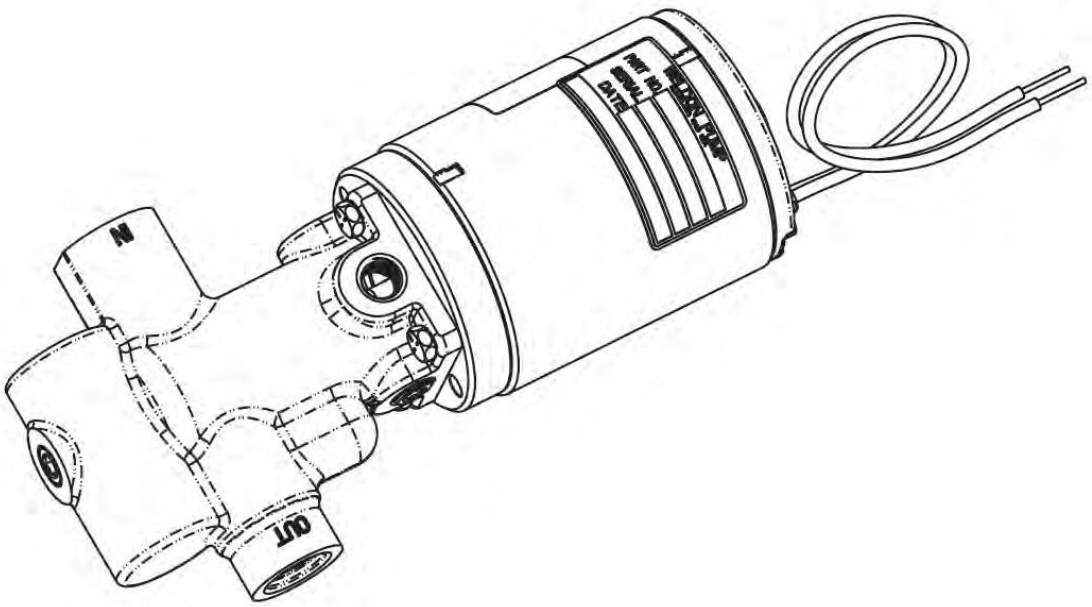
640 Golden Oak Parkway
Oakwood Village ▪ Ohio 44146, U.S.A.
tel: 440.232.2282 ▪ fax: 440.232.0606

Evaluation of Fuel Boost Pump
Part Number: 8163-A
Serial Number: 08934
From Make: Mooney, Model: M20J, Aircraft: N56039, for NTSB Case: WPR18FA210



Evaluated 12/DEC/2018

REV	DATE	DESCRIPTION
IR	07/Jan/2019	Initial Release
A	17/Jan/2019	Correction to Spelling of Sandor

WITNESSES

Inspection, evaluation, and testing of the fuel boost pump from the Mooney M20J Aircraft N56039 as documented in this report was witnessed by the following:

[redacted]

Steve Carpenter
Evaluation Technician
Weldon Pump

[redacted]

Dan Ramser
Chief Engineer
Weldon Pump

David Osborne
Aviation Safety Inspector
Cleveland Flight Standards District Office
Federal Aviation Administration

Sandor (Sonny) Janosy
Aviation Safety Inspector
Cleveland Manufacturing Inspection District Office
Federal Aviation Administration

1.0 SCOPE

This report documents the evaluation and testing of the Weldon pump model number: 8163-A, serial number: 08934, build date: 4th quarter 1984. This fuel boost pump is from Mooney Aircraft model: M20J: with registration number N56039.

2.0 RECEIPT OF PACKAGE

A sealed package was received, via common carrier, at Weldon Pump's Oakwood Village Facility. package was only opened (12/Dec/2018) in the presents, and under the instruction, of Mr. Janosy and Mr. Osborne (Both functioning in a government oversight capacity). The fuel pump was removed from its' packaging to allow for following steps.

- See Figure I for image of exterior packaging, large box, and common carrier's shipping label.
- See Figure II for image of small enclosed box with hand written instructions "Do Not Open/Test Without FAA Oversight".
- See Figure III for image of Article in resealable Anti-Static bag (as removed from smaller enclosed box).
- See Figure IV for image of accompanying NTSB Evidence Control Form.

3.0 EXTERNAL VISUAL INSPECTION

The unit was removed from all the packaging and visually inspected. The pump was supplied with some mounting hardware and fluid fittings, from the aircraft's installation, that aren't supplied by the Weldon factory as detailed below.

- See Figure V for image of the pump as removed from all packaging.
- The pump was supplied with the following items installed into both the inlet and outlet ports;
    - Mooney P/N: 610076-000,Description: Elbow ("Fitting Modified AN833-6D")
        - Note, the longer, bulkhead, end has the 37° flare removed and both inside diameters are drilled oversized from AN833 standard.
    - P/N: AN6289-6D, Description: Nut, Tube
    - P/N: AN6291-6, Description: Ring-Hydraulic Fitting, Gasket Back-Up.
        - Note, this part number is listed in the aircraft IPC yet is obsolete and superseded by MS28777
    - P/N: MS29512-6, Description: Packing, Preformed, Hydrocarbon Fuel Resistant, Tube Fitting, "O"Ring.
    - See Figure VI for image of the above four items sub-assembled.

- The pump was supplied with the following item installed into the overboard drain port;
    - P/N: AN816-4D, Description: Adapter, Straight, Pipe to Tube.
    - See Figure V , Figure VII, and Figure IX for images of the AN816-4D installed in the overboard drain port.
- The pump was supplied with two each the following items, as mounting provisions, around the motor;
    - P/N: AN735-D40, Description: Clamp, Loop Type Bonding.
    - P/N: AN526-1032R9, Description: Screw, Machine, Truss Head.
    - P/N: AN363-1032, Description: Nut, Self-Locking, 550°F.
    - See Figure V for the above three items sub-assembled and installed on the pump.
- The pump was supplied with the following item, as wire loom, around the motor hook-up wires;
    - P/N: B47287-I-1/8, Description: Tube, Spiral Wrap, Polytetrafluoroethlene and Polymide.
    - See Figure V for the above wire loom installed on the pump's hook-up wires.

Observations of note concerning the external visual appearance and tactile condition beyond that mentioned above;

- Both Inlet and outlet fittings had duct tape as a covering for the remaining 37° ends. When the tape was removed adhesive residue remained on the sealing surface.
    - See Figure V and Figure IX for images of duct tape covering inlet and outlet fittings.
- The overboard drain fitting's ID was completely blocked/mostly filled with impacted dirt/debris. There was no cap or tape on this fitting, as supplied, and worth mentioning that it didn't appear to have the normal/expected witness marks, on the 37° surface, from having been mated to a tube.
    - See Figure VII for close-up image of dirt/debris blocked AN816-4D fitting installed in pump housing.
    - See Figure VIII for image of AN816-4D fitting removed with dirt/debris along side.

4.0 PHYSICAL INSPECTION/TESTING/DISASSEMBLY

After the visual inspection, the following inspections, tests, and disassembly steps were conducted.

- An electrical multimeter was used to measure the resistance between the pump motor's positive hook-up wire and its' case then the negative hook-up wire and case. The meter indicated infinite resistance to the case from both lead wires consistent with a healthy motor (read, not shorted).

- 14 volts direct current was set, and momentarily applied, to the pump-motor assembly. The device exhibited results consistent with a locked rotor, and/or armature, condition (it drew maximum current when energized, note the drive used was limited to 25 amps). The pump-motor assembly did not exhibit evidence of initiation of rotation.

- Next in order to determine if the cause of the high current stated in the previous step was related to the pump or the motor. The motor was unbolted from the pump assembly via four pump mounting

screws. Note, after the four mounting screws were removed the motor and pump required "tapping" on the wooden bench to separate (this tapping isn't normally required for this pump style when in proper functioning condition) .

  - See Figure IX and Figure X for images of the pump and motor drives respectfully.

- Once apart, the pump assembly was turned by hand and found to turn freely/normally for a completely dry pump. In general, pumps have some assemble oil or residual fuel thus aren't dry to this extent. Note, the wear is minimal on the rotor's drive tenon consistent with only several tens of hours of operation.

  - See Figure IX , Figure XI , and Figure XII for the progression of the pump disassemble.

- The motor armature was turned by hand and found to be spin albeit a bit rough. Note, the wear is also minimal in the motor's drive slot consistent with rotor's drive tenon wear.

  - See Figure X for image of the motor's drive.

- 14 volts direct current was set, and applied, to the motor assembly. The motor functioned but with inconsistent/above average amperage draw. These results are consistent with, one or both, armature bearings having damage.

- The motor was disassembled to discover its' drive end armature bearing damaged and not turning smoothly. Otherwise, the motor internally is in very good condition with little wear consistent with both rotor's drive tenon wear and its' own drive slot wear.

  - See Figure XIII for image of the motor's armature.

- The motor's drive end bearing was removed from the armature and one of its' shields removed. Once said shield was removed it was evident that there was no grease remaining. There was a piece of the ribbon cage broken off , a calcium like chalky white residue on the cage, and both inner/outer races were rusted.

  - See Figure XIV (top, with piece of broken ribbon cage circled) , Figure XV (with piece of broken ribbon cage circled), and Figure XVI for images of the motor's drive end bearing.

- The motor's commutator end bearing was in good working condition so one of its' two shields was removed for comparison purposes.

  - See Figure XIV (Bottom) and Figure XVII for images of the motor's commutator end bearing.

5.0 EVALUATION SUMMARY

As provided for this evaluation the pump, identified as part number: 8163-A serial numbers: 08934, had very low hours of operation yet was not functional. The mode of failure was a "locked armature" caused by the poor condition of the motor's drive end bearing. The condition of the drive end bearing was likely caused by the improperly plumbed overboard drain thereby exposing said bearing to moisture and/or clean agents. Based on the condition of said bearing, it is speculated that this pump was nonfunctional for many months (or years) prior to the crash event (an abrupt failure would not have calcified/dried the bearing nor given it time to oxidize as it did).

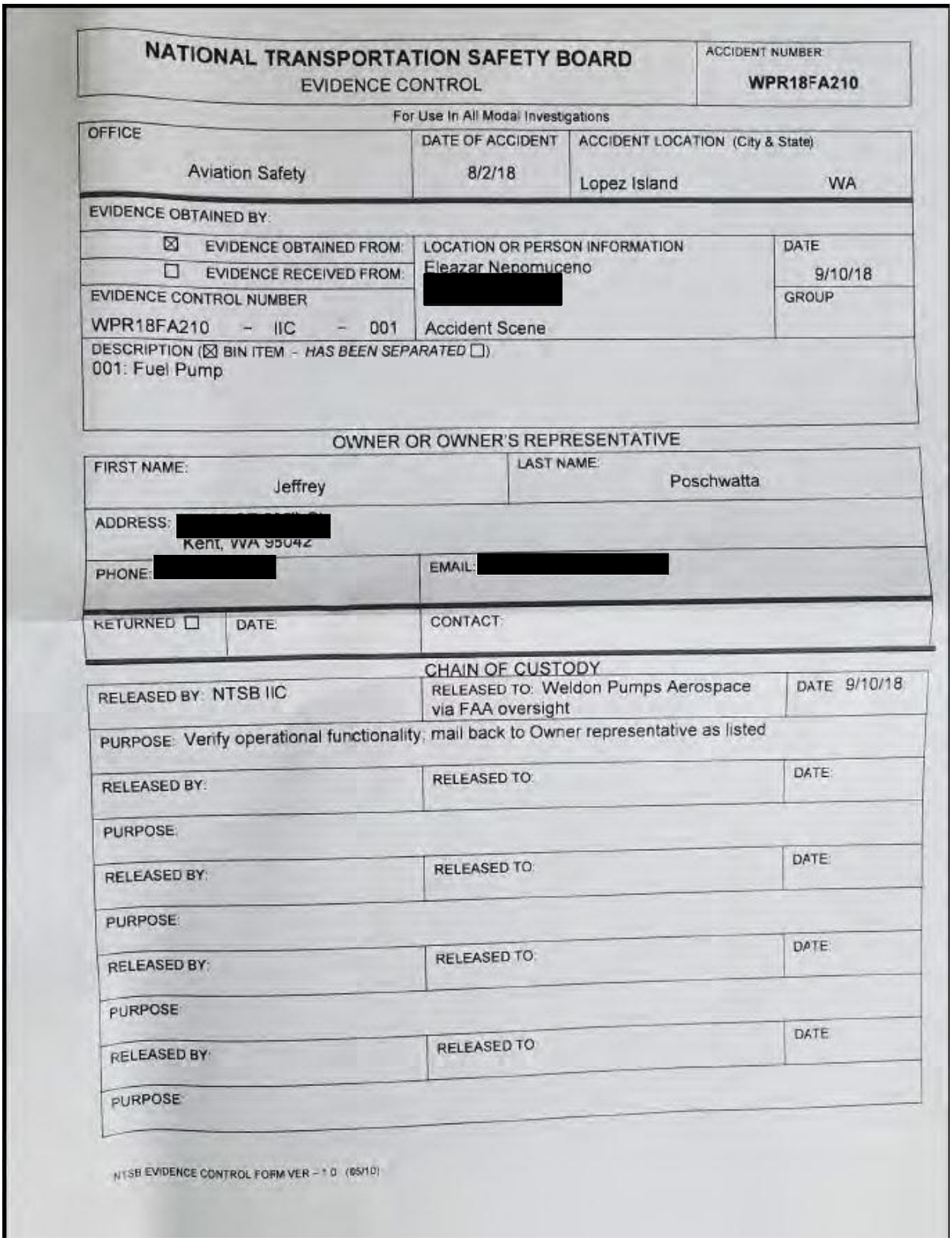

https://www.campusship.ups.com/cship/create?ActionOriginPair=default_PrintWindow... 9/13/2018
[redacted]
4 LBS
1 OF 1
SHIP TO:
JOHN DEMATTEIS
WELDON PUMPS
ATTN: JOHN DEMATTEIS
640 GOLDEN OAK PARKWAY
OAKWOOD VILLAGE OH 44146-6504
OH 441 9-02
UPS 2ND DAY AIR
TRACKING #: 1Z A50 9R8 02 9778 9819
2
BILLING P/P
WELDON PUMP
640 GOLDEN OAK PKWY
BEDFORD OH 44146-6504
P:BLACK S:TOPGRE I:328
ROME-7870
9819

Figure I


DO NOT OPEN WITHOUT TEST
FAA OVERSIGHT
WPR18FA210
FUEL PUMP

Figure II

Figure III



NATIONAL TRANSPORTATION SAFETY BOARD
EVIDENCE CONTROL

ACCIDENT NUMBER: **WPR18FA210**

For Use In All Modal Investigations

OFFICE	DATE OF ACCIDENT	ACCIDENT LOCATION (City & State)	
Aviation Safety	8/2/18	Lopez Island	WA

EVIDENCE OBTAINED BY:

☒ EVIDENCE OBTAINED FROM:	LOCATION OR PERSON INFORMATION: Eleazar Nepomuceno [redacted]	DATE: 9/10/18
☐ EVIDENCE RECEIVED FROM:		
EVIDENCE CONTROL NUMBER: WPR18FA210 – IIC – 001	Accident Scene	GROUP:

DESCRIPTION (☒ BIN ITEM - *HAS BEEN SEPARATED* ☐)
001: Fuel Pump

OWNER OR OWNER'S REPRESENTATIVE

FIRST NAME:	LAST NAME:
Jeffrey	Poschwatta

ADDRESS: [redacted]
Kent, WA 98042

PHONE: [redacted] EMAIL: [redacted]

RETURNED ☐	DATE:	CONTACT:

CHAIN OF CUSTODY

RELEASED BY: NTSB IIC	RELEASED TO: Weldon Pumps Aerospace via FAA oversight	DATE: 9/10/18
PURPOSE: Verify operational functionality, mail back to Owner representative as listed		
RELEASED BY:	RELEASED TO:	DATE:
PURPOSE:		
RELEASED BY:	RELEASED TO:	DATE:
PURPOSE:		
RELEASED BY:	RELEASED TO:	DATE:
PURPOSE:		
RELEASED BY:	RELEASED TO:	DATE:
PURPOSE:		

NTSB EVIDENCE CONTROL FORM VER – 1.0 (05/10)

Figure IV

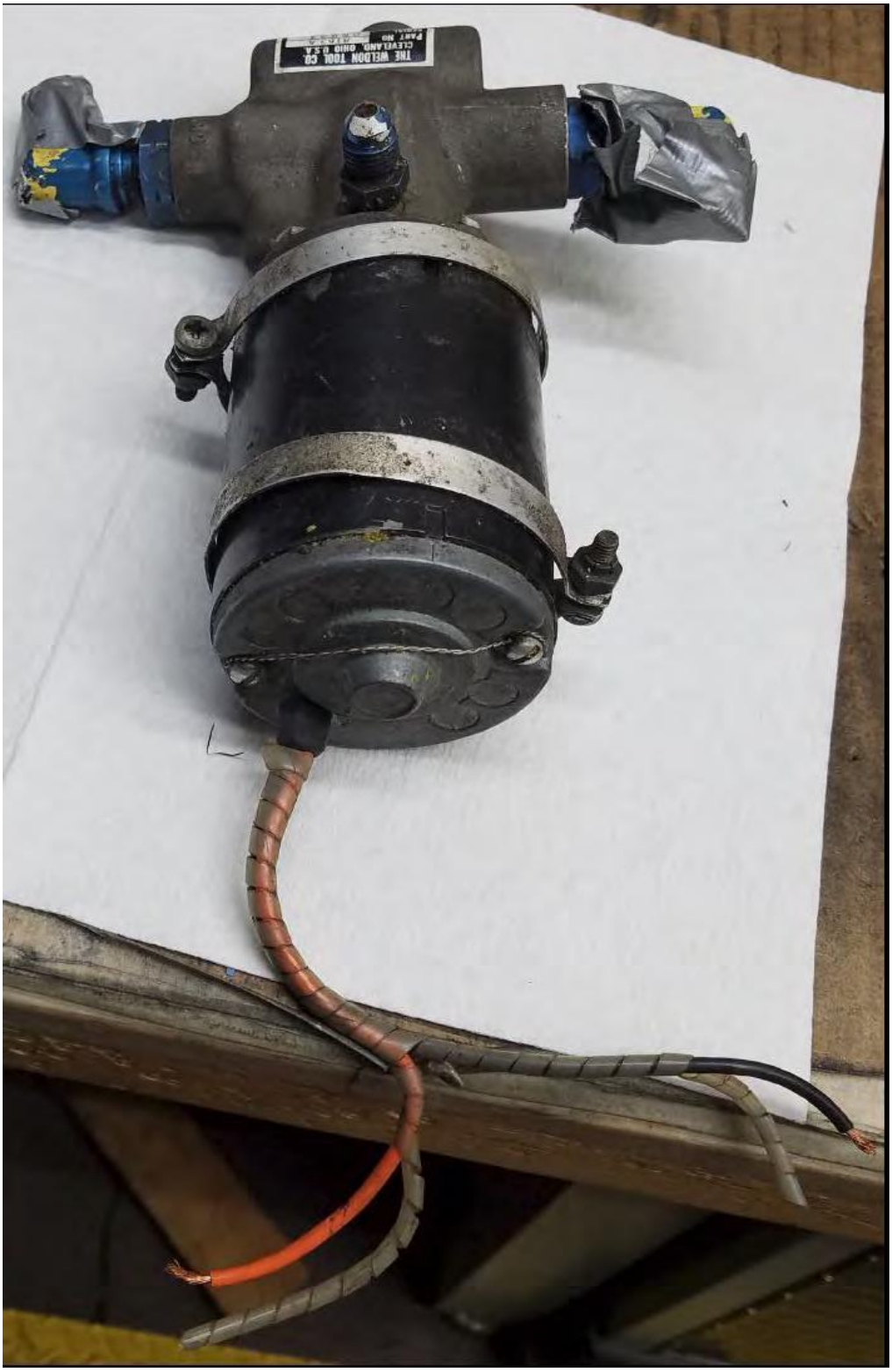


Figure V

Figure VI

Figure VII

Figure VIII

Figure IX

Figure X

Figure XI

Figure XII

Figure XIII

Figure XIV

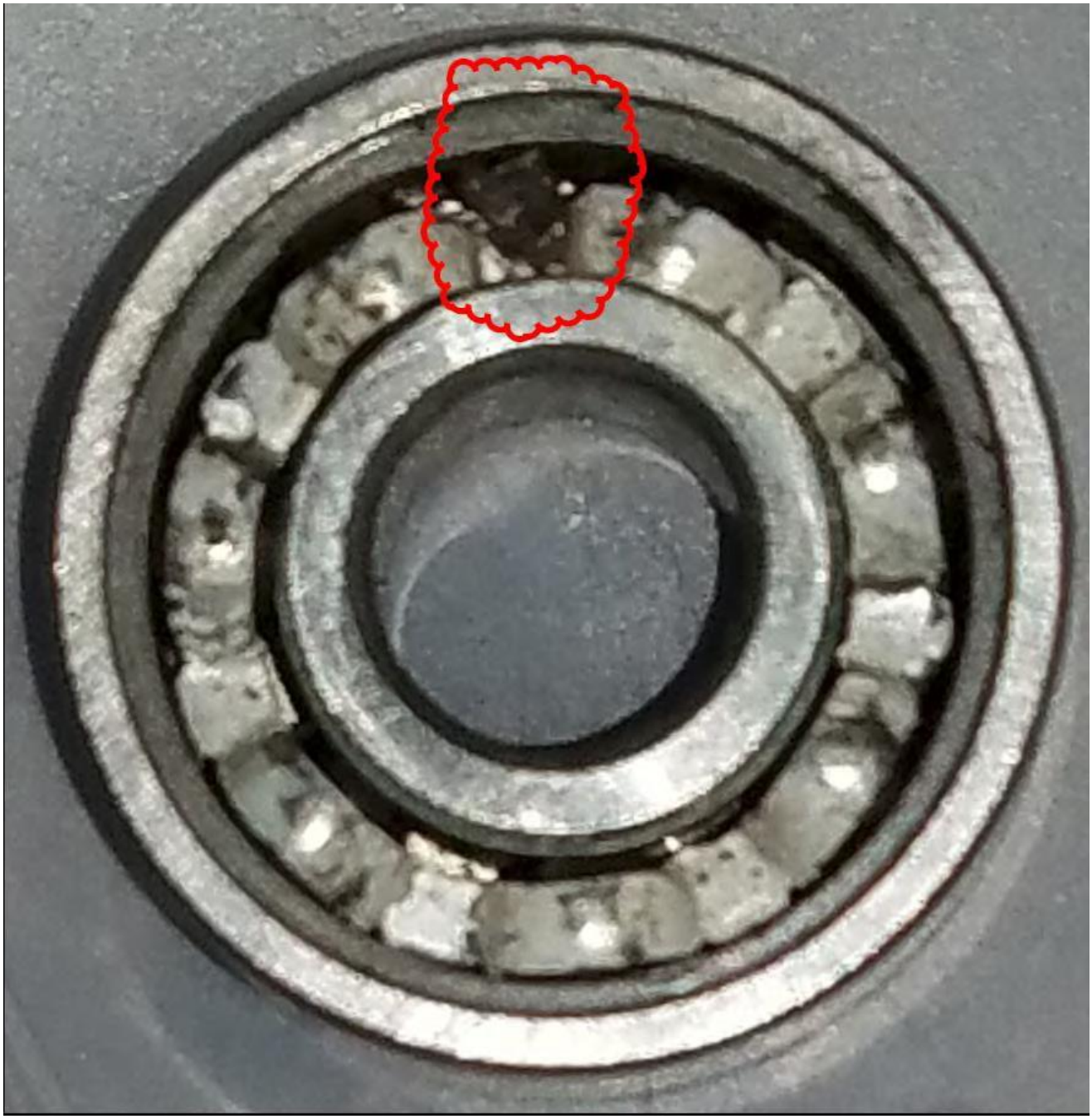


Figure XV

Figure XVI

Figure XVII