



Air Safety Office
Parker Hannifin Corporation
Parker Aerospace
[REDACTED]
Irvine, California [REDACTED]

Date: 7/6/2016, Revised 4/27/2017 (corrected typo LH to RH on MFR date)

Examination Location:

Aircraft Wheel and Brake
[REDACTED]
Avon, Ohio [REDACTED]

Subject: ERA16LA113, Liberty XL2 Brake Exam

Attendees:

FAA:
Richard Pottinger, Aviation Safety Inspector, CLE FSDO
Jeff Green, Aviation Safety Inspector, CLE MIDO
Maya Latson, intern, CLE FSDO

Parker:
Otto Miller, Air Safety Investigator, AWB
Jeremy Katt, Air Safety Officer
Brittany Reid, Quality Assurance, AWB

EXAM DETAILS:

FAA, Richard Pottinger hand carried the package to the exam. Photos were taken of the package. The package was opened and the parts were photographed. See photos 1 through 12.

Overall photographs were taken for each brake assembly. See photos 13 – 46 and 72 – 88 for the right hand brake (RH) and 47 – 71 for the left hand (LH) brake. Both brakes were received partially disassembled with backplates removed, tie bolts loose and anchor bolt nuts removed.

P/N Information:

30-9C for each brake. The brakes are not serialized.

Date of Manufacture for LH Brake is 07/06, which is July 2006 noted on the lower right quadrant of the nameplate.

Date of Manufacture for RH Brake is 08/06, which is August 2006 noted on the lower right quadrant of the nameplate.

The lining thickness of each pressure plate and backplate was measured with calipers. The measurements were taken on each side and are as follows:

LH Brake:

Backplate lining: 0.150 – 0.160"

Pressure plate lining: 0.140 – 0.150"

RH Brake:

Backplate lining: 0.130 – 0.140"

Pressure plate lining: 0.140 – 0.160"

New Parker linings (P/N 066-10600) are 0.187" thick.

The LH brake linings were generally in good condition with normal rotor surface conditioning noted.

The RH brake linings had an appearance of corrosion or rust and a small crack in the lining from an outermost rivet hole to the edge of the lining (picture 18). Normal lining surface conditioning/wear from the rotor contact was not observed on the RH linings. The RH linings displayed evidence of edge crumbling around the perimeter of the lining. The RH pressure plate surface at the piston contact area had displayed evidence of corrosion (picture 87).

The RH and LH brakes did not have evidence of overheating typically evident by paint discoloration (bronze color).

The LH brake was reassembled by installing the backplates, and torquing tie bolts to nameplate requirements 75-80 in-lb. The brake was installed on a hydraulic test bench utilizing MIL-PRF-5606 fluid. The bleeder fitting was opened and brake tipped upside down. No fluid came out. The brake was pressure bled and the bleeder port tightened for testing. A disc segment P/N 164-01700 was placed between the linings of pressure and back plates simulating the full rotor. Testing per IP106 method A which requires testing at 600 psi. There should be no external leakage and the brake pressure plates should seat properly against the rotor. No external leakage was noted on the LH brake and the brake met the testing requirements.

The LH brake was removed from the test bench and backplates removed. The piston was removed from the cylinder housing with low pressure compressed air. Photos 121 – 137 document the LH brake teardown.

The O-ring was removed from the piston. The O-ring appeared intact and was generally in a round condition. The O-ring was placed on a calibrated cone and corresponded to a -218 O-ring. The drawing specifies an MS28775-218 (AS28775-218 is equivalent). The O-ring cross section width and axial dimensions were measured in 4 locations around the O-ring and noted in chart below.

The RH brake was reassembled by installing the backplates, and torquing tie bolts to nameplate requirements 75-80 in-lb. The brake was installed on a hydraulic test bench utilizing MIL-PRF-5606 fluid. The bleeder fitting was opened and brake tipped upside down. No fluid came out. The brake was pressure bled and the bleeder port tightened for testing. A disc segment P/N 164-01700 was placed between the linings of pressure and back plates simulating the full rotor. Testing per IP106 method A which requires testing at 600 psi. There should be no external leakage and the brake pressure plates should seat properly against the rotor. As the pressure was applied external leakage was immediately noticed coming from the piston. Pressurizing to 30 psi for approximately one minute resulted in 9.4 ml of leakage from around the piston and then stopped. Increasing pressure up to 600psi did not show additional leakage. The pressure plates seated properly against the rotor.

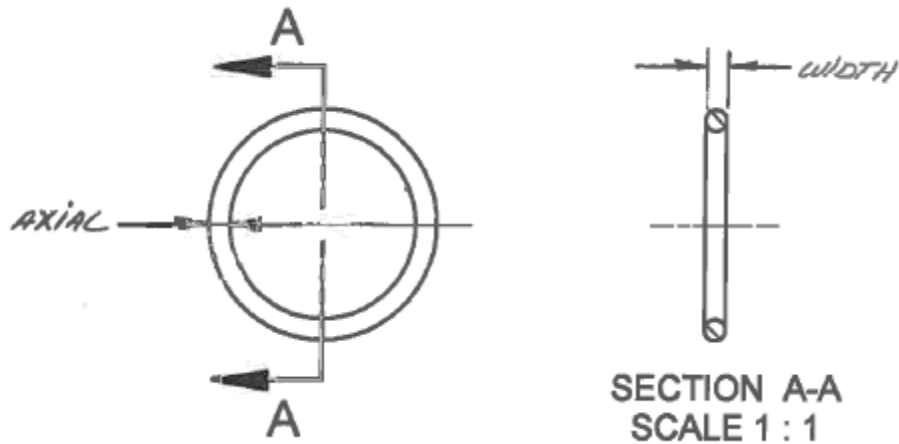
The LH brake was retested at 30psi similar to the RH brake above. No external leakage was noted.

The RH brake was removed from the test bench and backplates removed. The piston was removed from the cylinder housing with low pressure compressed air. Photos 138 – 179 document the RH brake teardown.

The O-ring was removed from the piston. The O-ring appeared square in shape with the exterior side being more square than the interior pressure side (photos 168-173). The O-ring was placed on a calibrated cone and corresponded to a -218 O-ring. The drawing specifies an MS28775-218 (AS28775-218 is equivalent). The O-ring cross section width and axial dimensions were measured in 4 locations around the O-ring. See table below for dimensions. Photos of the O-ring were taken with a microscope. One small round recess, one linear indentation, and an area of scuff on the outer edge were photographed with the microscope.

The O-ring Durometer was not measured as the equipment was not available. The Durometer can be measured at Parker's M&P lab if required.

A new O-ring was pulled from stock and measured similar to the LH and RH brake and dimensions noted in the chart below (all dimensions in inches).



LH

Axial	Width
0.135	0.148
0.137	0.147
0.132	0.147
0.133	0.147

RH

Axial	Width
0.13	0.146
0.133	0.147
0.136	0.147
0.132	0.149

New O-ring

Axial	Width
0.137	0.141
0.136	0.142
0.136	0.142
0.136	0.142

The new O-ring was installed in the RH brake piston and the brake reassembled and tested similar to above. At 30 psi the brake did not leak externally. The pressure was then increased to 600 psi and no external leakage was noted. The pressure plates seated properly against the rotor. The pressure plate was noticed in a canted position and photos were taken (180 – 182). The canted position still allowed the plates to seat against the rotor, but the position of the pressure plate was different than as tested originally as received. Because of the canted position of the pressure plate, a dimensional inspection was performed on the anchor bolts (alignment), piston bore diameter, piston outer diameter, piston O-ring groove diameter and width, and pressure plate thickness. All dimensions measured met drawing requirements.

The RH backplate was removed and the lining was removed by drilling out rivets. This was an attempt to determine if the linings were Parker linings or aftermarket PMA linings. No identification markings were observed on the back (non-contact side) of the lining (photos 196 & 197).

All parts were packaged in original box and hand carried by Richard Pottinger.

SUMMARY

- RH brake leakage (9.4ml) was observed at low pressure (<30 psi) and stopped after approximately one minute.
- RH brake was retested with a new O-ring and passed both low pressure and high pressure (600 psi) tests with no leakage observed.
- RH & LH brake passed 600 psi pressure test with no leakage observed.
- RH piston O-ring displayed evidence of compression set.



U.S. Department
of Transportation
**Federal Aviation
Administration**

Flight Standards District Office
Great Northern Tech Bldg. II
[REDACTED]
North Olmsted, Ohio [REDACTED]

April 28, 2017

Timothy W. Monville
Sr. Air Safety Investigator
National Transportation Safety Board
45065 Riverside Parkway
Ashburn, VA 20147

Dear Mr. Monville:

I Richard Pottinger, ASI at Cleveland FSDO was present at the testing and examination of ERA16LA113, Liberty XL2 Brake at Parker facility in Avon OH.

I have also read Parker Aerospace's Report.

I also, concur with what was reported.

Sincerely,

[REDACTED]

Richard Pottinger, PMI
CLE FSDO, GL25
[REDACTED]