DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GS MAINTENANCE MANUAL

CENTRIFUGAL FUEL BOOSTER PUMP

PART No. RG12470

Headquarters, Department of the Army, Washington, D.C.

25 August 1966

WARNING

PRECAUTIONARY DATA

Personnel performing instructions involving operations, procedures, and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, death, or an aborted mission.

Solvent clean parts in an approved cleaning cabinet or in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of cleaners to skin. Observe local regulations regarding the use and handling of flammable liquids.

High speed turbine driven equipment may be operating at excessively high speeds. Always have proper guards in place. Do not stand or work along side of, or in the plane of rotation of this pump when it is running.

SECTION I

INTRODUCTION

1. General Information

This technical manual comprises overhaul instructions for Part No. RG12470 Air Turbine Driven Single Stage Centrifugal Fuel Booster Pump (fig. 1), manufactured by Lear Siegler, Inc., Romec Division (Federal Manufacturer's Code 51663), Elyria, Ohio. Sections I through IV of this technical manual contain instructions for Part No. RG12470.

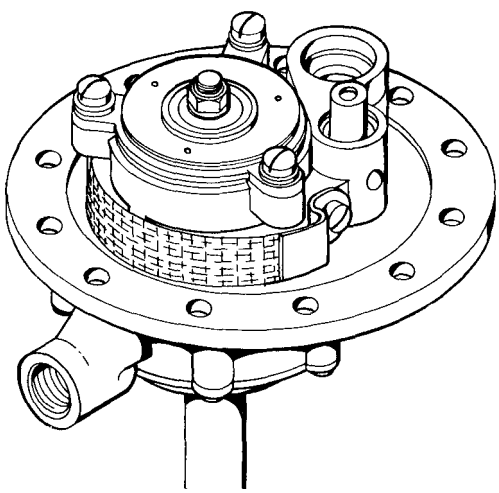

Figure 1. Air Turbine Driven Centrifugal Fuel Booster Pump.

2. Reporting Improvements

The direct reporting by the individual user of errors, omissions, and recommendations for improving this technical manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to Commanding General, U.S. Army Aviation Materiel Command, ATTN: AMSAV-ML, P.O. Box 209, St. Louis, Mo. 63166.

3. Purpose

The fuel booster pump primes the fuel distribution system insuring a vapor-free fuel supply to the engine driven pump.

4. Equipment Records

The Army equipment record system and procedures established in TM 38-750 apply to this equipment. The applicable forms required by TM 38–750 shall be used.

5. Description and Leading Particulars

The pump consists of an air turbine drive unit and a centrifugal pumping element. Bleed air from the aircraft engine is channeled into holes in the turbine shaft and expelled through

nozzles, causing the turbine to spin. The centrifugal impeller is mounted on the shaft and extends in a pumping chamber in the housing. Fuel enters the pumping chamber through an inlet in the bottom of the housing. The whirling impeller blades pick up the fuel and throw it by centrifugal force away from the impeller hub and against the chamber walls. The fuel follows the spiral passage in the housing to the discharge port. Refer to table 1 for leading particulars.

Table 1. Leading Particulars

Pump type	Air turbine driven single stage centrifugal fuel booster.
Capacity	690 PHR @ 8 PSI discharge pressure.
Pumping medium	Fuel per MIL–J–5624 (JP–4).
Rotation	Clockwise viewing turbine cone end.
Fuel temperature range	—60° F to + 130° F.
Ambient temperature range	—60° F to + 130° F.

SECTION II

TEST EQUIPMENT, SPECIAL TOOLS AND MATERIALS

6. Test Equipment

Equipment required to test the pump is listed in table 2.

7. Special Tools

No special tools are required.

8. Consumable Materials

Consumable materials required to overhaul the pump are listed in table 3.

Table 2. Test Equipment Required

Part, Model or mil des	Nomenclature	Technical Description
0–100 PSI (3 ea)	Pressure Gage	Used to monitor air and fuel pressure at final test. Typical manufacturer: Helicord Gage Div. of American Chain and Cable Co., Bridgeport, Connecticut.
0–1000 PHR (1 ea)	Flowmeter	Used to monitor fuel flow at final test. Instrument to be calibrated for MIL–F–7024A type II fluid Sp Gr 77 @ 60° F. Typical manufacturer: Cox Instruments Corp., Detroit, Michigan.
25 Gallon	Test Tank	Suitable for mounting pump in its normal operating attitude during test. Fabricate locally.
2.5–100 PSI	Air Pressure Source	Used to drive turbine.
	Profilometer	Used to gage roughness of critical surfaces. Typical manufacturer: Micrometrical Manufacturing Co., Ann Arbor, Michigan.
—70° F to + 140° F (2 ea)	Temperature Gage	Used to monitor fluid and air temperature.

Table 3. Consumable Materials Required

Item Number	Material	Type or Grade	Government Specification
1.	Dry cleaning solvent		P–D–680
2.	Calibration fluid	II	MIL–F–7024A
3.	Alodine		MIL–A–8625
4.	Lapping compound	1800 *	
5.	O-Ring grease	10924 **	
6.	Crocus cloth	#400	P–C–458
7.	Polyethylene bag		MIL–B–43165
8.	Lockwire		MS20995NC32
9.	Protective plug		NAS818–6
10.	Protective plug		NAS816–48
11.	Protective plug		NAS816–23
12.	Protective plug		NAS816–72

* Manufactured by Crane Packing Co. or equivalent.
** Manufactured by Standard Oil Co. or equivalent.

SECTION III

OVERHAUL INSTRUCTIONS

9. Disassembly

Disassemble the equipment only to the extent necessary for inspection, cleaning and repairs. Detailed instructions follow.

a. Remove screen (18), washer (19), screw (20), and relief valve (parts 13 through 16, figure 2). With fingers, restrain valve guide (14) to prevent it from abruptly unseating when retaining ring is removed. With a scribe or similar pointed tool, remove retaining ring (13). Remove valve guide (14), spring (15) and ball (16).

b. Remove screws (21) and lift off air outlet vane and cone (22).

c. Hold turbine (23) and remove nut (1) and washers (2). Unless it requires replacement, do not remove identification plate (6). If its replacement is required, pry out screws (31). Take out screws (30) and washers (29). Take off cover (7). Insert a knife blade between the cover and the pump housing and continue to use progressively larger wedges until the cover is free. Push bearing (4), bushing (3) and shims (5) from cover.

d. Take out impeller (9), key (8), shim (10), packing (11) and seal (12). Remove turbine (23). Exact retaining ring (28) with a scribe or similar tool. Tap seal (26) and spring washer (25) into palm of hand. Remove preformed packing (27) with a suitable picking tool.

e. Do not remove sleeve bearing (24) unless inspection indicates its replacement is necessary. If removal is required, heat pump housing in an oven to a temperature of 350° F. Remove from oven and knock out bearing on a wood block. Use a wood dowel to apply pressure if impact fails to free bearing.

10. Cleaning

a. Remove any loose accumulation of foreign matter from disassembled parts with clean, dry, compressed air. Air hose nozzle pressure shall not exceed 100 PSI. Particular attention should be given to internal passage of the pump housing.

b. Clean metal parts by immersing in or spraying with solvent (item 1, table 3). Remove heavy concentrations of grease or other deposits by scrubbing with a nonmetallic brush. Dry parts with filtered dehumidified air having a nozzle pressure no greater than 100 PSI.

c. Store cleaned parts in plastic bags or similar containers to prevent contamination.

11. Inspection

a. Examine parts for obvious damage or wear. Cracks, warped or mutilated mating surface, scored or grooved rotating parts are usually cause for rejection of the parts. Table 4 provides a guide for determining the serviceability of a part.

b. Parts suspected of having minute cracks or metal fatigue shall be inspected with either magnetic particle or fluorescent penetrant (Military Specifications MIL-I-6868 or MIL-1-6866 respectively).

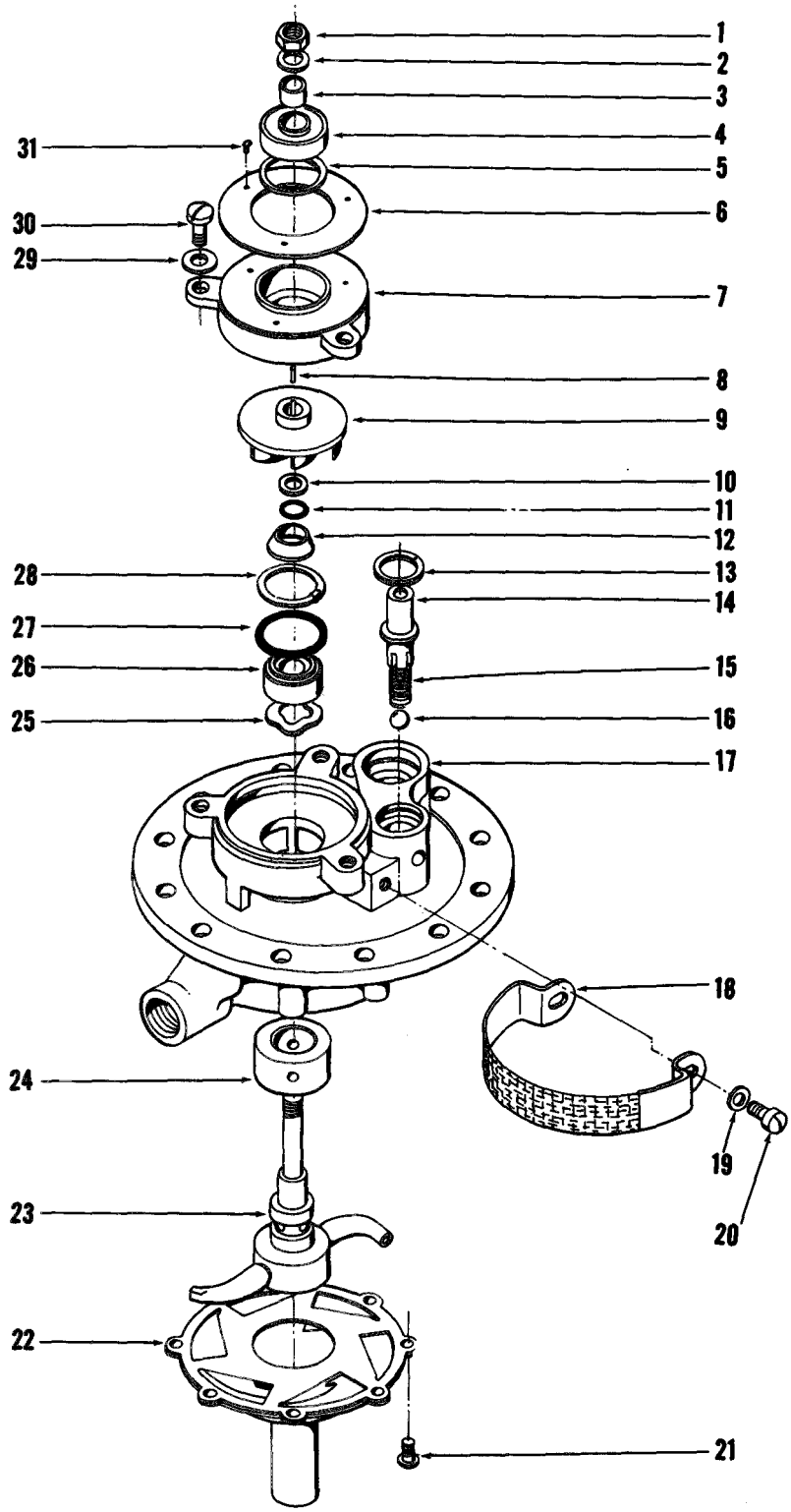

Figure 2. Exploded View of Air Turbine Driven Centrifugal Fuel Booster Pump.

1. Nut
2. Washer
3. Bushing
4. Bearing
5. Shim
6. Identification plate
7. Cover
8. Key
9. Impeller
10. Shim
11. Packing
12. Seal
13. Retaining ring
14. Valve guide
15. Spring
16. Ball
17. Pump housing
18. Screen
19. Washer
20. Screw
21. Screw
22. Air outlet vane and cone
23. Turbine
24. Bearing, sleeve
25. Spring washer
26. Seal
27. Preformed packing
28. Retaining ring
29. Washer
30. Screw
31. Screw

Figure 2. *Exploded View of Air Turbine Driven Centrifugal Fuel Booster Pump.*—Continued

Table 4. *Inspection*

Part Identification Noun.	Fig. 2 Index No.	Type of Inspection	Non-Destructive Inspection Test	Acceptable Defects
End Cover	7	Visual/Mechanical	Examine pump housing mating surfaces for nicks, burrs or other defects. Check bearing bore for scoring or an oversize condition. Roughness of bore shall not exceed 32 micro-inches. Maximum bore diameter is 0.8666 inch.	Minor surface damage may be dressed out. Replace if bearing bore is rough or oversize.
Impeller	9	Visual	Examine for bent, cracked or crushed vanes. Inspect for elongation or other damage to the bore and keyway.	Replace if any of these conditions exist.
Seal Seat	12	Visual/Mechanical	Check seal surface for scoring, pitting or other surface damage. This surface must be flat within 2 lightbands and have a surface finish of 4 microinches.	Seal surface may be lapped to remove minor surface irregularities (see table 3, item 4).
Pump Housing	17	Visual/Mechanical	Examine all machined surfaces for nicks, burrs, dents or other defects that would affect fit or sealing ability. Check impeller housing for grooving. Inspect tapped holes for thread damage. Make sure preformed packing seats are smooth and free of burrs of hanging metal. Examine the carbon bearing for cracks or chips. Measure the bearing bores for a maximum diameter of 0.5558 inch.	Minor surface irregularities may be blended with an abrasive. Light scoring in the impeller housing is acceptable; gouging or deep scoring is cause for rejection. Replace sleeve bearing if damaged or oversize.
Air Outlet Vane and Cone	22	Visual	Examine for dents or tears.	Minor dents are acceptable provided unit meets test requirements. Replace if torn.

Table 4. *Inspection*—Continued

Part Identification Noun.	Fig. 2 Index No.	Type of Inspection	Non-Destructive Inspection Test	Acceptable Defects
Turbine	23	Visual/Mechanical	Examine for thread damage. Measure bearing journal for a minimum diameter of 0.5542 inch. Surface roughness of journal shall not exceed 4 microinches.	Replace if threads are damaged or if journal is worn or rough.
Seal	26	Visual	Inspect carbon insert for chips, cracks or scoring.	Replace if any of these conditions exist.

12. Repair or Replacement

Replace defective parts as directed at inspection. Procedures for reconditioning repairable parts are given in the following paragraphs.

Note. All preformed packings must be replaced at overhaul.

a. Restore contact surface of seal seat (12, fig. 2) on a cast iron lap using compound (item 4, table 3). This surface must be flat within 2 light bands gaged with an optical flat and monochomatic light, and smooth with 4 microinches gaged with a profilometer.

b. Remove or blend nicks, burrs and other defects from machined surfaces of aluminum parts with a mill file and dress out with #400 crocus cloth. Correct minor entrance thread damage in threaded holes with a suitable tap. Blend out preformed packing seats in port entrances with crocus cloth. Thread damage shall not exceed 30 percent of the entrance thread, or 10 percent each of the two entrance threads when the remaining threads are intact.

c. Replace carbon sleeve bearing (24) if necessary per paragraph 9e. Thoroughly clean the bearing cavity by scrubbing with item 1, table 3. Heat pump housing in an oven to a temperature of 350° F. Remove from oven and fit bearing into cavity. The bearing must be positioned so that two of the holes straddle the air inlet channel. Position the bearing so that its chamfered end faces the impeller side of the housing. (Grind the bearing bore to 0.5556 + 0.0002, - 0.0001 inch.

d. Touch up metal exposed by rework using item 3, table 3.

13. Reassembly and Testing of Components

Reassembly instructions are given in the following paragraphs:

a. Lubricate preformed packing (27, fig. 2) with (item 6, table 3) and install. Set the spring tension washer (25) and seal (26) in the housing and secure with retaining ring (28).

b. Calculate the number and thickness of shims (10) required for a running clearance of 0.011 to 0.014 inch between the impeller and pump housing.

(1) Temporarily insert turbine (23) and slide the impeller on to its shaft. With the impeller thus bottomed against the pump housing, measure the dimension represented by (A, fig. 3).

(2) Temporarily install seal seat (12) on shaft and a 0.050 inch shim stack. Take measurement represented by (B, fig. 3). Compare dimensions to determine the thickness of shims required for the desired clearance. Take into consideration the 0.050 inch shim stack, and the thickness of the seal seat. Select fewest number of shims required.

c. Lubricate preformed packing (11) with (item 15, table 3) and install in seal seat (12). Install turbine (23), seal seat (12), shims (10), key (8) and impeller (9).

d. Calculate the thickness of shims (5) required to obtain a clearance of 0.0025 to 0.0045 inch between the impeller (9) and end cover (7).

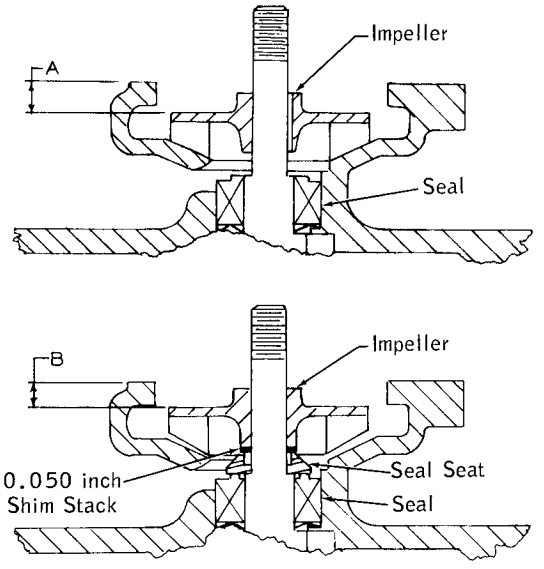

Figure 3. Impeller Shimming.

(1) Measure the depth of the bearing bore (A, fig. 4).

(2) Set the end cover in place and measure depth to the impeller hub (B, fig. 4).

(3) Compare A and B to determine the amount of built-in clearance or interference. Select fewest number of shims (5) required to obtain the desired end play.

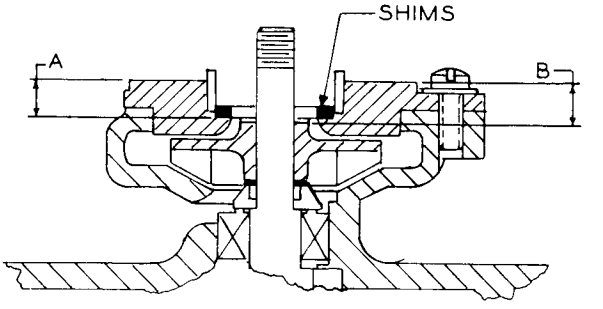

Figure 4. End Cover Shimming.

e. Fit shims (5), bushings (3) and bearing (4) into end cover (7). Guide end cover over turbine (23) and secure with screws (29) and washers (30). Hold turbine (23) and attach nut (1) and washer (2). Tighten nut (1) to 30-40 inch-pound torque. Turn turbine to check freedom of rotation.

f. Install relief valve components (14 through 16). Secure with retaining ring (13).

SECTION IV

FINAL TEST PROCEDURE

14. Test Setup

The test setup consists of a tank suitable for mounting the unit and instrumentation for monitoring flow, fluid pressure, air pressure, fluid temperature and air temperature (fig. 5). A rotating tank is recommended; in that, the test fluid need not be drained each time the pump is installed or removed.

a. Fluid (item 2, table 3) used for testing shall be maintained at 80° ± 20° F. during tests. Fluid must be in sufficient quantity to produce a 10 inch head above the pump mounting flange.

b. The air source shall be capable of supplying at a pressure of 75 PSIG.

Note. The pump inlet fitting shall be an AN919–12 or AN919–12D reducer with 0.566 inch thread length on small end reduced to 0.370 inch.

Warning: **High speed turbine driven equipment may be operating at excessively high speeds. Always have proper guards in place. Do not stand or work along side of, or in the**

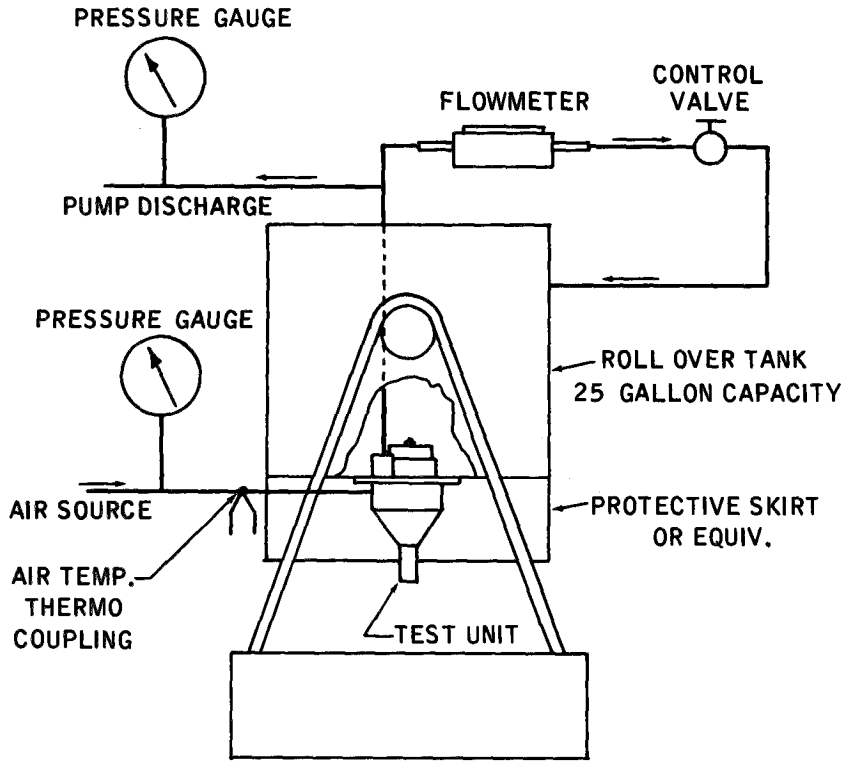

Figure 5. Test Setup.

plane of rotation of this pump, when it is running.

15. Break-In Run

Operate the pump at 100 to 125 percent of rated flow for not less than 30 minutes nor more than 3 hours (850 to 1000 PHR). Room temperature air shall be supplied at a pressure of 35 PSIG to the pump inlet. During the break-in run, there shall be no leakage from the casting or seal. Seal leakage will be evidenced by fuel flow though the air exhaust cone.

16. Calibration Test

Pump flow and discharge pressure shall agree with the values in table 5 for each air inlet pressure setting. Leakage as described in paragraph 15 shall be cause for rejection.

Table 5. Calibration Test Values

Air Inlet Press (PSIG)	Air Inlet Temp (° F)	Fuel Flow (PHR)	Fuel Discharge Press (PSIG)
27.5	80 ± 20	690	14 minimum–25 maximum
48	80 ± 20	855	14 minimum–25 maximum
6	80 ± 20	100	3 minimum

17. External Leakage Test

Mount the pump in a suitable tank to which air pressure can be applied. Fill the tank with test fluid as before. The air inlet fitting shall be removed from the pump and its discharge port closed. Apply 15 PSI air pressure within the tank for ten minutes. There shall be no leakage at the pump air inlet port, the exhaust cone, or between the pump housing and exhaust cone mating surfaces.

18. Soak Test

Install the pump in the text fixture described in paragraph 17, except fluid level shall be 6 inches above the pump mounting flange. Apply an air pressure of 2.5 PSI for a period of 8 hours. Wetting at the pump air inlet and exhaust cone is permissible, but drippage is cause for rejection. Indicating paper (such as brown wrapping paper) located under the test unit shall be used to detect dripping.

19. Troubleshooting

Units failing to meet the foregoing requirements shall be rejected. Table 6 lists typical failures, their causes and remedial action to be taken. Units successfully completing tests shall be wiped clean of fluid and lockwired per Military Standard (MS33540). Install all protective plugs and caps.

Table 6. Troubleshooting

Trouble	Probable Cause	Remedy
Unit fails to operate	Binding.	Disassemble and inspect all rotating parts. Make sure proper running clearances are maintained.
Low system pressure	Insufficient clearance between impeller and housing.	Adjust clearance per Section III, paragraph 13*b*.
Surging Discharge	Excessive end play.	Adjust end play per Section III, paragraph 13*d*.
Seal leakage	Cut preformed packing, foreign matter or scoring of rotating and stationary seals.	Replace or clean parts as necessary.

APPENDIX I

REFERENCES

TM 38-750 Army Equipment Record Procedures

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:

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CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *19 September 1974*

GS Maintenance Manual

CENTRIFUGAL FUEL BOOSTER PUMP PART NO. RG12470

TM 55-2915-282-40, 25 August 1966, is changed as follows:

Pages 7 and 8. Paragraphs *13c, d, e,* and *f* are superseded as follow:

c. Calculate seal face working load as follows:

(1) With turbine (23) installed in pump housing temporarily install seal seat (12) shims (10) impeller (9) bushing (3) washer (2) and nut (1). Measure force required to depress turbine shaft from threaded end. Force required to move shaft will indicate seal face working load. Force required should be 1.1 to 1.3 lbs.

NOTE

The shaft will only move .011 to .014 inch as established in paragraph 13b.

(2) If seal face working load exceeds 1.3 lbs, remove a number of shims from between seal seat (12) and impeller (9) and install below seal seat. Repeat step (1) above.

NOTE

Total shim thickness must remain the same as established in paragraph 13b.

(3) If seal face working force is less than 1.1 lbs, replace seal (26) and repeat step (1) above.

d. Remove nut (1) washer (2) bushing (3) and impeller (9). Remove shims (10) that are installed between impeller (9) and seal seat (12). Lubricate preformed packing (11) with (item 5 table 3) and install over shaft into recess in seal seat (12).

CAUTION

Exercise care in installation of packing (11) to prevent damage from sharp edges of woodruff key slot on shaft.

Install shims (10) woodruff key (8) and impeller (9). Install cover (7) and secure with screws (30) and washer (29).

f. Add shims (5) as required, obtain shaft end play of 0.0025 to 0.0045 inch. Install bushing (3) bearing (4) washer (2) and nut (1). Torque nut (1) 30-40 inch lbs. Verify shaft end play of 0.0025 to 0.0045 inch and check turbine assembly for freedom of rotation.

Page 8. Paragraph 13*g* is added.

g. Install relief valve components (14 thru 16) and secure with retaining ring (13).

Page 8. Figure 4 is deleted.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Vice Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

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NOTE

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NOTE

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e. Install shims (10) woodruff key (8) and impeller (9). Install cover (7) and secure with screws (30) and washer (29).

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