

**TECHNICAL MANUAL
OPERATION, SERVICE AND REPAIR
INSTRUCTIONS**

10 TON HYDRAULIC AIRCRAFT HAND JACK

TYPE A-6, PART NO. 53D22004

(COLUMBUS JACK CORP.)

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SECTION I INTRODUCTION

1-1. GENERAL. (See figure 1-1.) This publication is issued as the basic Handbook of Operation, Service and Repair Instructions for 10 Ton Hydraulic Aircraft Hand Jack, Type A-6, USAF Part No. 53D22004, manufactured by the Columbus Jack Corporation, Columbus, Ohio.

1-2. DESCRIPTION. (See figures 1-1 and 2-1.) The jack is a portable self-contained unit with a single speed manually operated pump. The lift consists of

three rams and an extension screw, allencased within an outer cylinder which is integral with the base. A rectangular tank is welded to the base, forming the fluid reservoir.

1-3. PURPOSE. This jack is used for vertical lifting of loads up to 10 tons (20,000 pounds). At the maximum allowable load of 11 tons (22,000 pounds) the hydraulic operating fluid is by-passed within the jack by an automatic valve, and the jack will not continue to lift.

1-4. LEADING PARTICULARS.

Use	Vertical Load Lift
Rated Load	20,000 lb
Maximum Allowable Load	22,000 lb
Operating Force (at rated load).	75 lb (approx)
Operating Fluid Specifications:	
Above -20°F	MIL-0-5606
Below -20°F.	75% MIL-0-5606 25% Naptha, Spec TT-N-95
Hydraulic System Fluid Capacity	3.6 pt
Pump Handle Length18 in.
Hydraulic Lift (rams extended)	13 in.
Extension Screw Lift (fully extended)	4 in.
Height of Rams (collapsed).	8 in.
Height Over-all:	
Collapsed	8 in.
Fully Extended	25 in.
Weight (with fluid)	50 lb

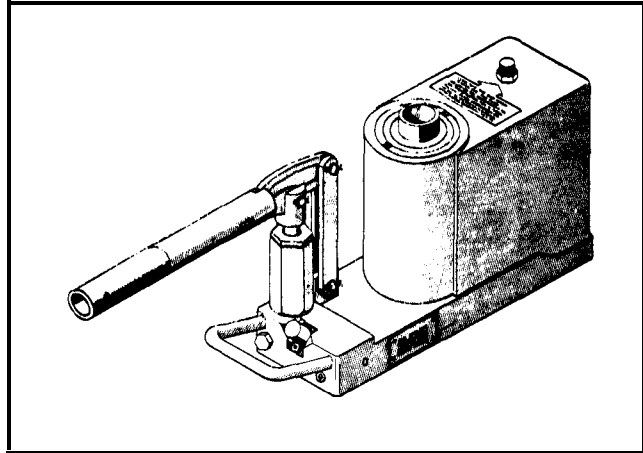


Figure 1-1. 10-Ton Hydraulic Aircraft Hand Jack, Type A-6 (typical view)

SECTION II OPERATION AND SERVICE INSTRUCTIONS

2-1. PRINCIPLE OF OPERATION. (See figure 2-1.) The valve assembly, (14, figure 3-1) is located beneath the pump actuating cylinder (12). The valve assembly contains a gravity check valve, a spring-loaded check valve and a safety by-pass valve. On the "up" stroke the pump piston (8) draws hydraulic fluid from the reservoir, and on the "down" stroke forces fluid under pressure through the spring-loaded check valve and into the base assembly (56) cylinder and rams (33, 39, 44). This fluid pressure is retained by the spring-loaded check valve. Pressure may be released, and the fluid returned to the reservoir, by opening the release valve (25). The safety by-pass valve is operative when load on the rams exceeds the maximum allowable load of 11 tons (10% greater than 10 ton rated load).

2-2. OPERATING PREPARATION. The following procedure is used to prepare the jack for service:

a. Apply a light film of lubricating oil (Specification MIL-L-7870) to outer bearing surfaces of rams. Wipe away excess oil with a clean, lint-free cloth to prevent dust and grit accumulation on ram surfaces.

b. Open release valve (25) approximately one-half turn and manually collapse rams until flush with cylinder of base assembly (56).

c. Remove vent assembly (52) and inspect reservoir fluid level to ascertain that fluid is within 1/4 inch of reservoir filler hole boss.

d. If fluid level is low, add sufficient operating fluid (refer to Leading Particulars, paragraph 1-4, for proper fluid specification) to fill reservoir to correct fluid level.

NOTE

Reservoir shall be filled with fresh, clean fluid. Fluid that has been filtered to remove dirt, sand and all other solid matter may be used only in emergency cases. Immediately after emergency operation, flush jack with clean hydraulic fluid, and fill reservoir to correct level.

e. Replace vent assembly (52), allowing vent screw to remain open approximately two turns. Open release valve (25) one complete turn. Operate jack handle (1) for ten to twenty pressure strokes to expel all trapped air.

f. Close release valve (25). Close screw of vent assembly (52) if jack is to be stored. Vent assembly screw shall remain open when jack is in service.

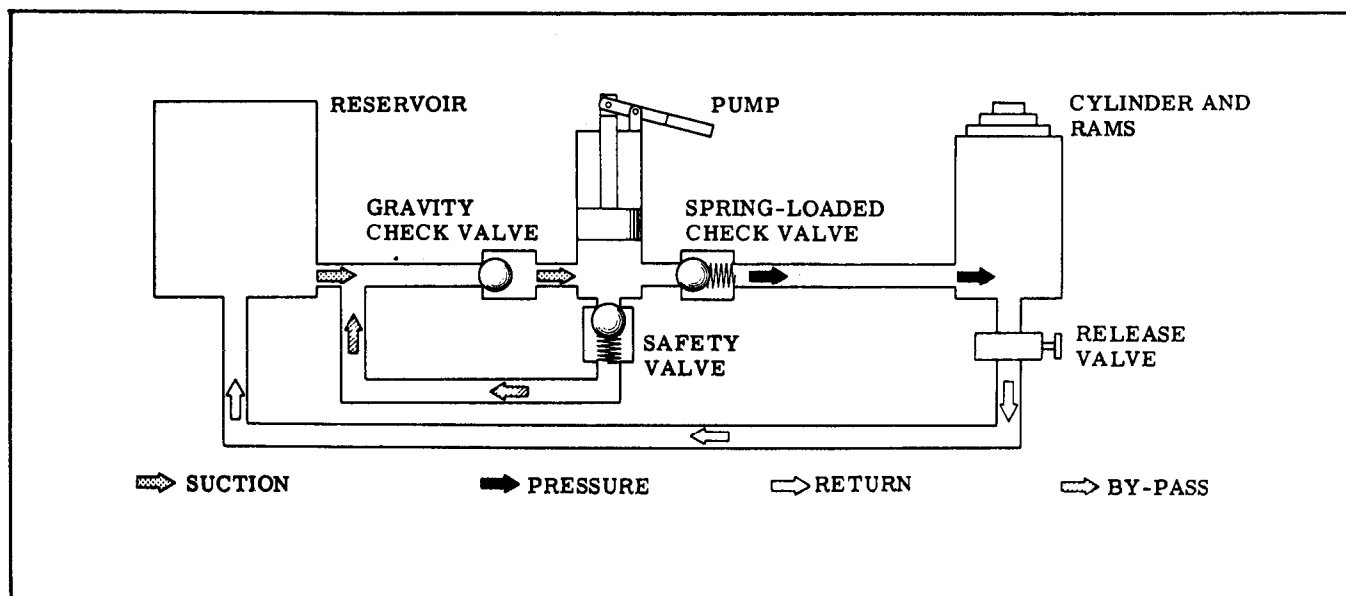


Figure 2-1. Operational Schematic Diagram

2-3. **LIFTING PROCEDURE.** The following procedure is to be used when using jack to lift vertical loads:

- a. Close release valve (25) fully. Unscrew vent assembly (52) vent screw two turns.
- b. Make sure that jack base rests on a firm and level foundation. If necessary, place a flat metal plate under jack base to provide secure footing for the jack.



Do not attempt to lift loads exceeding 20,000 pounds (10 tons) with this jack.

- c. Operate jack handle (1) to lift rams partially.
- d. Position jack under load and, if necessary, partially unscrew extension screw (49) to contact the load and to provide additional lift. Do not attempt to unscrew the extension screw (49) more than four inches (refer to paragraph 3-4e). Operate handle (1) to lift rams (33, 39, 44) to contact the load if maximum extension screw lift is insufficient.
- e. After jack is firmly positioned under load, operate jack handle (1) using long, smooth strokes until jack has lifted load.

NOTE

If jack lifting stops before rams are fully extended, an overload is indicated and by-pass valve is relieving fluid pressure (refer to paragraph 2-1). In this event, a jack with greater capacity shall be used to lift the load.

2-4. **LOWERING PROCEDURE.** The following procedure is used to lower the jack under load:

- a. Allow vent assembly vent screw (52) to remain

open. Open release valve (25) slowly, using slotted end of handle (1), until jack begins to lower under load. The rate of load descent is in proportion to the degree of release valve opening.

NOTE

Do not open release valve (25) more than two complete turns.

b. With release valve (25), open, rams will lower under load until the load supports itself. Withdraw jack from under load. Lower extension screw (49), and manually press rams (33, 39, 44) until they lie flush with base cylinder.

c. Fully close and tighten release valve (25). If jack is to be stored, close vent assembly (52) vent screw.

2-5. **PERIODIC LUBRICATION.** No specific schedule of lubrication is required. All internal parts operate in the hydraulic system fluid, which provides adequate internal lubrication. When extension screw (49), rams (33, 39, 44), pump lever (5) or link pins (4, 7) appear dry or in need of lubrication, wipe clean of accumulated dirt and grit, and apply a light film of lubricating oil, Specification MIL-L-7870. Wipe away excess with a clean, lint-free cloth.

2-6. **PERIODIC INSPECTION.** No specific schedule of inspection is required. However, the following visual checks shall be made whenever the jack is used:

a. After each lifting operation, inspect for evidence of fluid leaks, especially in the areas around pump packing nut (9) and piston (8), between rams (33, 39, 44) and inside diameter of cylinder bushing (31).

b. Prior to using jack, inspect vent assembly (52) vent screw for dirt or other obstructions in air passage; and remove pump intake strainer (30) by unscrewing pipe plug (28) and withdrawing spring (29), and inspect strainer (30) for accumulation of dirt, metallic particles, or other foreign material.

2-7. **TROUBLE SHOOTING.** If any operational troubles are encountered, locate the probable cause and remedy, using figure 2-2.

TROUBLE	PROBABLE CAUSE	REMEDY
Rams (33, 39, 44) fail to lift when jack is operated, or jack fails to lift rated load. (See figure 3-1.)	Incomplete closure of release valve (25).	Tighten release valve (25) securely with slotted end of jack handle (1).
	Obstructed fluid suction passage.	Disassemble jack. Blow passages clear with compressed air. Reassemble jack, flush and fill with clean fluid.
	Low fluid level.	Inspect and fill to correct fluid level if necessary (refer to paragraphs 2-2c, 2-2d).

Figure 2-2. Trouble Shooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Rams (33, 39, 44) fail to lift when jack is operated, or jack fails to lift rated load. (See figure 3-1.) (Continued)	By-pass valve improperly adjusted.	Remove screw (22). Adjust screw (15) as outlined in paragraphs 3-11a through 3-11c.
	Broken by-pass valve spring (16).	Remove screws (15, 22). Remove, inspect, and if necessary replace spring (16). Install screw (15) and adjust as outlined in paragraphs 3-11a through 3-11c. Install screw (22).
Rams will not fully elevate. (See figure 3-1.)	Low fluid level.	Inspect and fill to correct fluid level if necessary (refer to paragraphs 2-2c and 2-2d).
	Leaking discharge valve.	Remove valve assembly (14). Inspect ball (20) and ball seating surfaces of valve body (21). Replace ball (20) if defective; reseal if necessary (refer to paragraph 3-7a).
Rams will not support load. (See figure 3-1.)	Oil leaks around rams (33, 39, 44).	Remove rams (33, 39, 44). Replace packing retainers (37, 43, 48), and packings (36, 42, 47). Inspect bearings (35, 41, 46) and bushing (31) for damaged grooving or uneven wear. Replace defective parts.
	Leaking discharge valve.	Remove valve assembly (14). Inspect ball (20) and ball seating surfaces of valve body (21). Replace ball (20) if defective. Reseat if necessary (refer to paragraph 3-7a).
	Leaking release valve ball (27) or seat.	Remove, inspect and if necessary replace ball (27). Inspect ball seating surface in base assembly (56) and reseal if necessary (refer to paragraph 3-7a).
Rams rise and fall with each stroke. (See figure 3-1.)	Incomplete closure of release valve (25).	Tighten release valve (25) securely.
	Leaking discharge valve.	Remove valve assembly (14). Inspect ball (20) and ball seating surfaces of valve body (21). Replace ball if defective. Reseat if necessary (refer to paragraph 3-7a).
Pump inoperative or difficult to operate. (See figure 3-1.)	Vacuum created in reservoir due to closed vent assembly (52) vent screw.	Unscrew vent assembly (52) vent screw 2 turns.

Figure 2-2. Trouble Shooting Chart (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Pump operates, and fluid pressure fails to by-pass at maximum ram extension or with overload applied. (See figure 3-1.)	By-pass valve improperly adjusted.	Remove screw (22). Adjust screw (15) as outlined in paragraphs 3-11a through 3-11c.
	Defective by-pass spring (16) or ball (17).	Remove screw (22), screw (15), spring (16) and ball (17). Inspect and replace spring (16) or ball (17) if necessary. Adjust screw (14) as outlined in paragraphs 3-11a through 3-11c.
Rams will not lower. (See figure 3-1.)	Loose retaining ring (34, 40, 45) lodged beneath rams (33, 39 or 44).	Remove rams (33, 39, 44). Inspect and replace retaining rings (34, 40, 45) if necessary.
	Excessively worn rams (33, 39 or 44) have jammed.	Relieve load with another jack. Remove, inspect and replace rams (33, 39, or 44) if necessary.

Figure 2-2. Trouble Shooting Chart (Continued)

SECTION III

REPAIR INSTRUCTIONS

3-1. SPECIAL TOOLS. No special tools are required for normal repair of the jack.

3-2. DISASSEMBLY. (See figure 3-1.) Disassemble the jack according to the procedure set forth in paragraphs 3-3 and 3-4.

3-3. REMOVAL OF VALVE ASSEMBLY. If removal of the valve assembly (14) is necessitated, proceed as follows:

- a. Tighten vent assembly (52) vent screw securely.
- b. Remove cotter pin (6) and straight headed pin (7) securing pump piston (8) to pump lever (5).
- c. Stand jack on end, resting on reservoir to prevent excessive fluid loss, and unscrew pump cylinder (12) with associated parts (8) through (11). Remove upper valve copper gasket (13) from threaded hole in base assembly (56), if it has not come out with the pump cylinder (12).
- d. Screw a 1-1/2 inch long, 1/4-20UNC-2B screw into threaded hole atop valve body (21) and remove valve assembly (14).

NOTE

For service and repair purposes, do not disassemble valve assembly (14) beyond the point necessary for each service or repair problem. Removal or rotation of adjusting screw (15) will necessitate readjustment and testing of jack by-pass pressure setting (refer to paragraphs 3-11a through 3-11c).

3-4. DISASSEMBLY OF JACK ASSEMBLY. Disassemble the detail parts of the jack in the same order as the key index numbers assigned to the exploded view, figure 3-1, noting the following:

- a. Remove handle (1). Unscrew vent assembly (52). Remove release valve (25), while simultaneously unscrewing lock screw (24). Remove ball (27).
- b. Pour hydraulic fluid from jack into a clean container.
- c. Do not disassemble valve assembly (14) unless defective valve operation indicates the necessity of such disassembly (refer to Figure 2-2 and NOTE, following paragraph 3-3d).

d. Rap lightly with a soft-head mallet at inner bearing circumference to facilitate removal of bearings (35, 41, 46).

e. Do not remove extension screw (49) from third-stage ram (44) unless either part is damaged. Forcible removal of extension screw (49) will damage plunger (50), which with spring (51), internally limits screw extension to a safe height.

NOTE

If damage necessitates removal of extension screw (49) from third-stage ram (44), clamp ram (44) in a vise, using wood blocks to protect outer ram surfaces. Unscrew extension screw (49) forcibly, shearing internal plunger (50). Install new plunger and spring (51) in hole in extension screw (49) prior to reassembling screw and third-stage ram (44).

3-5. CLEANING. Wash parts with dry cleaning solvent, Federal Specification No. P-S-661, and dry thoroughly with a clean, lint-free cloth.

WARNING

Use dry cleaning solvent only in a well-ventilated area. Avoid prolonged contact with skin, and inhalation of solvent vapors.

3-6. INSPECTION. Inspect all parts for damage, distortion, corrosion, and other faults as outlined in Figures 3-2 and 3-3.

3-7. REPAIR. (See figure 3-1.) The following procedures shall be used to accomplish repair of the jack.

- a. Defective ball seats in valve body (21) and base assembly (56) shall be refaced, using a standard valve seat facing tool. Using a brass dowel, a mallet, and a ball of the same size used with seat being refaced, form new seat by tapping lightly at seated ball until a 1/64 inch wide seat is formed. Discard ball used for seating operation. Wash refaced seat with dry cleaning solvent, Federal Specification P-S-661, and dry thoroughly (refer to WARNING following paragraph 3-5). Install a new ball of proper size at each refaced seat.

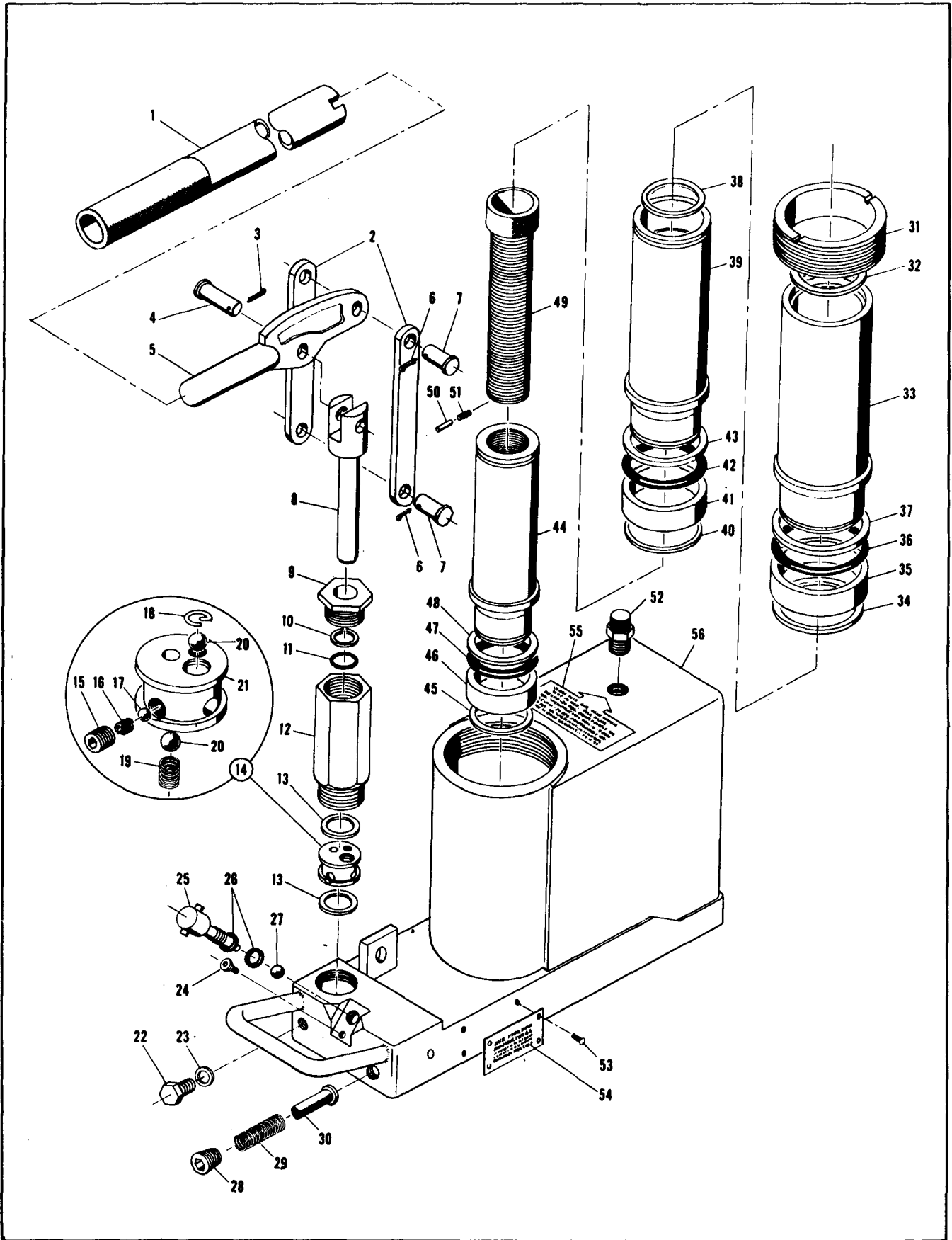


Figure 3-1. 10-Ton Hydraulic Aircraft Hand Jack Assembly, Part No. 53D22004



LEGEND FOR FIGURE 3-1

- | | | | |
|--------------------|-------------|--------------|-------------------|
| 1. Handle | 15. Screw | 29. Spring | 43. Ring |
| 2. Link | 16. Spring | 30. Strainer | 44. Ram |
| 3. Cotter Pin | 17. Ball | 31. Bushing | 45. Ring |
| 4. Pin | 18. Ring | 32. Ring | 46. Bearing |
| 5. Lever | 19. Spring | 33. Ram | 47. Packing |
| 6. Cotter Pin | 20. Ball | 34. Ring | 48. Ring |
| 7. Pin | 21. Valve | 35. Bearing | 49. Screw |
| 8. Piston | 22. Screw | 36. Packing | 50. Plunger |
| 9. Nut | 23. Gasket | 37. Ring | 51. Spring |
| 10. Ring | 24. Screw | 38. Ring | 52. Vent Assembly |
| 11. Packing | 25. Valve | 39. Ram | 53. Screw |
| 12. Body | 26. Packing | 40. Ring | 54. Nameplate |
| 13. Gasket | 27. Ball | 41. Bearing | 55. Decal |
| 14. Valve Assembly | 28. Plug | 42. Packing | 56. Base Assembly |

Part	Index No. (figure 3-1)	Inspect For
Pins	4, 7	Grooving.
Links	2	Out-of-round holes.
Lever	5	Out-of-round holes.
Piston	8	Grooving and scoring; out-of-round hole.
Nut, Packing	9	Grooving and scoring at ID; condition of threads.
Cylinder, Pump	12	Grooving and scoring at ID; condition of threads.
Spring	16	Cracks; free length of 3/8 inch; compressed height of 5/16 inch at 15-pound load.
Balls	17, 20, 27	Nicks and grooves; flat spots.
Spring	19	Cracks; free length of 1/2 inch.
Valve body	21	Nicked and scratched ball seats.
Spring	29	Cracks; free length of 1-1/2 inch.
Strainer	30	Breaks in wire mesh; buckling; loosened ends.
Bushing	31	Grooving, scoring, and gouging; condition of threads.
Rams	33, 39, 44	Cracks, with magnetic particle inspection, Specification MIL-I-6868; grooving and scoring.
Bearings	35, 41, 46	Grooving and scoring.
Screw	49	Cracks, as outlined for rams (33, 39, 44); condition of threads.
Base assembly	56	Cracks, as outlined for rams (33, 39, 44); grooving and scoring at cylinder ID; condition of threads; nicked and scratched seat for ball (27).

Figure 3-2. Inspection Chart

b. Non-critical structural areas of the base assembly (56) may be welded, after it is certain that machined areas will be unaffected by the welding. Cracks or breaks at cylindrical machined surfaces necessitate replacement of base assembly. Before attempting to weld any portion of base assembly, wash, flush and thoroughly drain fluid passages and reservoir with a non-combustible solvent.

WARNING

All weld repairs shall be performed in a ventilated area.

3-8. REPLACEMENT. (See figure 3-1.) Damaged or defective parts other than reparable valve body (21) seats and base assembly (56) shall be replaced (refer to paragraphs 3-7a, 3-7b and to "REMEDY" column of Figure 2-2).

3-9. LUBRICATION PRIOR TO REASSEMBLY. (See figure 3-1.) Prior to reassembly, dip all parts except handle (1), pins (3, 4, 6, 7), links (2), lever (5), head of piston (8), and external surfaces of base assembly (56) in hydraulic oil, Specification MIL-O-5606. Lightly coat pins (4, 7) with oil, Specification MIL-L-7870. Protect oiled surfaces from dust accumulation pending reassembly.

3-10. REASSEMBLY. (See figure 3-1.) Reassemble the jack in reverse order of disassembly, noting the following:

a. Install packing retainer (43) and packing (47) onto third-stage ram (44). Work retainer and packing into place between rams by manually pressing against packing at several points.

b. After retainer (48) and packing (47) have been properly seated, install bearing (46), rapping lightly at lower edge of bearing with a soft-head mallet until seated, and install retaining ring (45) on lower end of third-stage ram (44). Insert third-stage ram into second-stage ram (39) until ring (38) groove is accessible. Install ring (38).

c. Repeat procedure outlined in paragraphs 3-10a and 3-10b for second-stage ram (39) and first-stage ram (33) and associated parts.

d. Install valve assembly (14) with gaskets (13) in base assembly (56) so that screw (15) hole is aligned with screw (22) hole in base assembly. Maintain hole alignment with a wood dowel, and screw cylinder (12) into base assembly snugly, securing valve assembly.

e. After reassembling the jack, conduct by-pass valve adjustment as outlined in paragraphs 3-11a through 3-11c.

3-11. BY-PASS VALVE ADJUSTMENT. (See figure 3-1.) Using test stand described in paragraph 3-14, adjust by-pass valve in valve assembly (14) as follows:

a. Ascertain that the reservoir is filled with fluid, and that jack is in operating condition (refer to paragraph 2-2).

b. Using the test stand, apply an 11 ton load to the jack. Operate handle (1) to lift the load. Third-stage ram (44) shall extend partially. If lift ceases, remove screw (22), rotate screw (15) slightly clockwise, replace screw (22) and attempt to lift load. If necessary, repeat clockwise adjustment of screw (15) until partial lift of third-stage ram is permitted with the 11 ton load.

WARNING

If handle fails to "drop" or "go soft" with continued pumping at full ram extension, cease pumping immediately. Serious injury may result because of excessively high by-pass pressure and sudden collapse of load.

If excessively high pressure adjustment is evidenced, screw (15) shall be adjusted slightly counterclockwise until by-pass valve is operative when pumping is continued at 11 ton load with third-stage ram partially extended.

c. Allow jack to remain with the third-stage ram partially extended and increase load from 11 tons to 11-1/2 tons. Screw (15) shall be set so that the next pumping stroke of handle (1) will operate by-pass valve, causing handle to "drop" or "go soft".

NOTE

An exact adjustment setting to a maximum lift load (with by-pass functioning) of 11 tons is often difficult. Therefore a safety tolerance of plus 1 ton is allowable (12 ton maximum load). However, whenever possible, the 11 ton limit setting shall be observed.

3-12. TESTING. AFTER REASSEMBLY. (See figure 3-1.) After reassembly and by-pass valve adjustment, test the jack as outlined in paragraphs 3-13 through 3-17.

3-13. FUNCTIONAL TEST. Operate handle (1) with no load applied to jack until rams (33, 39, 44) have extended thirteen inches. Action of handle shall feel solid at each pressure (downward) stroke. Open release valve (25) and collapse rams with an 80-pound load. Rams shall collapse flush under this load.

3-14. TEST STAND. The test stand shall be used for adjustments and tests outlined in paragraphs 3-11 and 3-15 through 3-17, and shall consist of the following:

a. A hydraulic or pneumatic actuating cylinder with a 12 ton maximum load capacity and a source of hydraulic or air pressure equipped with an adjustable relief valve to operate the cylinder.

b. A platform type weighing scale calibrated to 24,000 pounds for load measurement. Mount cylinder (refer to paragraph 3-4a) in a stationary, vertical position, and place scale directly beneath, so that jack can be positioned between cylinder and scale. These components shall be positioned so that thirteen-inch compression of cylinder ram is permitted.

3-15. LEAKAGE TEST. Place jack in test stand (refer to paragraph 3-14). Operate handle (1) to lift rams (33, 39, 44) to contact cylinder. Adjust cylinder loading to provide 20,000 pound (ten-ton) reading on scale. With this load applied to jack, operate handle until the third-stage ram is partially extended. Visually inspect jack for fluid leakage at pump packing nut (9), release valve (25), and rams. There shall be no fluid leakage at any point. After test, open release valve (25) to lower jack.

3-16. OPERATING FORCE TEST. Apply ten ton load to jack. Operate handle (1), applying force perpendicularly to axis of handle. Operating force required during compression (downward) stroke shall be from 75 to 80 pounds.

3-17. SETTling TEST. Apply ten ton load to jack and operate handle (1) to raise rams against load. Settling at this load shall not exceed 0.020 inch per hour. Perform this test twice with a 15-minute interval between each test. Settling shall not exceed 0.005 inch at the end of each 15-minute period, a total maximum of 0.010 inch at the end of the 30-minute period. Open release valve (25) to lower jack after completion of tests.

Part and Index No. (figure 3-1)	Description	Tolerance (in.)	
		Max	Min
Piston (8)	Minor diameter	---	0.496
Nut (9)	ID	0.507	---
Body (12)	Minor ID	0.502	---
Bushing (31)	ID	3.496	---
Ram (33)	Outer wear surfaces	---	3.487
	Major inner wear surface diameter	2.991	---
	Minor inner wear surface diameter	2.793	---
Bearing (35)	OD	---	3.667
Ram (39)	Outer wear surface diameter	---	2.784
	Major inner wear surface diameter	2.364	---
	Minor inner wear surface diameter	2.147	---
Bearing (41)	OD	---	2.980
Ram (44)	Outer wear surface diameter	---	2.138
Bearing (46)	OD	---	2.353
Base assembly (56)	Cylinder wear surface ID	3.678	---

Figure 3-3. Wear Tolerance

