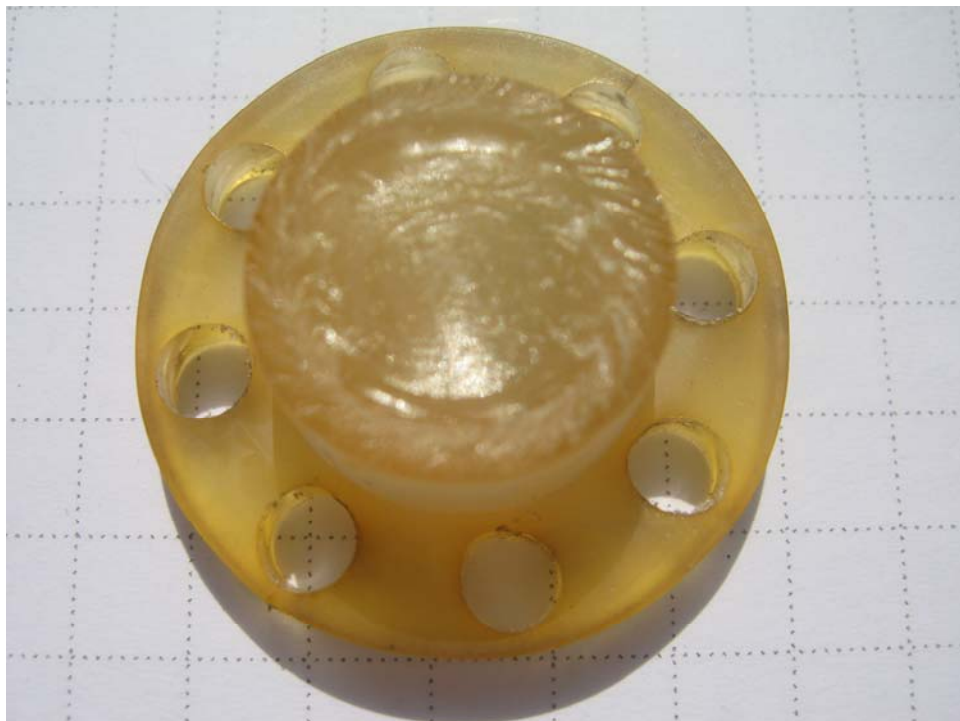
Sample 3 Outside External Face View



Sample 3 inside External Face View

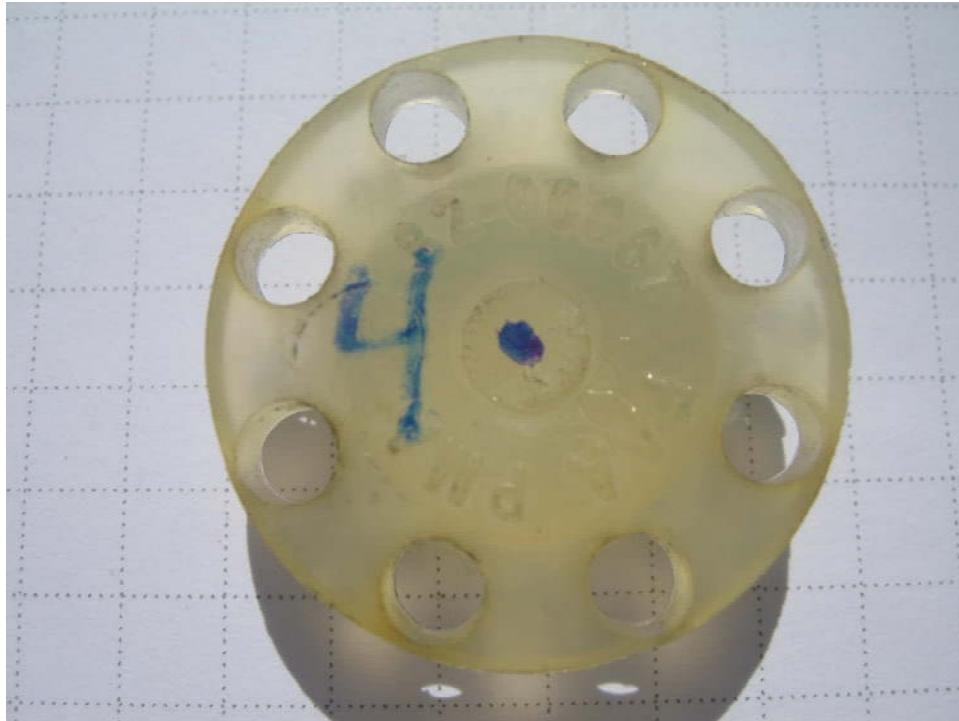


Sample 3 Outside Internal Face View

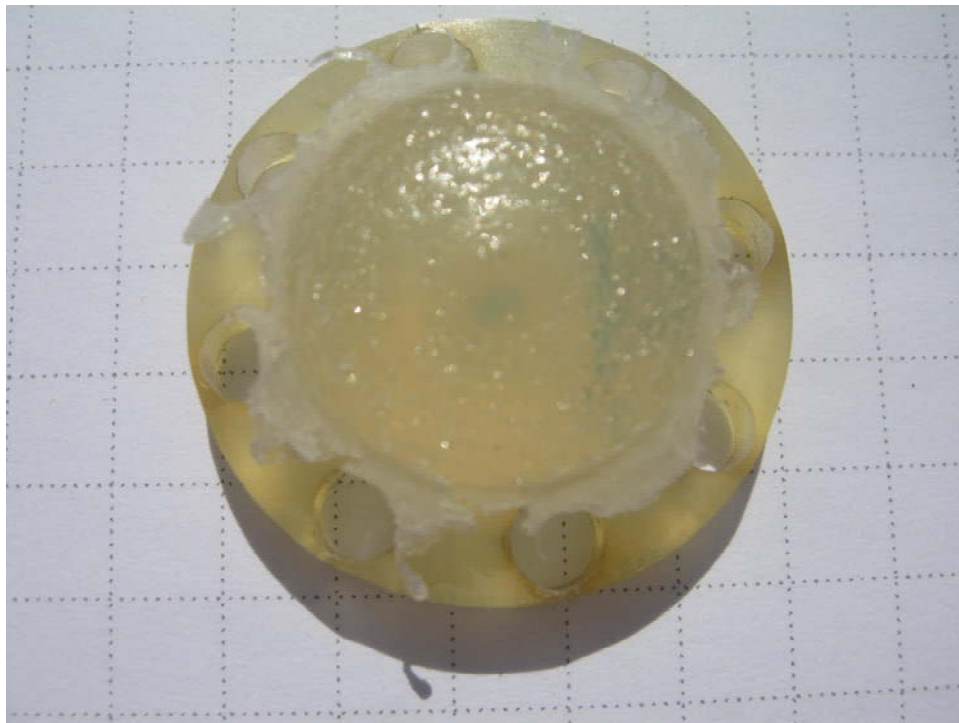


Sample 3 Inside Internal Face View

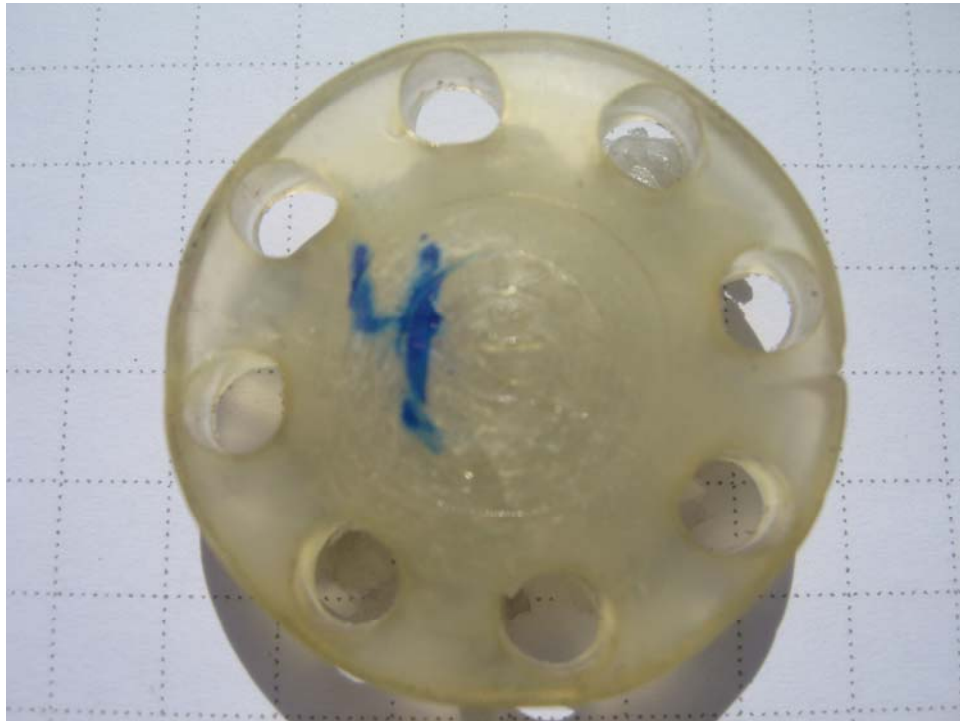
Post Test Pictures Sample 4 (5 Minute Run Time After Failure)



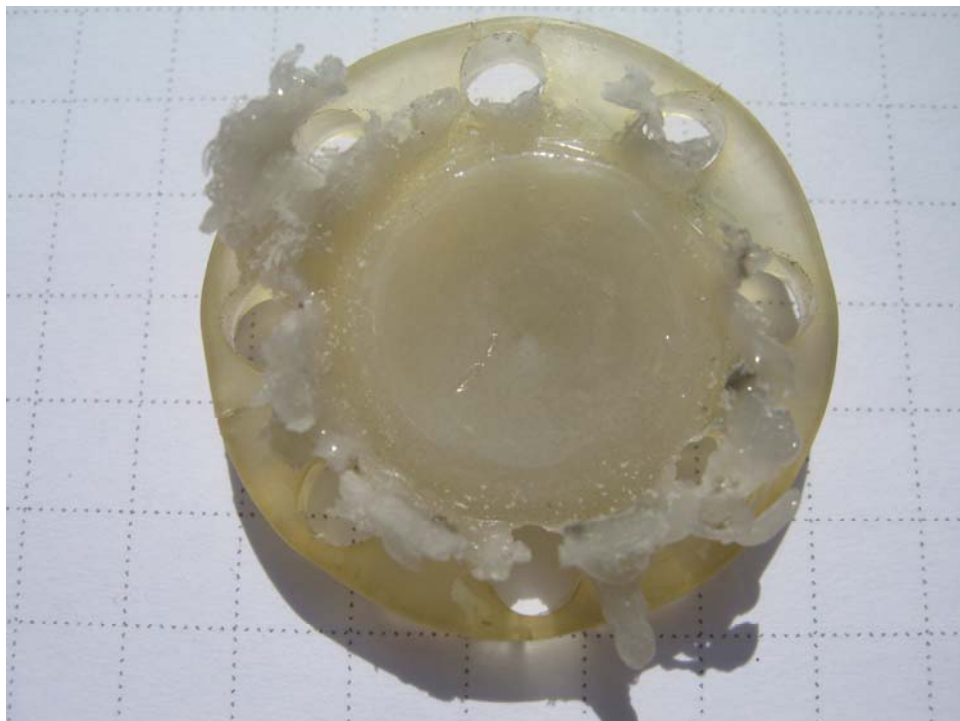
Sample 4 Outside External Face View



Sample 4 Inside External Face View



Sample 4 Outside Internal Face View



Sample 4 Inside Internal Face View