

PFR-015

Title: Bearing Failure of Release Ring on SPB

Assembly : SPB, S/N 906	SubAssembly : Release Ring Assy
Component : Inner Bearing, Dynaroll Part Number: SR144ZZMC3 3GM6	
Originator: B. Donakowski/ 05 FEB 05	Organization: UCB/SSL/EFI
Phone : 510.642.9050	Email : billd@ssl.berkeley.edu

Failure Occurred During (Check one ✓)

☒ Functional test
 ☐ Qualification test
 ☐ S/C Integration
 ☐ Launch operations

Environment when failure occurred:

☒ Ambient
 ☐ Vibration
 ☐ Shock
 ☐ Acoustic
☐ Thermal
 ☐ Vacuum
 ☐ Thermal-Vacuum
 ☐ EMI/EMC

Problem Description

(In this section it is important to document the specific symptoms which exhibited the problem. In the event we see it happen again, we would like to know as much as possible.)

Following Vibration and TVAC, it was noticed in inspection that an inner bearing was cracked. This bearing is a part of the Release Ring Assy which opens the SPB Front Cover. The crack was on the outside race. (See Pictures 1 and 2.)

Analyses Performed to Determine Cause

(How do we know how the failure happened? Was it a bad part, bad handling, what?)

Dynaroll Technical Rep (Dave Cook) came on-site to inspect subject part. His opinion was that the bearing was well below its thermal and static capability in our application (verified by UCB). On taking the bearing apart, it was obvious some divots had been formed on the OD of the inner race which were obviously caused by the balls being dragged in an axial direction. As the bearing receives almost no load in axial, and the only loading occurred axially during installation, it is believed the bearing was damaged during installation. On these units, the release ring assy had been put together incorrectly (incorrect lengths shafts first installed). The removal and replacement of the bearings on the axles was required to put the assy in the flight configuration. Removal and replacement of bearings may have been a possible cause of this failure, though it is not known if the original bearings had been re-used on the rebuild. On further investigation, it was noted the shafts (new, unused ones still in the bag) for the assy were out of round, being out of center by a few ten thousandths (visible to the naked eye). An out-of-round axle would induce further loading during installation.

Corrective Action/ Resolution

(How do we fix the unit? And how do we make sure it doesn't happen again?)

1. Verify circularity of all pins prior to installation.
2. Provide proper press fit tooling to technicians to ensure proper installation.
3. Use spacers on either side of bearings to make sure press is made to inner race only.
4. For all SPB units, remove and replace subject bearings with new bearings and pins using custom press tooling. Verify all bearings are free to turn following rework. See Tech Memo 2005-PFR-015 for complete rework procedures (attached to this PFR).

Acceptance:

MAM: Ron Jackson _____; MSE: Ellen Taylor _____

PM: Peter Harvey _____; Cognizant Engineer _____

Date of Closure _____



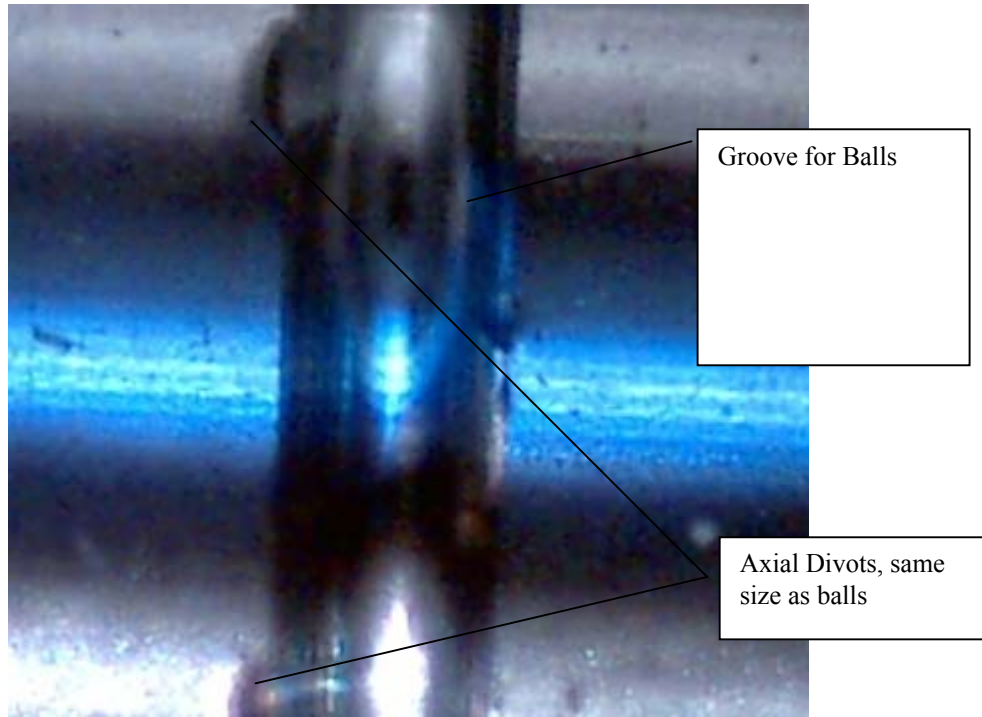
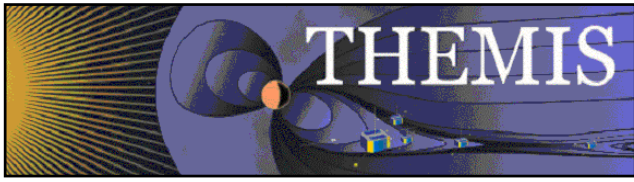
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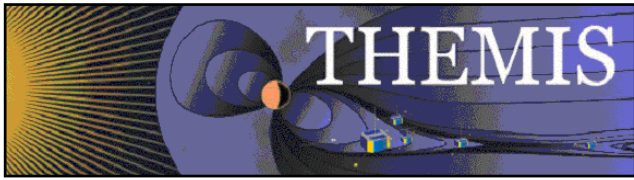
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Picture 1: Bearing Failure, Part number SR144ZZMC3 3GM6 (Inner Bearing of Assembly)



Picture 2: Divots around center groove of OD of Inner Race



Scope

This procedure to be used to rework existing SPB Release Ring Assys. These Assys need to be reworked to verify bearings are installed correctly and maintain their functionality. Rework as propagated by PFR-15.

Removal of existing bearings:

1. Carefully remove 2 X pins (.125 DIA X .375" Lg) and 4X Bearings by pressing out using special bearing removal tool. Keep all removed parts segregated and labeled so as not to be confused with new. See Figure 1 for bearing locations.
2. Verify 2X bearings that were left installed are turning properly. Move with finger. (See figure 1.)
3. Inspect holes where pins were removed. Deburr to remove any rough edges or metal bits.
4. Turn down many pins per UCB drawing THM-SPB-MEC-456. This can be done by chucking up pin and slightly removing a few ten thousands of an inch using emery cloth. Verify final dims meet print. Two ends of part shall be denoted 'A' for side with smaller ID (less than .125") and "B" for side with larger ID (.1252, the stock diameter). See Figure 6.

Installation of new bearings.

5. Press one bearing onto the end of the THM-SPB-MEC-456 shaft, side 'B'. (Bearing Part Number Dynaroll # SR144ZZMC3 3GM6.) End of 'B' side of shaft to be flush with end of bearing. Use custom Arbor Press (with canted surface and cylindrical piece) and proper tool end. See Figure 3.
6. Shear Bearing Spacers as shown in Figure 4.
7. Pre-position a bearing into the opening of the Release Ring, line up the centerlines of bearing and ring. Place three spacers as shown in Figure 5. Place the bearing and ring into the press (see figure 3). Using the Axle and pin (from step 5), press Side 'A' thru the ring, the pre-positioned bearing and spacers, and back into the ring flange.
8. Verify 2 X bearings are free to turn, verify pin is completely installed, verify pin is not exceeding ID of Release Ring, verify outside bearing is flush with pin end, verify pin can not pull out of ring easily.

Technician/Date: _____

SPB Serial Number(s): _____

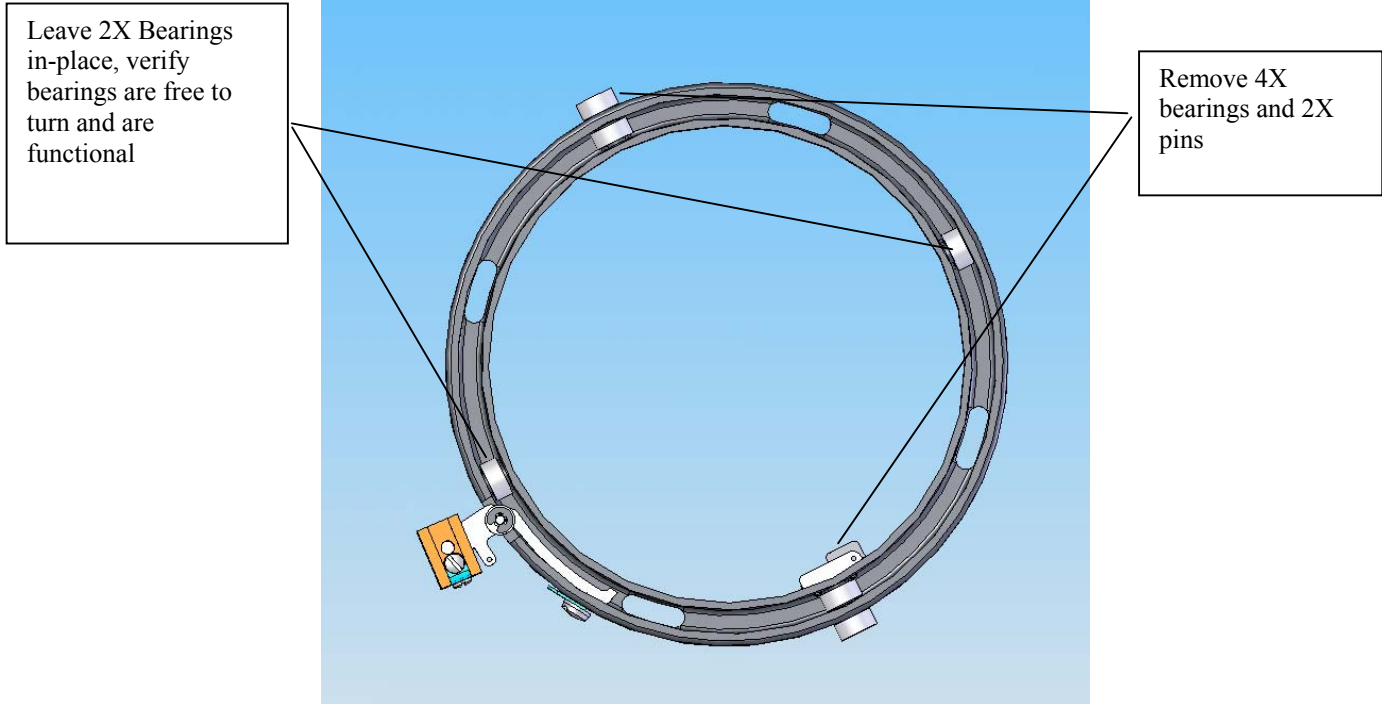


Figure 1: Bearing Removal

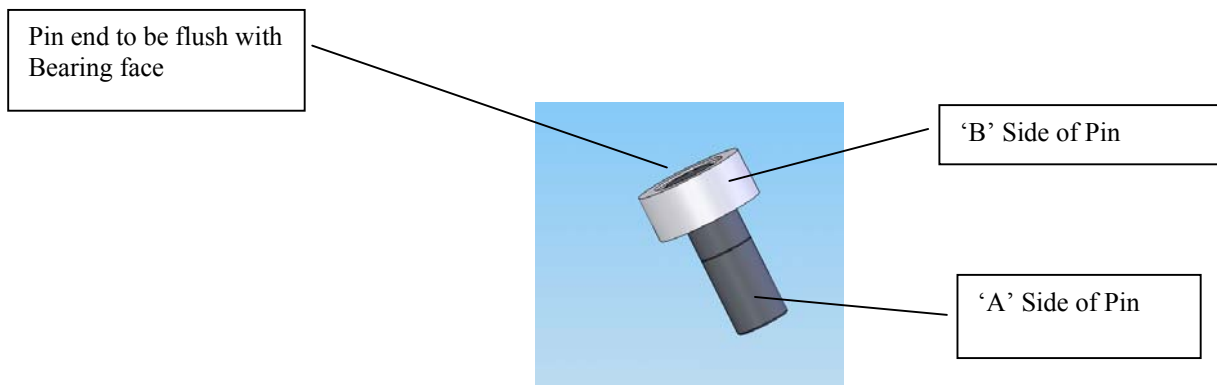


Figure 2: Bearing pressed onto 'B' side of Pin

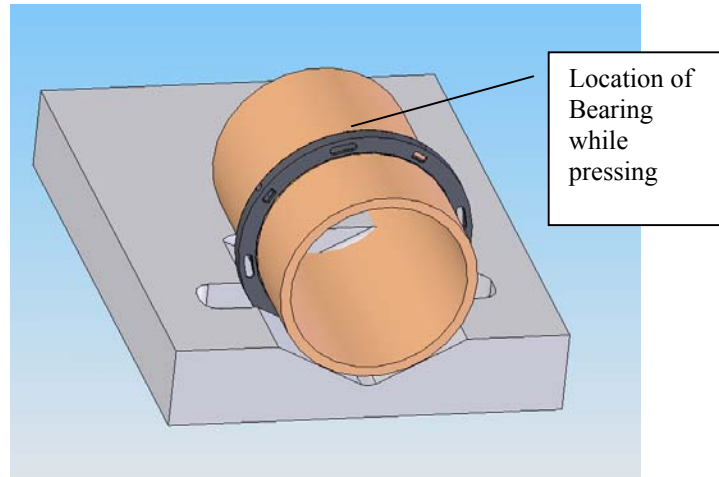


Figure 3: Release Ring shown over Cylinder in Bearing Installation Set-Up

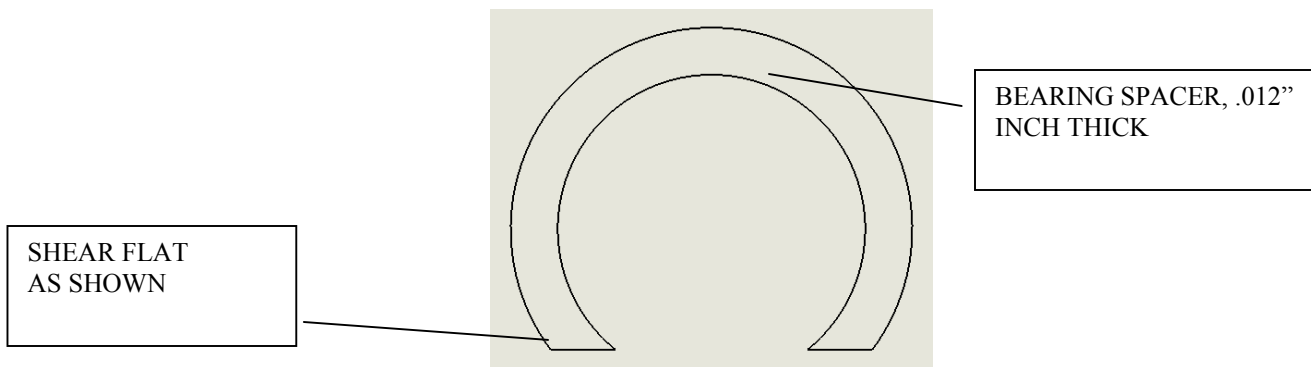
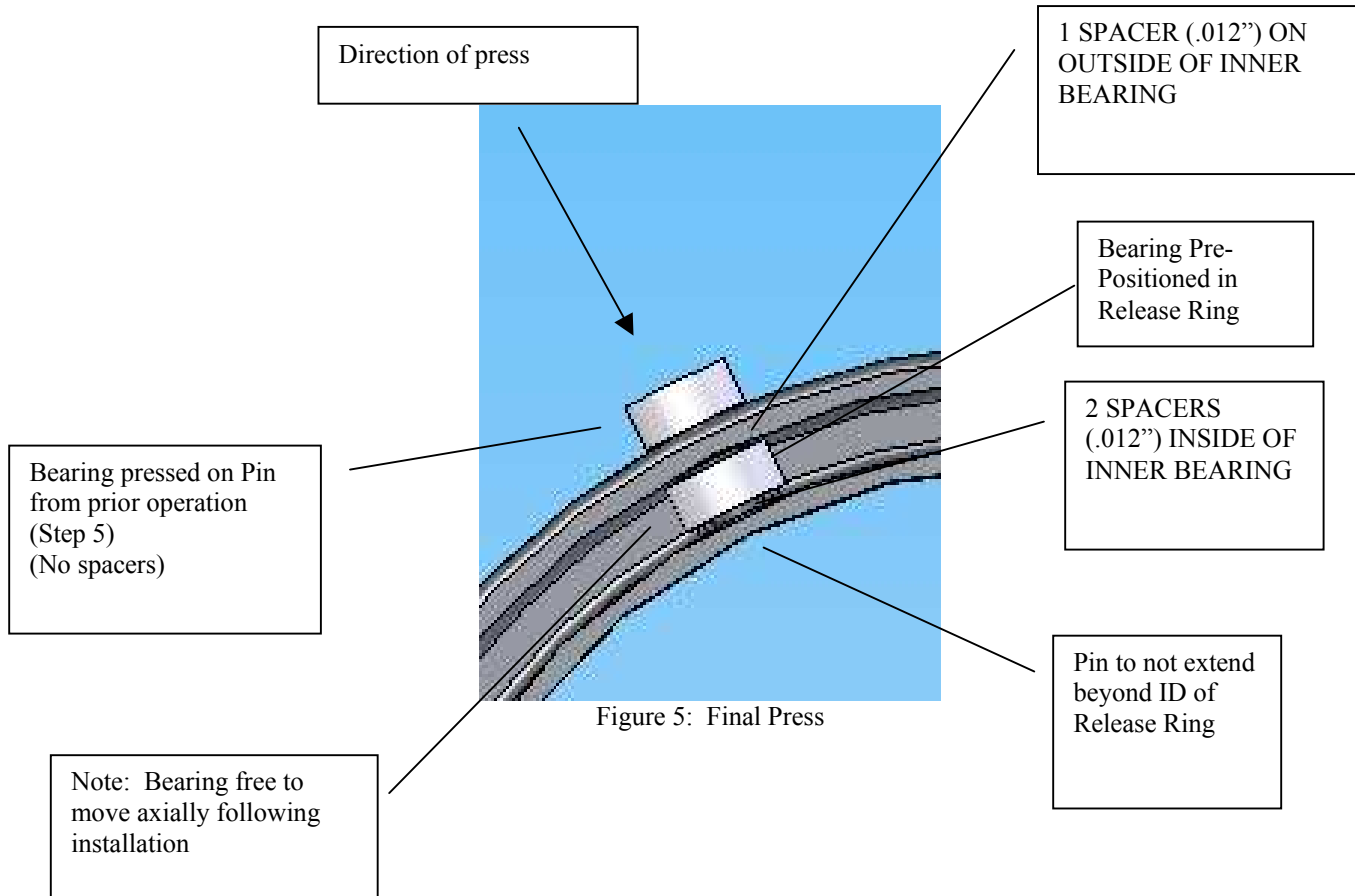


Figure 4: Modification of Bearing Spacer (all units)



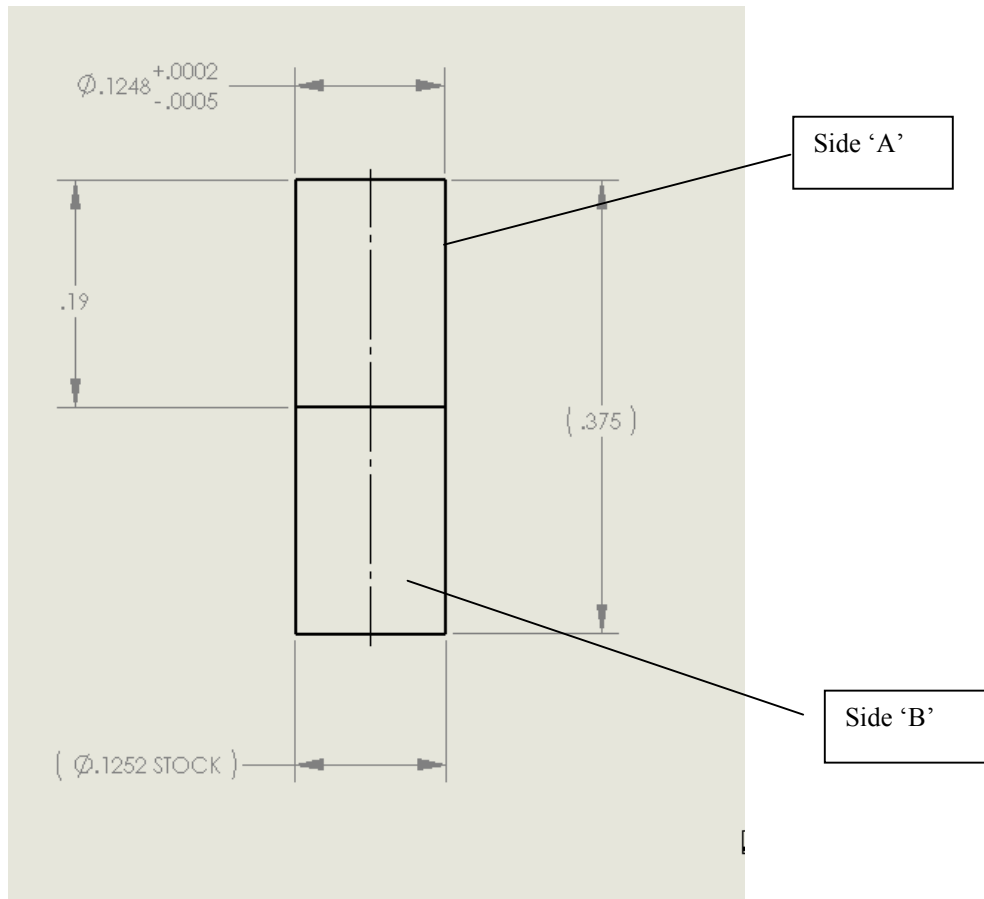


Figure 6: THM-SPB-MEC-456 Pin Detail