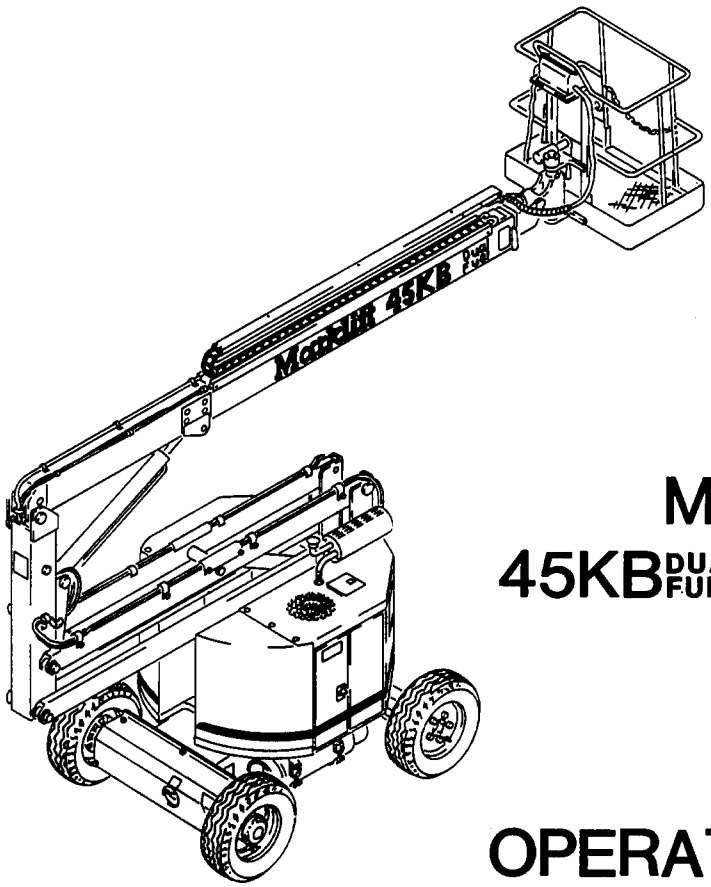
Marklift®

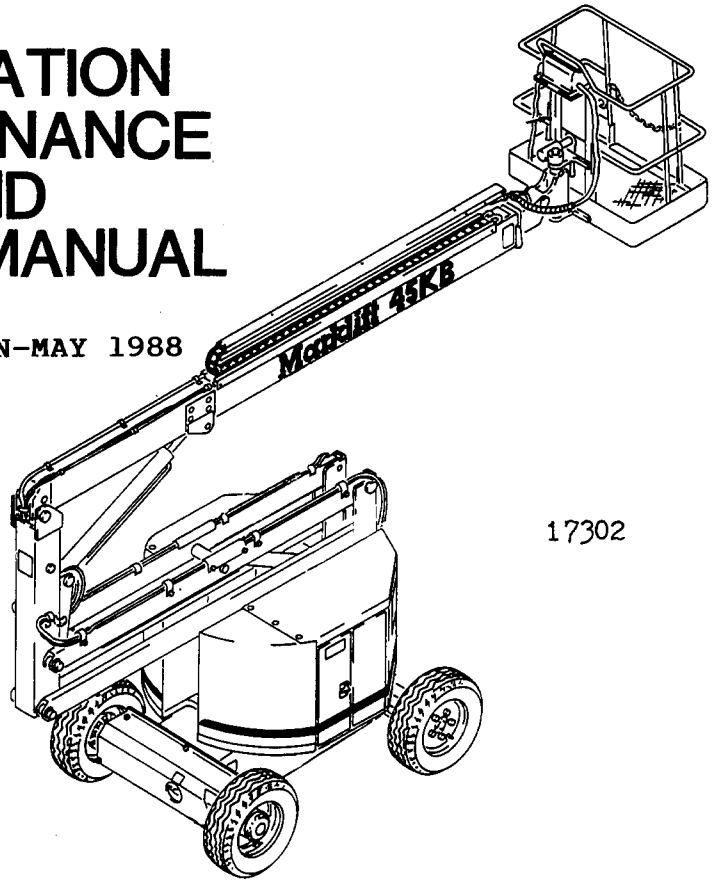


Marklift SELF PROPELLED KNUCKLE BOOM

MODELS 45KB DUAL FUEL AND 45KB

OPERATION MAINTENANCE AND PARTS MANUAL

FIRST EDITION-MAY 1988



17302

Mark of Quality

Mark Industries
P. O. Box 720
Long Beach Calif. 90801
(213) 639-9700
Toll Free (800) 421-1826
Telex 677-361

THIS **MARKLIFT** SELF PROPELLED KNUCKLE BOOM MODELS 45KBDF and 45KB OPERATION, MAINTENANCE AND PARTS MANUAL IS DESIGNED AS:

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The purpose of this manual is to provide the customer with operation, maintenance and parts information that will enhance the reliable performance of the **MARKLIFT.** Schematic and vendor information is also furnished.

WARNING: IMPROPER USE OF THIS **MARKLIFT** WILL RESULT IN SERIOUS INJURY OR DEATH! TO PROTECT YOURSELF AND THE EQUIPMENT, **STUDY THIS MANUAL BEFORE STARTING OPERATIONS.**

The model capacity, pressure settings and serial number can be found on the ID Plate mounted on the side, rear of the base.

The serial number should be used when ordering parts. This will insure our Parts Department in giving prompt and accurate service.

If additional information or service is needed, we recommend the customer contact his local dealer. If this is not possible, contact the **MARK INDUSTRIES** Service Department.

All **MARKLIFTS** are tested and operated to assure their proper operating condition before shipment. All necessary adjustments have been made and an overall physical inspection was conducted. After the unit is delivered, however, some minor adjustments and inspections must be made before putting the unit in service. These functions are outlined in the **INSPECTION AND CHECKOUT INSTRUCTIONS** in the operation section of this manual.

DESCRIPTION:

Model	45KB DUAL FUEL
Working height (maximum)	51'0" (15.54m)
Platform height (maximum)	45'0" (13.72m)
Load capacity	500 lbs. (226.8kg)
Platform dimensions	30" x 48" (.76m x 1.22m) Steel
Platform rotation	Manual
Horizontal reach Centerline rotation Clear reach	 27'9" (8.46m) 24'10" (7.57m)
Stowed height	6'10" (2.08m)
Stowed length	18'11" (5.77m)
Width	5'9" (1.75m)
Wheelbase	5'10 1/2" (1.79m)
Tailswing	Zero
Turret rotation	Noncontinuous 360°
Travel speed	0-3MPH (0-4.83km/h)
Controls	Proportional
Turning radius (inside) (outside)	6'8" (2.03m) 13'0" (3.96m)
Tires (pneumatic)	8.75 x 16.5LT
Ground clearance	7" (.18m)
Hydraulic capacity	20 gallons (75.71 L)
Fuel capacity	12 gallons (45.42 L)
Double hydraulic pump	Gear type
Power source	35HP Nissan water cooled, dual fuel
Weight	12,960 lbs.

Mark Industries' products are designed and tested to meet or exceed OSHA, ANSI and international safety standards.

Specifications are nominal and may be revised to reflect design improvements.

DESCRIPTION:

Model	45KB
Working height (maximum)	51'0" (15.54m)
Platform height (maximum)	45'0" (13.72m)
Load capacity	500 lbs. (226.8kg)
Platform dimensions	30" x 48" (.76m x 1.22m) Steel
Platform rotation	Manual
Horizontal reach	
Centerline rotation	27'9" (8.46m)
Clear reach	24'10" (7.57m)
Minimum stowed height	6'7" (2.01m)
Stowed height	6'10" (2.08)
Stowed length	18'11" (5.77m)
Width	5'9" (1.75m)
Wheelbase	5'10 1/2" (1.79m)
Tailswing	Zero
Turret rotation	Noncontinuous 360°
Travel speed	0-3MPH (0-4.83km/h)
Controls	Proportional
Turning radius (inside)	6'8" (2.03m)
(outside)	13'0" (3.96)
Tires (pneumatic)	8.75 x 16.5LT
Ground clearance	7" (.18m)
Hydraulic capacity	20 gallons (75.71 L)
Fuel capacity	-
Double hydraulic pump	Gear type
Power source	36VDC
Weight	12,960 lbs.

Mark Industries' products are designed and tested to meet or exceed OSHA, ANSI and international safety standards.

Specifications are nominal and may be revised to reflect design improvements.

MANUFACTURERS' LIMITED WARRANTY

Mark Industries makes no warranty, express or implied, on any product manufactured or sold by Mark Industries except for the following limited warranty against defects in materials and workmanship on products manufactured by Mark Industries.

Mark Industries warrants the products manufactured by Mark Industries to be free from defects in material and workmanship under normal use and service for a period of six (6) months from the date of shipment. This limited warranty does not extend to any product of another manufacturer or to any part, component, accessory or attachment not manufactured by Mark industries. The warranty, if any, with respect to any product of another manufacturer or to any part, component, accessory or attachment not manufactured by Mark Industries is limited to the warranty, if any extended to mark Industries by the manufacturer of the other product, part, component, accessory or attachment.

This limited warranty does not extend to any product (or any part or parts of any product) which has been subject to improper use or application, misuse, abuse, operation beyond its rated capacity, repair or maintenance except in accordance with the sales and service manuals and special instructions of Mark Industries, or modification without the prior written authorization of mark Industries (whether by the substitution of nonapproved parts or otherwise).

The sole obligation and liability of Mark Industries under this limited warranty (and the exclusive remedy for any purchaser, owner or user of Mark Industries products) is limited to the repair or replacement, at the option of Mark Industries, of any product (or any part or parts of any product) manufactured by Mark Industries which, within six (6) months from the date of shipment, shall have been returned to the Mark Industries facility in Carson, California (or any other location within the United States as shall be designated by Mark Industries), at no expense to Mark Industries, and demonstrated to the satisfaction of Mark Industries as being defective in material or workmanship.

To make a claim under this limited warranty, contact Mark Industries or the Mark Industries distributor from whom the product was originally purchased. A statement giving the model and serial number of the allegedly defective product, the date and a descrtiption of the alleged defect, the date of the purchase and proof of the purchase and purchase date must accompany the returned product (or any part or parts of any product). Any product (or any part or parts of any product) determined by Mark Industries to be defective will be repaired or replaced, at the option of Mark Industries, free of charge, f.o.b. Carson, California. No credit will be given for any allegedly defective product (or any part or parts of any product) not returned to Mark Industries.

There are no other warranties, express or implied, in addition to this limited warranty. **This limited warranty is exclusive and in lieu of all other warranties, express or implied (in fact or by operation of law or otherwise), including the implied warranties of merchantability and fitness for a particular purpose.**

Mark Industries shall not be liable for any special, indirect or consequential damages. Further, no representation or warranty made by any person, including any representative of Mark Industries, which is inconsistent or in conflict with, or in addition to the terms of the foregoing limited warranty (or the limitations of the liability of mark Industries as set forth above) shall be binding upon Mark Indkustries unless reduced to writing and approved by an officer of Mark Industries.

Tires, batteries, filter elements and electrical components are specifically excluded from this limited warranty.

Mark Industries
P.O. Box 720 • Long Beach, CA 90801
213-639-9700 • 800-421-1826 • TELEX 677-361

WARRANTY REGISTRATION

PURCHASER

_____

COMPANY NAME

_____

ADDRESS

_____

_____

TELEPHONE NUMBER

_____

DATE SHIPMENT RECEIVED

UNIT WILL BE USED _____

_____

DATE OF INVOICE

UNIT WILL BE SOLD _____

_____

DATE UNIT PUT INTO SERVICE

_____

INSPECTION	_____	GEN'L MAINTENANCE	_____	PAINTING/SANDBLAST	_____
MINING	_____	HEATING/AIR COND.	_____	STEEL FABRICATION	_____
WELDING	_____	CARPENTRY	_____	RIGGING	_____
CONSTRUCTION	_____	PLUMBING	_____	ROOFING	_____
SCAFFOLDING	_____	ELECTRICAL	_____	GLAZING	_____
MECHANICAL	_____	SPRINKLER	_____	OTHER	_____

_____

COMMENTS:

_____

_____

_____

_____

_____

_____

INSPECTION COMPLETED BY:

WARRANTY WILL BE VOID UNLESS THIS INSPECTION REPORT IS POSTMARKED TO MARK INDUSTRIES NOT MORE THAN 14 DAYS FROM DATE SHIPMENT RECEIVED.

REV

NEW EQUIPMENT CONDITION REPORT

		YES	NO
1.	PLATFORM CAPACITY DECAL _____ LBS.	☐	☐
2.	ALL WARNING, CAUTION & EMERGENCY DECALS INSTALLED	☐	☐
3.	EMERGENCY DESCENT VALVE FUNCTIONS PROPERLY	☐	☐
4.	OPERATION INSTRUCTIONS PROPERLY INSTALLED	☐	☐
5.	OPERATION & SAFETY HANDBOOK RECEIVED	☐	☐
6.	ELECTRICAL SCHEMATIC RECEIVED	☐	☐
7.	ALL CONTROLS (AERIAL & GROUND) ARE IDENTIFIED AND OPERATE CORRECTLY	☐	☐
8.	STOP SWITCHES OPERATE PROPERLY (AERIAL & GROUND)	☐	☐
9.	PLATFORM GUARD RAILS, SECURE AND UNDAMAGED	☐	☐
10.	PLATFORM ACCESS GATE WORKS PROPERLY	☐	☐
11.	HORN AND BEACON OPERATE PROPERLY (OPTIONAL)	☐	☐
12.	BRAKES ADJUSTED AND OPERATE CORRECTLY	☐	☐
13.	CIRCUIT BREAKERS OPERATE PROPERLY	☐	☐
14.	ENGINE R.P.M. _____	☐	☐
15.	ALL HYDRAULIC CYLINDERS FREE OF LEAKS	☐	☐
16.	ALL HYDRAULIC CYLINDER RODS FREE OF PAINT OR SCRATCHES	☐	☐
17.	HYDRAULIC PUMP FREE OF LEAKS	☐	☐
18.	HYDRAULIC HOSES & FITTINGS TIGHT	☐	☐
19.	HYDRAULIC OIL LEVEL _____	☐	☐
20.	HYDRAULIC TANK & FITTINGS FREE OF LEAKS	☐	☐
21.	DRIVE MOTORS FREE OF LEAKS	☐	☐
22.	TURRET ROTATION GEAR BOX OIL LEVEL _____	☐	☐
23.	TURRET RING GEAR BOLTS TORQUED TO _____ FT. LBS.	☐	☐
24.	WHEEL LUG NUTS TORQUED TO _____ FT. LBS.	☐	☐
25.	BATTERY WATER LEVEL _____	☐	☐
26.	ENGINE COOLANT (RADIATOR) LEVEL _____	☐	☐
27.	COOLANT HOSES & FITTINGS FREE OF LEAKS	☐	☐
28.	ELECTRIC RADIATOR FAN OPERATES PROPERLY	☐	☐
29.	TIRE PRESSURE _____ PSI	☐	☐
30.	SYSTEM PRESSURE _____ PSIG	☐	☐
31.	PILOT PRESSURE _____ PSIG	☐	☐
32.	FUEL TANK & FITTINGS FREE OF LEAKS	☐	☐
33.	MANUAL OVERRIDES OPERATE PROPERLY	☐	☐
34.	MUFFLER TIGHT AND FREE OF LEAKS	☐	☐
35.	ENGINE OIL LEVEL _____	☐	☐
36.	ENGINE OIL FILTER, FREE OF LEAKS	☐	☐
37.	ALL ELECTRICAL CONNECTIONS TIGHT	☐	☐
38.	ENGINE ALTERNATOR FUNCTIONS PROPERLY	☐	☐
39.	VALVE MANIFOLD & FITTINGS, FREE OF LEAKS	☐	☐
40.	DRIVE WHEEL, TORQUE HUB OIL LEVEL _____	☐	☐
41.	RETRACTION CABLE TENSION _____ FT. LBS.	☐	☐
42.	110V GENERATOR OPERATES PROPERLY (OPTIONAL)	☐	☐

MODEL NUMBER _____ SERIAL NUMBER _____

INSPECTOR _____ OPTIONS _____

Every operator of the **MARKLIFT** must read, understand and follow the safety rules set forth herein.

1. The **MARKLIFT** self-propelled aerial work platform is a personnel lifting device, and it is essential that it be properly maintained and operated to perform all functions with maximum safety and efficiency.

2. The operation of any new and unfamiliar equipment can be hazardous in the hands of untrained operators. Only trained operators must be assigned to operate the **MARKLIFT.**

3. It is the responsibility of the operator to read and understand this manual and to follow all recommendations made. Never exceed manufacturer's recommended platform load capacity.

4. Although the **MARKLIFT** conforms to specified **ANSI & OSHA** requirements, it is the responsibility of the owner to instruct the operators with safety requirements made not only by **MARK INDUSTRIES,** but by the various safety boards in your area, as well as requirements set forth by **ANSI & OSHA.**

5. The **MARKLIFT** is a non-insulated personnel carrier and **must not** be operated within 10 feet of a 50,000 volt line. (See page 3 & 4 articles.)

6. Remember, the load capacity of the **MARKLIFT** is total combined weight of personnel and tools, fixtures, accessories, etc.

7. Always distribute load evenly over platform floor area.

8. The **MARKLIFT** platform is equipped with safety belt rings. A body belt for **each person must be worn attached** with lanyard to anchor points provided.

9. It is recommended that head gear (hard hats) be worn by all personnel in the work platform.

10. Under no circumstances should horseplay be tolerated.

11. The **MARKLIFT** structure must not be used as a welding ground. Disconnect both battery leads prior to performing any welding operations.

12. **DO NOT** lean over platform guard railings to perform work.

13. **DO NOT** use ladders or scaffolding on the platform to obtain greater height.

14. **DO NOT** raise or lower boom into protuding objects.

15. **DO NOT** drive carriage or platform into stationary objects.

16. **DO NOT** store loose material in the work platform such as pipe, rope, extension cords, wire or miscellaneous boxes. If necessary to store such items, they must be positioned in such a way that no one will trip over them when operating or working in the platform.

17. **DO NOT** alter equipment in any fashion.

18. **DO NOT** override any hydraulic, mechanical, or electrical safety devices.

19. **DO NOT** drive on uneven, sloping or soft terrain, as this is hazardous and must be avoided. The **MARKLIFT** must not be operated on more than a 5 degree out-of-plumb condition.

20. **DO NOT** work on platform if your physical condition is such that you feel dizzy or unsteady in any way.

21. **DO NOT** jump start other vehicles using **MARKLIFT** battery.

TITLE 8 DIVISION OF INDUSTRIAL SAFETY 358.38.113
(Register 73, No. 30--7-28-73)

Article 86. Provisions for Preventing Accidents

Article 86. Provisions for Preventing Accidents Due to Proximity to Overhead Lines

2946. Provisions for Preventing Accidents Due to Proximity to Overhead lines. (a) General. No person, firm, or corporation, or agent of same, shall require or permit any employee to perform any function in proximity to energized high-voltage lines; to enter upon any land, building, or other premises and thereto engage in any excavation, demolition, construction, repair, or other operation; or to erect, install, operate, or store in or upon such premises any tools, machinery, equipment, materials, or structures (including scaffolding, house moving, well drilling, pile driving, or hoisting equipment) unless and until danger from accidental contact with said high-voltage lines has been effectively guarded against.

(b) Clearances or Safeguards Required. Except where electrical distribution and transmission lines have been de-energized and visibly grounded or effective barriers have been erected to prevent physical and arcing contacts with the high-voltage lines, the following provisions shall be met:

(1) Over Lines. The operation, erection, or handling of tools, machinery, apparatus, supplies, or materials, or any part thereof, over energized high-voltage lines shall be prohibited.

(2) Equipment and Materials in Use. The operation, erection, or handling of tools, machinery, equipment, apparatus, materials, or supplies, or any part thereof within the minimum clearances from energized lines set forth in Table X shall be prohibited.

Table X
Required Clearances from Overhead High-Voltage Lines

Nominal voltage (Phase to Phase)	Minimum Required Clearance (Feet)
750 - 50,000	10
over 50,000 - 75,000	11
over 75,000 - 125,000	13
over 125,000 - 175,000	15
over 175,000 - 250,000	17
over 250,000 - 370,000	21
over 370,000 - 550,000	27
over 550,000 - 1,000,000	42

(3) Transportation or Transit. The transportation or transit of any tool, machinery, equipment, or apparatus, or the moving of any house or other building in proximity to overhead high-voltage lines shall be expressly prohibited if at any time during such transportation or transit such tool, machinery, equipment, apparatus, or building, or any part thereof, can come closer to high-voltage lines than the minimum clearances set forth in Table Y.

Article 86. Provisions for Preventing Accidents

Except where the boom of boom-type equipment is lowered and no load is imposed thereon, the equipment in transit shall conform to the minimum required clearances set forth in Table X.

Table Y
Required Clearances from Energized High-Voltage Conductors
(While in Transit)

Nominal Voltage (Phase to Phase)	Minimum Required Clearance (Feet)
750 - 50,000	6
over 50,000 - 345,000	10
over 345,000 - 750,000	16
over 750,000 - 1,000,000	20

(4) Storage. The storage of tools, machinery, equipment, supplies, materials, or apparatus under, by, or near energized high-voltage lines is hereby expressly prohibited if at any time during such handling or other manipulation it is possible to bring such tools, machinery, equipment, supplies, materials, or apparatus, or any part thereof, within the minimum required clearances from high-voltage lines as set forth in Table X.

(c) The specified clearance shall not be reduced by movement due to any strains impressed (by attachments or otherwise) upon the structures supporting the high-voltage line or upon any equipment, fixtures, or attachments thereon.

(d) Insulated cage-type boom guards, boom stops, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the required clearances set forth in Table X.

(e) Any overhead conductor shall be considered to be energized unless and until the person owning or operating such line verifies that the line is not energized, and the line is visibly grounded at the work site.

2947. Warning Signs Required. The owner, agent, or employer responsible for the operations of equipment shall post and maintain in plain view of the operator and driver on each crane, derrick, power shovel, drilling rig, hay loader, hay stacker, pile driver, or similar apparatus, a durable warning sign legible at 12 feet reading: "Unlawful To Operate This Equipment Within 10 Feet of High-Voltage Lines of 50,000 Volts Or Less."

In addition to the above wording, the following statement in small lettering shall be provided on the warning sign: "For Minimum Clearances of High-Voltage Lines In Excess of 50,000 Volts, See Article 86, Title 8, High-Voltage Electrical Safety Orders."

OBSERVE ALL DANGER, WARNING, CAUTION AND EMERGENCY DECALS AT THE VARIOUS LOCATIONS ON THE **MARKLIFT** IN ORDER TO TAKE TIMELY PREVENTIVE AND CORRECTIVE ACTIONS.



THE ANSI SAFETY ALERT SYMBOL ⚠ IDENTIFIES PERSONNEL SAFETY HAZARDS DESCRIBED ON **MARKLIFT** DECALS. BE ALERT TO THE POTENTIAL HAZARDS INDICATED BY THESE MESSAGES.

IT IS THE PRIMARY RESPONSIBILITY OF THE USER AND OPERATOR TO BE THOROUGHLY KNOWLEDGEABLE OF ALL DECAL - INFORMATION, DEFINITION AND LOCATION.

THE FOLLOWING PAGE ILLUSTRATES A CHART IN WHICH DECALS FOR THE **MARKLIFT** CAN BE REPLACED IF THE EXISTING DECAL(S) IS WORN-OUT, TORN, OR ILLEGIBLE. THIS CHART ALSO REFERS TO ITS LOCATION AND QUANTITY USED IN THAT APPLICATION.

DECAL P/N	DECAL DESCRIPTION 45KBDF	ASSEMBLY (LOCATION)	QTY
67397	DECAL SET	(ALL STANDARD DECALS)	1
2003	BATTERY WATER	FINAL ASSY	1
2017	HYDRAULIC SYSTEM	FINAL ASSY	2
2020	GAS OR PETROLEUM	FINAL ASSY	2
2022	LOAD CAPACITY 500 LBS	FINAL ASSY	2
11064	ATTACH SAFETY CHAIN	FINAL ASSY	2
20409	STANDARD PEDESTAL	FINAL ASSY	1
20410	LOGO "MARK INDUSTRIES"	FINAL ASSY	1
20411	BLUE STRIP	FINAL ASSY	4
20412	BLUE STRIP	FINAL ASSY	2
20416	CAUTION	FINAL ASSY	2
20417	DANGER, DO NOT OPERATE	FINAL ASSY	2
20418	DANGER, ELECTROCUTION HAZARD	FINAL ASSY	2
20419	DANGER, KEEP CLEAR	FINAL ASSY	2
20420	TIRE PRESSURE 75 PSI	FINAL ASSY	2
20461	FORWARD ARROW	FINAL ASSY	1
20462	FORWARD ARROW	FINAL ASSY	1
20660	I.D. PLATE	FINAL ASSY	1
20661	ANSI PLATE	FINAL ASSY	1
20879	DIPSTICK	FINAL ASSY	1
20896	BRAKE	FINAL ASSY	1
22385	CAUTION, ATTACH SAFETY BELT	FINAL ASSY	1
22386	D-RING, ATTACH SAFETY BELT	FINAL ASSY	2
23558	LIQUID TANK ONLY	FINAL ASSY	1
130820	OPERATION & SAFETY HANDBOOK	FINAL ASSY	1
140372	GROUND CONTROL	GROUND CONT'L PANEL ASSY	1
140419	MARKLIFT 45KB (REV.)	FINAL ASSY	2
140420	DUAL FUEL	FINAL ASSY	2

DECAL P/N	DECAL DESCRIPTION 45KBDF	ASSEMBLY (LOCATION)	QTY
140495	EMERGENCY HAND PUMP OPERATION	FINAL ASSY	1
140496	EMERGENCY HAND PUMP	FINAL ASSY	1
140550	AERIAL CONTROL SWITCH	AERIAL CONT'L BOX ASSY	1
140551	FAN	FINAL ASSY	1
140552	FAN FUSE	FINAL ASSY	1
140579	UPPER CONTROL	AERIAL CONT'L BOX ASSY	1
140595	TIE DOWN	FINAL ASSY	2
182101	CAUTION	FINAL ASSY	1
182701	GENERAL CHECKOUT	FINAL ASSY	1
182703	PLATFORM LEVELING	AERIAL CONT'L BOX ASSY	1
183301	WARNING LEAD COUNTERWEIGHT	FINAL ASSY	1
185702	(110VAC) CIRCUIT BREAKER	GROUND CONT'L PANEL ASSY	1

DECAL P/N	DECAL DESCRIPTION 45KB	ASSEMBLY (LOCATION)	QTY
67398	DECAL SET	(ALL STANDARD DECALS)	1
2003	BATTERY WATER	FINAL ASSY	1
2005	BATTERY CHARGER PLUG	FINAL ASSY	1
2017	HYDRAULIC SYSTEM	FINAL ASSY	2
2022	LOAD CAPACITY 500 LBS	FINAL ASSY	2
11064	ATTACH SAFETY CHAIN	FINAL ASSY	2
20409	STANDARD PEDESTAL	FINAL ASSY	1
20410	LOGO "MARK INDUSTRIES"	FINAL ASSY	1
20411	BLUE STRIP	FINAL ASSY	4
20412	BLUE STRIP	FINAL ASSY	2
20416	CAUTION	FINAL ASSY	2
20417	DANGER, DO NOT OPERATE	FINAL ASSY	2
20418	DANGER, ELECTROCUTION HAZARD	FINAL ASSY	2
20419	DANGER, KEEP CLEAR	FINAL ASSY	2
20420	TIRE PRESSURE 75 PSI	FINAL ASSY	2

DECAL P/N	DECAL DESCRIPTION 45KB	ASSEMBLY (LOCATION)	QTY
20461	FORWARD ARROW	FINAL ASSY	1
20462	FORWARD ARROW	FINAL ASSY	1
20660	I.D. PLATE	FINAL ASSY	1
20661	ANSI PLATE	FINAL ASSY	1
20896	BRAKE	FINAL ASSY	1
22385	CAUTION, ATTACH SAFETY BELT	FINAL ASSY	1
22386	D-RING, ATTACH SAFETY BELT	FINAL ASSY	2
22449	NO SMOKING DURING CHARGE	FINAL ASSY	1
130820	OPERATION & SAFETY HANDBOOK	FINAL ASSY	1
140372	GROUND CONTROL	GROUND CONT'L PANEL ASSY	1
140419	MARKLIFT 45KB (REV.)	FINAL ASSY	2
140495	EMERGENCY HAND PUMP OPERATION	FINAL ASSY	1
140496	EMERGENCY HAND PUMP	FINAL ASSY	1
140579	UPPER CONTROL	AERIAL CONT'L BOX ASSY	1
140595	TIE DOWN	FINAL ASSY	2
182001	WARNING, LOW BATTERY	AERIAL CONT'L BOX ASSY	1
182002	WARNING, LOW BATTERY	GROUND CONT'L PANEL ASSY	1
182101	DANGER & AERIAL OPER. INSTR.	FINAL ASSY	1
182701	OPERATING INSTRUCTIONS	FINAL ASSY	1
182703	PLATFORM LEVELING	AERIAL CONT'L BOX ASSY	1
183301	WARNING LEAD COUNTERWEIGHT	FINAL ASSY	1
185701	BATTERY CHARGER INSIDE	FINAL ASSY	1
185702	(110 VAC) CIRCUIT BREAKER	GROUND CONT'L PANEL ASSY	1

It shall be the responsibility of all **MARKLIFT** operators to read and comply with the following operating instructions. They are designed to promote safety and a better understanding of the operation of the **MARKLIFT** self-propelled knuckle boom.

It is recommended that the **MARKLIFT** be moved into an area-free of any overhead obstructions on a flat, level surface with no hazardous irregularities or accumulation of debris.

1. STARTING

The **MARKLIFT** can be started from either the **AERIAL CONTROL** or the **GROUND CONTROL EMERGENCY.** Before either position will function the master switch must be "ON", and the selector switch must be activated. Push the selector switch to the top to activate the aerial control box or to the bottom to activate to ground control panel.

GENERAL CHECKOUT AND OPERATING INSTRUCTIONS

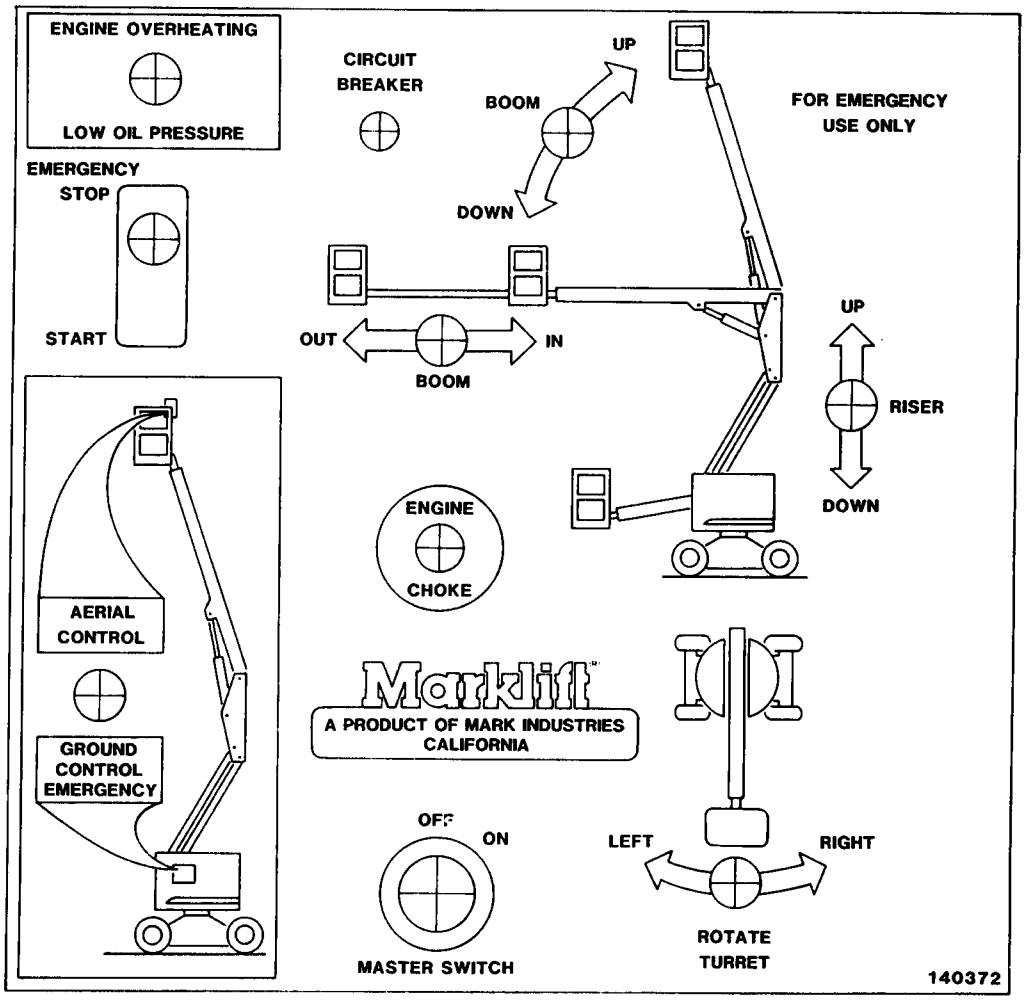
	GENERAL CHECK OUT LIST	DAILY	WEEKLY	MONTHLY
1.	CHECK FUEL & HYDRAULIC TANK LEVELS	X		
2.	CHECK ENGINE OIL LEVEL	X		
3.	CHECK BATTERY WATER LEVEL	X		
4.	CHECK FOR ANY LOOSE OR WORN HARDWARE	X		
5.	CHECK CRITICAL WELD AREAS FOR CRACKS	X		
6.	CHECK TIRE PRESSURES (IF APPLICABLE)	X		
7.	CHECK FOR ANY HYDRAULIC LEAKS & CORRECT		X	
8.	CHECK FOR ANY STRUCTURAL DAMAGE & CORRECT		X	
9.	CHECK OVERALL PERFORMANCE OF MACHINE		X	
10.	CHECK & CLEAN ENGINE INTAKE AIR FILTER		X	
11.	CHECK FOR WEAR ON CABLES & HOSES		X	
12.	GREASE* STEERING LINKAGE			X
13.	GREASE* TURRET ROTATION GEAR BOX			X
14.	GREASE* RING GEAR			X

* REFER TO OPERATION AND MAINTENANCE INSTRUCTION MANUAL FOR TYPE OF LUBRICANTS.

OPERATE THE MARKLIFT IN FOLLOWING MANNER FROM GROUND CONTROL BOX.

1. TURN IGNITION SWITCH TO START.
2. ALLOW ENGINE TO IDLE AT LEAST ONE MINUTE.
3. MAKE SURE AMMETER INDICATES "CHARGE".
4. POSITION AERIAL/GROUND SELECTOR SWITCH TO GROUND.
5. OPERATE ALL THREE BOOM FUNCTIONS MOMENTARILY IN BOTH DIRECTIONS MAKING SURE THE UNIT RESPONDS ACCORDINGLY.
6. POSITION SELECTOR SWITCH TO AERIAL AND ENTER WORK PLATFORM.

20860



GROUND CONTROL PANEL

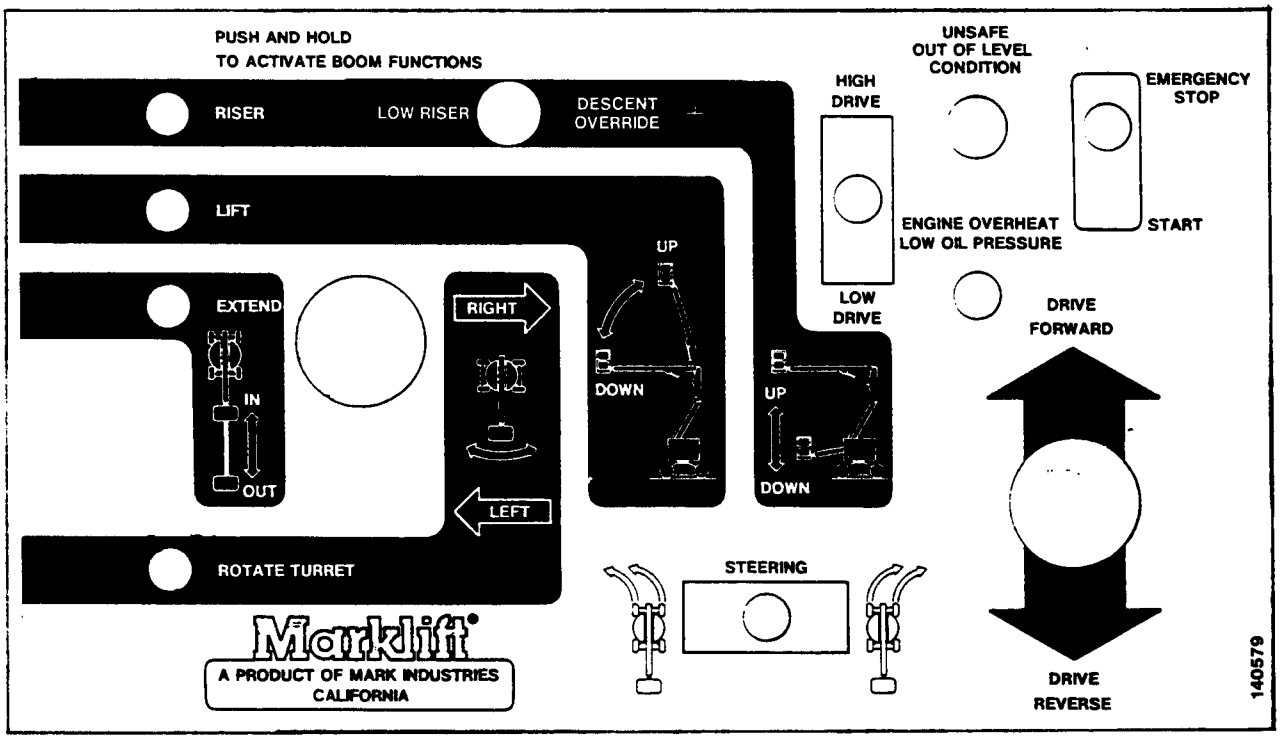
A. GROUND CONTROL EMERGENCY

The only functions that can be operated from the ground control station are "ON/OFF", boom riser, extend and rotate turret. To start:

Position selector switch to "GROUND CONTROL EMERGENCY", pull up the red emergency stop switch cover located on the top left of Ground Control Panel. Pull down the toggle switch to the start position. The **MARKLIFT** is now operational.

B. AERIAL CONTROL

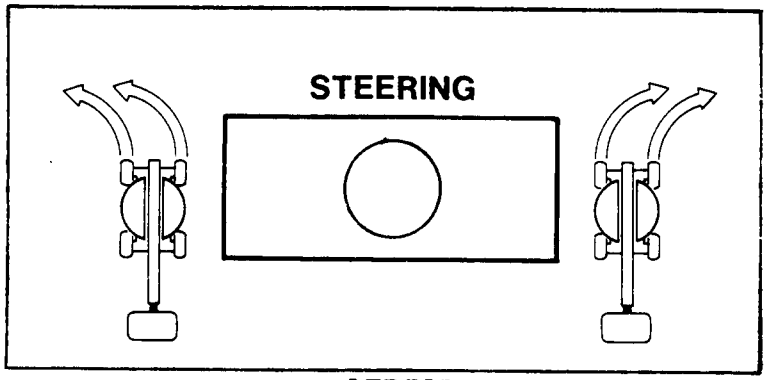
Turn power switch at ground control station to "ON". Position selector switch to "AERIAL CONTROL". Enter the platform **ATTACHING SAFETY CHAIN AFTER ENTERING.** Pull up the red emergency stop switch cover located on the top right of aerial control box. Pull down the toggle switch to the start position.



AERIAL CONTROL STATION

2. STEERING

The steering function is performed from the aerial control station only and steering the **MARKLIFT** is achieved by pressing the foot-switch and operating the steering toggle switch, depending on the direction to pursue, left or right. The steering toggle switch is a momentary switch that self centers itself to the "OFF" position. However, the steering wheels will resume in the last angle of direction until the switch is again used to re-maneuver the direction of the **MARKLIFT.**

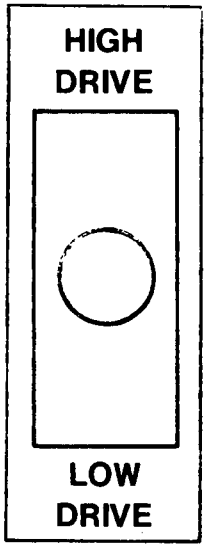


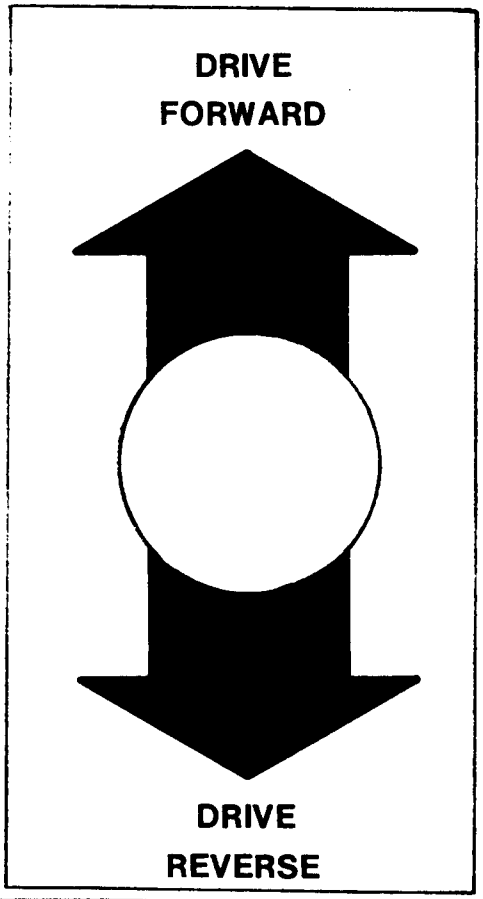
AERIAL CONTROL STATION

3. **DRIVE**

Forward and reverse drive is performed from the aerial control station only. The MARKLIFT is equipped with a high and low speed drive variance. For the drive to function, choose the drive desired and use both the forward / reverse joystick and the footswitch.

NOTE: Your **MARKLIFT** is equipped with a proportional drive control. When using the proportional drive function, press foot switch, raise controller locking device, then gradually move controller in direction selected.





AERIAL CONTROL STATION

The controller handle is spring-centered and self locking to prevent accidental operation. Familiarize yourself with the operation of the controller until you are able to start and stop the drive function in forward and reverse, obtaining a gradual, smooth start and stop.

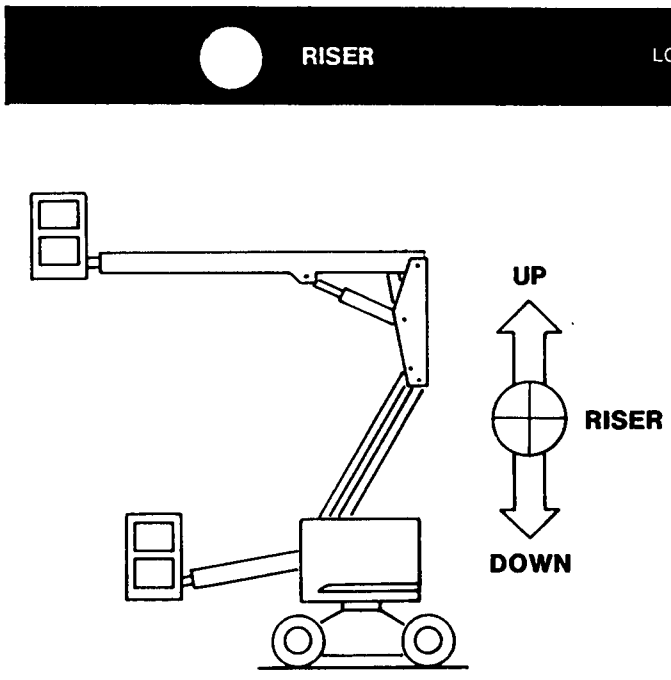
CAUTION: As a safety feature, the HI throttle will not function if the boom is fifteen degrees above horizontal or if the boom is extended.

4. RAISE/LOWER

Raising and lowering of the boom is performed from either the Ground Control Panel or Aerial Control Box.

A. GROUND CONTROL EMERGENCY

To raise or lower the boom from the ground control station, check the selector switch. It must be in the "GROUND CONTROL EMERGENCY" position. A momentary switch has been designed so that in order to raise boom the operator must push the switch to the "UP" position. To lower the boom, the operator must push the switch to the "DOWN" position. When the switch is released, it will automatically self center to the off position, and the boom will remain stationary.



GROUND CONTROL PANEL

AERIAL CONTROL STATION

B. AERIAL CONTROL

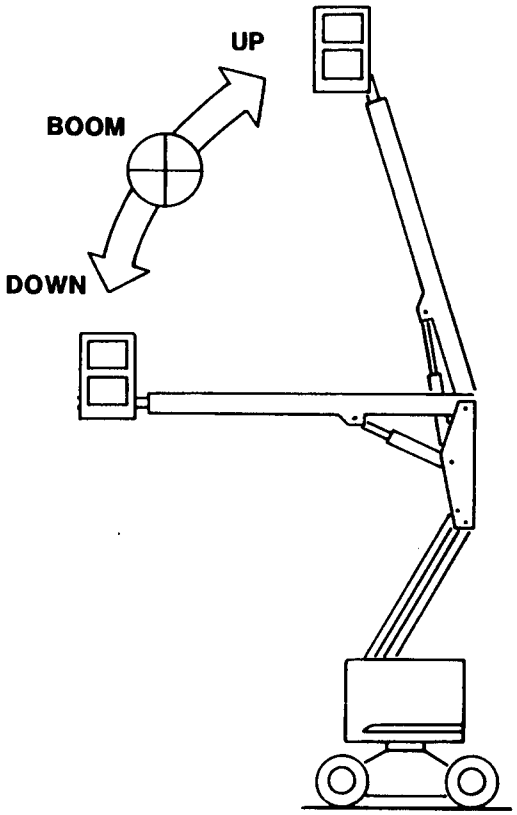
To operate from the aerial control box, position selector switch to "AERIAL CONTROL" in ground control panel. Enter the platform and **ATTACH SAFETY CHAINS BEFORE RAISING PLATFORM.** Depress and hold the foot switch in platform to operate all aerial control box functions except engine starting. Push and hold "RISER" button or toggle switch and joystick to desired direction. These controls are also self centering momentary switches.

NOTE: As a safety feature, the **MARKLIFT** is equipped with a "LOW RISER" warning light to alert the operator of the minimum clearance to the tires and wheels of the carriage.

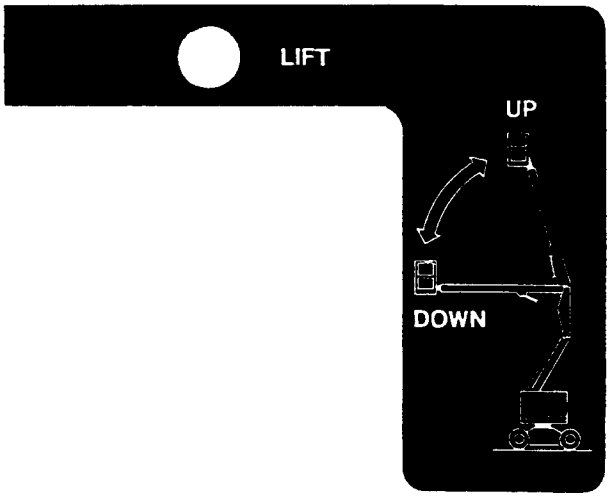
If "LOW RISER" warning light is on, and the boom is clear of the wheels, depress and hold the "DESCENT OVERRIDE" button, move joystick and use the footswitch until descent is accomplished.

5. LIFT / LOWER

Lifting and lowering of the platform is achieved from either the Ground Control Panel or the Aerial Control Box.



GROUND CONTROL PANEL



AERIAL CONTROL STATION

A. GROUND CONTROL EMERGENCY

To lift or lower the platform from the ground control station, check the selector switch. It must be in the "GROUND CONTROL EMERGENCY" position. A momentary switch has been designed so that in order to lift the platform the operator must push the switch to the "UP" position. To lower the platform, the operator must push the switch to the "DOWN" position. When the switch is released, it will automatically self center to the off position, and the boom will remain stationary.

B. AERIAL CONTROL

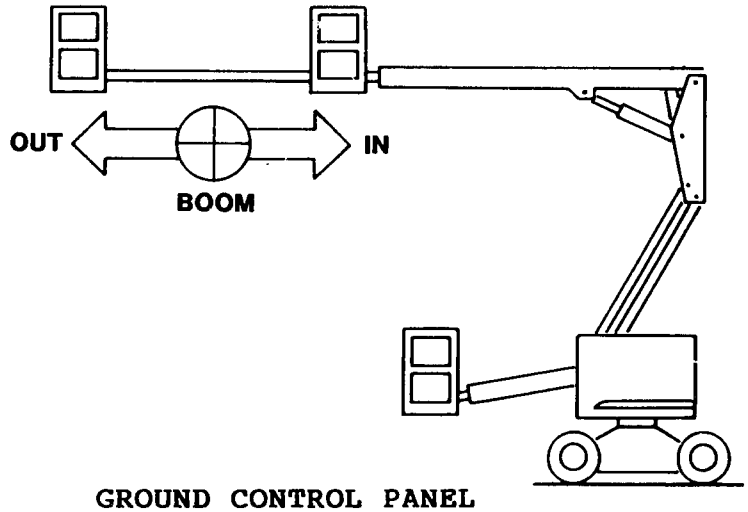
To operate from the aerial control box, position select switch to "AERIAL CONTROL" located on the ground control panel. Enter the platform **ATTACHING SAFETY CHAINS AFTER ENTERING.** Depress and hold the foot switch in the platform to operate all aerial control box functions except engine starting. Push and hold "LIFT" button or toggle switch and move function joystick to desired direction. These controls are also self centering momentary switches.

6. EXTENDING / RETRACTING

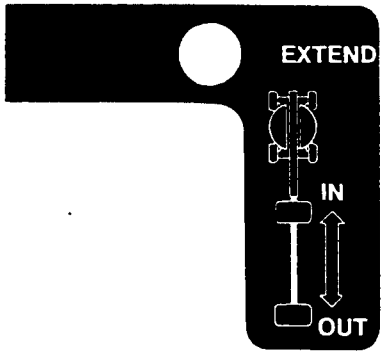
The boom extension and retraction switch is located on the face of the Ground Control Panel and on the Aerial Control Box. The boom may be extended reverse and retracted forward.

A. GROUND CONTROL EMERGENCY

To extend and retract the boom from the ground control station, check the selector switch. It must be in the "GROUND CONTROL EMERGENCY" position. A momentary switch has been designed so that in order to extend boom the operator must push the switch to the "OUT" position. To retract the boom, the operator must push the switch to the "IN" position. When the switch is released, it will



GROUND CONTROL PANEL



AERIAL CONTROL STATION

automatically self center to the off position, and the boom will remain stationary.

B. AERIAL CONTROL

To operate from the aerial control box, position selector switch to "AERIAL CONTROL" in ground control panel. After entering the platform, **ATTACH SAFETY CHAINS BEFORE RAISING PLATFORM.** Depress and hold the foot switch in the platform to operate all aerial control box functions except engine starting. Push and hold "EXTEND" button or toggle switch and move function joystick to desired direction. These controls are also self centering momentary switches.

7. ROTATE TURRET

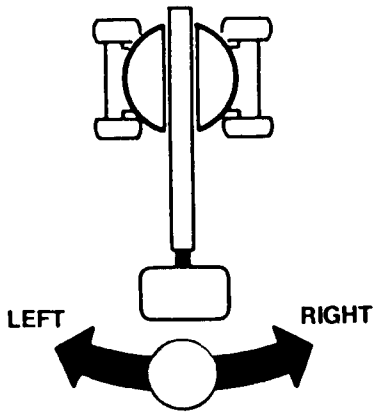
Rotation of the turret of the **MARKLIFT** could be operated from either the Ground Control Panel or the Aerial Control Box.

IMPORTANT: BEFORE ATTEMPTING TO ROTATE, MAKE SURE THE BOOM RISER IS ABOVE THE TIRES TO PREVENT ROTATION OBSTRUCTION AND POSIBLE DAMAGE TO THE **MARKLIFT.**

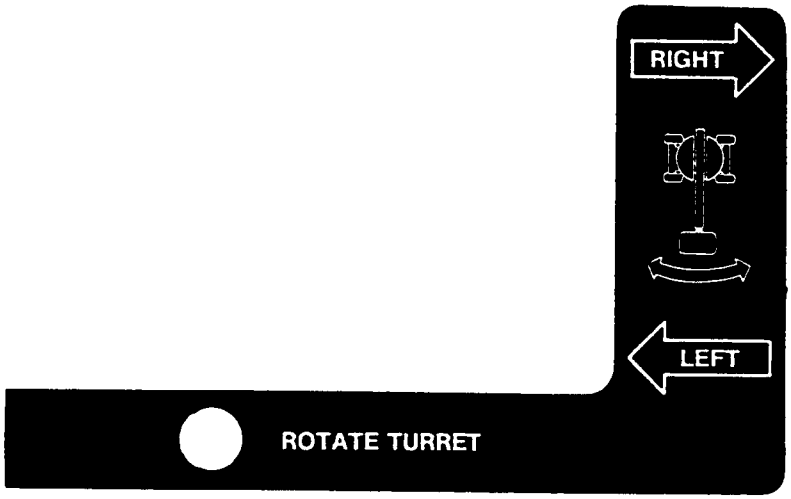
A. GROUND CONTROL EMERGENCY

To rotate the turret from the ground control station,

check the selector switch. It must be in the "GROUND CONTROL EMERGENCY" position. A momentary switch has been designed so that in order to turn to the left, the operator must push the switch to the "LEFT" position. To turn to the right, the operator must push the switch to the "RIGHT" position. When the switch is released, it will automatically self center to the off position, and the boom will remain stationary.



GROUND CONTROL PANEL



AERIAL CONTROL STATION

B. AERIAL CONTROL

To operate from the aerial control box, position select switch to "AERIAL CONTROL" in ground control panel. Enter the platform **ATTACHING SAFETY CHAINS AFTER ENTERING.** Depress and hold foot switch in platform to operate all aerial control box functions except engine starting. Push and hold "ROTATE TURRET" button then move function joystick to desired direction. This control is also a self centering momentary switch.

8. **EMERGENCY HAND PUMP**

An emergency hand pump is provided which is located behind the right door in the front sheet metal cowling of the **MARKLIFT.** This pump is part of the hydraulic system and can be used to safely operate boom functions if there is a loss of electrical power, or if the operator is injured while on the fully extended platform. The hand pump operation decal (Mark Industries part number 140495) and location of hand pump decal (140496) are located on the sheet metal, in the event of an emergency to operate: Check that the key in the master switch is at position "ON". Depress the red emergency stop switch cover located on the top left of ground control panel and position selector switch to "GROUND CONTROL". Open door which is marked "EMERGENCY HAND PUMP INSIDE". Operate hand pump with right hand use the left hand for selecting boom function switches to operate platform in desired direction.

9. **WARNING LIGHT AND BUZZER**

As a safety feature, the **MARKLIFT** is equipped with an "UNSAFE OUT OF LEVEL" sensor that will disable the knuckle boom functions whenever the **MARKLIFT** is in an unsafe out of level situation.

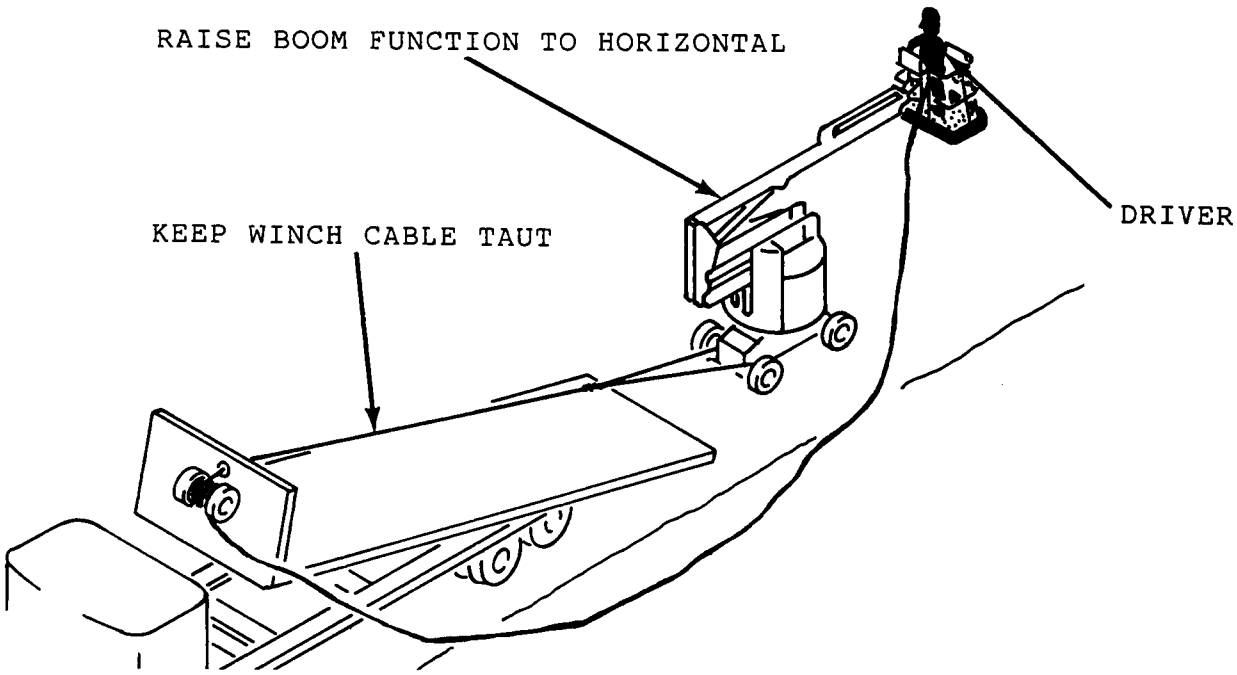
An unsafe out of level situation is sensed by the level sensor when the **MARKLIFT** is tilted five (5) degrees or more in any direction.

The unsafe out of level condition is indicated by a red warning light and buzzer located on the top right of the aerial control box. When this warning light and buzzer is on, riser/lower, lift/lower, extend/retract, and turret rotation will not operate, while the drive and steer functions will. Should this warning occur, maneuver the **MARKLIFT** until it is on a safe operating surface and all functions are restored.

BEFORE LOADING OR UNLOADING THE **MARKLIFT**, INSPECT FOR ANY PHYSICAL DAMAGE. NOTE ANY SUCH DAMAGE ON FREIGHT BILL AND REPORT SAME TO CARRIER. THESE FOLLOWING PAGES ARE THE **MARK INDUSTRIES** AUTHORIZED LOADING/UNLOADING PROCEDURES FOR ALL **MARKLIFT** SELF-PROPELLED KNUCKLE BOOMS.

1. TILT TYPE TRUCK

Loading and unloading on a tilt truck requires a combination of winching and driving in low drive. This means, either one man to operate the winch, while a second man operates the **MARKLIFT** or the winch control must be provided with an extension cord or remote control.



Attach winch cable to the **MARKLIFT** at the drive wheel end of the base through the twin pad-eyes as shown.

A. LOADING

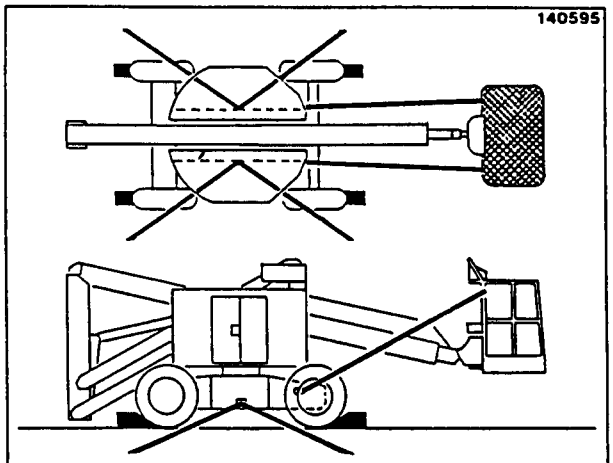
1) The truck must be fitted with adequate winch to handle 12,300 lbs (5,580 Kg.).

2) Align the boom with the steering wheels away from the trailer and the platform in a horizontal or slightly higher position.

3) Insure that the parking brake is set to activate immediately. This is accomplished by opening flow control needle valve. (see page 22)

4) Select low drive at the aerial control box.

5) When the **MARKLIFT** is on the truck in position for proper weight distribution, it is chained down in the manner illustrated by the drawings below.



FACTORY RECOMMENDED TIE DOWN TRANSPORTING DIAGRAM

NOTE: BOTTOM OF PLATFORM FORK MUST NOT REST ON TRUCK BED.

B. UNLOADING

1) Release the hold down chains and remove the block under platform end of the boom assembly. Lift the boom function to horizontal or slightly above the horizontal position.

2) Insure that the winch cable is in a taut position and then lower the truck bed.

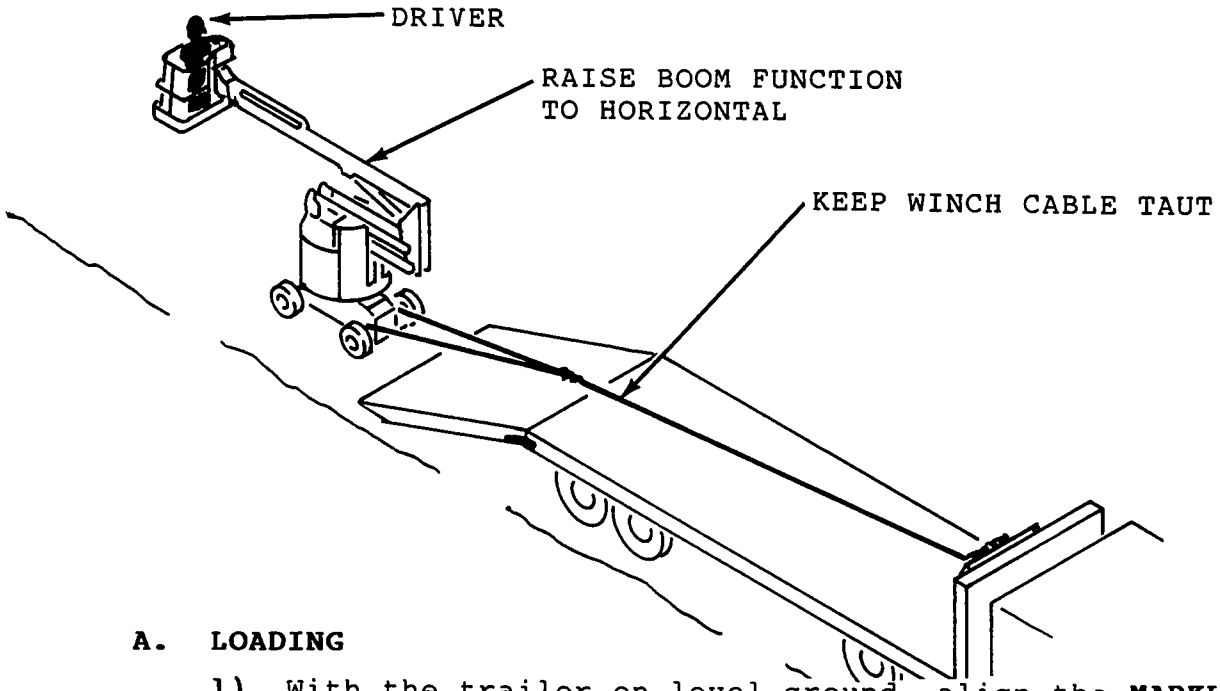
3) Allow the **MARKLIFT** to gradually roll down the truck bed by winching out.

4) When the **MARKLIFT** is completely on level ground, remove the winch cable.

5) Re-adjust parking brakes to energize immediately after the dynamic brakes stop the **MARKLIFT.** (see procedure, page 23)

2. FLATBED TRUCK

Due to the width of the **MARKLIFT** and the overall width of the flatbed truck, insure that the parking brake is set to activate immediately. This is accomplished by opening the flow control needle valve, and driving the **MARKLIFT** in low drive speed. (see page 22)



A. LOADING

1) With the trailor on level ground, align the **MARKLIFT** with the back end of the trailor.

2) Attach winch cable to the **MARKLIFT** at the drive wheel end of the base through the twin pad-eyes.

3) Using great care while driving and steering the **MARKLIFT** up the ramp in low drive, keep all slack out of the winch cable. (If the ramp is too steep of a grade for the **MARKLIFT** to climb, the winch will pull the unit up). You must keep drive function engaged while winching or the brakes will stop the machine from rolling.

4) When the **MARKLIFT** is in the position for the proper weight distribution for transporting, tie down to the trailor using procedure described in Operation Chapter, Page 20.

NOTE: Immediate full reversal of controller handle when driving will automatically change the direction of drive and will not stall the engine, even if attempted on a ramp. This procedure is not recommended as standard reversing of drive or any other function, but may be used in emergency situations without damage to the **MARKLIFT**.

B. UNLOADING

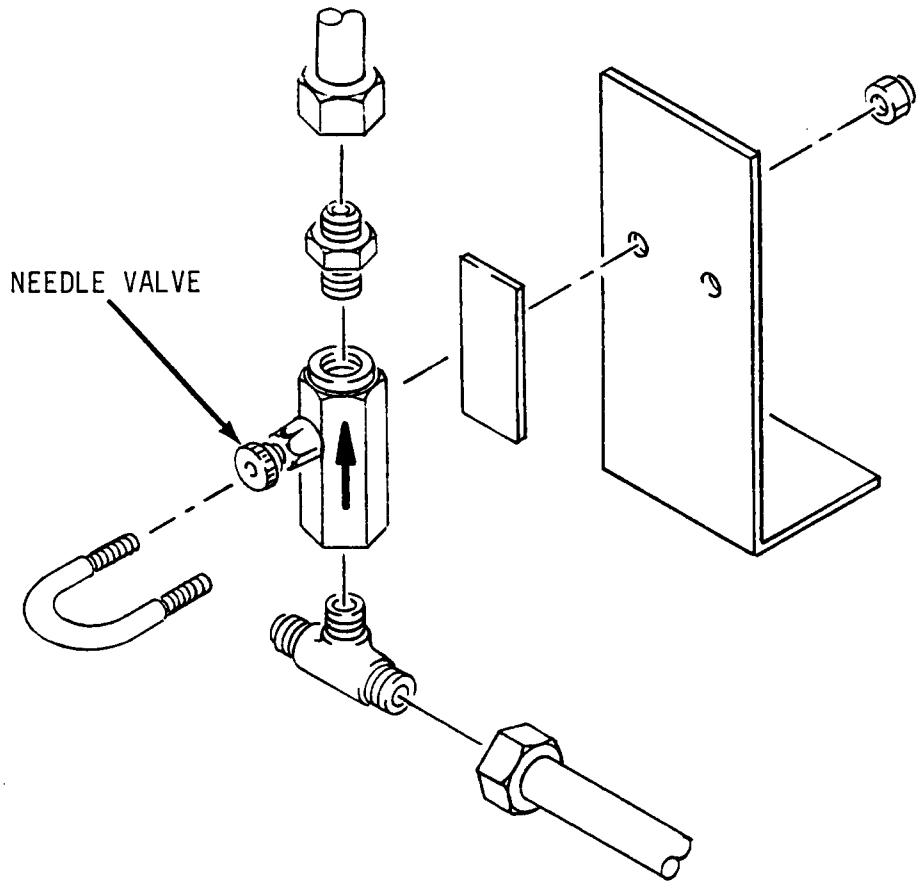
1) With the trailer on level ground, disconnect the tiedowns from the boom and insure that the winch cable is still properly attached to the **MARKLIFT.**

2) Select the low drive speed at the platform control console.

3) Using great care while driving and steering the **MARKLIFT** off the trailor, keep all slack out of the winch cable.

> **WARNING:** Do not allow slack in the winch cable when descending the ramp, due to the possibility of snapping the cable if the **MARKLIFT** descends too quickly in drive.

4) When all wheels are on level ground, disconnect the winch cable.



5) Re-adjust parking brakes to energize immediately after the dynamic brakes stop the **MARKLIFT.**

PROCEDURE:

a) Close needle valve completely, then open 1/8 turn.

b) Place the **MARKLIFT** on flat surface, about 10' wide x 30' long.

c) Position boom slightly below horizontal and completely retracted.

d) Select high drive speed and high throttle at the platform console.

e) Drive **MARKLIFT** with contoller handle in maximum position, approximately 15', letting go of the controller as one wheel is adjacent to a visual marker on the ground.

f) A suitable deceleration and braking distance would be 3' measured from the marker to the center line of same wheel when the **MARKLIFT** has completely stopped.

g) Adjust needle valve on parking brakes to achieve this dimension .

h) Repeat above procedure, driving in both directions until the **MARKLIFT** completely stops within 18" to 24".

The deceleration valves have been set at the factory and should not be readjusted without first consulting **MARK INDUSTRIES** Field Service Department.

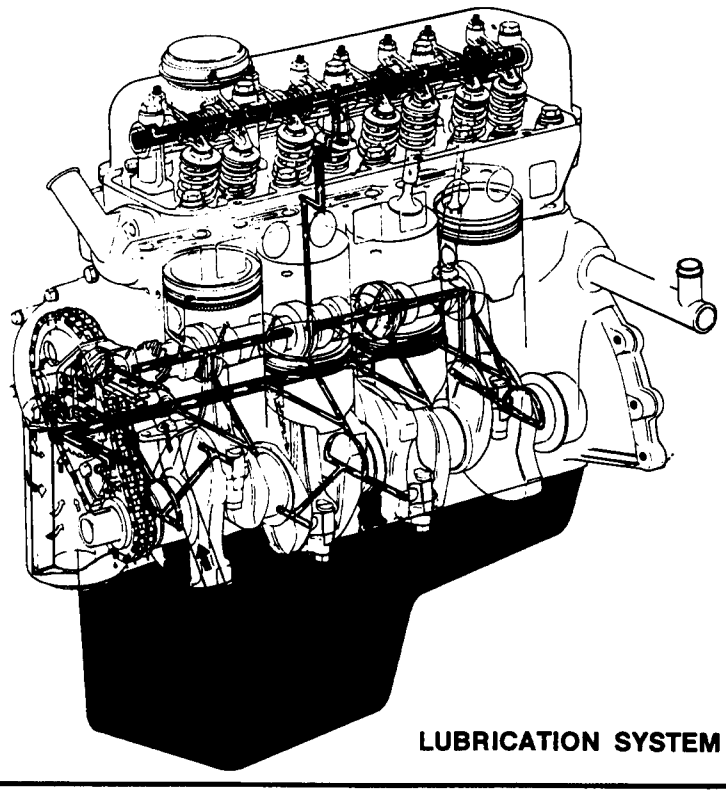
It is advisable to completely open the needle valve if the unit is to be used in a facility with severe ramps or inclines. However, very abrupt stops will be experienced with the unit driving on flat surfaces when drive controller is rapidly returned to the neutral position.

ALL **MARKLIFTS** ARE TESTED AND OPERATED TO ASSURE THEIR PROPER OPERATING CONDITION BEFORE SHIPMENT.

At this time, all necessary adjustments are made and an overall physical inspection is conducted. After the unit is delivered, some minor adjustments and inspections must be made before putting the unit into service.

THE FOLLOWING ITEMS SHOULD BE REVIEWED:

1. **Check gasoline power units.**
   - **A.** Engine oil level
   - **B.** Air filter and Fuel filter
   - **C.** Engine coolant level
   - **D.** Fuel line and valves
   - **E.** Fuel level: Fill fuel tank - use regular gasolines only or switch to propane.
   - **F.** Start engine and allow engine to warm up.
   - **G.** After initial warm-up of gasoline engine, press engine stop button making sure stop circuit is operational. The ignition switch may be left in the "ON" position indefinitely if engine stop button has been pressed, without fear of burning distributor points. However, should engine stall, the operator must push the stop button or turn off ignition switch to prevent current path to coil.



LUBRICATION SYSTEM DIAGRAM

2. **Check electric power units.**
   - **A.** Electric power
   - **B.** Battery water level/gravity readings
   - **C.** Battery charger
   - **D.** Battery connections

3. **Check systems**
   - **A.** Position selector switch to "GROUND CONTROL EMERGENCY" then operate functions.
     - **1)** Test boom functions
       - **a)** Riser boom: Up and Down
       - **b)** Lift boom: Up and Down
       - **c)** Extend boom: In and Out
     - **2)** Test rotate turret: Left and Right.
     - **3)** Check hoses and fittings for leaks.
   - **B.** After check-out of ground control functions, position selector switch to "AERIAL CONTROL" for operation at work platform. After entering platform, first ATTACH SAFETY CHAINS. If your unit is operated by engine, depress foot switch before using any control function switches. This increases engine RPM and electrically completes circuit to controls.

     1) Test boom and rotate turret functions - **PUSH AND HOLD EACH SELECTED FUNCTIONAL BUTTONS THEN OPERATE JOYSTICK** as follows:
       - **a)** Riser boom: Up and Down
       - **b)** If low riser light is on, use "DESCENT OVERRIDE" button.
       - **c)** Lift boom: Up and Down
       - **d)** Extend boom: In and Out
       - **e)** Rotate turret: Left and Right

     2) Test steering: Left and Right

     3) Test drive
       - **a)** Speed: High and Low
       - **b)** Drive: Forward and Reverse

4. **Inspect all electrical connections.**
   - **A.** See
   - **B.** Feel
   - **C.** Tighten

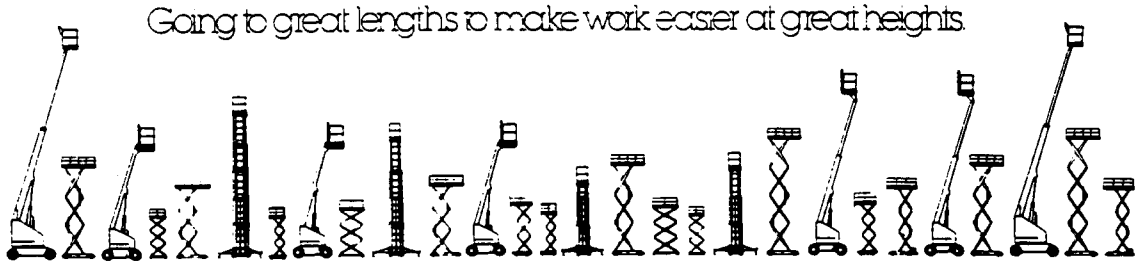
5. **Check hydraulic system.**
   - **A.** Hydraulic fluid level
   - **B.** In-line pressure valve filter
   - **C.** Hydraulic lines
   - **D.** Hydraulic pump
   - **E.** Hydraulic cylinders
   - **F.** Emergency handpump

6. **Check Tires and Wheels.**
   - **A.** For Cuts
   - **B.** Correct pressure
   - **C.** Tight lugs and wheel spindle nuts

7. **Structural connections and fittings.**
   - **A.** Check all nuts and bolts for tightness.
   - **B.** Check for any structual damage.

8. **Brakes.**
   - **A.** Check for holding on incline up to four (4) degrees

NOTES: See Chapter General NEW EQUIPMENT CONDITION REPORT that is sent with each **MARKLIFT.**



This preventative maintenance information is intended as a general guide, refer to vendor section in this manual for detailed information on engine, battery, etc.

Mark Industries recommends the following items be checked:

DAILY

1. Operation and safety decals in place and legible.
2. Check gas & hydraulic tank levels.
3. Check engine oil level.
4. Check battery water level.
5. Check for loose or worn hardware.

WEEKLY

1. Check tire condition (free of serious cuts or defects)
2. Check & clean engine intake air cleaner.
3. Operation and safety decals in place and legible.
4. Proper brake operation.
5. Record hour meter reading.
6. Clean unit by removing all dirt, oil, and grease. Machine may be washed with soap and water.
7. Check for hydraulic leaks and correct.
8. Check for structural damage and correct.
9. Check overall performance.
10. Check for wear on cables and hoses.

MONTHLY (or first 50 hours)

1. Check and lube, if necessary. (See lubrication instructions).
2. Check battery condition.
3. Change engine oil & filter.
4. Change hydraulic oil return filter.
5. Check ring gear bolts in turret and base for correct torque.
   15/16 bolts - 175 ft. lbs. lubricated
   3/4 bolts - 87 ft. lbs. lubricated
6. Check oil level, turret rotation gear box.
7. Grease ring gear.
8. Grease steering linkage.
9. Check & clean engine intake air cleaner.

EVERY SIX MONTHS (or 100 hours)

1. Check and lube, if necessary. (See lubrication instructions).
2. Change pilot filter element. (See lubrication instructions).
3. Change engine oil filter.
4. Change hydraulic oil return filter.

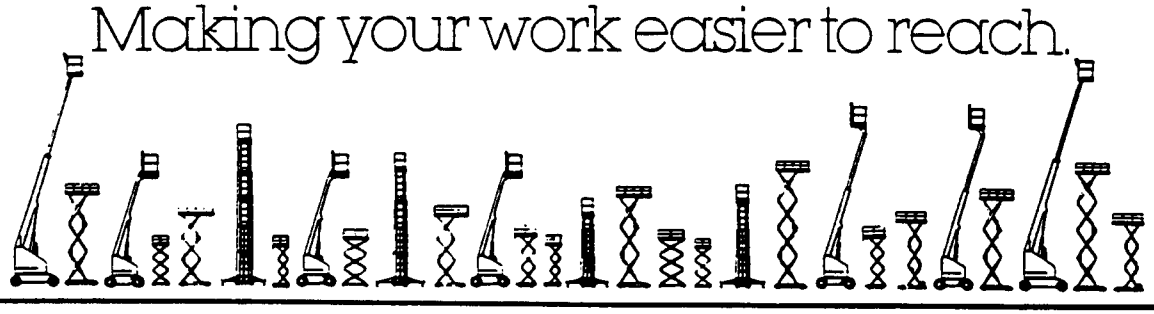
EVERY YEAR

1. Repack all wheel bearings.
2. Change hydraulic oil.
3. Check torque hub oil level.
4. Check ring gear bolts in turret and base, for correct torque.
5. Change hydraulic oil return filter.
6. Change pilot line filter.

To properly and efficiently service your **MARKLIFT**, several basic tools are required. The following list of tools should be available.

SERVICE TOOLS

1. Volt/OHM meter
2. Hydraulic pressure gauge (0-1,000 PSI and 0-3,000 PSI)
3. Battery hydrometer
4. Battery load tester
5. Photo tachometer
6. Standard mechanics hand tools
7. Cable tensioning tool MI #20053
8. Radiator pressure tester
9. Electrical test light
10. Female quick disconnect Coupler (MI #842)
11. Fuel pump vac./press. gauge (automatic type)



INTRODUCTION

Whenever trouble shooting any problem, the initial consideration must be to **"Check the basics".**

Check the basics, means to insure that the batteries are in good shape and have **at least a three quarter charge,** determined by use of a hydrometer and battery maintenance instructions.

A large percentage of electrical problems can be attributed to insufficiently charged or defective batteries.

1. ELECTRICAL

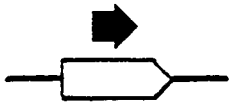
A. If a problem seems to be electrical, utilize your applicable schematic, (see Schematic Chapter for more information) and test light to trace power flow (electrical current) starting at battery and continuing through system until the problem is located.

B. Keep in mind, if you **DO NOT** have a good ground to a valve coil, relay, etc., then even if you have proper electrical current to the coil or relay, the items will not function properly.

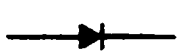
C. Diodes can be thought of as **"One way electrical check valves"** they permit current flow in one direction and stop it in the opposite direction.

Current Flow

ACTUAL



SCHEMATIC



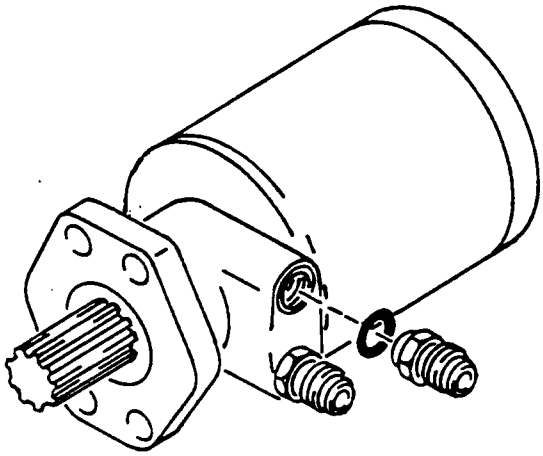
D. The basic purpose of a relay is to maintain full electrical current. When sending an electrical signal to the relay coil, the electrical current flows through the relay contacts and to the desired valve coil.

2. HYDRAULIC

A. For the various hydraulic functions the system pressure is utilized. If a slower drive speed is needed, a portion of the hydraulic fluid is dumped to tank by the low speed valve.

B. Directional valves (outriggers, steering, and drive) have two opposite electrical coils with a moveable spool between the coils.

C. One way valves (lift, descent, dump, and creep) all can be both N/C (normally closed) or N/O (normally open) depending on if flow is desired or not.



1. **ENGINE**

   A. **Will not start or run.**

      1) Check ground control box circuit breaker.
      2) Make sure fuel shut-off valve is open.
      3) Fuel selector should be in the "gasoline" position.
      4) Check for low battery.
      5) Check for fouled spark plugs.
      6) Check for water in gas tank.
      7) Check engine points.

   B. **No high speed.**

      1) Check aerial HIGH/LOW throttle switch.
      2) Check throttle solenoid valve.

   C. **No idle.**

      1) Check aerial HIGH-LOW throttle switch.
      2) Check throttle solenoid valve.

   D. **Dies under load.**

      1) Check governor setting.
      2) Check carburetor air/fuel mixture.

2. **HYDRAULIC WHEEL DRIVE MOTOR AND PUMP**

   A. Wheel drive motor turns wheel while unloaded, but slows down or stops when load is applied.

      1) Check hydraulic high pressure port with 3000 PSI gauge.

   B. **Pump producing excessive noise.**

      1) Check suction hose from tank to pump for kinks.
      2) Check hydraulic oil level (sight gauge on tank.)
      3) Check suction line fittings for tightness.
      4) Check oil.

3. **STEERING**

A. **Steers in one direction only.**

1) Loose electrical connection.
2) Loss of ground to coil on affected direction.
3) Spool sticking in one direction.
4) Faulty steering switch in the lower control (hand control box).
5) Flow control valve to steering cylinder out of adjustment.
6) Faulty diode.

4. **DRIVE**

A. **Will drive forward. No reverse.**

1) Loose electrical connection in reverse circuit.
2) Faulty drive switch.
3) Valve spool sticking in one direction.
4) Faulty diode.

B. **No forward or reverse drive.**

1) Free wheeling valve open.
2) Faulty drive switch
3) Both forward and reverse diodes inoperative on terminal strip.
4) Stuck valve spool
5) Drive cut out switch in outrigger inoperative.

C. **No high speed.**

1) Loose electrical connections.
2) Low speed relay inoperative.
3) High speed dump valve inoperative.
4) High speed valve inoperative (3 speed machines only).

D. **No creep speed.** (If applicable)

1) Loose electrical connections.
2) Creep speed relay inoperative.
3) Faulty creep switch.
4) Faulty creep dump valve.
5) Creep or low speed flow valve out of adjustment.

E. No functions working.

1) Faulty circuit breaker
2) Loose power connections.
3) Power relay inoperative.
4) Dump relay.
5) Dump valve inoperative.

F. No system pressure.

1) No hydraulic oil.
2) Hydraulic tank valve is in "OFF" position.
3) Loose electrical connections in dump circuit.
4) Dump relay inoperative.
5) Dump valve inoperative.
6) Pressure relief valve inoperative.
7) Hydraulic pump inoperative.

G. Low system pressure.

1) Pressure relief valve out of adjustment.
2) Dump valve faulty.
3) Low speed dump valve faulty.
4) Hydraulic pump faulty.
5) Hydraulic tank suction filter obstructed.

5. LIFT

A. Will not lift. All other functions work.

1) Emergency lowering valve is open. (if applicable)
2) Low batteries.
3) Loose electrical connections.
4) Descent valve stuck open.
5) Faulty lift controller.
6) Pressure limit switch out of adjustment.
7) Tilt switches out of adjustment.

B. Will not lift rated load.

1) Low system pressure.
2) Low batteries.
3) Pressure limit switch out of adjustment.
4) Internal seal leaking in cylinder.

If this trouble shooting check list does not help to solve your problem, contact your local **MARKLIFT** representative or the **MARK INDUSTRIES** service department.

A new fully charged battery will have a specific gravity of 1.260 or 1.280 at 80°F.

The tables (on Maintenance page10) show the specific gravity as a function of percentage battery charge

1.260 Sp. Gr.	1.280	100% charged
1.230	1.250	75% charged
1.200	1.220	50% charged
1.170	1.190	25% charged
1.40	1.160	Very little useful capacity
1.110	1.130	Discharged

The percentage charge of a battery should be checked with a good hydrometer that has a thermometer and temperature correction scale built into it. This allows a temperature correction to be made readily. A correction of 0.04 points in gravity shall be made for each ten degrees either above or below 80°F. For every 10°F below 80°F, subtract 0.04 points; and for every 10°F above 80°F, add 0.04 points.

Within every thirty day period, the cell of each battery should be checked to determine the percentage charge. If any cell has a hydrometer reading of more than 0.020 less than the other cells in the battery, that cell is bad and the battery should be removed from service.

Periodic checks by hydrometer after charging, but prior to any discharge, is recommended to determine if batteries are receiving a full charge.

Either excessive overcharge or moderate undercharge can shorten battery life.

With proper attention to water level and charging time, compared to hydrometer reading, the batteries should give a long useful life.

TEMPERATURE/SPECIFIC GRAVITY CORRECTION TABLE FOR BATTERIES

Actual Hydrometer Reading at Actual Temperature*

80°F (27°C)	0°F (-18°C)	-10°F (-23°C)	-20°F (-29°C)	-30°F (-34°C)	-45°F (-43°C)	-65°F (-54°C)	Approx. State of Charge In %
1.280	1.312	1.316	1.320	1.324	1.330	1.338	100
1.250	1.282	1.286	1.290	1.294	1.300	1.308	75
1.220	1.252	1.256	1.260	1.264	1.270	1.278	50
1.190	1.222	1.226	1.230	1.234	1.240	1.248	25
1.160	1.192	1.196	1.200	1.204	1.210	1.218	0

Specific Gravity Corrected to 80°F (17°C)	Freezing Temperature	
1.280	-90°F	-68°C
1.250	-62°F	-52°C
1.200	-16°F	-27°C
1.150	+ 5°F	-15°C
1.000	+19°F	- 7°C

MILESTONE			HYDRAULIC FLUID TABLE			
OIL COMPANY			CHEVRON	GULF	SHELL	UNION
BRAND NAME			ATF DEXRON II	ATF DEXRON II	DONAX-T6	ATF DEXRON
VISCOSITY	SUS AT 100°F (37.8°C)		187.4	195	200	200
	SUS AT 210°F (98.9°C)		49.2	50.4	50	52.3
	INDEX	°F	153°	155°	160°	172°
		°C	67.2°	68.3°	71.1°	77.8°
FLASH POINT		°F	400°	405°	390°	395°
		°C	204.4°	207.2°	198.9°	201.7°
POUR POINT		°F	-40°	-50°	-50°	-45°
		°C	-40°	-45.6°	-45.6°	-42.8°

PRESSURE ADJUSTMENT PROCEDURE

MODEL: 45KBDF, 45KB

A. SCOPE:

THIS PROCEDURE WILL DESCRIBE PROPER ADJUSTMENT OF THE PRESSURE RELIEF SETTING ON THE FOLLOWING FUNCTIONS:

PROCEDURE:

1. DRIVE PRESSURE
2. STEERING PRESSURE
3. FUNCTION CONTROL VALVE
4. TURRET ROTATION PRESSURE
5. PLATFORM LEVELING PRESSURE

NOTE: IF PRESSURES DO NOT INCREASE OR DECREASE WITH ADJUSTMENT OTHER PROBLEMS MAY EXIST. TURN ADJUSTING SCREW COUNTER CLOCKWISE ½ TURN PAST ORIGINAL SETTING BEFORE INVESTIGATING OTHER PROBLEMS.

B. TOOLS REQUIRED:

3/16" ALLEN WRENCH
5/16" ALLEN WRENCH
7/16" OPEN END/BOX WRENCH
9/16" OPEN END/BOX WRENCH
0-600 PSI PRESSURE GAUGE
0-3000 PSI PRESSURE GAUGE

FIG. I ASSEMBLY, PRESSURE GAUGE/HOSE

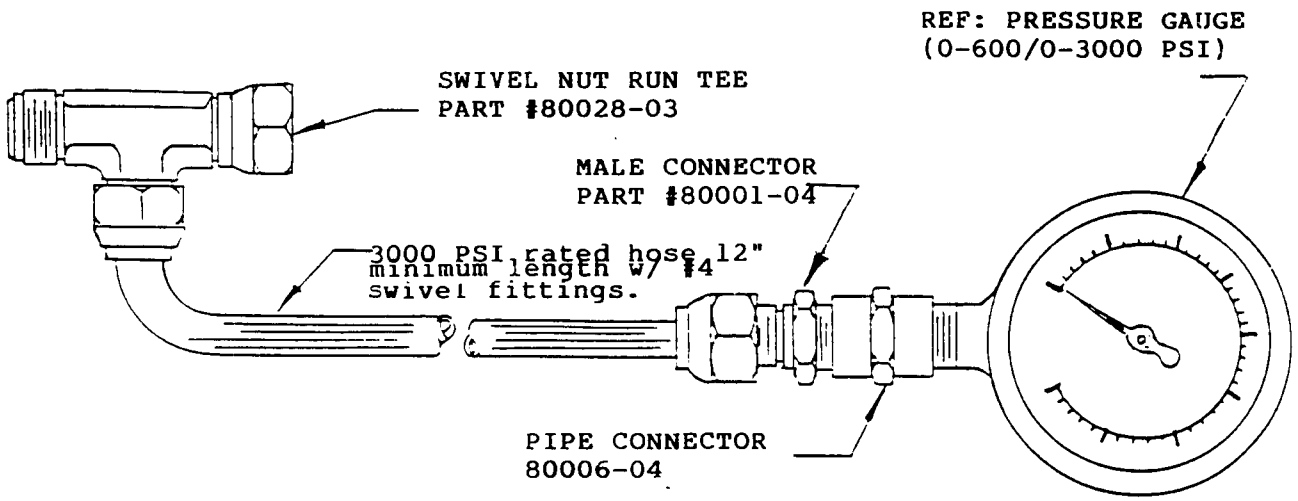


FIG. 2 ASSEMBLY, PRESSURE GAUGE/QUICK DISCONNECT

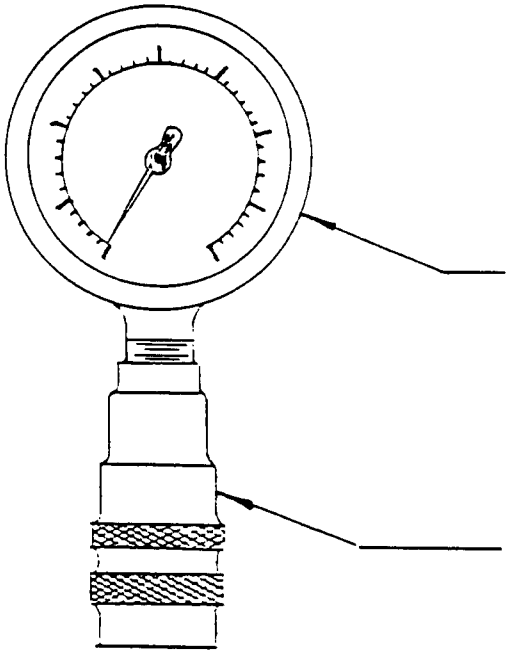


FIG. 3 DRIVE/STEER VALVE

MODEL: 45KBDF
PART # 81219

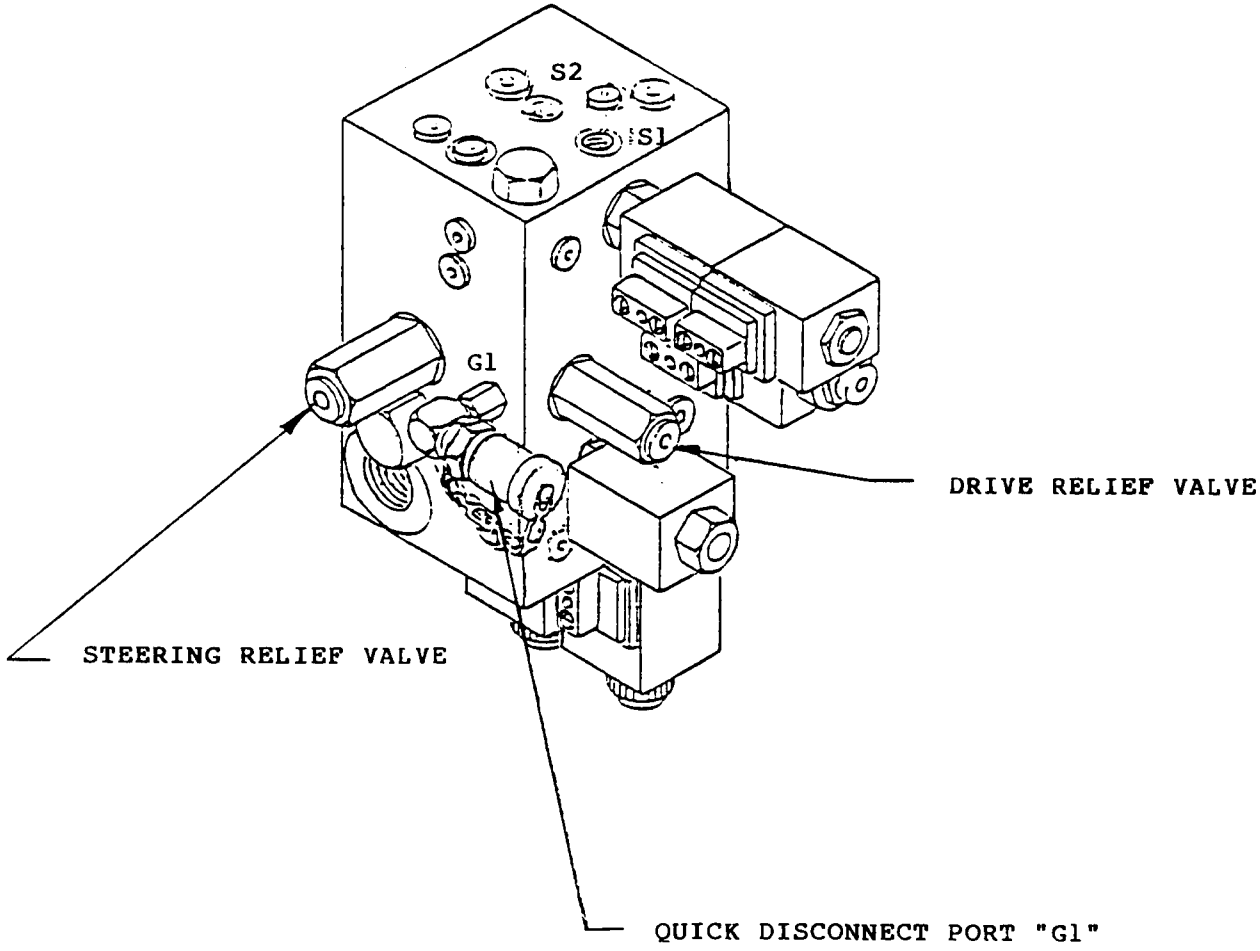


FIG. 4 DRIVE/STEER VALVE

MODEL: 45KB
PART # 81212

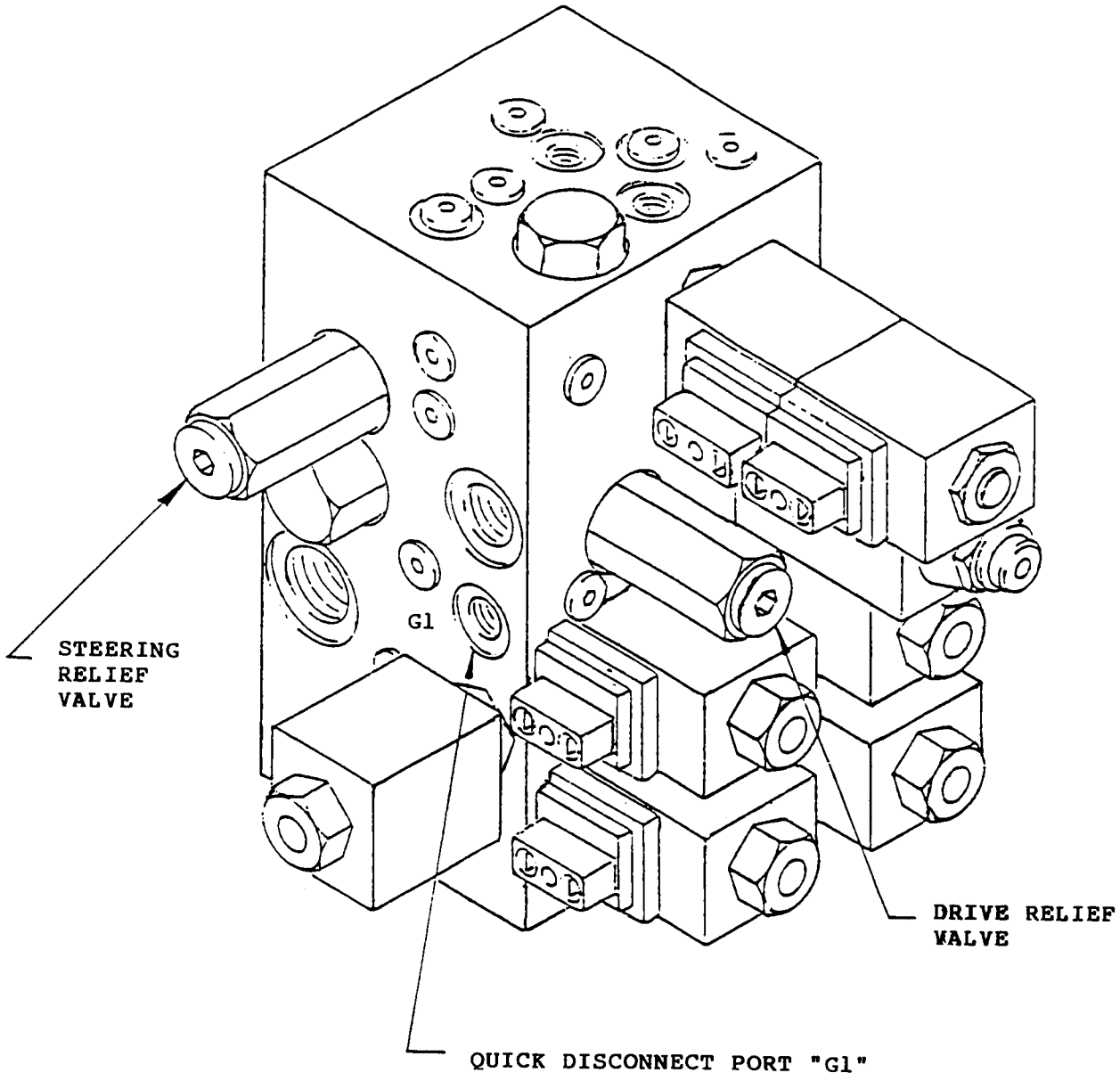
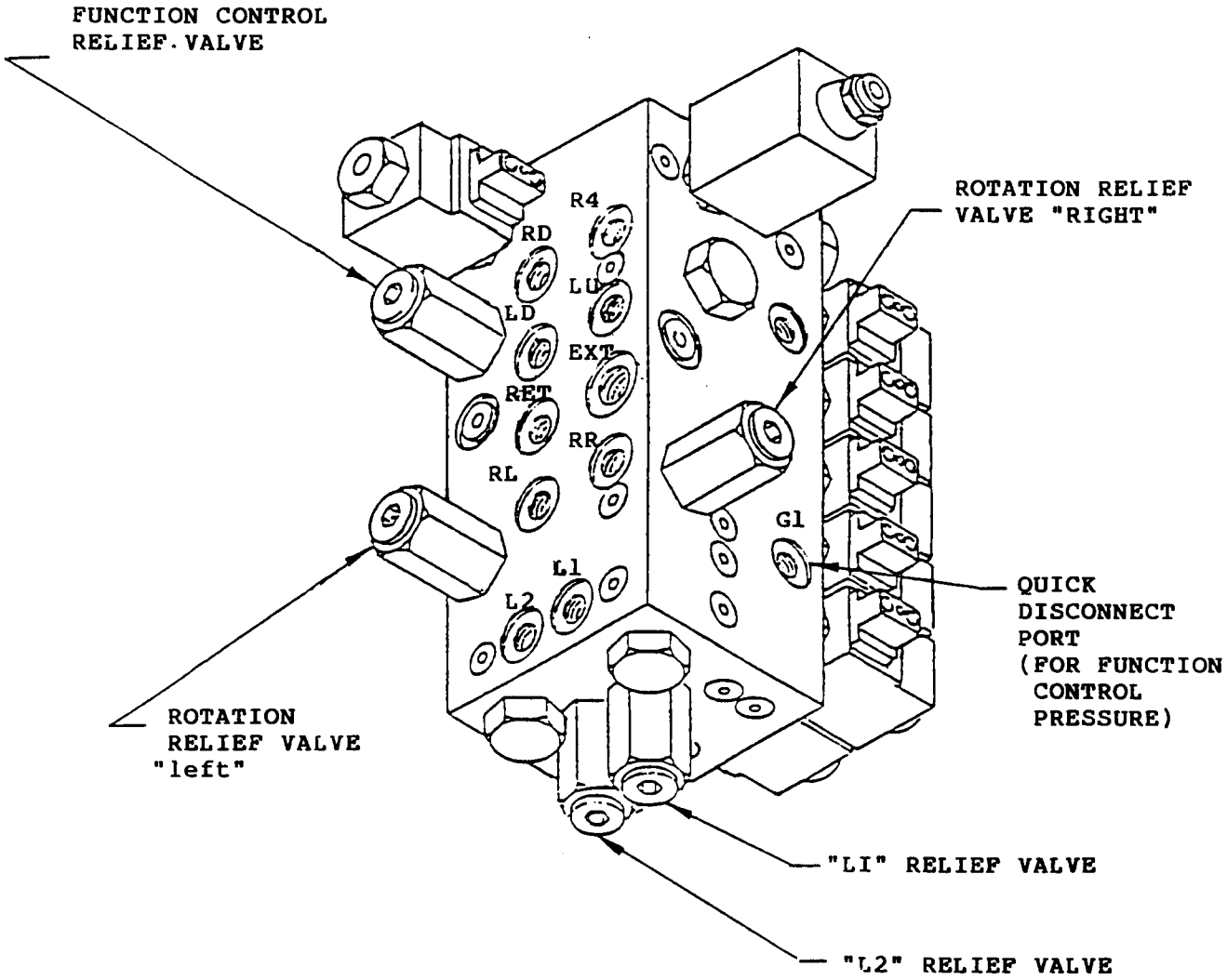


FIG. 5 BOOM FUNCTIONAL VALVE

PART #81221 - 45KBDF
PART #81213 - 45KB



C. PROCEDURES:

1. DRIVE PRESSURES (REFER TO FIG. 3 or 4).

1.1 CONNECT PRESSURE GAUGE ASSEMBLY (FIG.2) TO "GI" PORT.

1.2 CLOSE BRAKE ADJUSTING NEEDLE VALVE TO LOCK ON BRAKES.

1.3. START MACHINE AND OPERATE DRIVE FUNCTION (FORWARD OR REVERSE)

1.4 WITH BRAKES LOCKED, MAXIMUM DRIVE PRESSURE WILL REGISTER ON THE GAUGE.

1.5 DRIVE PRESSURE SHOULD BE: REFER TO TABLE I. (Page 18)

1.6 IF PRESSURE IS INCORRECT, REMOVE PLUG FROM DRIVE RELIEF VALVE WITH 5/16" ALLEN WRENCH.

1.7 INSERT 3/16" ALLEN WRENCH INTO RELIEF VALVE.

1.8 TO INCREASE PRESSURE TURN ALLEN WRENCH CLOCKWISE (CW) to DECREASE PRESSURE TURN COUNTERCLOCKWISE (CCW).

1.9 REPEAT OPERATING DRIVE FUNCTION UNTIL CORRECT PRESSURE SETTING IS ACHIEVED.

1.10 RE-ASSEMBLE RELIEF VALVE PLUG.

1.11 OPEN BRAKE ADJUSTING NEEDLE VALVE.

1.12 VERIFY BRAKE OPERATION, ADJUST IF NECESSARY.

2. STEERING PRESSURES (REFER TO FIG. 3 or 4)

2.1 CONNECT PRESSURE GAUGE. ASSEMBLY (FIG.2) TO "G1" PORT.

2.2 START MACHINE AND OPERATE STEERING FUNCTION UNTIL STEERING CYLINDER IS BOTTOMED OUT. HOLD AND READ PRESSURE GAUGE.

2.3 STEERING PRESSURE SHOULD BE: REFER TO TABLE I (Page 18)

2.4 IF PRESSURE IS INCORRECT, COMPLETE STEPS 1.6 THRU 1.10 ON STEERING RELIEF VALVE.

3. FUNCTION CONTROL VALVE PRESSURE (REFER TO FIG. 5)

3.1 CONNECT PRESSURE GAUGES. ASSEMBLY (FIG.2) to "GI" PORT.

3.2 START MACHINE AND OPERATE BOOM EXTENSION FUNCTION UNTIL CYLINDER IS BOTTOMED OUT. HOLD AND READ PRESSURE GAUGE.

3.3 PRESSURE SHOULD BE: REFER TO TABLE I (Page 18).

3.4 IF PRESSURE IS INCORRECT, COMPLETE STEPS 1.6 THRU 1.10 ON FUNCTION CONTROL RELIEF VALVE.

4. TURRET ROTATION PRESSURE (REFER TO FIG. 5)

4.1 REMOVE HOSE END FROM PORT MARKED "RR" AND INSTALL HOSE/PRESSURE GAUGE (3000 PSI) ASSEMBLY (FIG. I)

4.2 ATTACH THE REMOVED HOSE END TO THE SWIVEL RUN TEE.

4.3 START MACHINE AND OPERATE TURRET ROTATION "RIGHT" FUNCTION AGAINST TURRET STOP. HOLD AND READ PRESSURE GAUGE.

4.4 ROTATION PRESSURE SHOULD BE: REFER TO TABLE I. (Page 18)

4.5 INSTALL 0-600 PSI PRESSURE GAUGE ON HOSE ASSEMBLY AND VERIFY THE INDICATED PRESSURE (TABLE I)

4.6 IF PRESSURE IS INCORRECT, COMPLETE STEPS 1.6 THRU 1.9 ON ROTATION "RIGHT" RELIEF VALVE.

NOTE:
THE PURPOSE OF USING A 3000 PSI PRESSURE GAUGE FIRST AND 600 PSI PRESSURE GAUGE AFTER IS TO AVOID DAMAGING 600 PSI GAUGE WITH A POSSIBLE HIGH PRESSURE SPIKE.

4.7 REMOVE PRESSURE GAUGE ASSEMBLY AND RE-ATTACH THE HOSE END ON PORT "RR".

4.8 RE-INSTALL THE RELIEF VALVE PLUG.

4.9 REMOVE HOSE END FROM PORT MARKED "RL" AND INSTALL HOSE/PRESSURE GAUGE (3000 PSI) AS IN STEP 4.1

4.10 COMPLETE STEPS 4.2 THRU 4.8 ON ROTATION "LEFT" RELIEF VALVE WITH TURRET ROTATION LEFT FUNCTION.

5. PLATFORM LEVELING PRESSURE (REFER TO FIG. 5)

5.1 REMOVE HOSE END FROM PORT MARKED "LI" AND INSTALL HOSE/PRESSURE GAUGE ASSEMBLY (FIG.I)

5.2 ATTACH THE REMOVED HOSE END TO THE SWIVEL RUN TEE.

5.3 START MACHINE AND OPERATE LEVELING "DOWN" FUNCTION UNTIL SLAVE LEVELING CYLINDER IS BOTTOMED OUT. HOLD AND READ PRESSURE GAUGE.

5.4 PLATFORM LEVELING PRESSURE SHOULD BE; REF. TO TABLE I, BELOW

5.5 IF PRESSURE IS INCORRECT, REMOVE PLUG FROM "LI" RELIEF VALVE WITH 5/16 ALLEN WRENCH.

5.6 COMPLETE STEPS 1.7 THRU 1.9 ON L1 RELIEF VALVE.

5.7 REMOVE PRESSURE GAUGE ASSEMBLY AND RE-ATTACH HOSE END ON PORT "LI".

5.8 RE-INSTALL PLUG ON "LI" RELIEF VALVE.

5.9 COMPLETE STEPS 5.1 THRU 5.8 ON PORT MARKED "L2" OPERATION FUNCTION LEVELING "UP" ADJUST "L2" RELIEF VALVE IF NECESSARY.

TABLE I PRESSURE SETTING

(NOTE: Pressures indicated are nominal).

FUNCTION	45KBDF (± 50 PSI)	45KB (± 50 PSI)
DRIVE (FORWD. & REV.)	2500	1750
STEERING (RIGHT & LEFT)	1200	1200
FUNCTION CONTROL	2500	2250
TURRET ROTATION (RIGHT & LEFT)	400	400
PLATFORM LEVELING (UP & DOWN)	1500	1500

45 KBDF
TORQUE VALUES:

TORQUE HUBS	- 175 FT. LBS.
DRIVE MOTORS	- 87 FT. LBS.
FRONT TIRE LUG NUTS	- 180 FT. LBS.
REAR TIRE LUG NUTS	- 300 FT. LBS.
TIRE PRESSURE	- 75 PSI
RING GEAR MOUNTED THRU TURRET PLATE	- 175 FT. LBS.
RING GEAR MOUNTED THRU BASE PLATE	- 175 FT. LBS.
ROTATION GEAR BOX	- 175 FT. LBS.
HUB TO SPINDLE	- 45 FT. LBS.
MOTOR MOUNTS	- 87 FT. LBS.
PIVOT PIN RETAINING BOLTS	- 36 FT. LBS.
PLATFORM MOUNTING BOLTS	- 87 FT. LBS.
FORK MOUNTING BOLTS	- 87 FT. LBS.
COUNTER WEIGHT	- 200 - 225 FT. LBS. Then tack weld in place.

PRESSURES: (NOMINAL)

SYSTEM - 2500 PSI
ROTATE - 400 PSI
DRIVE - 2500 PSI
LEVELING - 1500 PSI
STEERING - 1200 PSI

R.P.M.'S

LOW - 1800 - 2000
HIGH- 2700 - 2900

ALL PRESSURES ARE $\pm$ 50 PSI

45 KB
TORQUE VALUES:

TORQUE HUBS	- 175 FT. LBS.
DRIVE MOTORS	- 87 FT. LBS.
FRONT TIRE LUG NUTS	- 180 FT. LBS.
REAR TIRE LUG NUTS	- 300 FT. LBS.
TIRE PRESSURE	- 75 PSI
RING GEAR MOUNTED THRU TURRET PLATE	- 175 FT. LBS.
RING GEAR MOUNTED THRU BASE PLATE	- 175 FT. LBS.
ROTATION GEAR BOX	- 175 FT. LBS.
HUB TO SPINDLE	- 45 FT. LBS. Then back off to nearest cotter pin slot.
MOTOR MOUNTS	- N.A.
PIVOT PIN RETAINING BOLTS	- 36 FT. LBS.
PLATFORM MOUNTING BOLTS	- 87 FT. LBS.
FORK MOUNTING BOLTS	- 87 FT. LBS.
COUNTER WEIGHT	- 200 - 225 FT. LBS. Then tack weld in place.

PRESSURES: (NOMINAL)	R.P.M.'S
SYSTEM - 2250 PSI	(electric, not appl.)
ROTATE - 400 PSI	"
DRIVE - 1750 PSI	"
LEVELING - 1200 PSI	"
STEERING - 1200 PSI	"

ALL PRESSURES ARE $\pm$ 50 PSI

FUNCTION TIMING CHART

TIME (IN SECONDS) OF THE KB FUNCTIONS ARE AS FOLLOWS:

			45KB	45KBDF
DRIVE	Low	=	75-95	55-65
	High	=	35-55	27-33
RISERS	Up	=	35-45	15-20
	Down	=	35-45	15-20
BOOM	Up	=	35-55	25-31
	Down	=	30-50	25-31
ROTATION	CCW	=	85-115	90-120
	CW	=	85-115	90-120
EXTENSION		=	40-60	35-42
RETRACTION		=	40-60	35-42

NOTES:

BATTERY POWERED MACHINES SHOULD BE FULLY CHARGED BEFORE TIMES ARE TAKEN.

GASOLINE POWERED MACHINES SHOULD BE TIMED WITH THE ENGINE RUNNING AT HIGH THROTTLE.

REF: Low Engine Speed = 1800-2000 RPM
High Engine Speed= 2700-2900 RPM

IF EXTENSION AND RETRACTION TIMES ARE NOT EQUAL, CHECK LINES FROM REGENERATIVE VALVE TO CYLINDER (maybe reversed) REGENERATIVE VALVE ADJUSTMENT SCREW SHOULD BE FULLY OUT (highest pressure).

MODEL: _____ SER. NO.: _____ DATE SOLD _____

DATE IN SERVICE _____ OPTIONS _____ WARRANTY PERIOD _____

CODE:
C-CHECKED N-NEW PART
A-ADJUSTED X-NEEDS
R-REPAIRED REPAIR

MAINTENANCE CHECK LIST

DATE	W.O.	MECH.	HR METER	PREVENTIVE MAINT.												ELECTRICAL						HYDRAULIC										FUEL			STEER				TIRE		MAJ.		MISC.					
				OIL CHANGE	OIL FILTER	AIR CLEANER	HYDRAULIC OIL CHANGE	HYDRAULIC OIL FILTER	WHEEL BEARING PACK	DRIVE MOTOR	PUMP MOTOR BRUSHES	ELECTRICAL CONTROLS	TRANS & DIFF OIL CHG	TUNE UP SPARK PLUGS	GENERATOR	VOLTAGE REGULATOR	BATTERY	STARTER	POINTS AND CONDENSER	HYDRAULIC SYSTEM	LEV CYL	LIFT CYL SEALS	HYD CONTROL VALVE	HYD PUMP	ROTARY MANIFOLD	LIFT ROLLERS	HYD HOSES	FUEL SYS	CARBURATOR	FUEL PUMP	STEERING	STEERING HOSES	STEER GEAR	STEER CYL	DRIVE TIRE	STEER TIRE	ENGINE O/H	DRIVE AXLE O/H	BRAKES							

DATE	REMARKS	DATE	REMARKS	AGENCY

MARKLIFT SERVICE MAINTENANCE RECORD

MODEL: _____ SERIAL NO. _____

DATE: _____ EQUIP. NO. _____

LOCATION: _____ MECHANIC: _____

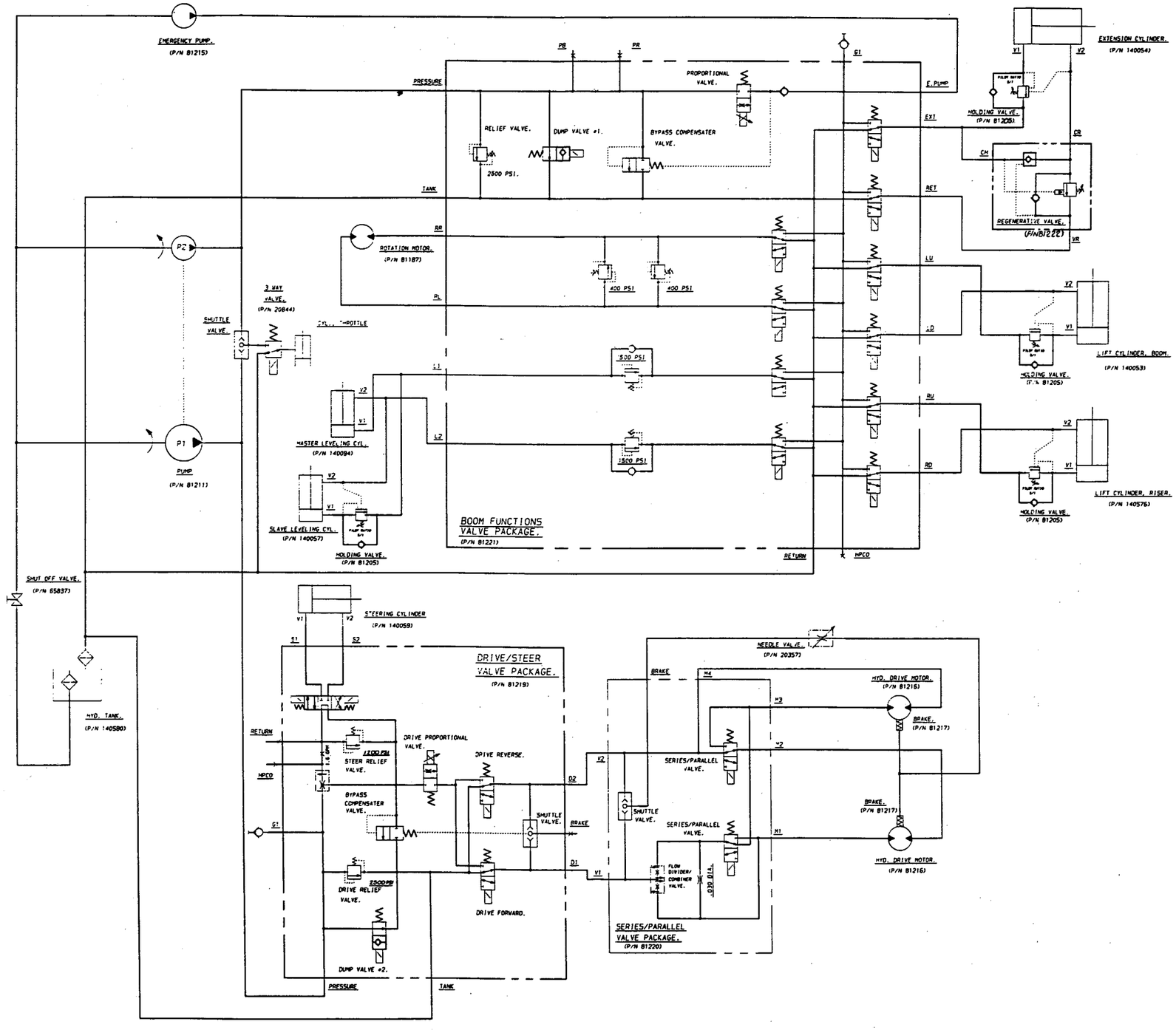
ITEM	CODE	COMMENTS	ITEM	CODE	COMMENTS
ENGINE OIL			SAFETY CUT-OUTS		
ENGINE OIL FILTER			BUSHINGS		
AIR FILTER			ROLLERS		
FUEL FILTER			WEAR PAD		
TUNE-UP			FRONT END ASSY.		
CHOKE			TIRE PRESSURE		
ENGINE RPM			TIRE CONDITION		
CHARGINE SYSTEM			WHEEL NUTS		
FUEL SYSTEM LPG-GAS			WHEEL BEARING		
BATTERIES			NUTS & BOLTS		
BATTERY TERMINALS			GUARD RAILS		
MOTOR BRUSHES			LUBRICATION		
HYDRAULIC FLUID			WARNING DECALS		
HYD. OIL FILTER			OPERATION INSTRUCTIONS		
HYDRAULIC SYSTEMS			GENERAL DECALS		
HYDRAULIC PRESSURE			PAINT		
HYDRAULIC HOSES			ALL OPERATIONS		
CYLINDERS			LIFT		
DRIVE MOTORS			STEERING		
BRAKES			FORWARD DRIVE		
EMERGENCY LOWERING VALVE			REVERSE DRIVE		
AERIAL CONTROL BOX			TILT SWITCHES		
GROUND CONTROL BOX			FUEL LEVEL		
RELAYS			LITERATURE		
WIRE CONNECTIONS			OPTIONS		

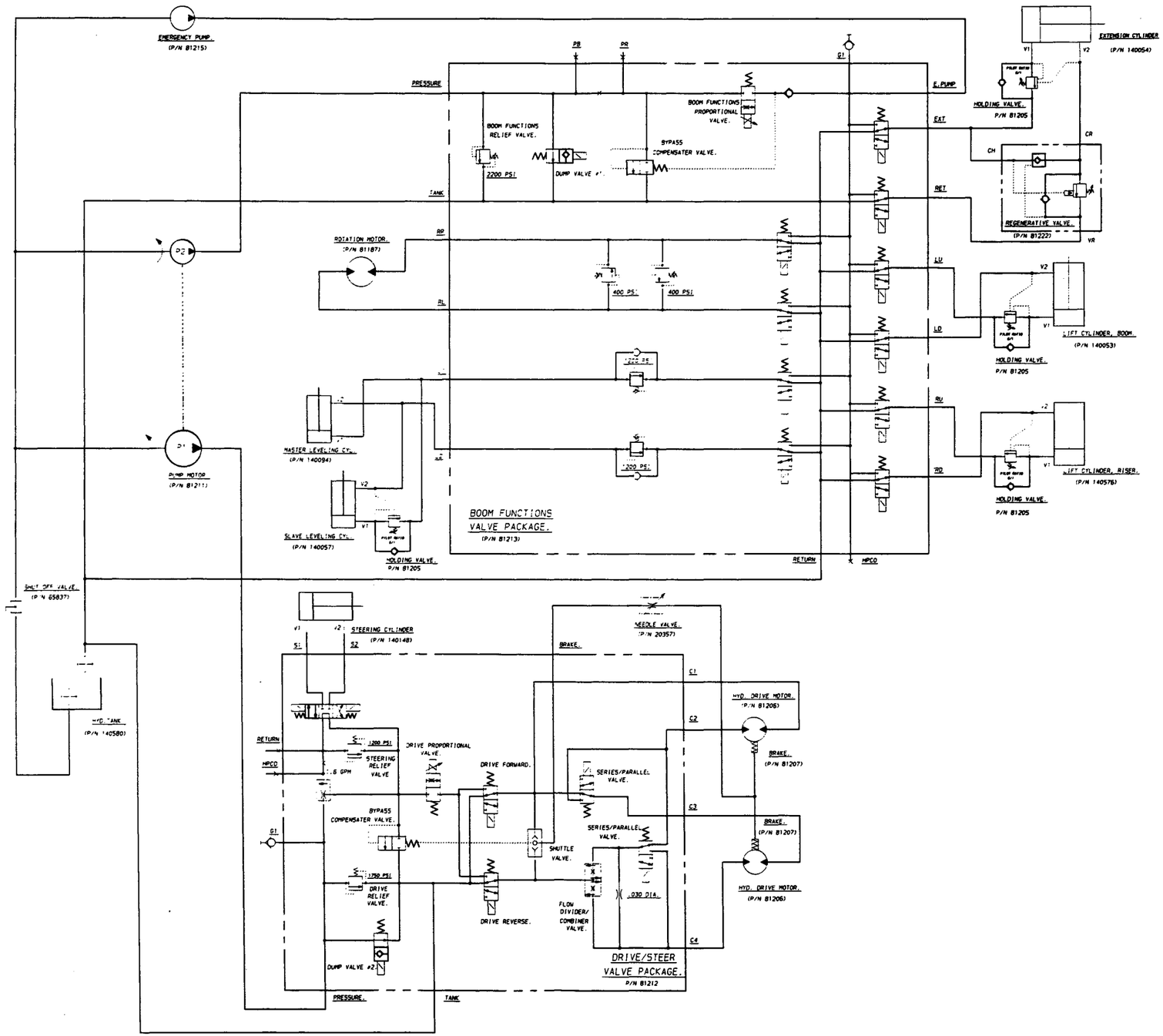
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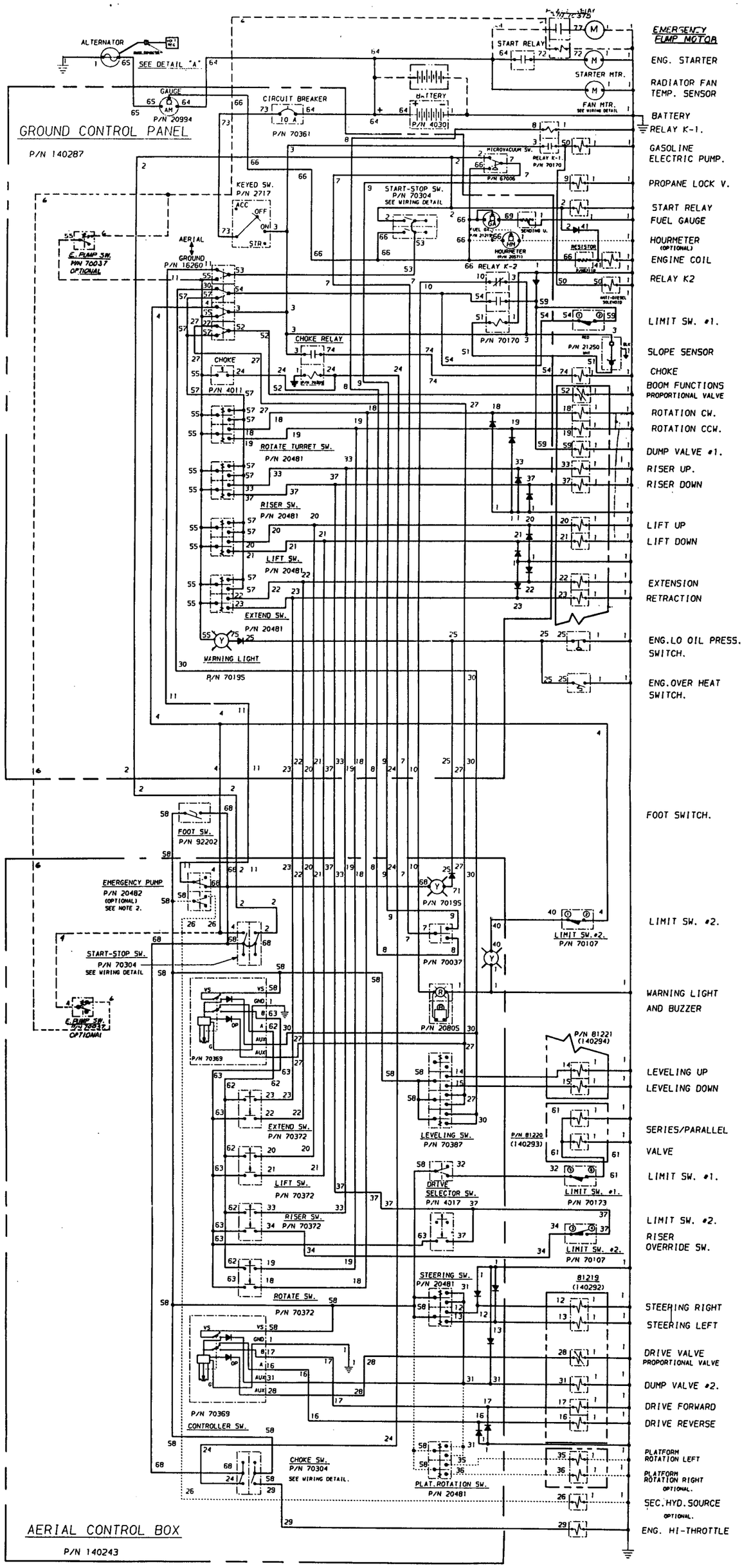
F - FILLED
R - REPAIRED
C - CHECKED
A - ADJUSTED
X - NEEDS REPAIR

OTHER COMMENTS:

REV.

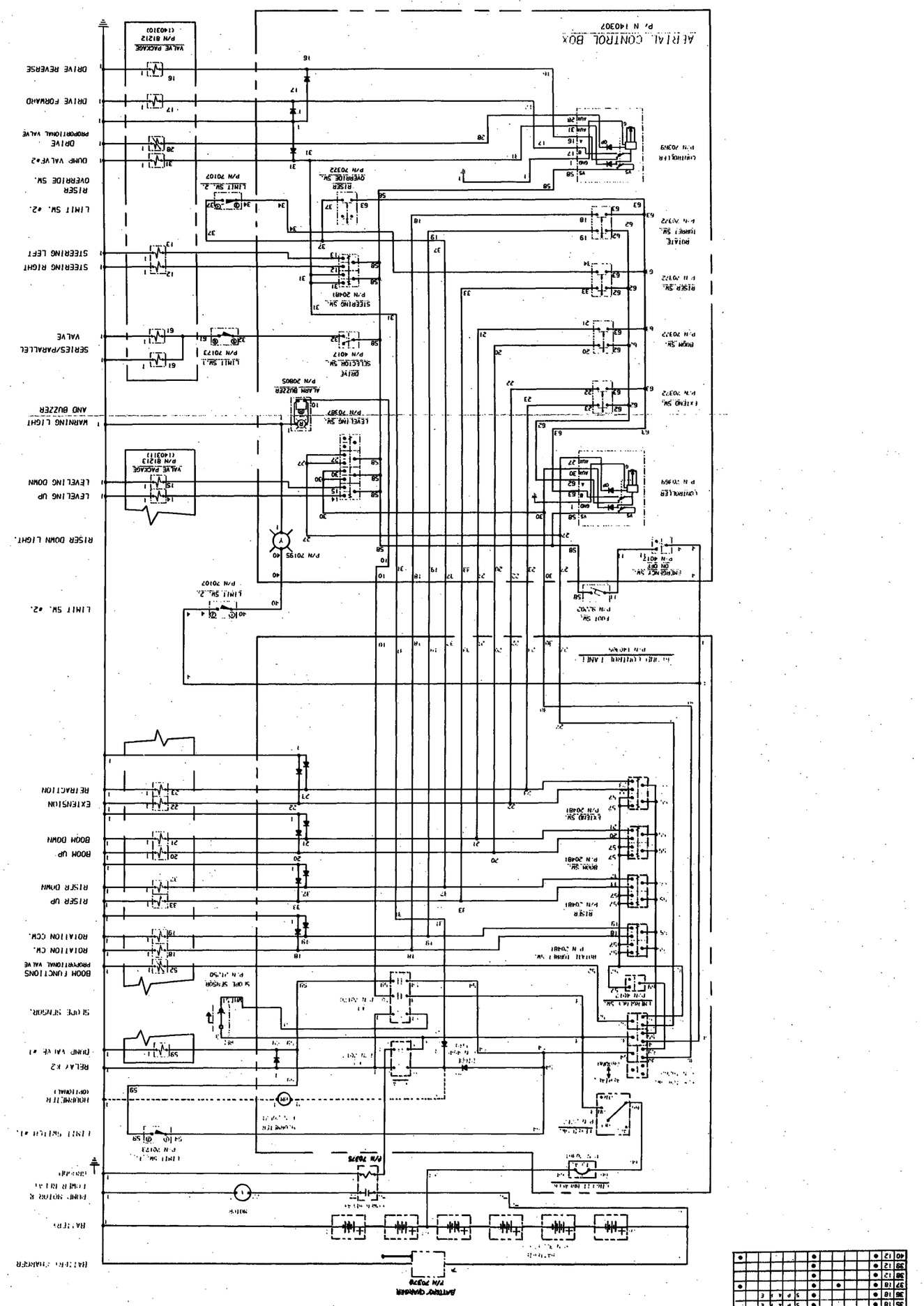

EMERGENCY PUMP.
(P/N 81215)
PB
PR
G1
PRESSURE
PROPORTIONAL VALVE.
F. PUMP
RELIEF VALVE.
2800 PSI.
DUMP VALVE #1.
BYPASS COMPENSATER VALVE.
EXT
EXTENSION CYLINDER.
(P/N 140054)
V1
V2
FLOW RATIO S/V
HOLDING VALVE.
(P/N 81205)
CR
CH
RET
REGENERATIVE VALVE.
(P/N 81222)
VR
TANK
RR
ROTATION MOTOR.
(P/N 81187)
400 PSI
400 PSI
RL
LU
3 WAY VALVE.
(P/N 20844)
SHUTTLE VALVE.
CYL. "BOTTLE
500 PSI
LL
LD
LIFT CYLINDER, BOOM.
(P/N 140053)
HOLDING VALVE
(P/N 81205)
MASTER LEVELING CYL.
(P/N 140094)
LZ
1500 PSI
RU
RD
LIFT CYLINDER, RISER.
(P/N 140576)
HOLDING VALVE.
(P/N 81205)
P2
P1
PUMP
(P/N 81211)
SLAVE LEVELING CYL.
(P/N 140057)
HOLDING VALVE.
(P/N 81205)
BOOM FUNCTIONS VALVE PACKAGE.
(P/N 81221)
RETURN
HPCO
SHUT OFF VALVE.
(P/N 65837)
HYD. TANK.
(P/N 140580)
STEERING CYLINDER
(P/N 140059)
S1
S2
DRIVE/STEER VALVE PACKAGE.
(P/N 81219)
RETURN
DRIVE PROPORTIONAL VALVE.
1500 PSI
STEER RELIEF VALVE.
DRIVE REVERSE.
HPCO
BYPASS COMPENSATER VALVE.
D2
SHUTTLE VALVE.
BRAKE
G1
D1
V1
2500 PSI
DRIVE RELIEF VALVE.
DRIVE FORWARD.
DUMP VALVE #2.
PRESSURE
TANK
NEEDLE VALVE.
(P/N 20357)
BRAKE
M4
HYD. DRIVE MOTOR.
(P/N 81216)
M3
BRAKE.
(P/N 81217)
M2
V2
SERIES/PARALLEL VALVE.
SHUTTLE VALVE.
BRAKE.
(P/N 81217)
SERIES/PARALLEL VALVE.
M1
FLOW DIVIDER/ COMBINER VALVE.
.030 DIA.
HYD. DRIVE MOTOR.
(P/N 81216)
SERIES/PARALLEL VALVE PACKAGE.
(P/N 81220)

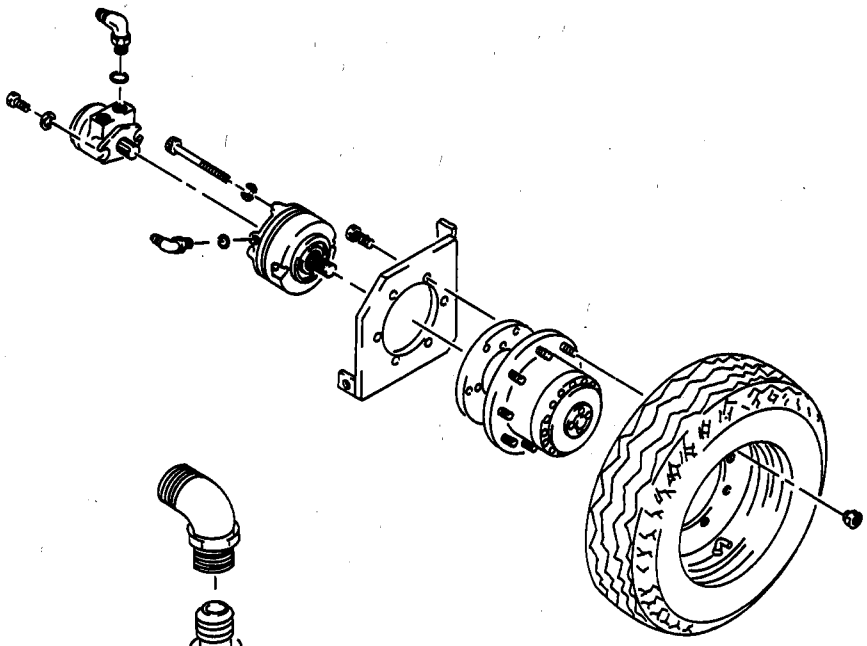

EMERGENCY PUMP
(P/N 81215)
PB
PR
G1
PRESSURE
E.PUMP
EXTENSION CYLINDER
(P/N 140054)
V1
V2
HOLDING VALVE.
P/N 81205
EXT
BOOM FUNCTIONS
RELIEF VALVE.
2200 PSI
BOOM FUNCTIONS
PROPORTIONAL
VALVE.
BYPASS
COMPENSATER VALVE.
DUMP VALVE #1
CH
CR
CB
RET
REGENERATIVE VALVE.
(P/N 81222)
VR
TANK
ROTATION MOTOR
(P/N 81187)
RP
RL
400 PSI
400 PSI
LU
LD
V2
V1
LIFT CYLINDER, BOOM
(P/N 140053)
HOLDING VALVE.
P/N 81205
2200 PSI
RU
RD
+2
V1
LIFT CYLINDER, RISER.
(P/N 140576)
HOLDING VALVE.
P/N 81205
MASTER LEVELING CYL.
(P/N 140094)
2200 PSI
SLAVE LEVELING CYL.
(P/N 140057)
V2
V1
HOLDING VALVE.
P/N 81205
BOOM FUNCTIONS
VALVE PACKAGE.
(P/N 81213)
RETURN
HPCO
SHUT OFF VALVE
(P/N 65837)
HYD. TANK
(P/N 140580)
V1
V2
STEERING CYLINDER
(P/N 140148)
S1
S2
NEEDLE VALVE.
P/N 20357
BRAKE.
C1
C2
C3
C4
HYD. DRIVE MOTOR.
(P/N 81206)
BRAKE.
(P/N 81207)
SERIES/PARALLEL
VALVE.
SERIES/PARALLEL
VALVE.
BRAKE.
(P/N 81207)
HYD. DRIVE MOTOR.
(P/N 81206)
RETURN
HPCO
1200 PSI
STEERING
RELIEF
VALVE
.6 GPM
DRIVE PROPORTIONAL
VALVE.
DRIVE FORWARD.
BYPASS
COMPENSATER VALVE.
G1
1750 PSI
DRIVE
RELIEF
VALVE.
DUMP VALVE #2
DRIVE REVERSE.
SHUTTLE
VALVE.
FLOW
DIVIDER/
COMBINER
VALVE.
.030 DIA.
DRIVE/STEER
VALVE PACKAGE.
P/N 81212
PRESSURE.
TANK

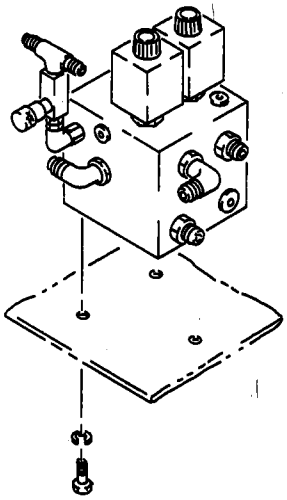

GROUND CONTROL PANEL
P/N 140287
AERIAL CONTROL BOX
P/N 140243
ALTERNATOR
SEE DETAIL "A"
GAUGE
P/N 20994
CIRCUIT BREAKER
10 A.
P/N 70361
BATTERY
P/N 4030
KEYED SW.
P/N 2717
START-STOP SW.
P/N 70304
SEE WIRING DETAIL
E. PUMP SW.
P/N 70037
OPTIONAL
AERIAL
GROUND
P/N 16260
CHOKE
P/N 4011
CHOKE RELAY
ROTATE TURRET SW.
P/N 20481
RISER SW.
P/N 20481
LIFT SW.
P/N 20481
EXTEND SW.
P/N 20481
WARNING LIGHT
P/N 70195
FOOT SW.
P/N 92202
EMERGENCY PUMP
P/N 20482
(OPTIONAL)
SEE NOTE 2.
P/N 70369
CONTROLLER SW.
CHOKE SW.
P/N 70304
SEE WIRING DETAIL.
EXTEND SW.
P/N 70372
LIFT SW.
P/N 70372
RISER SW.
P/N 70372
ROTATE SW.
P/N 70372
LEVELING SW.
P/N 70387
DRIVE SELECTOR SW.
P/N 4017
STEERING SW.
P/N 20481
PLAT.ROTATION SW.
P/N 20481
START RELAY
STARTER MTR.
FAN MTR.
SEE WIRING DETAIL
MICROVACUUM SW.
RELAY K-1
P/N 70170
P/N 67006
FUEL GA.
P/N 21250
SENDING U.
HOURMETER
(OPTIONAL)
RESISTOR
RELAY K-2
P/N 70170
P/N 21250
SHUT-DOWN SOLENOID
P/N 20805
P/N 70037
LIMIT SW. #2.
P/N 70107
P/N 81220
(140293)
LIMIT SW. #1.
P/N 70173
81219
(140292)
P/N 81221
(140294)
EMERGENCY PUMP MOTOR
ENG. STARTER
RADIATOR FAN TEMP. SENSOR
BATTERY RELAY K-1.
GASOLINE ELECTRIC PUMP.
PROPANE LOCK V.
START RELAY
FUEL GAUGE
HOURMETER (OPTIONAL)
ENGINE COIL
RELAY K2
LIMIT SW. #1.
SLOPE SENSOR
CHOKE
BOOM FUNCTIONS PROPORTIONAL VALVE
ROTATION CW.
ROTATION CCW.
DUMP VALVE #1.
RISER UP.
RISER DOWN
LIFT UP
LIFT DOWN
EXTENSION
RETRACTION
ENG.LO OIL PRESS. SWITCH.
ENG.OVER HEAT SWITCH.
FOOT SWITCH.
LIMIT SW. #2.
WARNING LIGHT AND BUZZER
LEVELING UP
LEVELING DOWN
SERIES/PARALLEL VALVE
LIMIT SW. #1.
LIMIT SW. #2.
RISER OVERRIDE SW.
STEERING RIGHT
STEERING LEFT
DRIVE VALVE PROPORTIONAL VALVE
DUMP VALVE #2.
DRIVE FORWARD
DRIVE REVERSE
PLATFORM ROTATION LEFT
PLATFORM ROTATION RIGHT OPTIONAL.
SEC.HYD.SOURCE OPTIONAL.
ENG. HI-THROTTLE

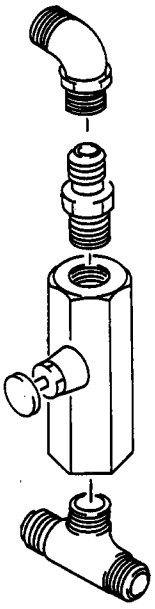
ELECTRICAL SCHEMATIC (45KB)

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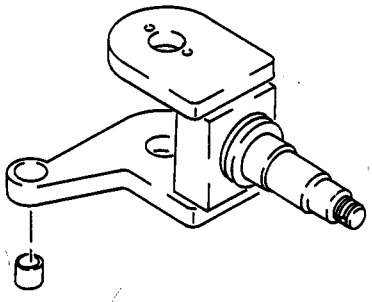


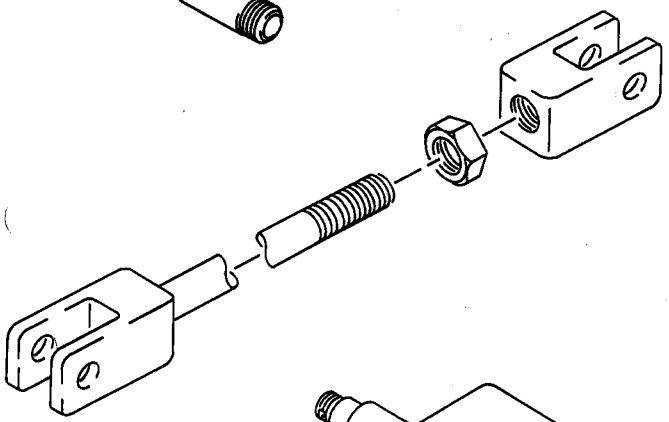
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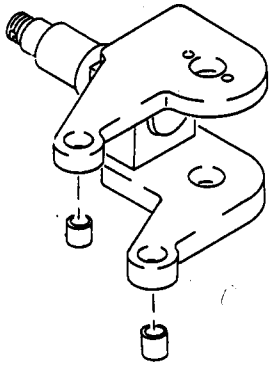
FIGURE 1 TABLE OF CONTENTS (PARTS ONLY)

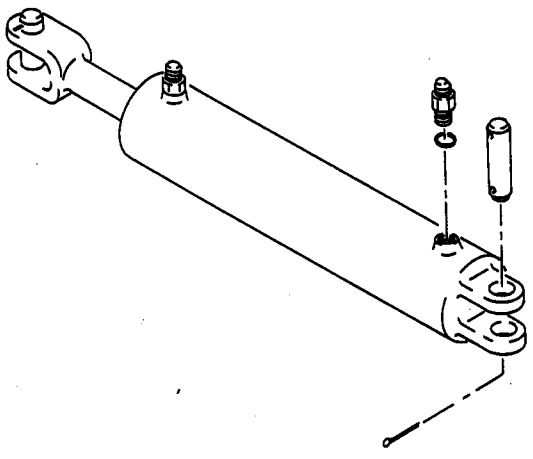
FIGURE 2 HOW TO USE PARTS CATALOG

FIGURE 3 HOW TO ORDER PARTS









THIS **PARTS CHAPTER** IS DESIGNED AS:

SECTION 1 THE MARKLIFT PARTS CATALOG

FIGURE 1 TABLE OF CONTENTS (PARTS ONLY)
FIGURE 2 HOW TO USE PARTS CATALOG
FIGURE 3 HOW TO ORDER PARTS

SECTION 2 FINAL ASSEMBLIES

FIGURE 1 FINAL ASSEMBLY (45KBDF)
FIGURE 2 FINAL ASSEMBLY (45KB)
FIGURE 3 GROUND CONTROL PANEL ASSEMBLY (45KBDF)
FIGURE 4 GROUND CONTROL PANEL ASSEMBLY (45KB)
FIGURE 5 HYDRAULIC HOSE INSTALLATION (45KBDF)
FIGURE 6 HYDRAULIC HOSE INSTALLATION (45KB)

SECTION 3 CARRIAGE ASSEMBLIES

FIGURE 1 CARRIAGE ASSEMBLY (45KBDF)
FIGURE 2 CARRIAGE ASSEMBLY (45KB)
FIGURE 3 LEFT HAND SPINDLE AND YOKE ASSEMBLY
FIGURE 4 RIGHT HAND SPINDLE AND YOKE ASSEMBLY
FIGURE 5 HUB ASSEMBLY
FIGURE 6 WHEEL ASSEMBLY
FIGURE 7 STEERING CYLINDER ASSEMBLY
FIGURE 8 STEERING TIE ROD ASSEMBLY
FIGURE 9 DRIVE MOTOR (45KBDF)
FIGURE 10 FRONT AXLE WHEEL ASSEMBLY (45KBDF)
FIGURE 11 SERIES PARALLEL VALVE ASSEMBLY (45KBDF)
FIGURE 12 DRIVE/BRAKE MOTOR ASSEMBLY (45KB)
FIGURE 13 DRIVE MOTOR ASSEMBLY (45KB)
FIGURE 14 BRAKE RELEASE VALVE ASSEMBLY (45KB)

SECTION 4 TURRET ASSEMBLIES

FIGURE 1 TURRET ASSEMBLY (45KBDF)
FIGURE 2 TURRET ASSEMBLY (45KB)
FIGURE 3 MASTER LEVELING CYLINDER ASSEMBLY
FIGURE 4 BOOM/RISER LIFT CYLINDER ASSEMBLY
FIGURE 5 ROTATION GEARBOX/BRACKET ASSEMBLY
FIGURE 6 HYDRAULIC TANK ASSEMBLY (45KBDF)
FIGURE 7 HYDRAULIC TANK ASSEMBLY (45KB)
FIGURE 8 REGENERATIVE VALVE ASSEMBLY
FIGURE 9 FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KBDF)
FIGURE 10 FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KB)
FIGURE 11 EMERGENCY PUMP ASSEMBLY
FIGURE 12 UPPER RIGHT RISER ARM ASSEMBLY
FIGURE 13 UPPER LEFT RISER ARM ASSEMBLY
FIGURE 14 LOWER RISER ARM ASSEMBLY
FIGURE 15 ENGINE AND PUMP ASSEMBLY (45KBDF)
FIGURE 16 SHIFT CYLINDER ASSEMBLY (45KBDF)
FIGURE 17 MOTOR/PUMP ASSEMBLY (45KB) *
FIGURE 18 BATTERY CHARGER ASSEMBLY (45KB)
FIGURE 19 14 INCH FAN ASSEMBLY (45KBDF)
FIGURE 20 HYDRAULIC MOTOR ASSEMBLY
FIGURE 21 DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KBDF)
FIGURE 22 DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KB)

SECTION 5 BOOM ASSEMBLIES

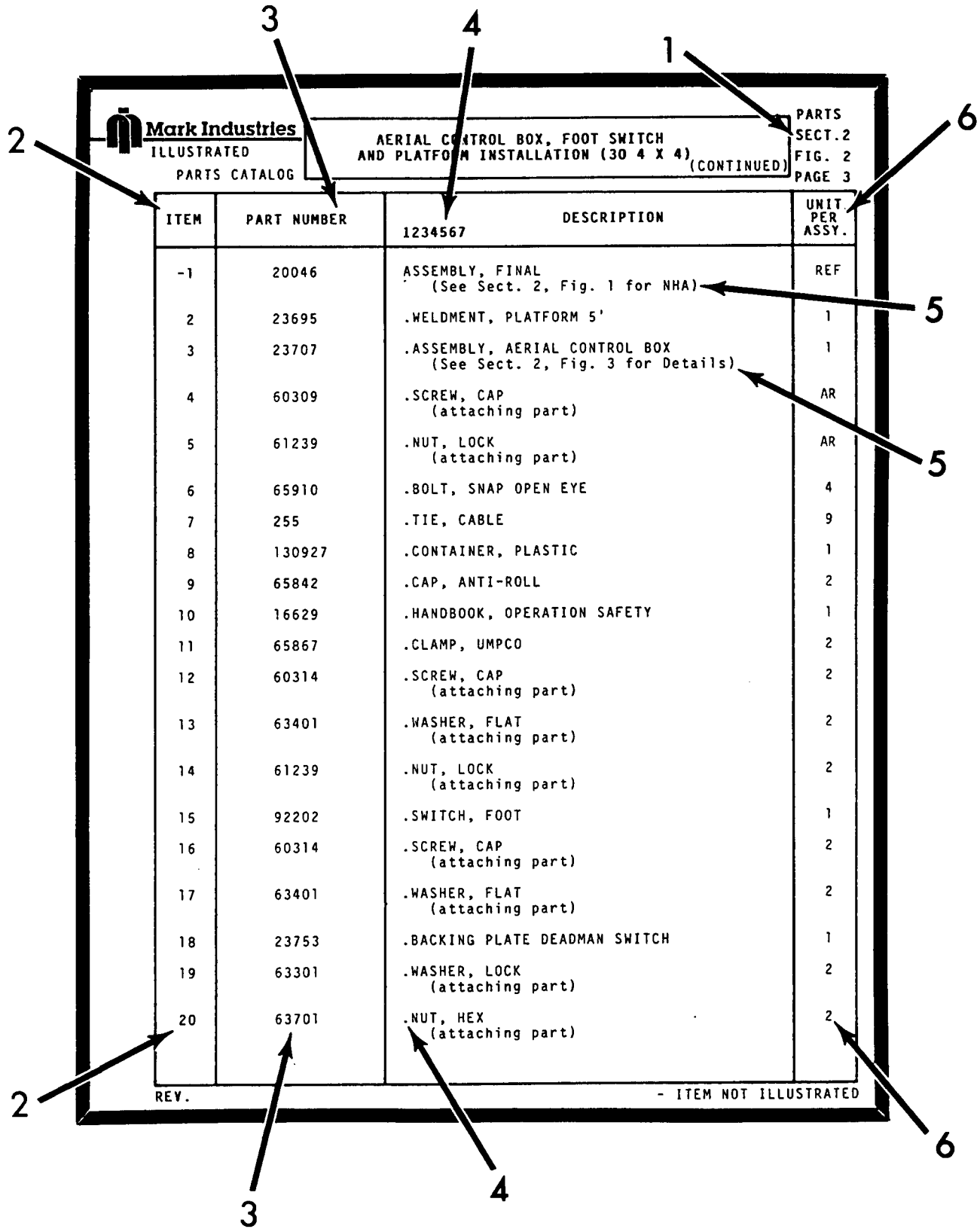
FIGURE 1 FINAL BOOM ASSEMBLY
FIGURE 2 INNER BOOM SUB-ASSEMBLY
FIGURE 3 EXTENSION CYLINDER ASSEMBLY
FIGURE 4 SLAVE CYLINDER SUB-ASSEMBLY

SECTION 6 PLATFORM ASSEMBLIES

FIGURE 1 PLATFORM ASSEMBLY (45KBDF)
FIGURE 2 PLATFORM ASSEMBLY (45KB)
FIGURE 3A AERIAL CONTROL BOX ASSEMBLY (45KBDF) (BEF. MAR. '88)
FIGURE 3B AERIAL CONTROL BOX ASSEMBLY (45KBDF) (AFT. MAR. '88)
FIGURE 4A AERIAL CONTROL BOX ASSEMBLY (45KB) (BEF. MAR. '88)
FIGURE 4B AERIAL CONTROL BOX ASSEMBLY (45KB) (AFT. MAR. '88)

SECTION 7 OPTIONAL ASSEMBLIES *

*** DRAWINGS NOT AVAILABLE THIS REVISION**



Mark Industries
ILLUSTRATED
PARTS CATALOG

AERIAL CONTROL BOX, FOOT SWITCH AND PLATFORM INSTALLATION (30 4 X 4) (CONTINUED)

PARTS SECT. 2 FIG. 2 PAGE 3

ITEM	PART NUMBER	1234567 DESCRIPTION	UNIT PER ASSY.
-1	20046	ASSEMBLY, FINAL (See Sect. 2, Fig. 1 for NHA)	REF
2	23695	.WELDMENT, PLATFORM 5'	1
3	23707	.ASSEMBLY, AERIAL CONTROL BOX (See Sect. 2, Fig. 3 for Details)	1
4	60309	.SCREW, CAP (attaching part)	AR
5	61239	.NUT, LOCK (attaching part)	AR
6	65910	.BOLT, SNAP OPEN EYE	4
7	255	.TIE, CABLE	9
8	130927	.CONTAINER, PLASTIC	1
9	65842	.CAP, ANTI-ROLL	2
10	16629	.HANDBOOK, OPERATION SAFETY	1
11	65867	.CLAMP, UMPCO	2
12	60314	.SCREW, CAP (attaching part)	2
13	63401	.WASHER, FLAT (attaching part)	2
14	61239	.NUT, LOCK (attaching part)	2
15	92202	.SWITCH, FOOT	1
16	60314	.SCREW, CAP (attaching part)	2
17	63401	.WASHER, FLAT (attaching part)	2
18	23753	.BACKING PLATE DEADMAN SWITCH	1
19	63301	.WASHER, LOCK (attaching part)	2
20	63701	.NUT, HEX (attaching part)	2

REV. - ITEM NOT ILLUSTRATED

1. This area refers to the corresponding illustration.

   1) **Chapter** should be divided with General, Operation, Maintenance, Schematics, Parts, Vendor and Service Bulletins.

   2) **Section and Figure** belong to Parts Chapter only. Please check page of contents and each Section in Parts Chapter.

   3) Page numbers are followed for chapter or section, and figure.

2. The **Item Number** corresponds to the item number shown for the part in the illustration. (Parts with item numbers preceded by a dash are not illustrated such as -1, -5, etc.)

3. **Parts** that carry a **Mark Industries** part number.

4. The **Indenture System** used in the detail parts list of this catalog shows the relationship of one part to another. For a given item, the number of indentures depicts the relationship of the item to the associated installation, next higher assembly, or components of the item as follows:

   1 2 3 4 5 6 7

   Installation
   . Detail parts for installation
   . Assembly
   . Attaching parts for Assembly
   . . Detail parts for Assembly
   . . Sub-Assembly
   . . Attaching parts for Sub-Assembly
   . . . Detail parts for Sub-Assembly
   . . . Sub-Sub-Assembly
   . . . Attaching parts for Sub-Sub-Assembly
   . . . . Detail parts for Sub-Sub-Assembly
   . . . . Sub-Sub-Sub-Assembly

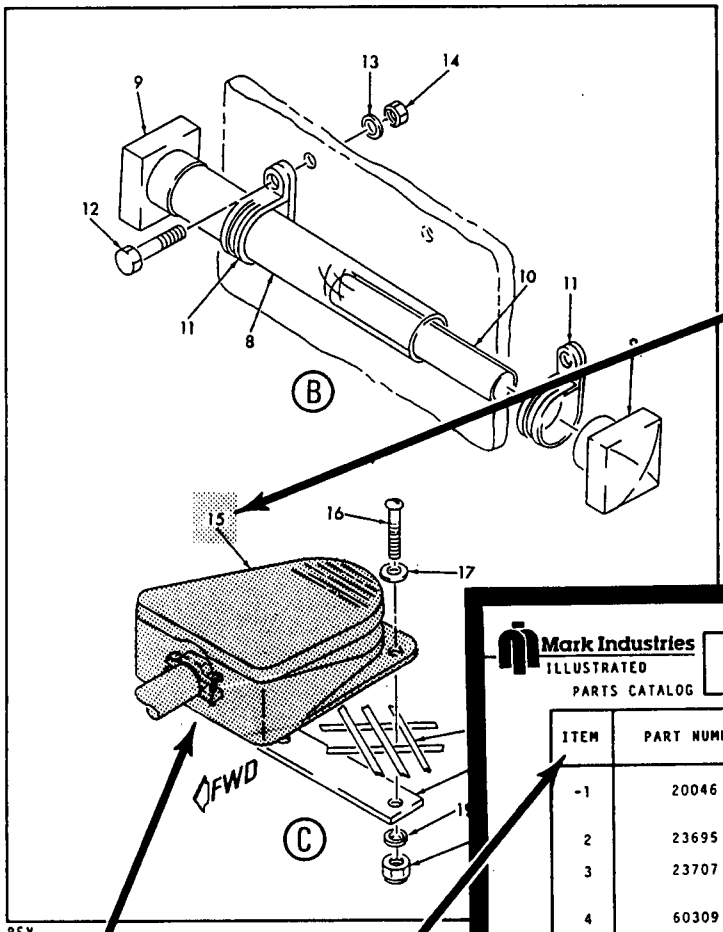
5. **NHA** (Next Higher Assembly) and **DETAILS** - Section and Figure reference catalog location indicates where the installation or assembly is listed under NHA and where illustrated for more detailed breakdown.

6. **UNIT PER ASSEMBLY** - Entries are as follows:

   1) **"REF"** indicates the item is listed previously in the NHA and then again in this figure.

   2) **"AR"** indicates the part is used in a quantity "As Required."

   3) **A number** entry indicates the quantity of the part used in its next higher application.



REV.

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	20046	ASSEMBLY, FINAL (See Sect. 2, Fig. 1 for NHA)	REF
2	23695	.WELDMENT, PLATFORM 5'	1
3	23707	.ASSEMBLY, AERIAL CONTROL BOX (See Sect. 2, Fig. 3 for Details)	1
4	60309	.SCREW, CAP (attaching part)	AR
5	61239	.NUT, LOCK (attaching part)	AR
6	65910	.BOLT, SNAP OPEN EYE	4
7	255	.TIE, CABLE	9
8	130927	.CONTAINER, PLASTIC	1
9	65842	.CAP, ANTI-ROLL	2
10	16629	.HANDBOOK, OPERATION SAFETY	1
11	65867	.CLAMP, UMPCO	2
12	60314	.SCREW, CAP (attaching part)	2
13	63401	.WASHER, FLAT (attaching part)	2
14	61239	.NUT, LOCK (attaching part)	2
15	92202	.SWITCH, FOOT	1
[illegible]	60314	.SCREW, CAP (attaching part)	2
17	63401	.WASHER, FLAT (attaching part)	2
18	23753	.BACKING PLATE DEADMAN SWITCH	1
19	63301	.WASHER, LOCK (attaching part)	2
20	63701	.NUT, HEX (attaching part)	2

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- ITEM NOT ILLUSTRATED

1. **PART NUMBER**

   STEP 1. Locate Section and Figure number within the table of contents and each Section page.

   STEP 2. Match your required part with the illustration page.

   STEP 3. Refer to the item number on the detail part list page.

   STEP 4. Part number is located in the part number column. Order by using that part number.

2. **TO ORDER:**

   BY FAX: (213) 604-9760

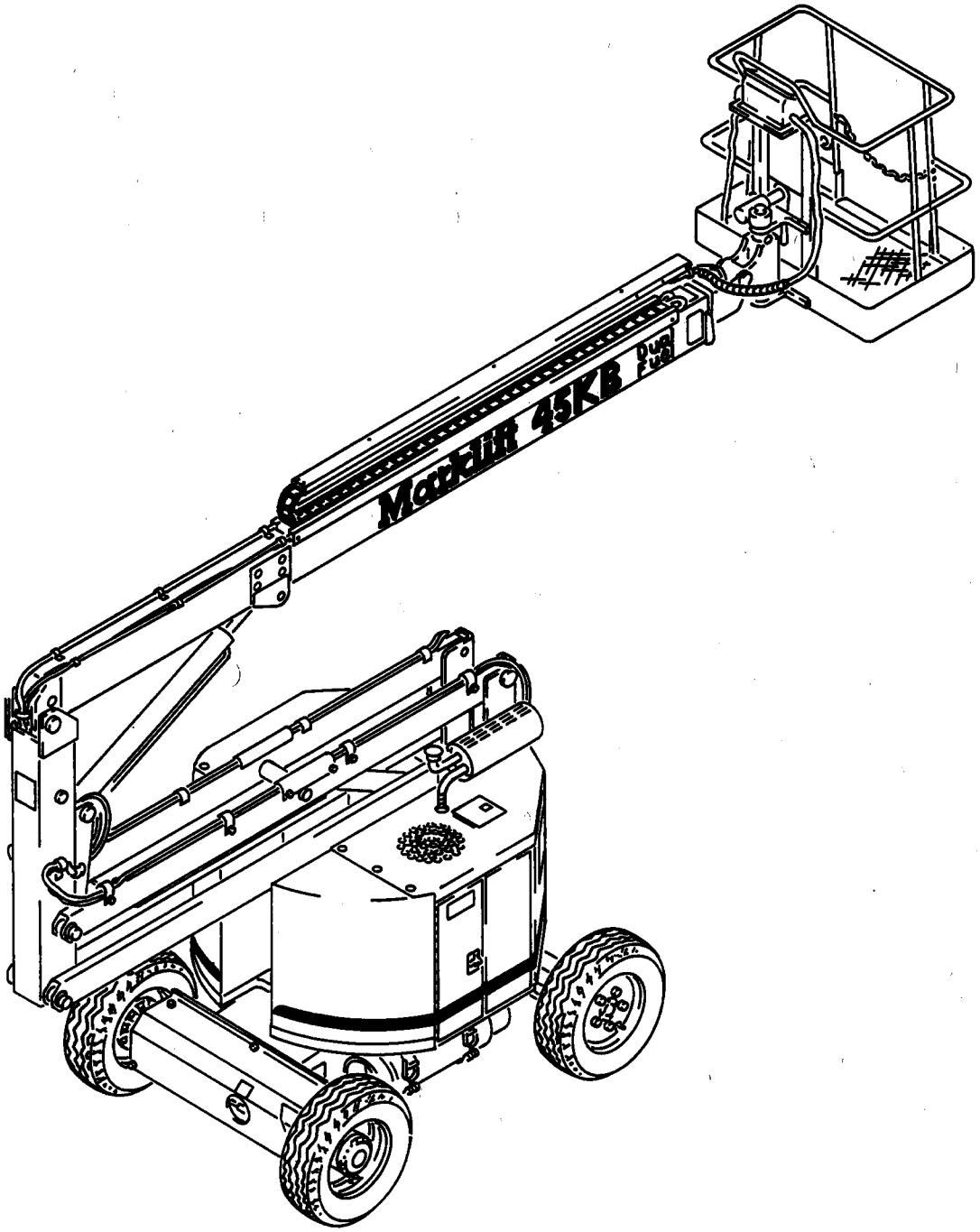
   BY PHONE: Parts Department
   (213) 639-9700

   BY MAIL: Attention Parts Department

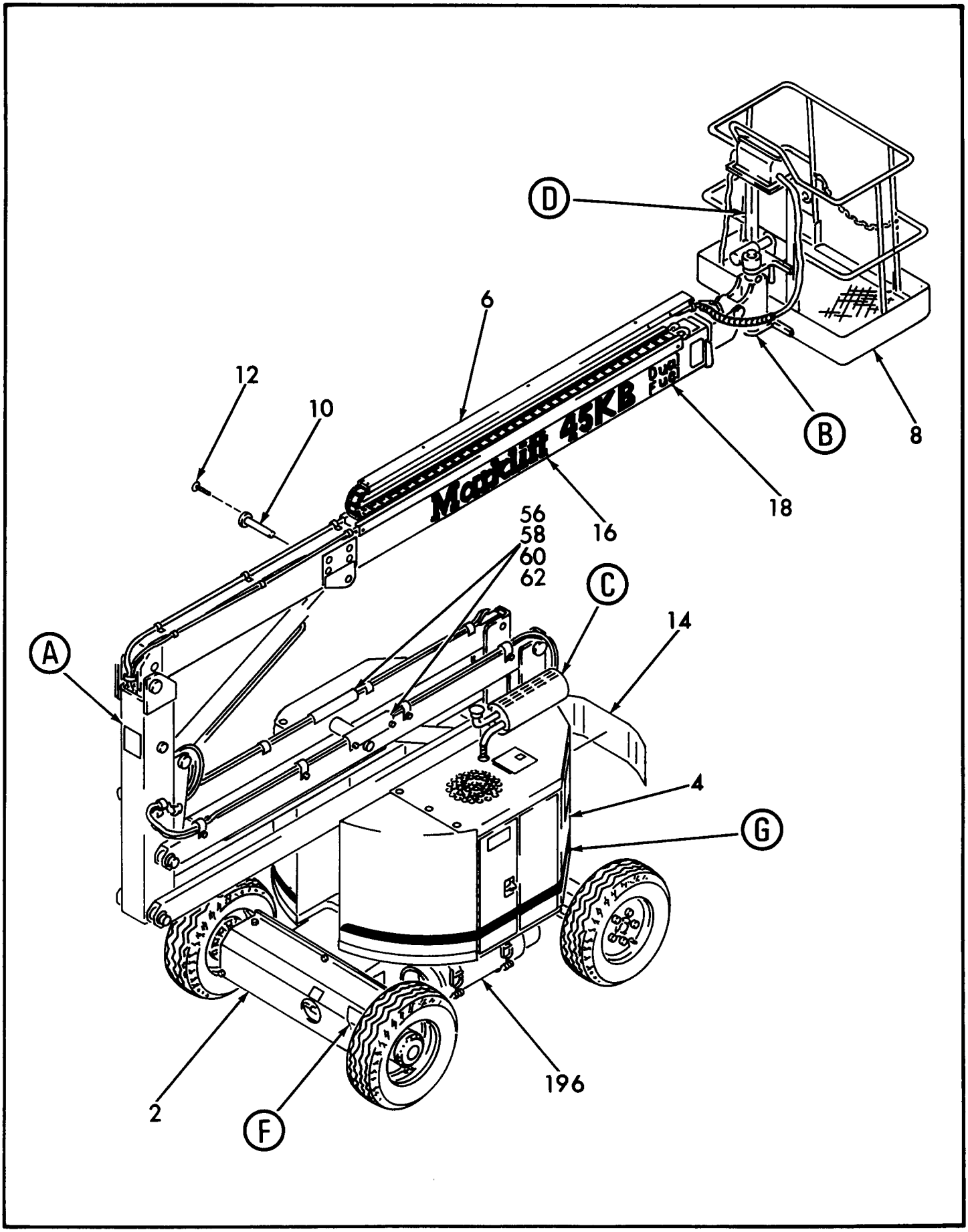
   MARK INDUSTRIES
   Post Office Box 720
   Long Beach, Calif. 90801

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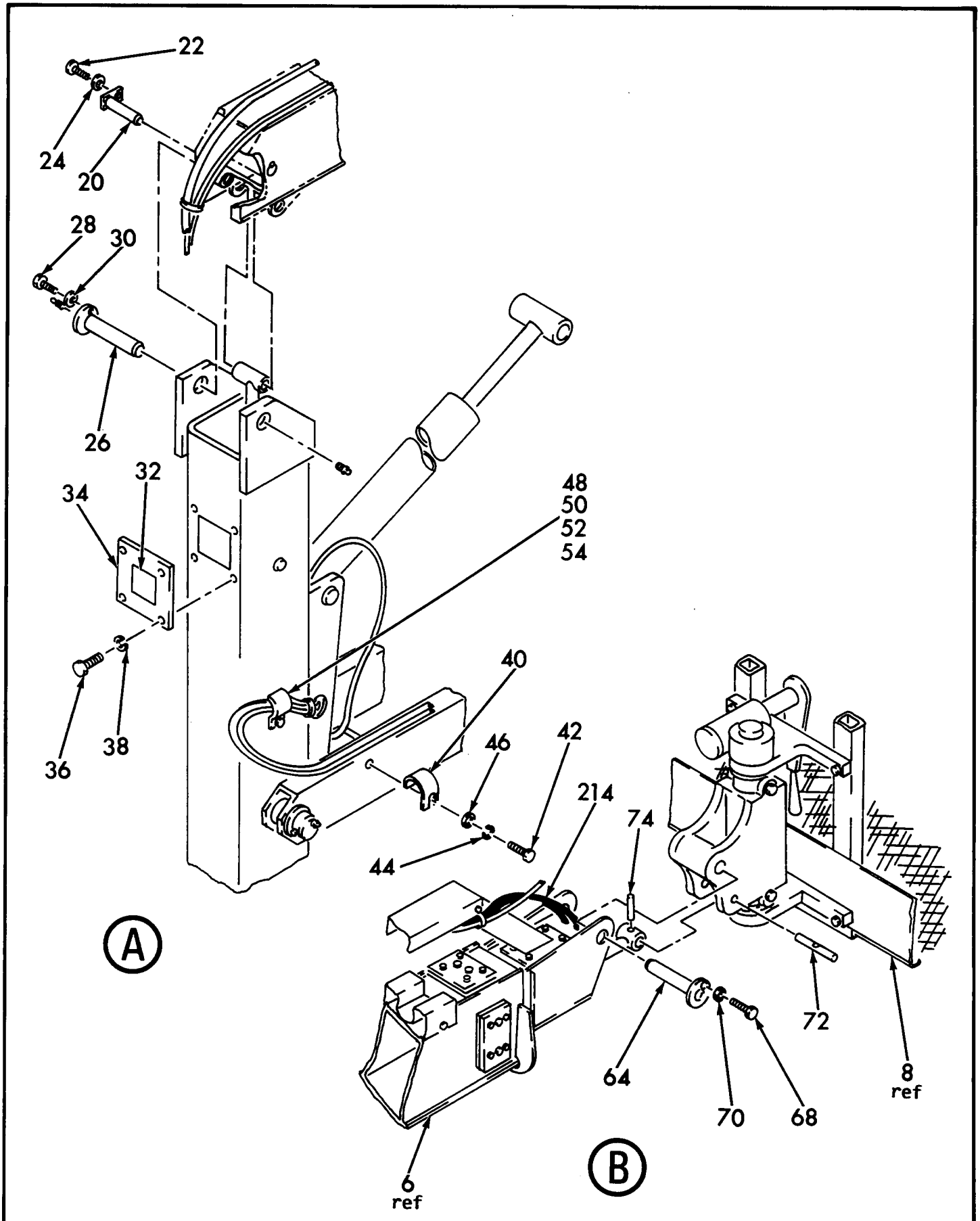
FIGURE	**1**	FINAL ASSEMBLY (45KBDF)
FIGURE	**2**	FINAL ASSEMBLY (45KB)
FIGURE	**3**	GROUND CONTROL PANEL ASSEMBLY (45KBDF)
FIGURE	**4**	GROUND CONTROL PANEL ASSEMBLY (45KB)
FIGURE	**5**	HYDRAULIC HOSE INSTALLATION (45KBDF)
FIGURE	**6**	HYDRAULIC HOSE INSTALLATION (45KB)

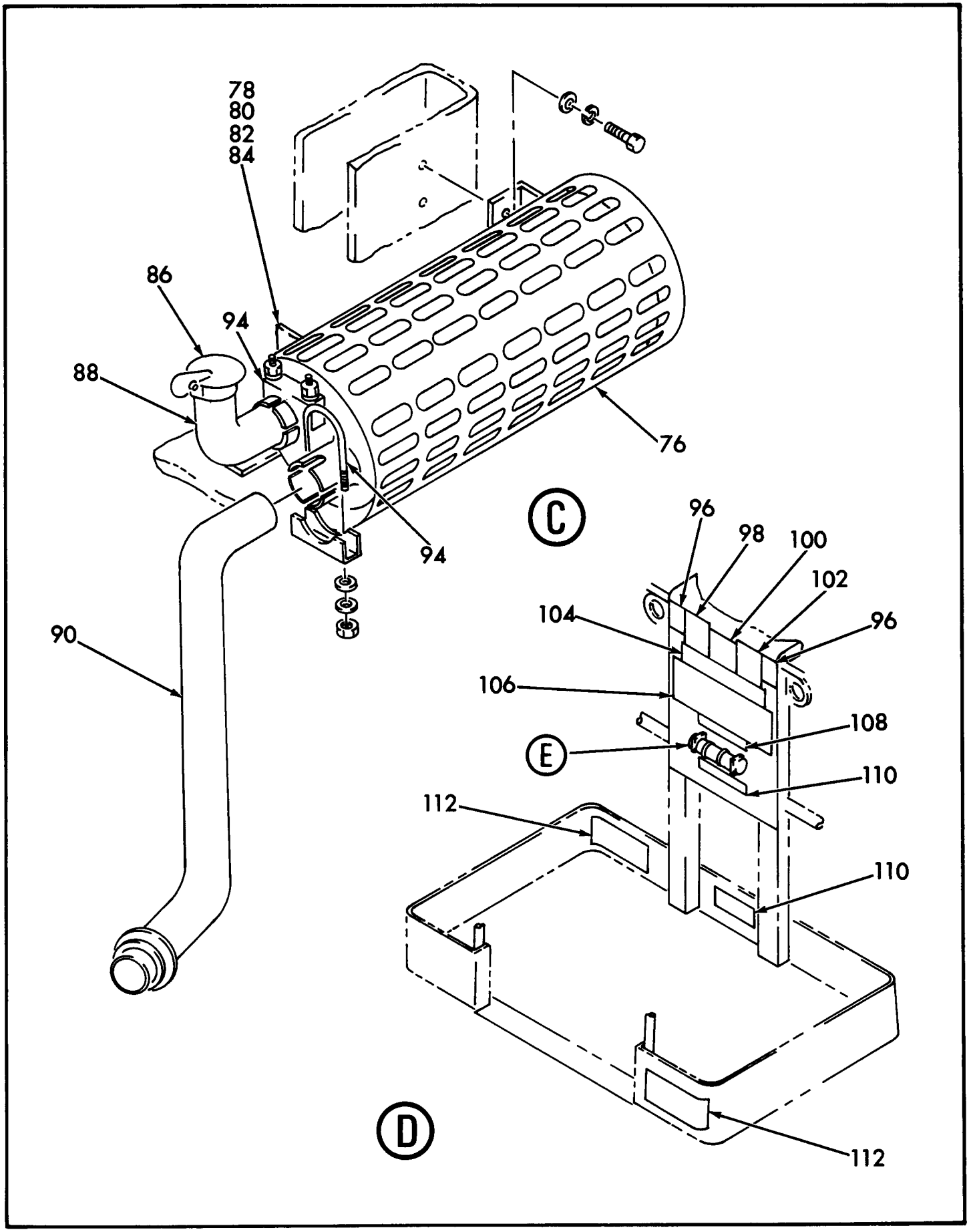


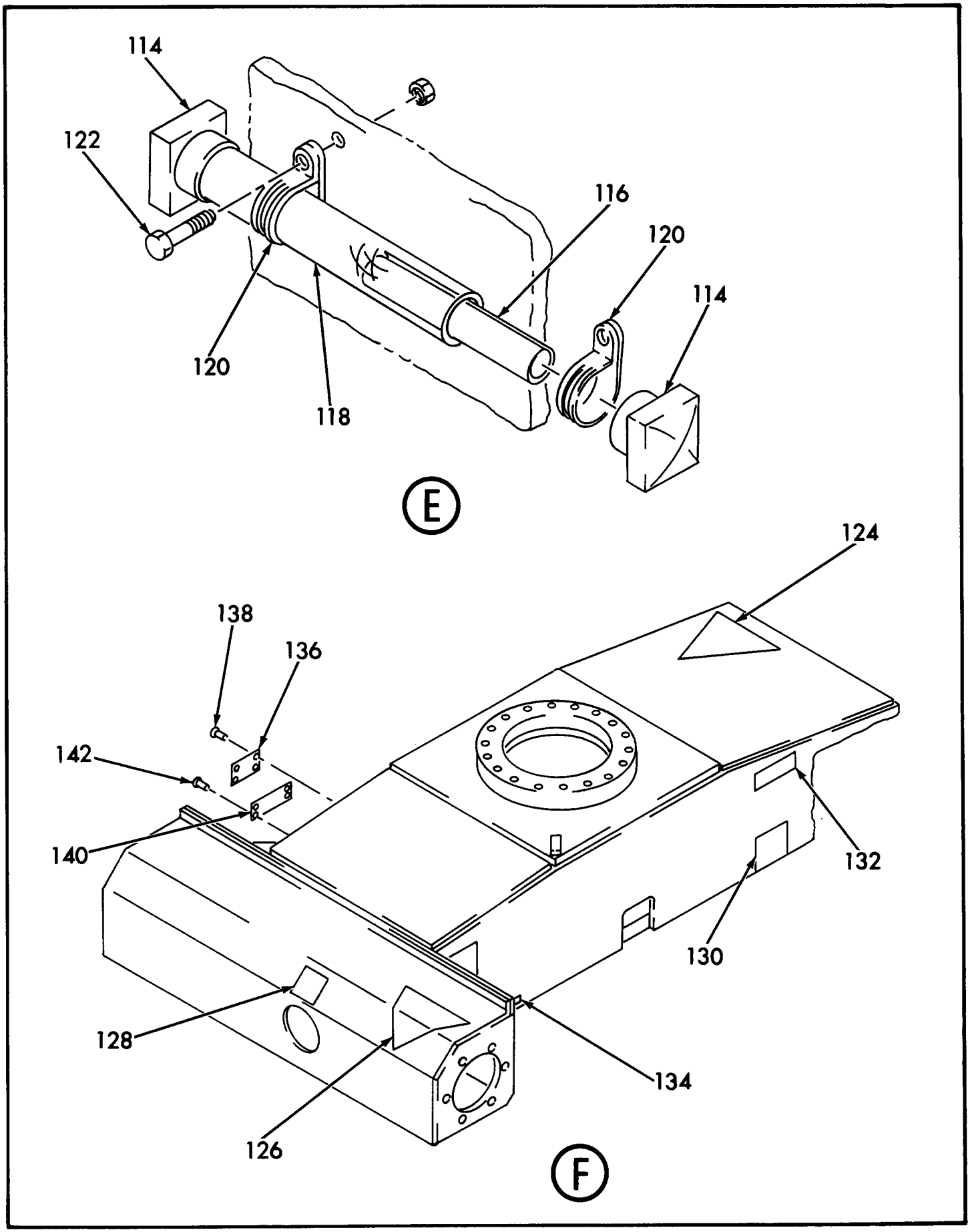
FINAL ASSEMBLY (45 KBDF)

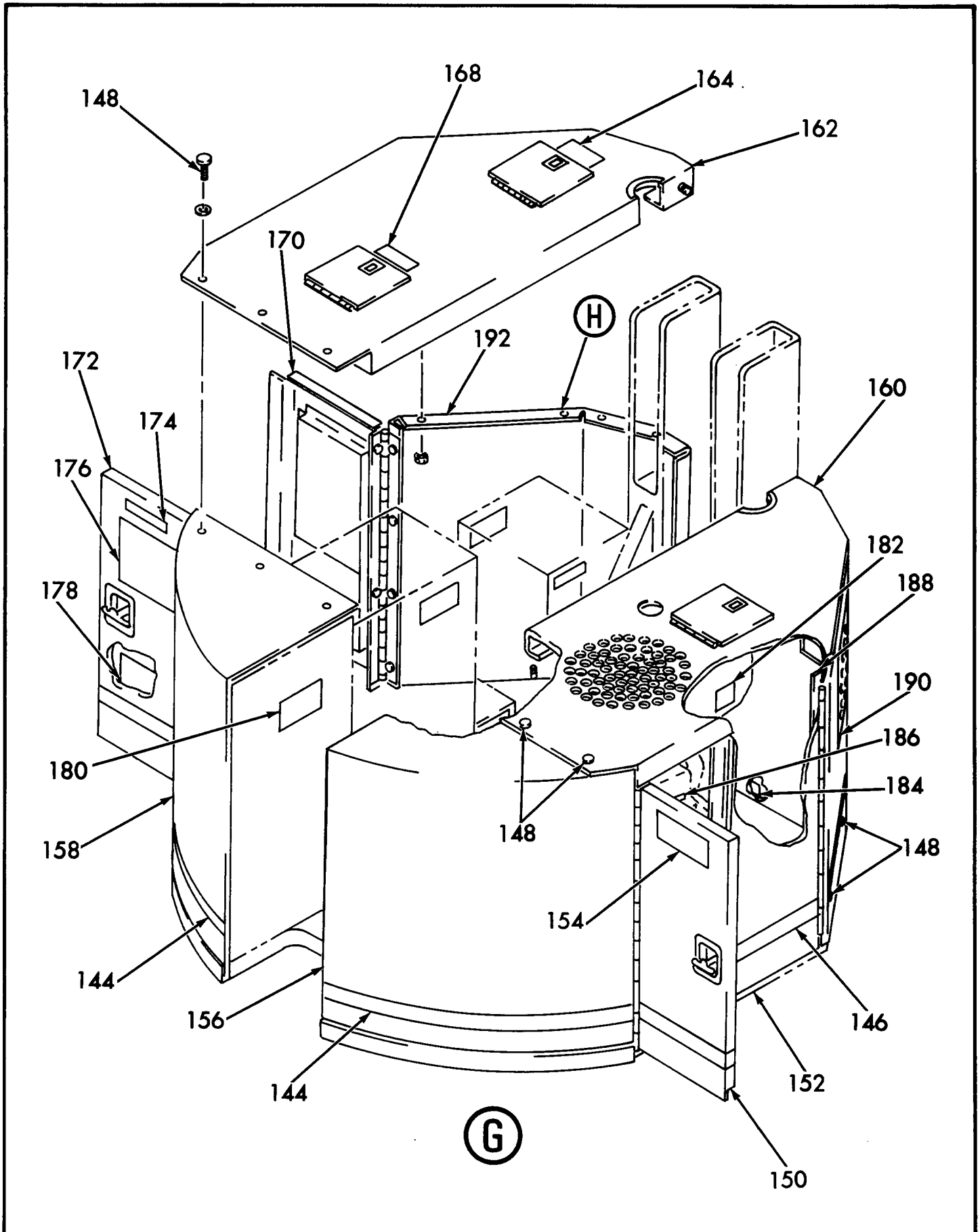


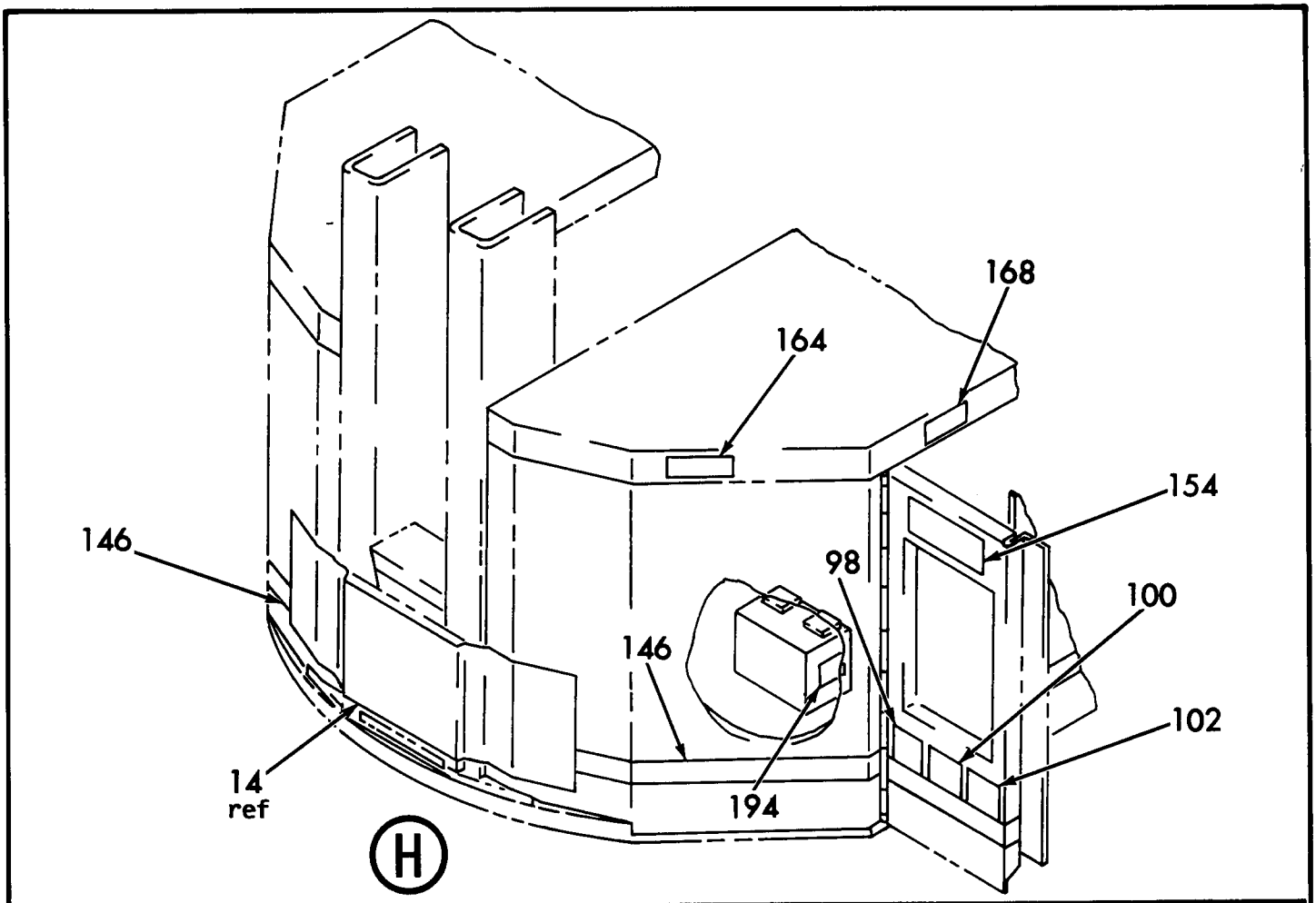
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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140000	ASSEMBLY, MARKLIFT 45KBDF FINAL	REF
2	140026	.ASSEMBLY, CARRIAGE (See Sect. 3, Fig. 1 for Details)	1
4	140149	.ASSEMBLY, TURRET (See Sect. 4, Fig. 1 for Details)	1
6	140122	.ASSEMBLY, BOOM (See Sect. 5, Fig. 1 for Details)	1
8	140164	.ASSEMBLY, PLATFORM (See Sect. 6, Fig. 1 for Details)	1
10	140428	.PIN, BOOM LIFT	1
12	61813	.SCREW, CAP (attaching part)	1
14	20409	.DECAL, STANDARD PEDESTAL	1
16	140419	.DECAL, MARKLIFT 45KB	2
18	140420	.DECAL, DUAL FUEL	2

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
20	140431	.PIN, MASTER CYLINDER/BOOM	1
22	60539	.SCREW, CAP (attaching part)	1
24	63303	.WASHER, LOCK (attaching part)	1
26	140425	.PIN, BOOM PIVOT	1
28	60539	.SCREW, CAP (attaching part)	1
30	63303	.WASHER, LOCK (attaching part)	1
32	20410	.DECAL, LOGO	1
34	140549	.PLATE, RISER COVER	1
36	60353	.SCREW, CAP (attaching part)	4
38	63301	.WASHER, LOCK (attaching part)	4
40	140602	.ASSEMBLY, ARM CABLE CLAMP	8
42	60324	.SCREW, CAP (attaching part)	8
44	63302	.WASHER, LOCK (attaching part)	8
46	63402	.WASHER, FLAT (attaching part)	8
48	140612	.ASSEMBLY, ARM CABLE CLAMP	4
50	60324	.SCREW, CAP (attaching part)	4
52	63302	.WASHER, LOCK (attaching part)	4
54	63402	.WASHER, FLAT (attaching part)	4
56	140612	.GUARD, ARM CABLE	2
58	60324	.SCREW, CAP (attaching part)	4
60	63302	.WASHER, LOCK (attaching part)	4
62	63402	.WASHER, FLAT (attaching part)	4

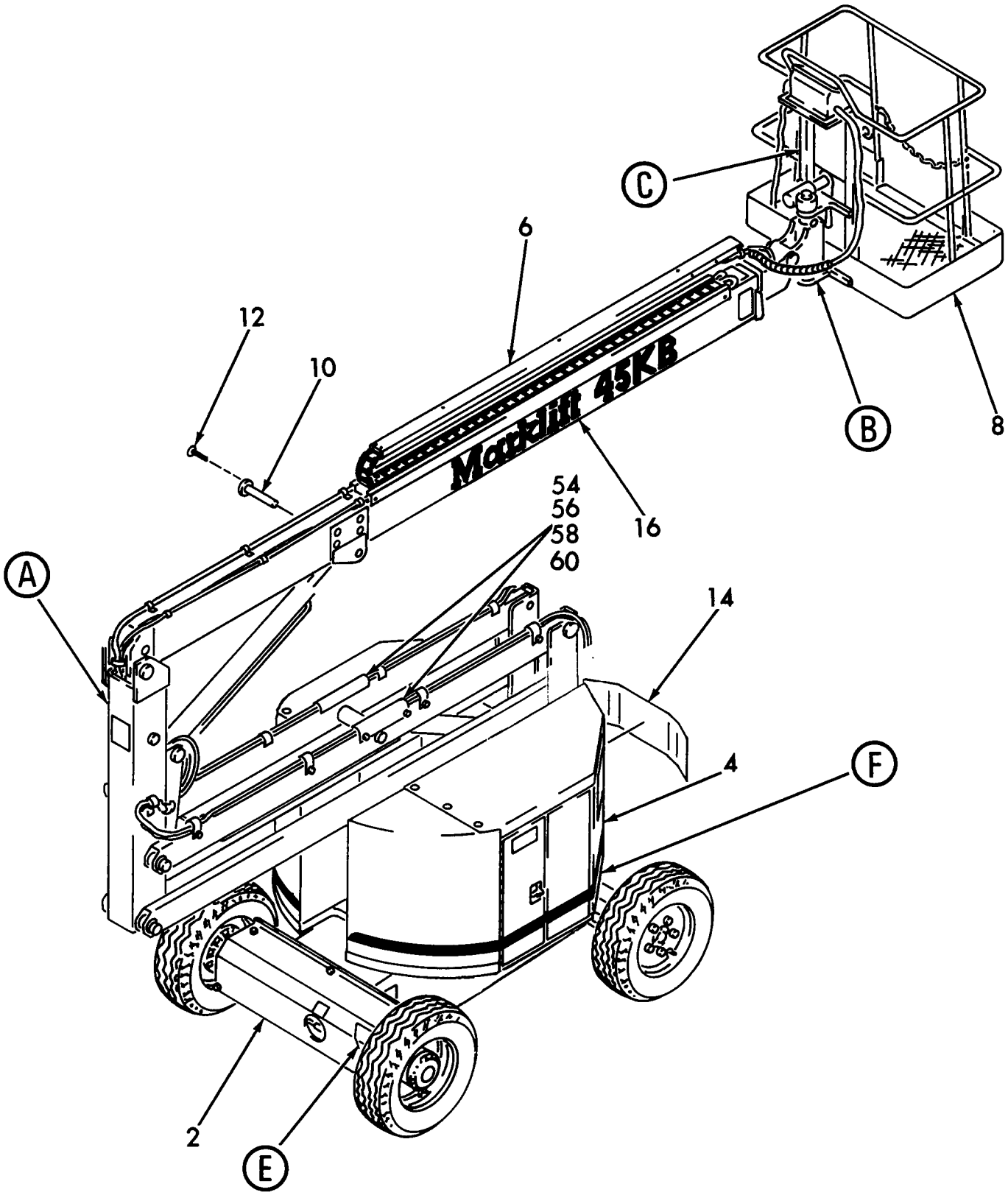
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
64	140436	.PIN, ROTATOR	1
68	60539	.SCREW, CAP (attaching part)	1
70	63303	.WASHER, LOCK (attaching part)	1
72	140437	.PIN, SLAVE CYLINDER/ROTATOR	1
74	64213	.PIN, ROLL	1
76	65751	.MUFFLER	1
78	140381	.BRACKET, MUFFLER	1
80	61921	.SCREW, BUTTON HEAD (attaching part)	2
82	63301	.WASHER, LOCK (attaching part)	2
84	60701	.NUT, HEX (attaching part)	2
86	21288	.CAP, MUFFLER RAIN	1
88	23546	.ELBOW, EXHAUST	1
90	140624	.WELDMENT, EXHAUST TUBE	1
-92	20835	.ASSEMBLY, FLEX EXHAUST (Deleted by Item #45)	1
94	16230	.CLAMP, MUFFLER	2
96	22386	.DECAL, D RING ATTACH SAFETY BELT	2
98	181103	.DECAL, CAUTION	2
100	181102	.DECAL, DANGER	2
102	181103	.DECAL, DANGER	2
104	22385	.DECAL, CAUTION	1
106	182101	.DECAL, CAUTION	1
108	130820	.DECAL, OPERATION & SAFETY HANDBOOK	1

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
110	2022	.DECAL, LOAD	2
112	11064	.DECAL, CHAIN	2
114	65842	.CAP, ANTI-ROLL	2
116	17407	.HANDBOOK, OPERATION AND SAFETY	1
118	130927	.CONTAINER, PLASTIC	1
120	65867	.CLAMP	2
122	61711	.SCREW, CAP (attaching part)	2
124	20461	.DECAL, FORWARD	1
126	20462	.DECAL, FORWARD	1
128	20896	.DECAL, BRAKE	1
130	140595	.DECAL, TIEDOWN	2
132	23558	.DECAL, LIQUID TANK ONLY	1
134	20420	.DECAL, TIRE PRESSURE	2
136	20660	.PLATE, IDENTIFICATION	1
138	63653	.RIVET, POP (attaching part)	4
140	20661	.PLATE, ANSI A92	1
142	63653	.RIVET, POP (attaching part)	4
144	20412	.DECAL, BLUE STRIP	2
146	20411	.DECAL, BLUE STRIP	4
148	61921	.SCREW, BUTTON HEAD	32
150	140569	.DOOR, LEFT LATCHING	1
152	140570	.DOOR, LEFT	1

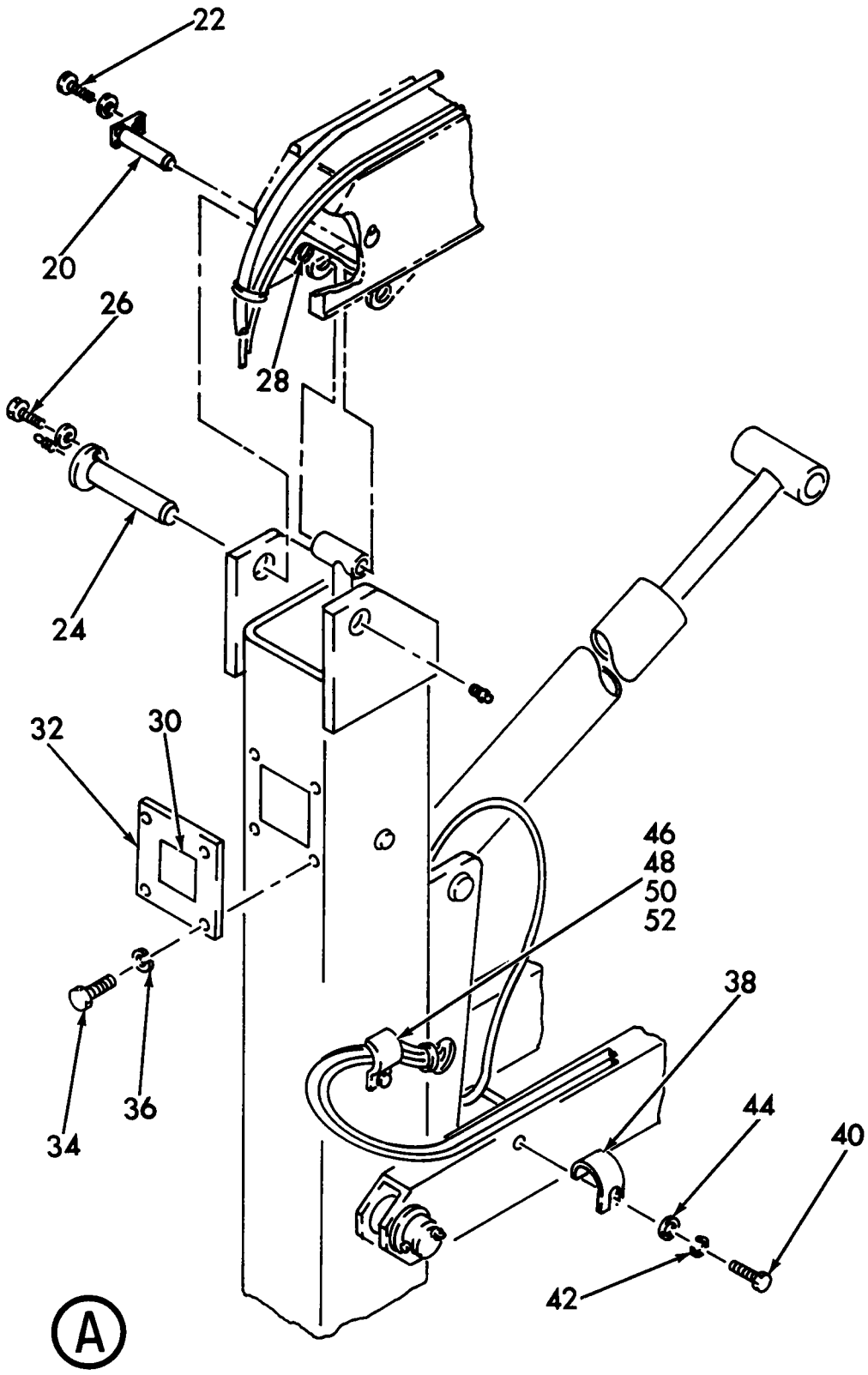
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
154	20419	.DECAL, DANGER KEEP CLEAR	2
156	140565	.COVER, LEFT FRONT	1
158	140566	.COVER, RIGHT FRONT	1
160	140562	.COVER, LEFT TOP	1
162	140563	.COVER, RIGHT TOP	1
164	2020	.DECAL, GAS OR PETROLEUM	2
168	2017	.DECAL, HYDRAULIC SYSTEM	2
170	140287	.ASSEMBLY, LOWER CONTROL PANEL (See Sect. 2, Fig. 3 for Details)	1
172	140564	.DOOR, RIGHT LATCHING	1
174	140496	.DECAL, EMERGENCY HAND PUMP	1
176	182701	.DECAL, GENERAL CHECKOUT	1
178	140495	.DECAL, EMERGENCY PUMP OPERATION	1
180	183301	.DECAL, WARNING	2
182	140551	.DECAL, FAN	1
184	140552	.DECAL, FAN FUSE	1
186	20879	.DECAL, DIPSTICK	1
188	140571	.BRACKET, RADIATOR	1
190	140567	.PANEL, LEFT REAR	1
192	140568	.PANEL, RIGHT REAR	1
194	2003	.DECAL, BATTERY WATER	1
196	65937	.TANK, PROPANE	1
-198	65135	.PROPANE (10 Gl.)	1

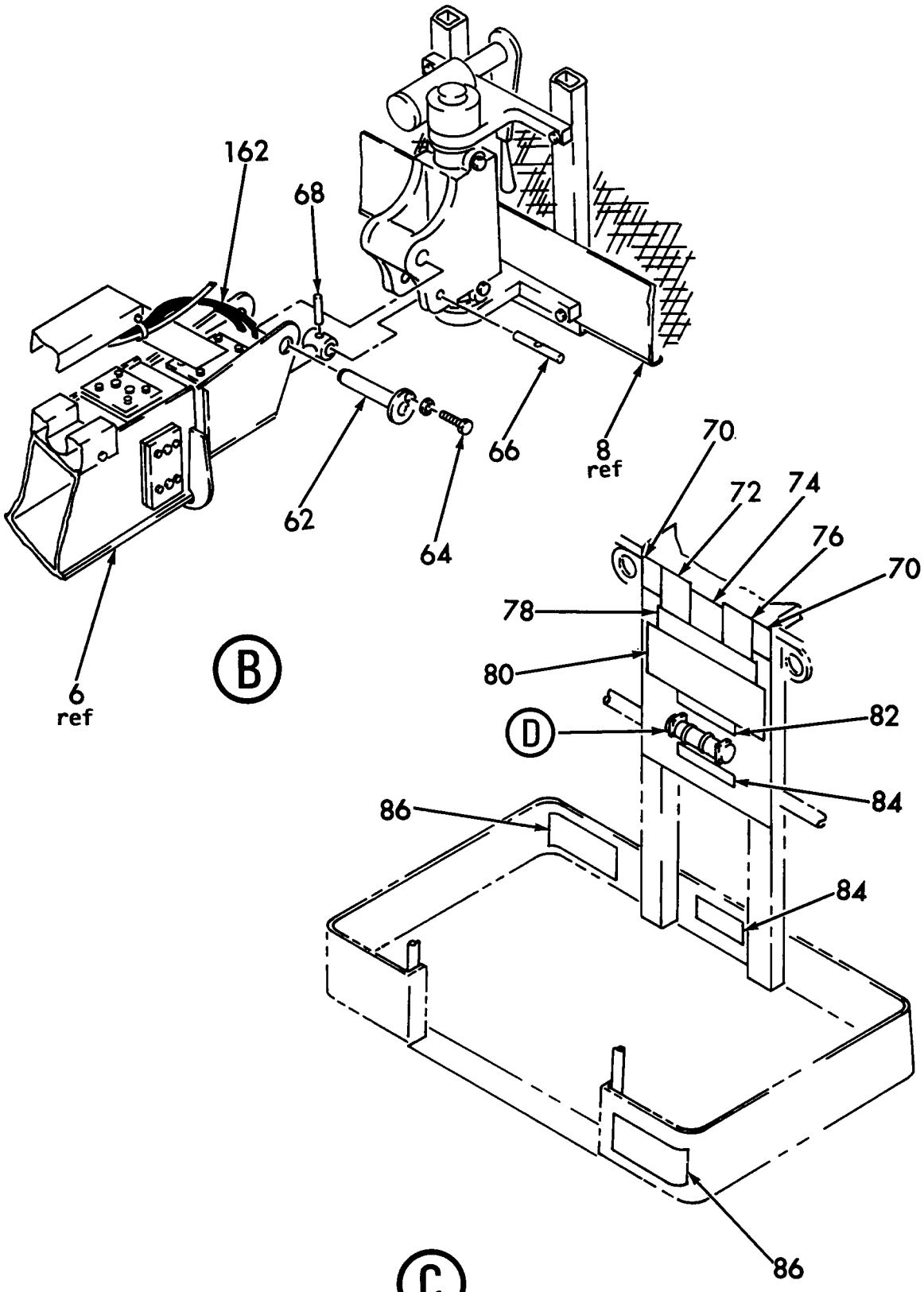
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-200	65114	.GASOLINE, REGULAR (2 Gl.)	AR
-202	2673	.PAINT, TOUCH-UP WHITE	1
-204	16609	.PAINT, WHITE (.5 Gl.)	AR
-206	16608	.PAINT, WHITE (3 Gl.)	AR
-208	65619	.ANIT-FREEZE, (.75 Gl.)	AR
-210	140500	.SCHEMATIC, ELECTRICAL (See Schematic Section for Details)	1
-212	140503	.SCHEMATIC, HYDRAULIC (See Schematic Section for Details)	1
214	140236	.DIAGRAM, HOSE KIT (See Sect. 2, Fig. 5 for Details)	1

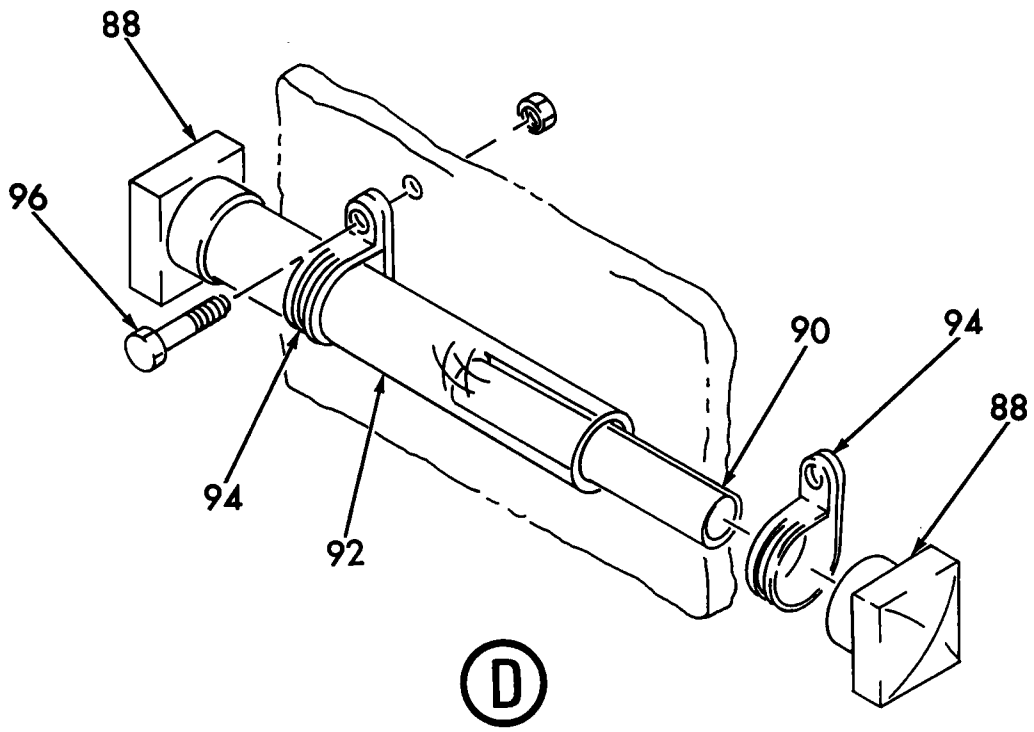
FINAL ASSEMBLY (45 KB)

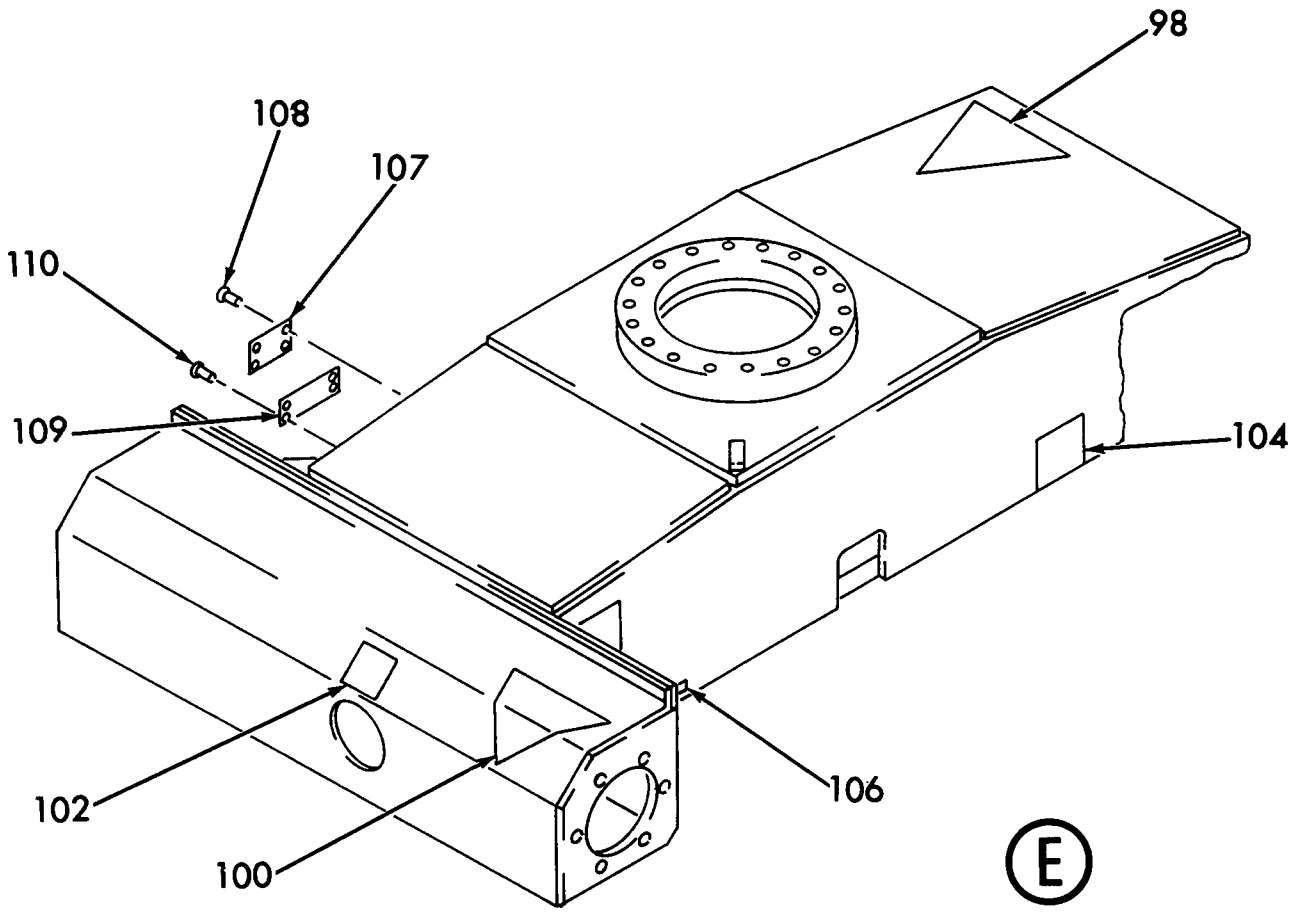


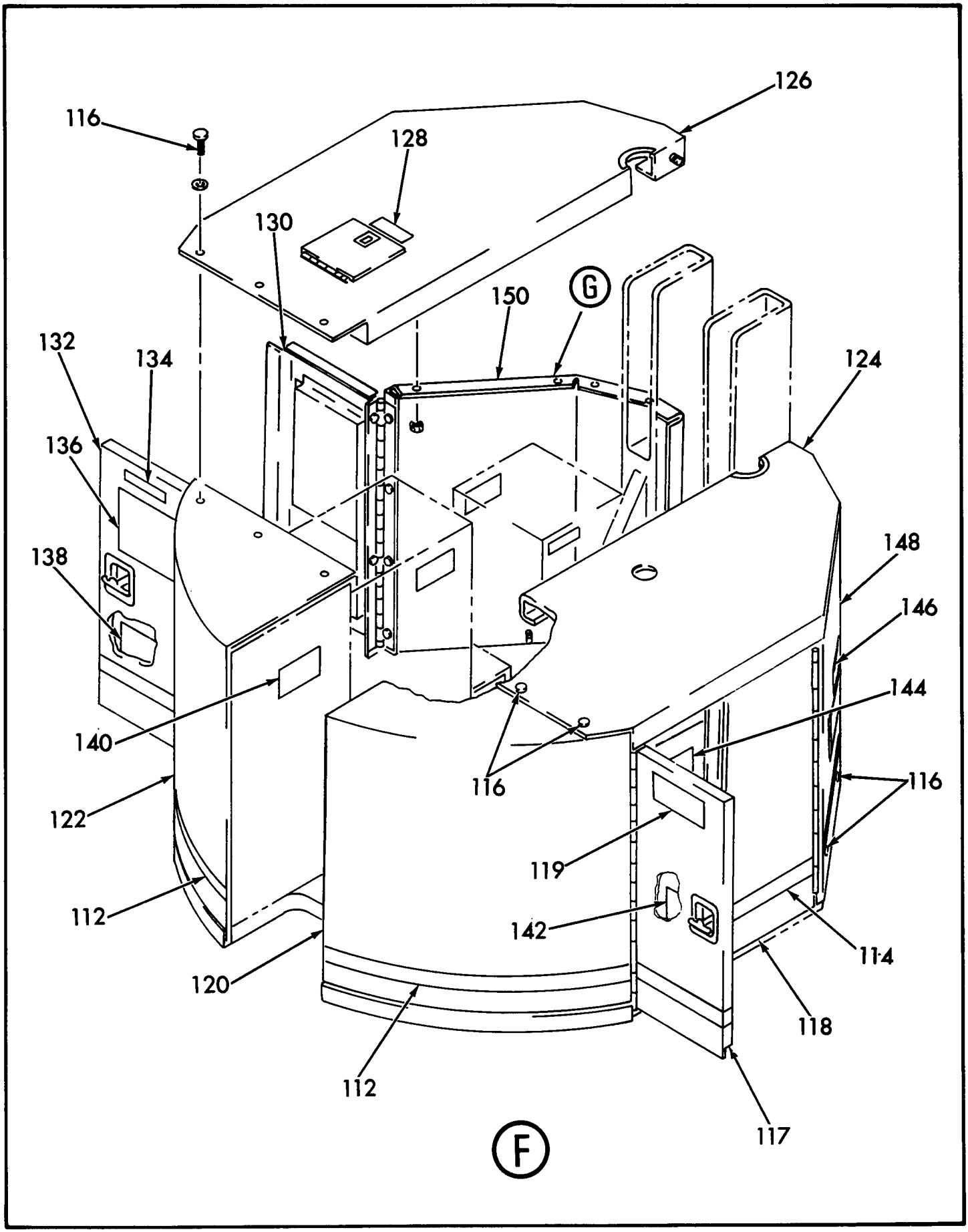
FINAL ASSEMBLY (45 KB)
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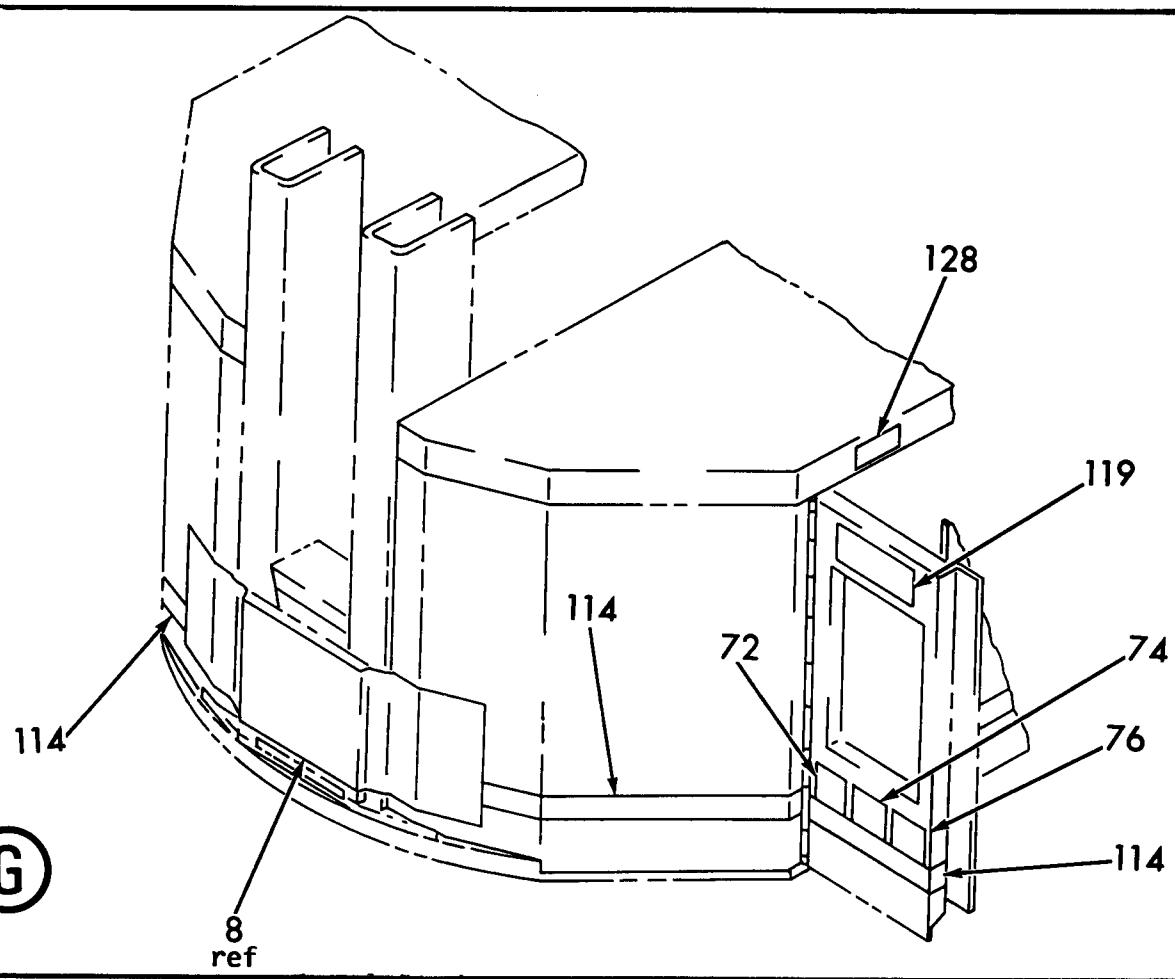



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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140002	ASSEMBLY, MARKLIFT 45KB FINAL	REF
2	140265	.ASSEMBLY, CARRIAGE (See Sect. 3, Fig. 2 for Details)	1
4	140309	.ASSEMBLY, TURRET (See Sect. 4, Fig. 2 for Details)	1
6	140122	.ASSEMBLY, BOOM (See Sect. 5, Fig. 1 for Details)	1
8	140306	.ASSEMBLY, PLATFORM (See Sect. 6, Fig. 2 for Details)	1
10	140428	.PIN, BOOM LIFT	1
12	61813	.SCREW, CAP (attaching part)	1
14	20409	.DECAL, STANDARD PEDESTAL	1
16	140419	.DECAL, MARKLIFT 45KB	2

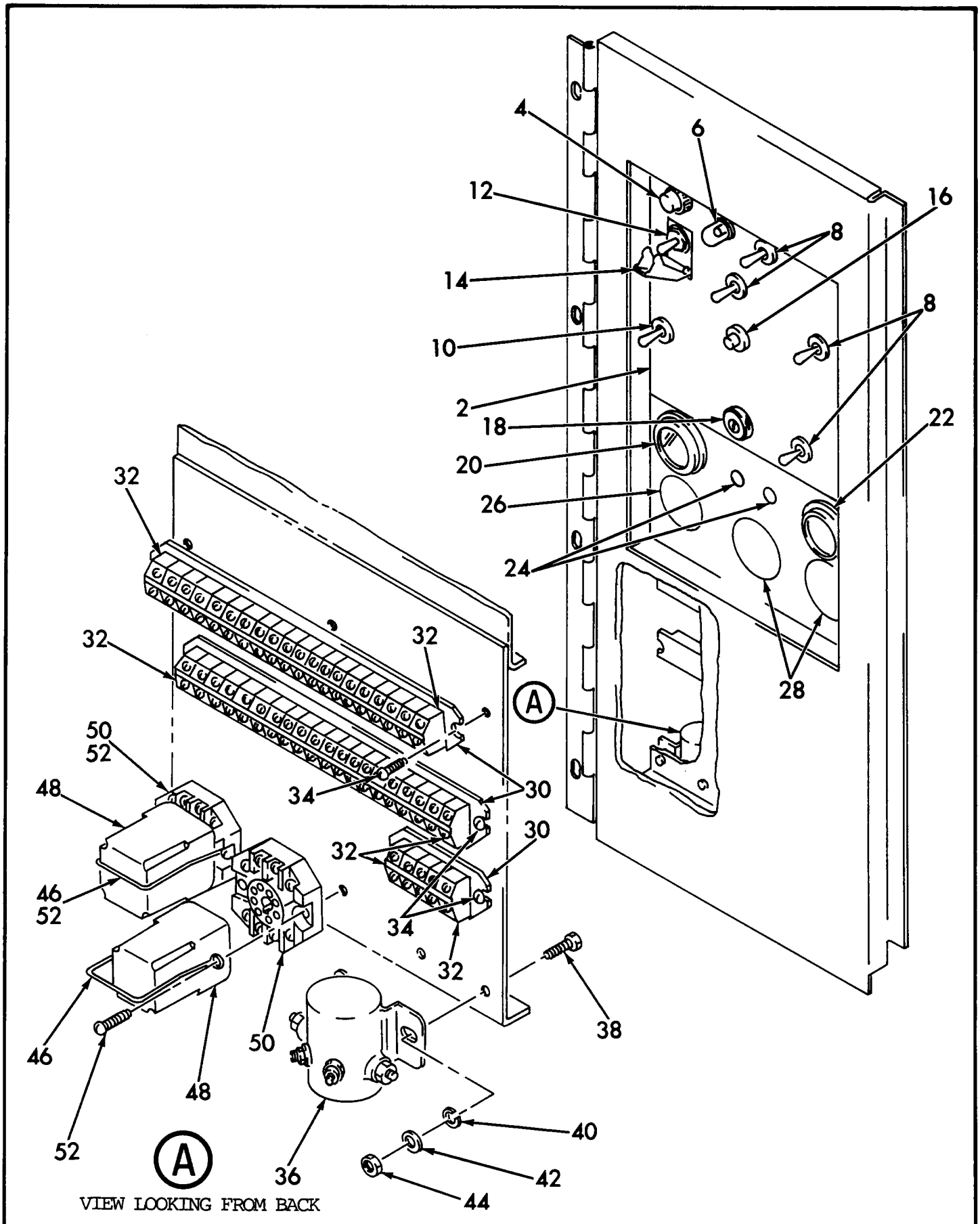
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
20	140431	.PIN, MASTER CYLINDER/BOOM	1
22	65984	.SCREW, CAP (attaching part)	1
24	140425	.PIN, BOOM PIVOT	1
26	65984	.SCREW, CAP (attaching part)	1
28	27277	.TUBE, ROUND	1
30	20410	.DECAL, LOGO	1
32	140549	.PLATE, RISER COVER	1
34	60353	.SCREW, CAP (attaching part)	4
36	63301	.WASHER, LOCK (attaching part)	4
38	140602	.ASSEMBLY, ARM CABLE CLAMP	8
40	60324	.SCREW, CAP (attaching part)	8
42	63302	.WASHER, LOCK (attaching part)	8
44	63402	.WASHER, FLAT (attaching part)	8
46	140612	.ASSEMBLY, ARM CABLE CLAMP	4
48	60324	.SCREW, CAP (attaching part)	4
50	63302	.WASHER, LOCK (attaching part)	4
52	63402	.WASHER, FLAT (attaching part)	4
54	140612	.GUARD, ARM CABLE	2
56	60324	.SCREW, CAP (attaching part)	4
58	63302	.WASHER, LOCK (attaching part)	4

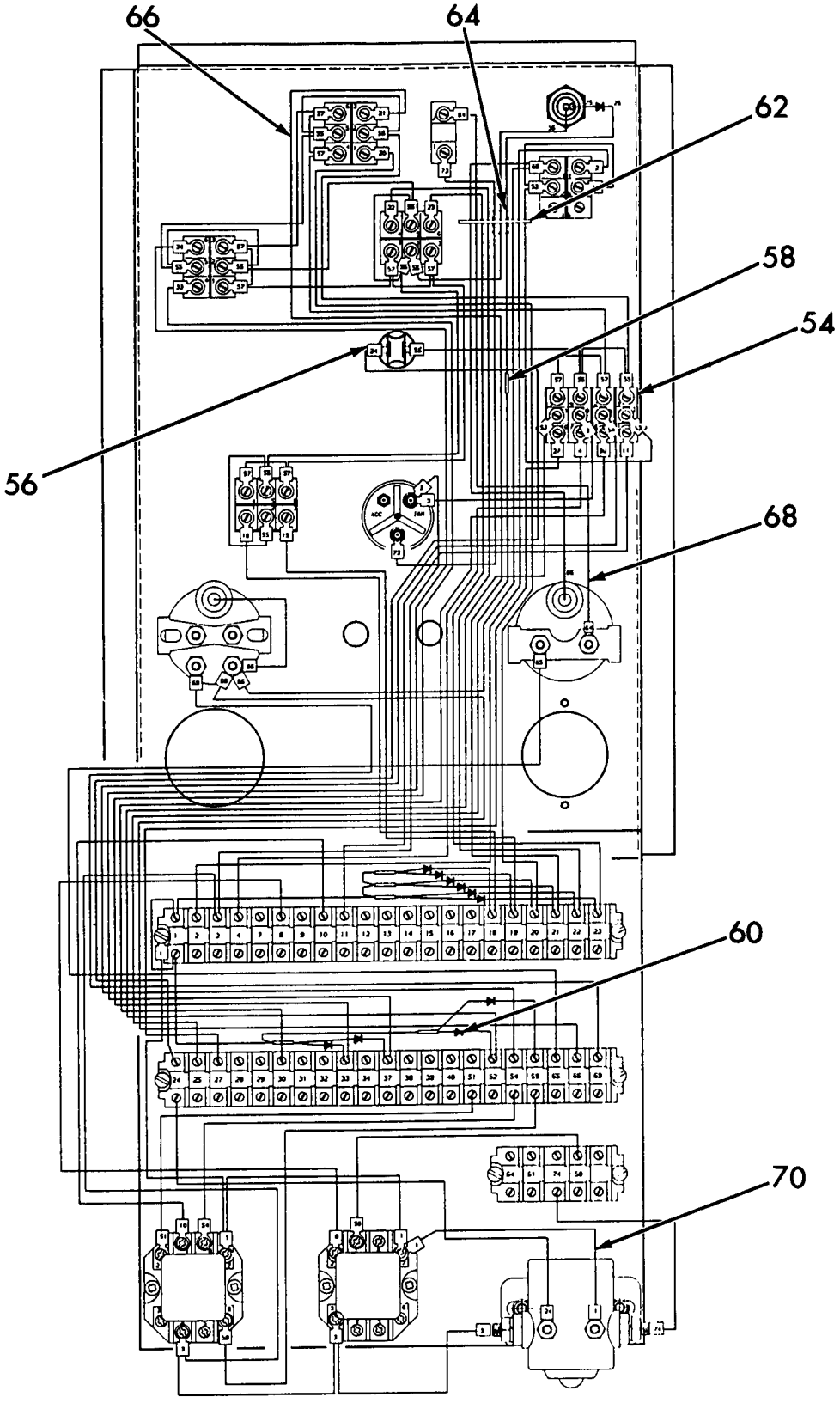
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
60	63402	.WASHER, FLAT (attaching part)	4
62	140436	.PIN, ROTATOR	1
64	65984	.SCREW, CAP (attaching part)	1
66	140437	.PIN, SLAVE CYLINDER/ROTATOR	1
68	64213	.PIN, ROLL	1
70	22386	.DECAL, D RING ATTACH SAFETY BELT	2
72	181103	.DECAL, CAUTION	2
74	181102	.DECAL, DANGER	2
76	181103	.DECAL, DANGER	2
78	22385	.DECAL, CAUTION	1
80	182101	.DECAL, CAUTION	1
82	130820	.DECAL, OPERATION AND SAFETY HANDBOOK	1
84	2022	.DECAL, LOAD	2
86	11064	.DECAL, CHAIN	2
88	65842	.CAP, ANTI-ROLL	2
90	17407	.HANDBOOK, OPERATION AND SAFETY	1
92	130927	.CONTAINER, PLASTIC	1
94	65867	.CLAMP	2
96	61711	.SCREW, CAP (attaching part)	2
98	20461	.DECAL, FORWARD	1
100	20462	.DECAL, FORWARD	1
102	20896	.DECAL, BRAKE	1
104	140595	.DECAL, TIEDOWN	2
106	20420	.DECAL, TIRE PRESSURE	2

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
107	20660	.PLATE, IDENTIFICATION	1
108	63653	.RIVET, POP (attaching part)	4
109	20661	.PLATE, ANSI A92	1
110	63653	.RIVET, POP (attaching part)	4
112	20412	.DECAL, BLUE STRIP	2
114	20411	.DECAL, BLUE STRIP	4
116	61921	.SCREW, BUTTON HEAD	32
117	140569	.DOOR, LEFT LATCHING	1
118	140570	.DOOR, LEFT	1
119	20419	.DECAL, DANGER KEEP CLEAR	2
120	140565	.COVER, LEFT FRONT	1
122	140566	.COVER, RIGHT FRONT	1
124	140574	.COVER, LEFT TOP	1
126	140563	.COVER, RIGHT TOP	1
128	2017	.DECAL, HYDRAULIC SYSTEM	2
130	140305	.ASSEMBLY, LOWER CONTROL PANEL (See Sect. 2, Fig. 4 for Details)	1
132	140564	.DOOR, RIGHT LATCHING	1
134	140496	.DECAL, EMERGENCY HAND PUMP	1
136	182701	.DECAL, GENERAL CHECKOUT	1
138	140495	.DECAL, EMERGENCY PUMP OPERATION	1
140	183301	.DECAL, WARNING	2
142	22449	.DECAL, NO SMOKING DURING CHARGE	1
144	2003	.DECAL, BATTERY WATER	1
146	185701	.DECAL, BATTERY CHARGER INSIDE	1

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
148	140575	.PANEL, LEFT REAR	1
150	140568	.PANEL, RIGHT REAR	1
-152	2673	.PAINT, TOUCH-UP WHITE	1
-154	16609	.PAINT, WHITE (.5 Gl.)	AR
-156	16608	.PAINT, WHITE (3 Gl.)	AR
-158	140502	.SCHEMATIC, ELECTRICAL (See Schematic Section for Details)	1
-160	140505	.SCHEMATIC, HYDRAULIC (See Schematic Section for Details)	1
162	140304	.DIAGRAM, HOSE KIT (See Sect. 2, Fig. 6 for Details)	1

GROUND CONTROL PANEL ASSEMBLY (45 KBDF)





WIRING DIAGRAM

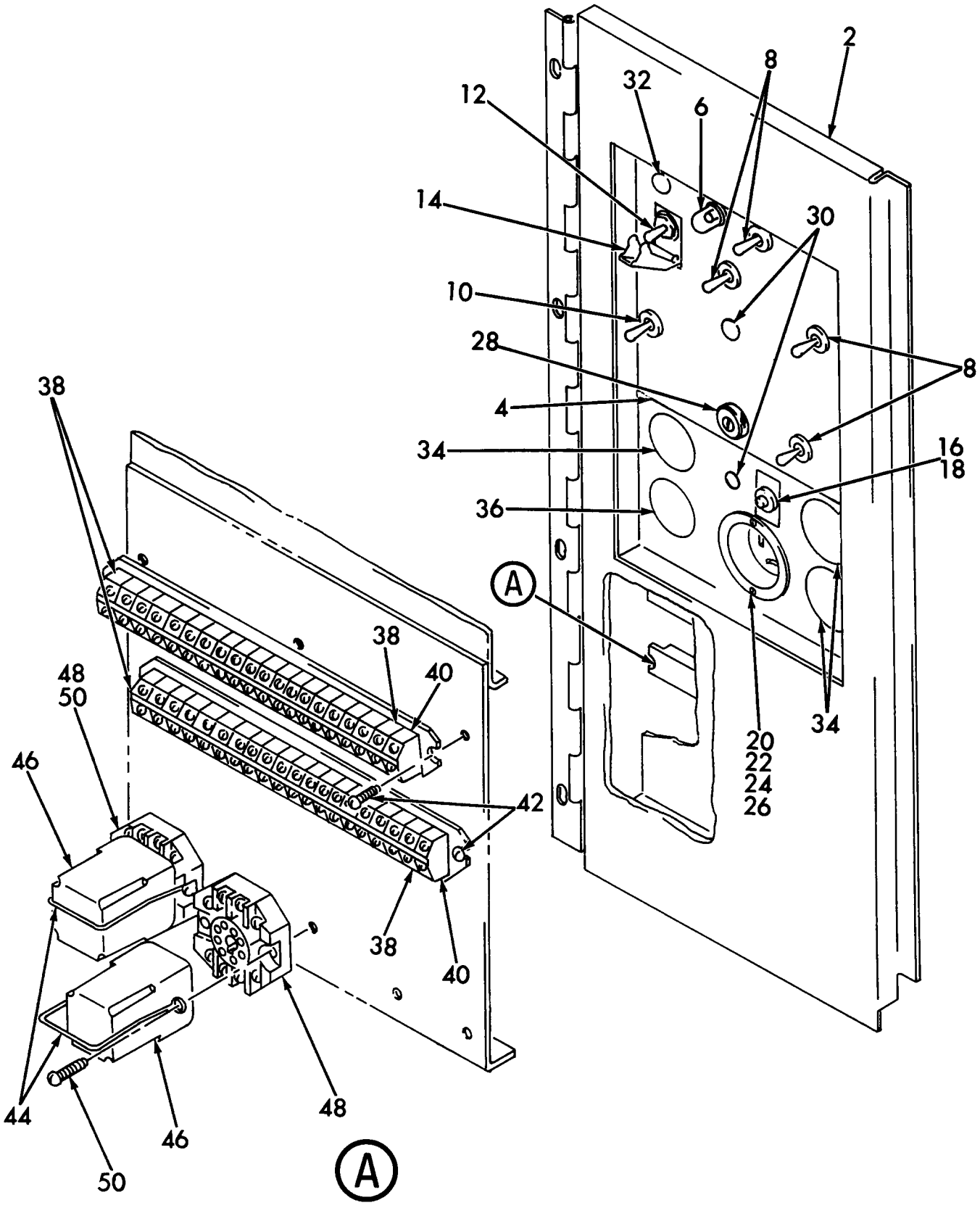
GROUND CONTROL PANEL ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140287	ASSEMBLY, GROUND CONTROL PANEL (See Sect. 2, Fig. 1 for NHA)	REF
2	182716	.DECAL, GROUND CONTROL	1
4	70195	.LIGHT, INDICATOR	1
6	70361	.BREAKER, CIRCUIT	1
8	20481	.SWITCH, TOGGLE	4
10	16260	.SWITCH, TOGGLE	1
12	70304	.SWITCH, TOGGLE	1
14	70303	.GUARD, SWITCH	1
16	4011	.SWITCH, PUSH BUTTON	1
18	2717	.SWITCH, IGNITION	1
20	20994	.AMMETER	1
22	21219	.GAUGE, FUEL	1
24	65240	.PLUG	2
26	65243	.PLUG	1
28	65244	.PLUG	2
30	117-A	.END, TERMINAL BLOCK	3
32	4027	.BLOCK, TERMINAL	47
34	61712	.SCREW, CAP (attaching part)	8
36	70209	.SOLENOID	1
38	60342	.SCREW, CAP (attaching part)	2
40	63301	.WASHER, LOCK (attaching part)	2
42	63401	.WASHER, FLAT (attaching part)	2

- ITEM NOT ILLUSTRATED

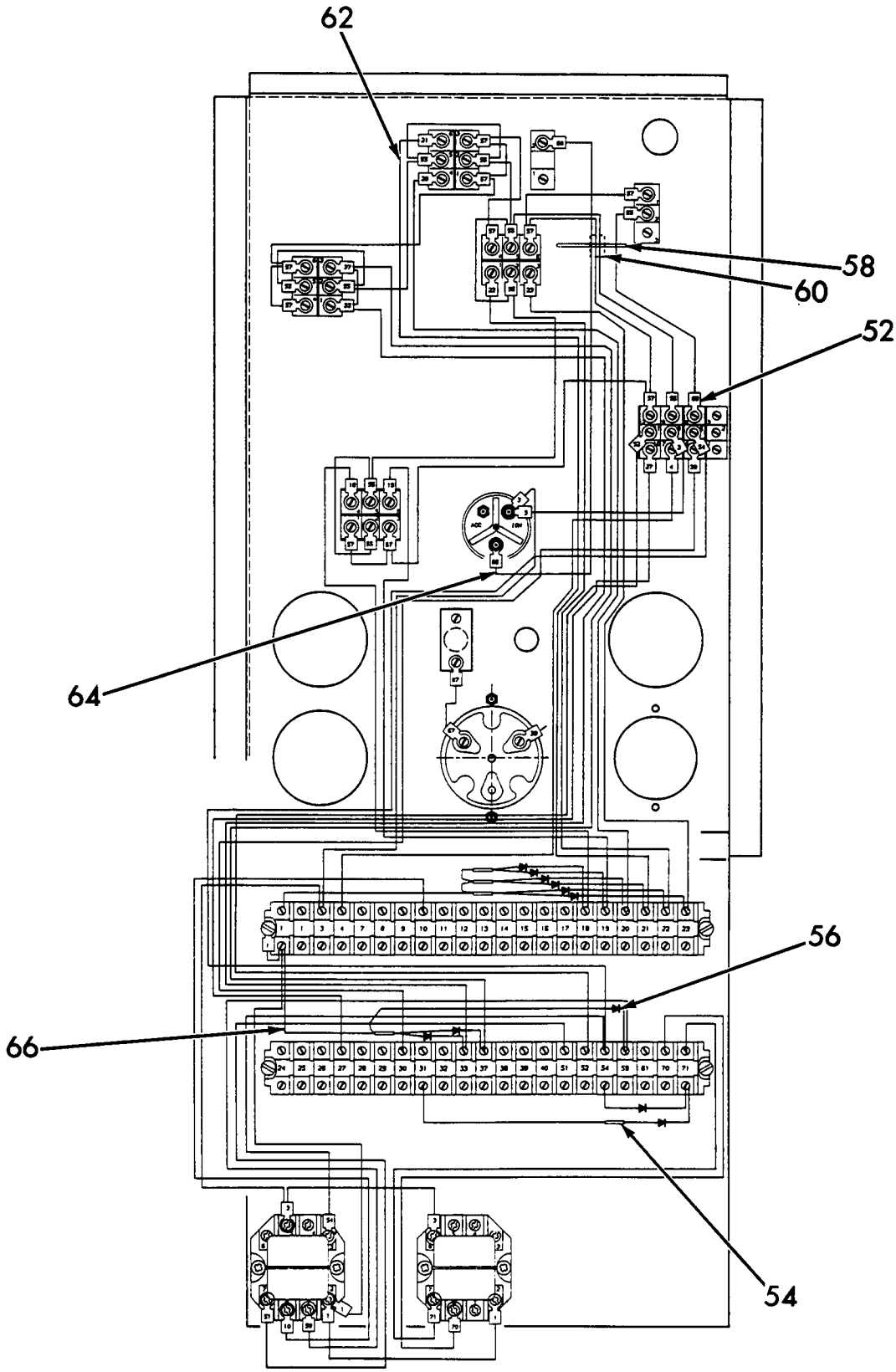
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
44	60701	.NUT, HEX (attaching part)	2
46	30215	.CLIP, RELAY HOLD DOWN	2
48	70170	.RELAY	2
50	784-A	.SOCKET, RELAY	2
52	61721	.SCREW, CAP (attaching part)	4
54	117-C	.RING, CONNECTOR	70
56	117-E	.TERMINAL, PUSH ON	2
58	117-D	.CONNECTOR, BUTT	10
60	4045	.DIODE	11
62	256	.TIE, CABLE	45
64	16214	.MOUNTS	8
66	2990	.WIRE	90
68	2991	.WIRE	12
70	70098	.WIRE	6

GROUND CONTROL PANEL ASSEMBLY (45 KB)



VIEW LOOKING FROM BACK

REV.



WIRING DIAGRAM

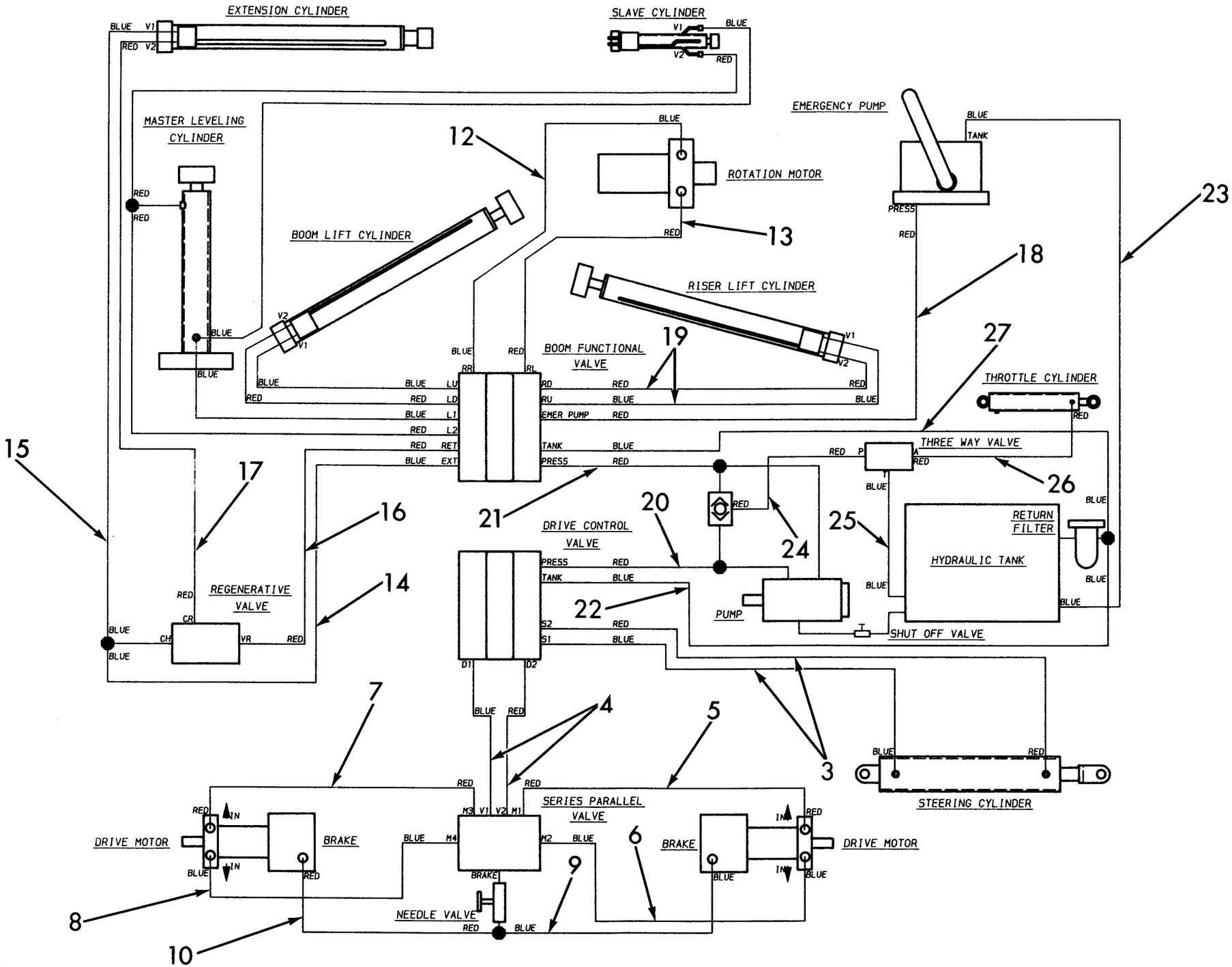
GROUND CONTROL PANEL ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140305	ASSEMBLY, GROUND CONTROL PANEL (See Sect. 2, Fig. 2 for NHA)	REF
2	140238	.PANEL, GROUND CONTROL	1
4	182716	.DECAL, GROUND CONTROL	1
6	70361	.BREAKER, CIRCUIT	1
8	20481	.SWITCH, TOGGLE	4
10	16260	.SWITCH, TOGGLE	1
12	4017	.SWITCH, TOGGLE	1
14	70303	.GUARD, SWITCH	1
16	20562	.BREAKER, CIRCUIT	1
18	185702	.DECAL, (110 VAC) CIRCUIT BREAKER	1
20	70409	.RECEPTACLE	1
22	62636	.SCREW, MACHINE (attaching part)	2
24	63312	.WASHER, LOCK (attaching part)	2
26	61502	.NUT, HEX (attaching part)	2
28	2717	.SWITCH, IGNITION	1
30	65240	.PLUG	2
32	775	.PLUG	1
34	65244	.PLUG	3
36	65243	.PLUG	1
38	4027	.BLOCK, TERMINAL	40
40	117-A	.END, TERMINAL BLOCK	2
42	61712	.SCREW, CAP (attaching part)	6

- ITEM NOT ILLUSTRATED

GROUND CONTROL PANEL ASSEMBLY (45 KB) (continued)

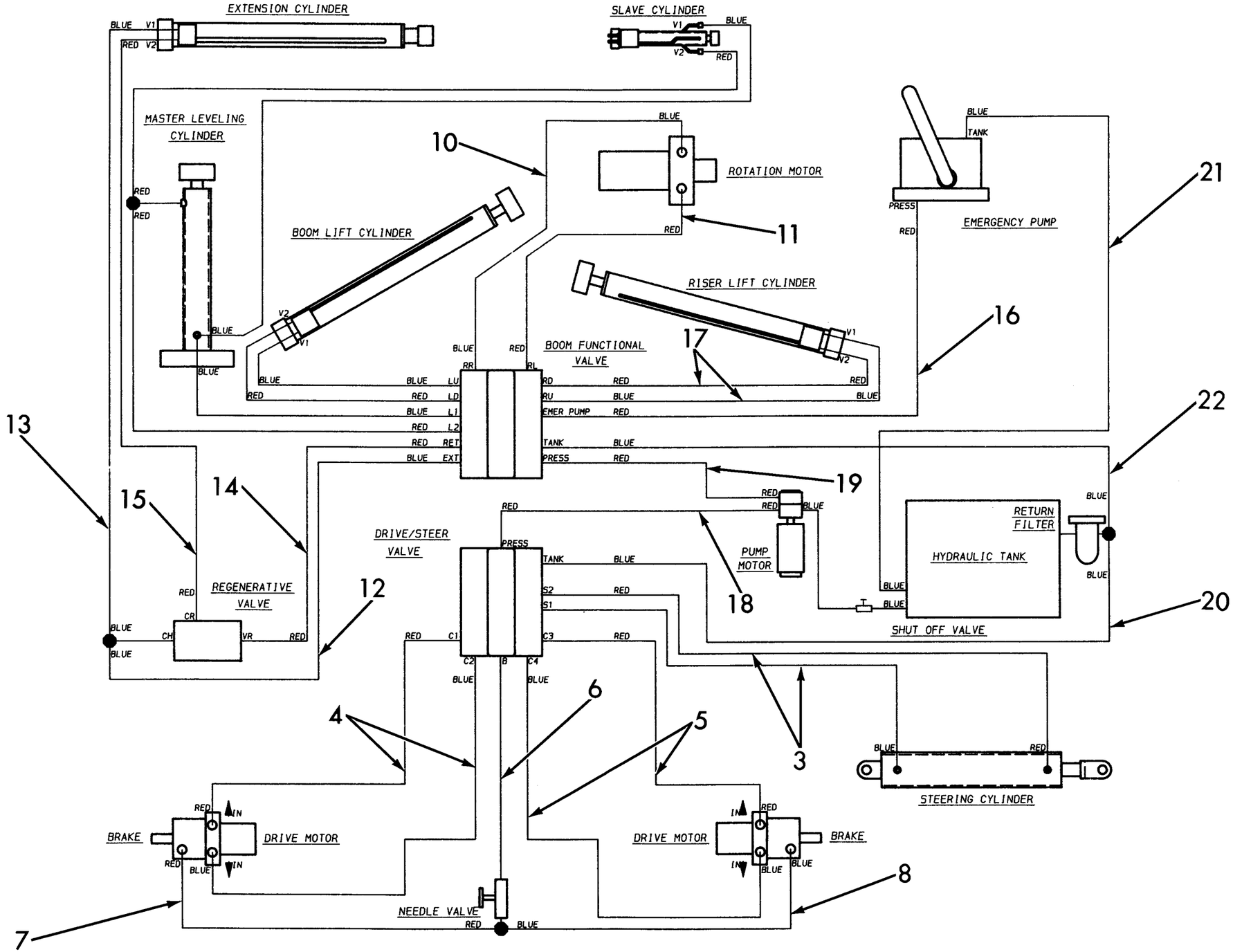
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
44	30215	.CLIP, RELAY HOLD DOWN	2
46	70170	.RELAY	2
48	784-A	.SOCKET, RELAY	2
50	61721	.SCREW, CAP (attaching part)	4
52	117-C	.CONNECTOR, RING	60
54	117-D	.CONNECTOR, BUTT	8
56	4045	.DIODE	11
58	256	.TIE, CABLE	45
60	16214	.MOUNTS	8
62	2990	.WIRE	90
64	2991	.WIRE	12
66	70098	.WIRE	6


EXTENSION CYLINDER
SLAVE CYLINDER
MASTER LEVELING CYLINDER
ROTATION MOTOR
EMERGENCY PUMP
BOOM LIFT CYLINDER
RISER LIFT CYLINDER
BOOM FUNCTIONAL VALVE
THROTTLE CYLINDER
THREE WAY VALVE
RETURN FILTER
HYDRAULIC TANK
DRIVE CONTROL VALVE
REGENERATIVE VALVE
PUMP
SHUT OFF VALVE
SERIES PARALLEL VALVE
DRIVE MOTOR
BRAKE
NEEDLE VALVE
STEERING CYLINDER
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HYDRAULIC HOSE INSTALLATION (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140236	DIAGRAM, HOSE KIT (See Sect. 2, Fig. 1 for NHA)	REF
-2		."A", HOSE KIT	REF
3	13213-04-1300	.ASSEMBLY, HOSE	2
4	13213-10-1300	.ASSEMBLY, HOSE	2
5	13212-08-0144	.ASSEMBLY, HOSE	1
6	13212-08-0120	.ASSEMBLY, HOSE	1
7	13213-08-0296	.ASSEMBLY, HOSE	1
8	13210-08-0250	.ASSEMBLY, HOSE	1
9	13210-04-0174	,ASSEMBLY, HOSE	1
10	13210-04-0244	.ASSEMBLY, HOSE	1
-11		."B", HOSE KIT	REF
12	13215-06-0420	.ASSEMBLY, HOSE	1
13	13214-06-0390	.ASSEMBLY, HOSE	1
14	13231-08-0250	.ASSEMBLY, HOSE	1
15	13210-08-3240	.ASSEMBLY, HOSE	1
16	13212-08-0190	.ASSEMBLY, HOSE	1
17	13211-08-3240	.ASSEMBLY, HOSE	1
18	13213-04-0350	.ASSEMBLY, HOSE	1
19	13212-06-0870	.ASSEMBLY, HOSE	2
20	13213-10-0640	.ASSEMBLY, HOSE	1
21	13213-08-0770	.ASSEMBLY, HOSE	1
22	13214-12-0320	.ASSEMBLY, HOSE	1

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	13210-06-0400	.ASSEMBLY, HOSE	1
24	13210-04-0330	.ASSEMBLY, HOSE	1
25	13210-06-0510	.ASSEMBLY, HOSE	1
26	13210-04-0110	.ASSEMBLY, HOSE	1
27	13210-10-0870	.ASSEMBLY, HOSE	1


EXTENSION CYLINDER
SLAVE CYLINDER
MASTER LEVELING CYLINDER
ROTATION MOTOR
BOOM LIFT CYLINDER
RISER LIFT CYLINDER
EMERGENCY PUMP
BOOM FUNCTIONAL VALVE
DRIVE/STEER VALVE
REGENERATIVE VALVE
PUMP MOTOR
HYDRAULIC TANK
RETURN FILTER
SHUT OFF VALVE
STEERING CYLINDER
BRAKE
DRIVE MOTOR
NEEDLE VALVE
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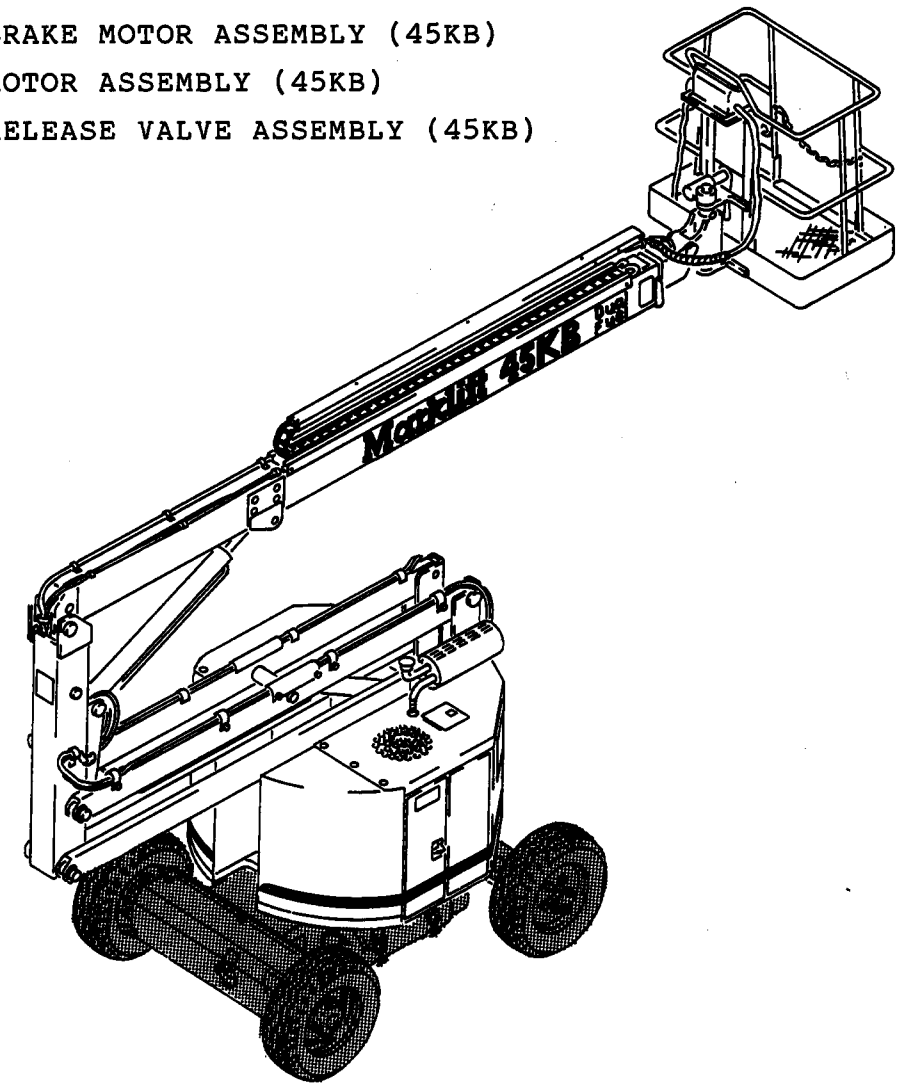
HYDRAULIC HOSE INSTALLATION (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140304	DIAGRAM, HOSE KIT (See Sect. 2, Fig. 2 for NHA)	REF
-2		."A", HOSE KIT	REF
3	13213-04-1300	.ASSEMBLY, HOSE	2
4	13210-08-1400	.ASSEMBLY, HOSE	2
5	13210-08-1610	.ASSEMBLY, HOSE	2
6	13210-04-1400	.ASSEMBLY, HOSE	1
7	13210-04-0250	.ASSEMBLY, HOSE	1
8	13210-04-0210	.ASSEMBLY, HOSE	1
-9		."B", HOSE KIT	REF
10	13215-06-0420	.ASSEMBLY, HOSE	1
11	13214-06-0390	.ASSEMBLY, HOSE	1
12	13231-08-0250	.ASSEMBLY, HOSE	1
13	13210-08-3240	.ASSEMBLY, HOSE	1
14	13212-08-0190	.ASSEMBLY, HOSE	1
15	13211-08-3240	.ASSEMBLY, HOSE	1
16	13213-04-0350	.ASSEMBLY, HOSE	1
17	13212-06-0870	.ASSEMBLY, HOSE	2
18	13215-08-0570	.ASSEMBLY, HOSE	1
19	13213-08-0640	.ASSEMBLY, HOSE	1
20	13214-12-0320	.ASSEMBLY, HOSE	1
21	13210-06-0400	.ASSEMBLY, HOSE	1
22	13210-10-0870	.ASSEMBLY, HOSE	1

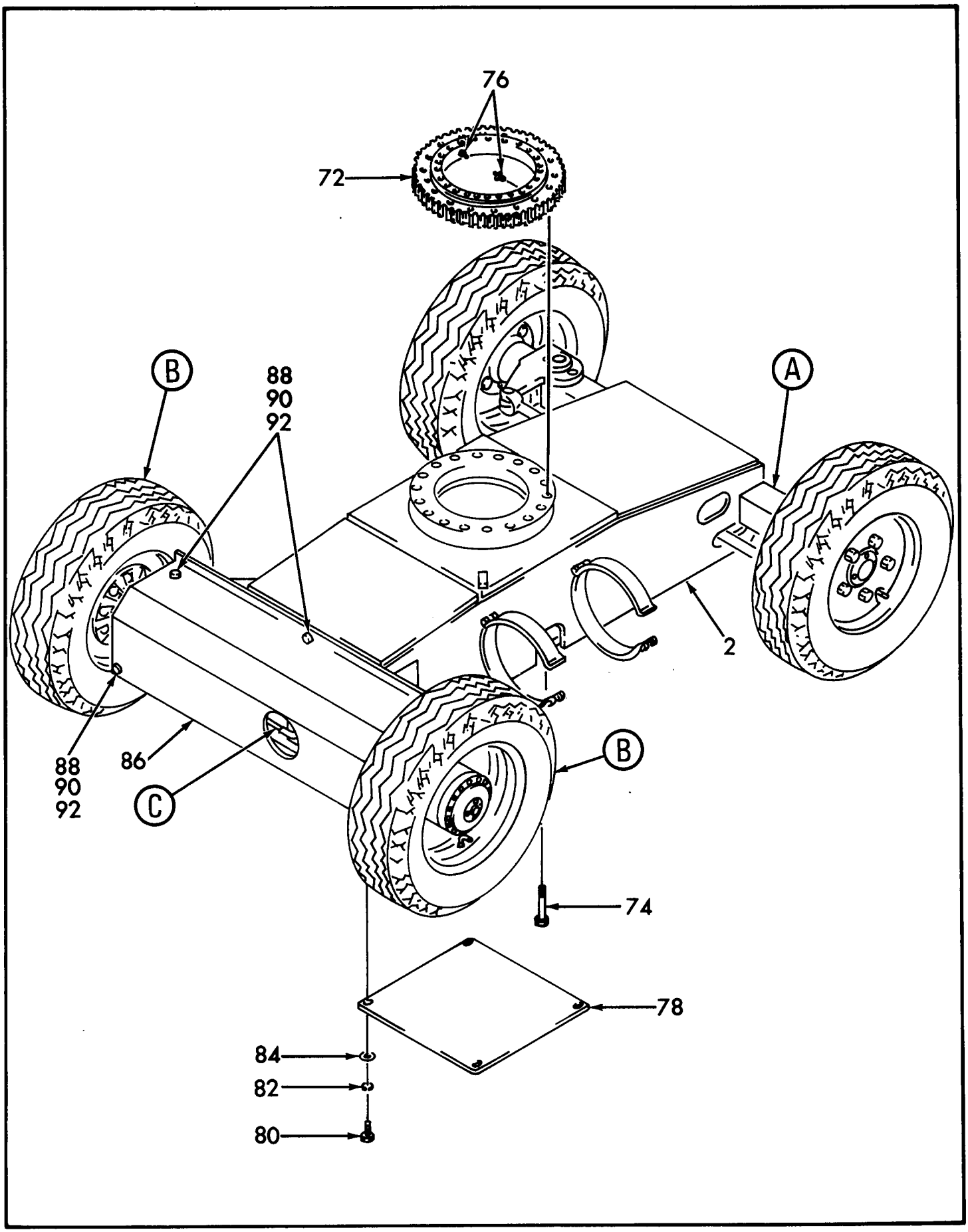
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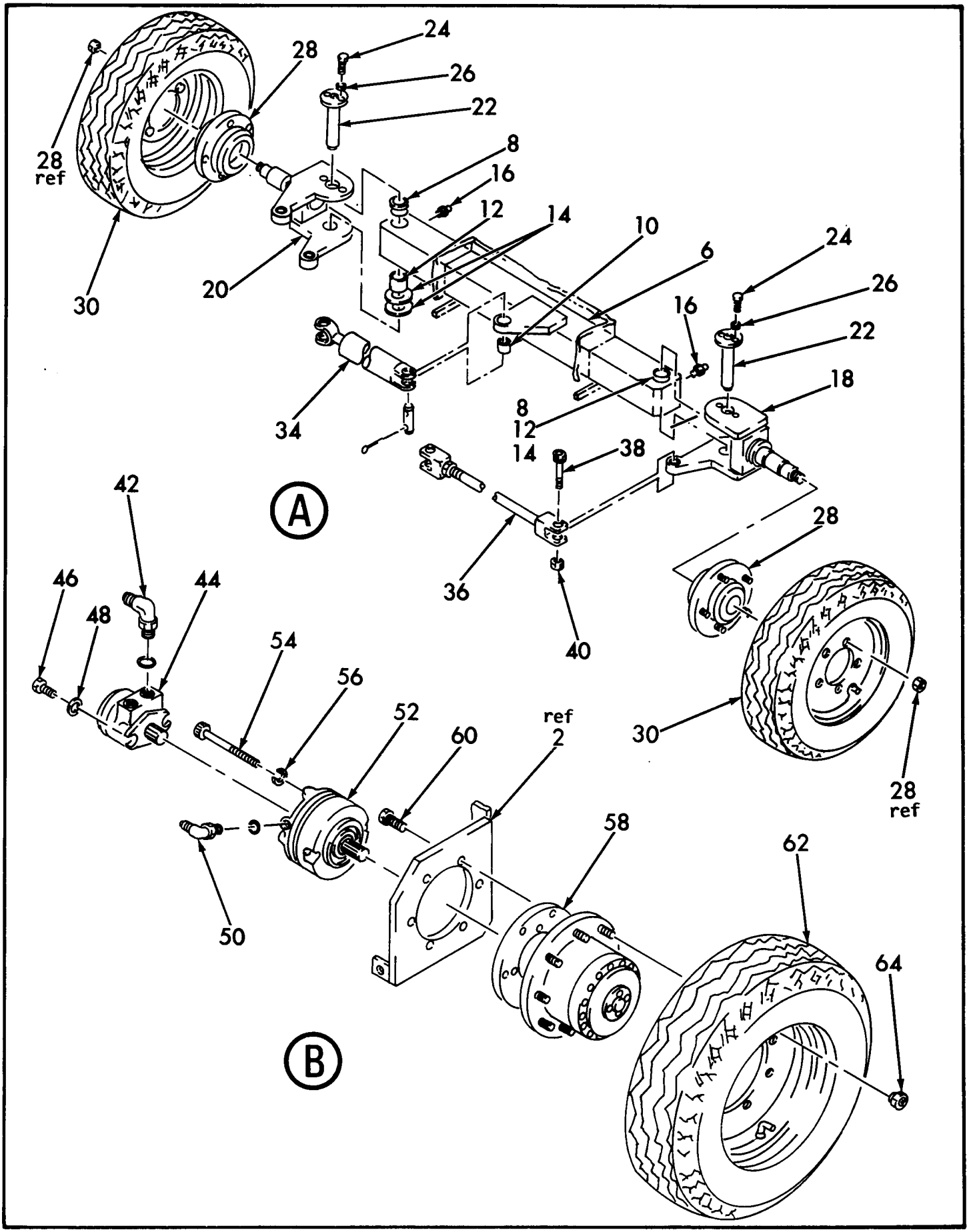
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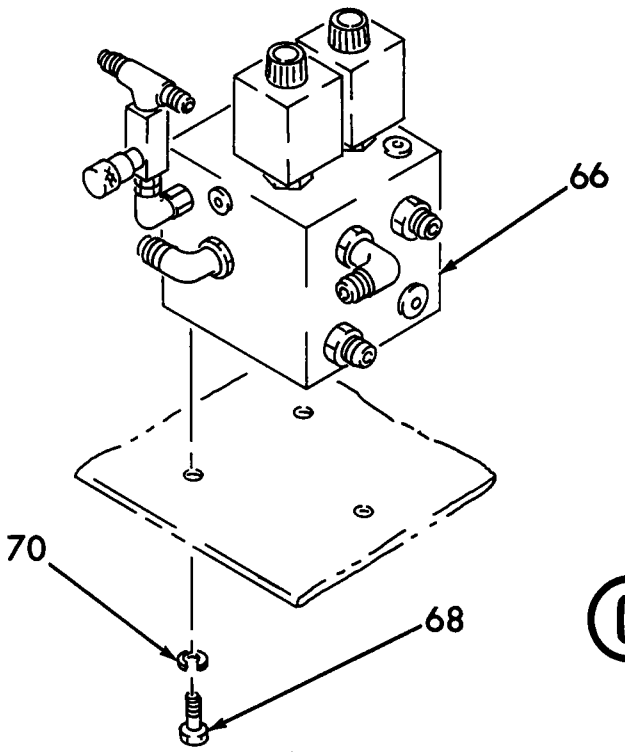
FIGURE 1 CARRIAGE ASSEMBLY (45KBDF)
FIGURE 2 CARRIAGE ASSEMBLY (45KB)
FIGURE 3 LEFT HAND SPINDLE AND YOKE ASSEMBLY
FIGURE 4 RIGHT HAND SPINDLE AND YOKE ASSEMBLY
FIGURE 5 HUB ASSEMBLY
FIGURE 6 WHEEL ASSEMBLY
FIGURE 7 STEERING CYLINDER ASSEMBLY
FIGURE 8 STEERING TIE ROD ASSEMBLY
FIGURE 9 DRIVE MOTOR (45KBDF)
FIGURE 10 FRONT AXLE WHEEL ASSEMBLY (45KBDF)
FIGURE 11 SERIES PARALLEL VALVE ASSEMBLY (45KBDF)
FIGURE 12 DRIVE/BRAKE MOTOR ASSEMBLY (45KB)
FIGURE 13 DRIVE MOTOR ASSEMBLY (45KB)
FIGURE 14 BRAKE RELEASE VALVE ASSEMBLY (45KB)



CARRIAGE ASSEMBLY (45 KBDF)




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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140026	ASSEMBLY, CARRIAGE (See Sect. 2, Fig. 1 for NHA)	REF
2	140346	.WELDMENT, CARRIAGE	1
-4	140039	..MACHINING, STEERING AXLE	1
6	140038	...WELDMENT, STEERING AXLE	1
8	64910	...BUSHING, FLANGED	2
10	2265	...BEARING, SLEEVE	1
12	64934	...BEARING, SLEEVE	2
14	65952	.WASHER, THRUST	4
16	65103	.FITTING, GREASE	2
18	140329	.ASSEMBLY, L.H. SPINDLE AND YOKE (See Sect. 3, Fig. 3 for Details)	1

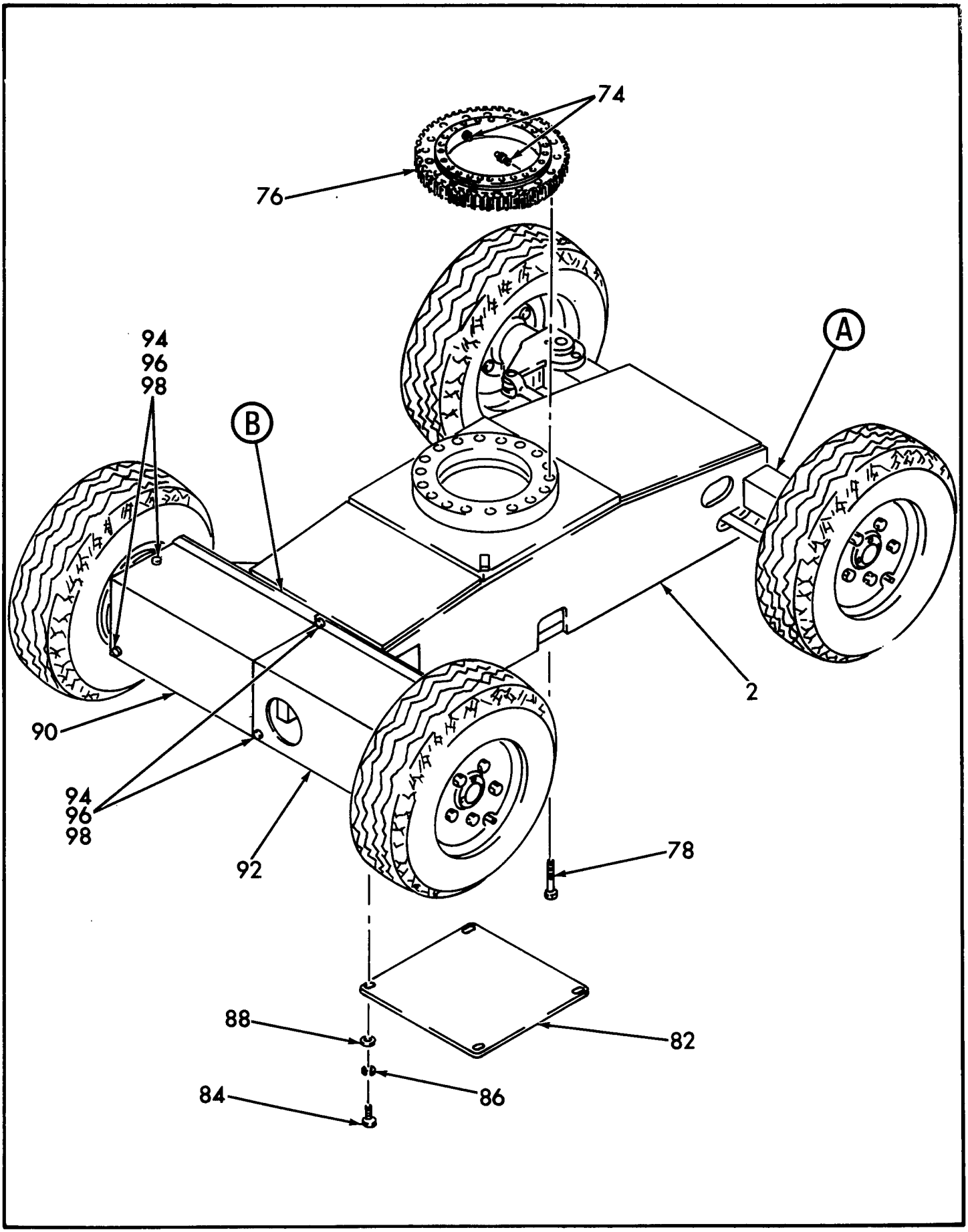
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
20	140328	.ASSEMBLY, R.H. SPINDLE AND YOKE (See Sect. 3, Fig. 4, for Details)	1
22	140338	.PIN, KING	2
24	60338	.SCREW, CAP (attaching part)	4
26	63302	.WASHER, LOCK (attaching part)	4
28	140089	.ASSEMBLY, HUB (See Sect. 3, Fig. 5 for Details)	2 2
30	140167	.ASSEMBLY, WHEEL (See Sect. 3, Fig. 6 for Details)	2
34	140291	.ASSEMBLY, STEERING CYLINDER (See Sect. 3, Fig. 7 for Details)	1
36	140237	.ASSEMBLY, STEERING TIE ROD (See Sect. 3, Fig. 8 for Details)	1
38	65966	.SCREW, SHOULDER (attaching part)	2
40	61236	.NUT, LOCK (attaching part)	2
42	80012-13	.ELBOW	4
44	81216	.MOTOR, DRIVE (See Section 3, Fig. 9 for Details)	2
48	63305	.WASHER, LOCK (attaching part)	4
50	80012-03	.ELBOW	2
52	81217	.BRAKE, MICO (See Vendor Chap. for more Information)	2
54	60610	.SCREW, CAP (attaching part)	4
56	63405	.WASHER, FLAT (attaching part)	4
58	81218	.HUB, TORQUE (See Vendor Chap. for more Information)	2
60	65945	.SCREW, CAP (attaching part)	12

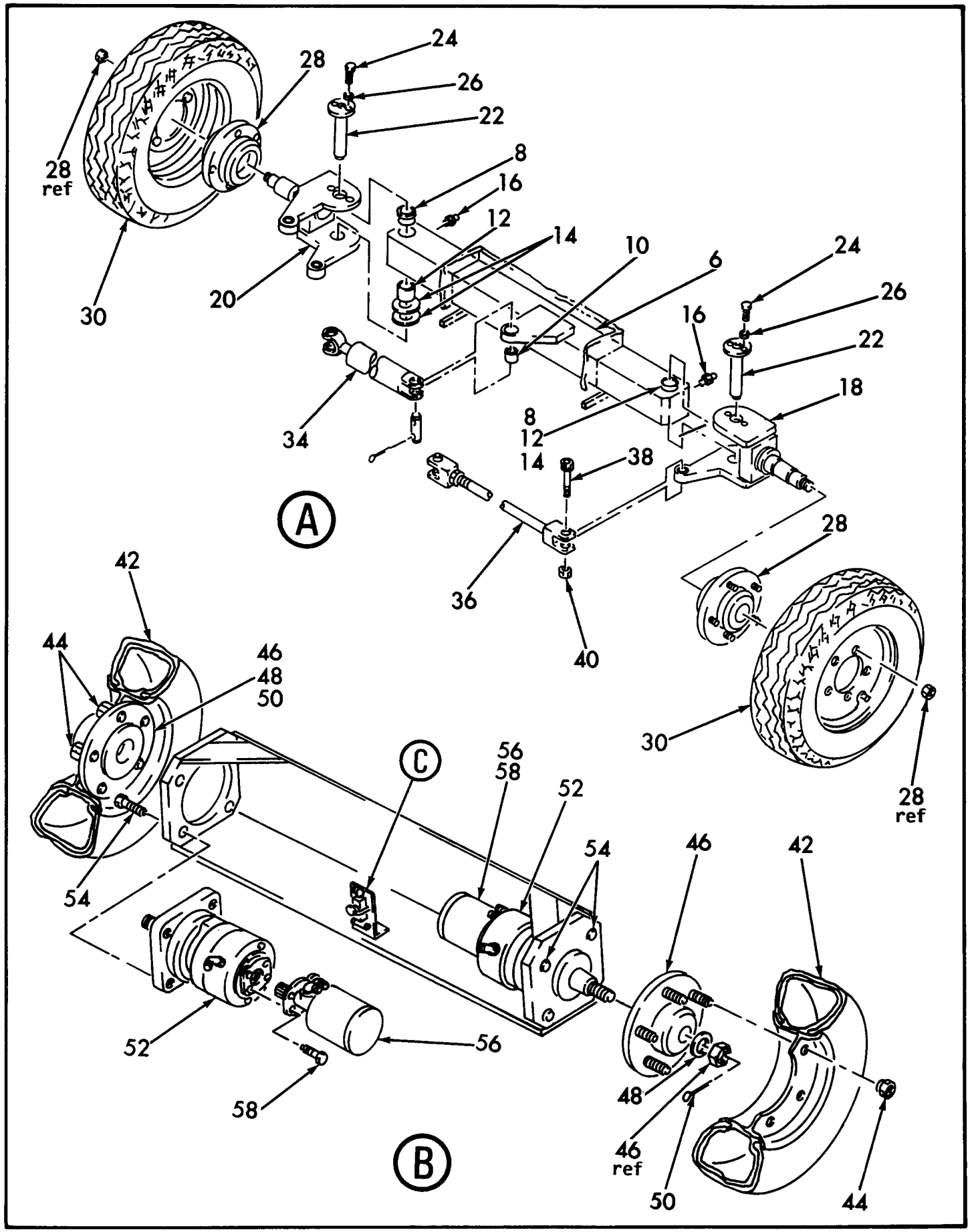
CARRIAGE ASSEMBLY (45 KBDF) (continued)

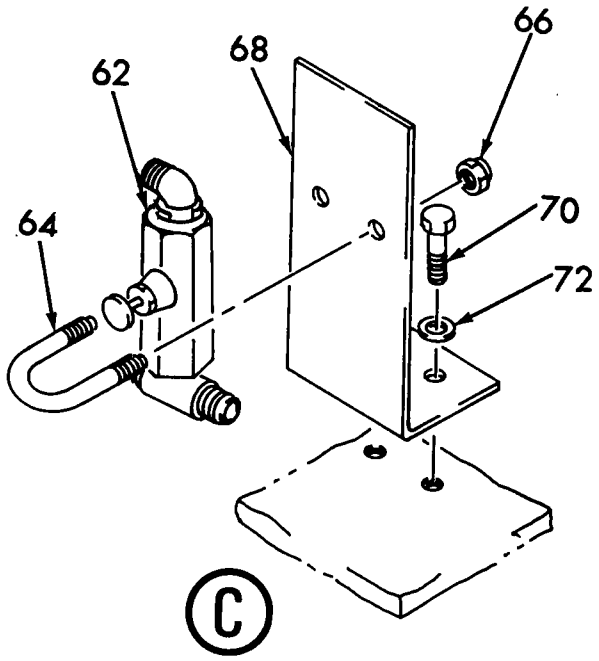
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
62	140166	.ASSEMBLY, FRONT AXLE WHEEL (See Sect. 3, Fig. 10 for Details)	2
64	65945	.NUT, CONICAL F.C. (attaching part)	18
66	140293	.ASSEMBLY, SERIES PARALLEL VALVE (See Sect. 3, Fig. 11 for Details)	1
68	60343	.SCREW, CAP (attaching part)	3
70	63319	.WASHER, LOCK (attaching part)	3
72	23722	.GEAR, RING	1
74	60546	.SCREW, CAP (attaching part)	18
76	65103	.FITTING, GREASE	2
78	140472	.PLATE, CARRIAGE BOTTOM COVER	1
80	60353	.SCREW, CAP (attaching part)	4
82	63401	.WASHER, LOCK (attaching part)	4
84	63301	.WASHER, FLAT (attaching part)	4
86	140438	.COVER	1
88	60353	.SCREW, CAP (attaching part)	5
90	63401	.WASHER, FLAT (attaching part)	5
92	63301	.WASHER, LOCK (attaching part)	5

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CARRIAGE ASSEMBLY (45 KB)




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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140265	ASSEMBLY, CARRIAGE (See Sect. 2, Fig. 2 for NHA)	REF
2	140264	.WELDMENT, CARRIAGE	1
-4	140039	..MACHINING, STEERING AXLE	1
6	140038	...WELDMENT, STEERING AXLE	1
8	64910	...BUSHING, FLANGED	2
10	2265	...BEARING, SLEEVE	1
12	64934	...BEARING, SLEEVE	2
14	65952	.WASHER, THRUST	4
16	65103	.FITTING, GREASE	2
18	140329	.ASSEMBLY, L.H. SPINDLE AND YOKE (See Sect. 3, Fig. 3 for Details)	1

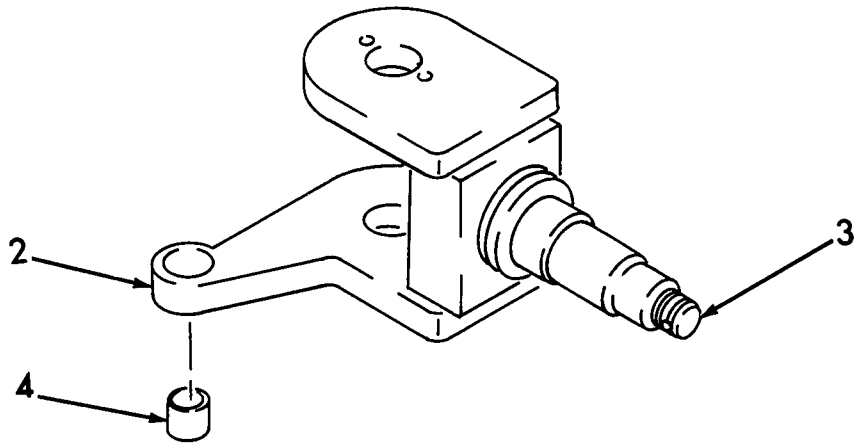
CARRIAGE ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
20	140328	.ASSEMBLY, R.H. SPINDLE AND YOKE (See Sect. 3, Fig. 4 for Details)	1
22	140338	.PIN, KING	2
24	60338	.SCREW, CAP (attaching part)	4
26	63302	.WASHER, LOCK (attaching part)	4
28	140089	.ASSEMBLY, HUB (See Sect. 3, Fig. 5 for Details)	2
30	140167	.ASSEMBLY, WHEEL (See Sect. 3, Fig. 6 for Details)	2
34	140291	.ASSEMBLY, STEERING CYLINDER (See Sect. 3, Fig. 7 for Details)	1
36	140237	.ASSEMBLY, STEERING TIE ROD (See Sect. 3, Fig. 8 for Details)	1
38	65966	.SCREW, SHOULDER (attaching part)	2
40	61236	.NUT, LOCK (attaching part)	2
42	140167	.ASSEMBLY, WHEEL (See Sect. 3, Fig. 6 for Details)	2
44	65117	.NUT, BALL (attaching part)	10
46	140090	.HUB, DRIVE	2
48	16159	.WASHER, FLAT (attaching part)	2
50	60604	.PIN, COTTER	2
52	140596	.ASSEMBLY, DRIVE/BRAKE MOTOR (See Sect. 3, Fig. 12 for Details)	2
54	60640	.SCREW, CAP (attaching part)	8
56	140650	.ASSEMBLY, DRIVE MOTOR (See Sect. 3, Fig. 13 for Details)	2
58	60622	.SCREW, CAP (attaching part)	2

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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-60	65106	.OIL, GEAR (2 QT.)	AR
62	140651	.ASSEMBLY, BRAKE RELEASE VALVE (See Sect. 3, Fig. 14 for Details)	1
64	65218	.BOLT, U (attaching part)	1
66	60708	.NUT, HEX (attaching part)	2
68	140506	.BRACKET, MOUNTING	1
70	60380	.SCREW, CAP	2
72	63302	.WASHER, LOCK	2
74	65103	.FITTING, GREASE	2
76	23722	.GEAR, RING	1
78	60546	.SCREW, CAP (attaching part)	18
-80	140614	.PROCEDURE, RING AND NORM GEAR INSTL.	1
82	140472	.PLATE, CARRIAGE BOTTOM COVER	1
84	60353	.SCREW, CAP (attaching part)	4
86	63301	.WASHER, LOCK (attaching part)	4
88	63401	.WASHER, FLAT (attaching part)	4
90	140524	.WELDMENT, L.H. DRIVE COVER	1
92	140521	.COVER, R.H. DRIVE	1
94	60353	.SCREW, CAP (attaching part)	6
96	63301	.WASHER, LOCK (attaching part)	6
98	63401	.WASHER, FLAT (attaching part)	6

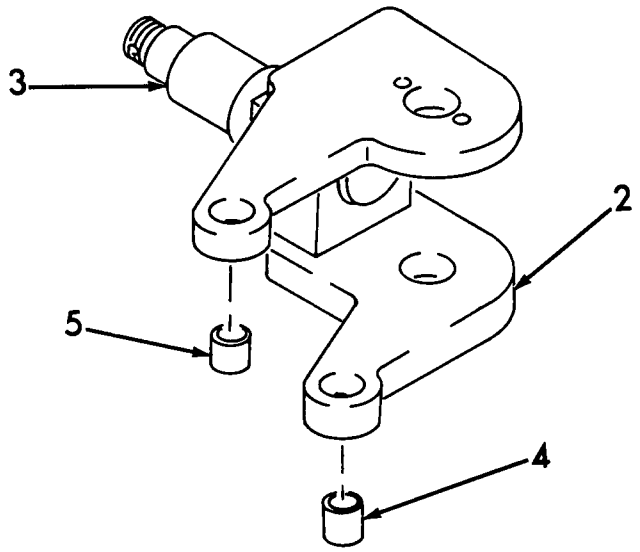
LEFT HAND SPINDLE AND YOKE ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140329	ASSEMBLY, L.H. SPINDLE AND YOKE (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	140327	.MACHINING, L.H. STEERING YOKE	1
3	140312	.SPINDLE	1
4	2265	.BEARING, SLEEVE	1

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RIGHT HAND SPINDLE AND YOKE ASSEMBLY

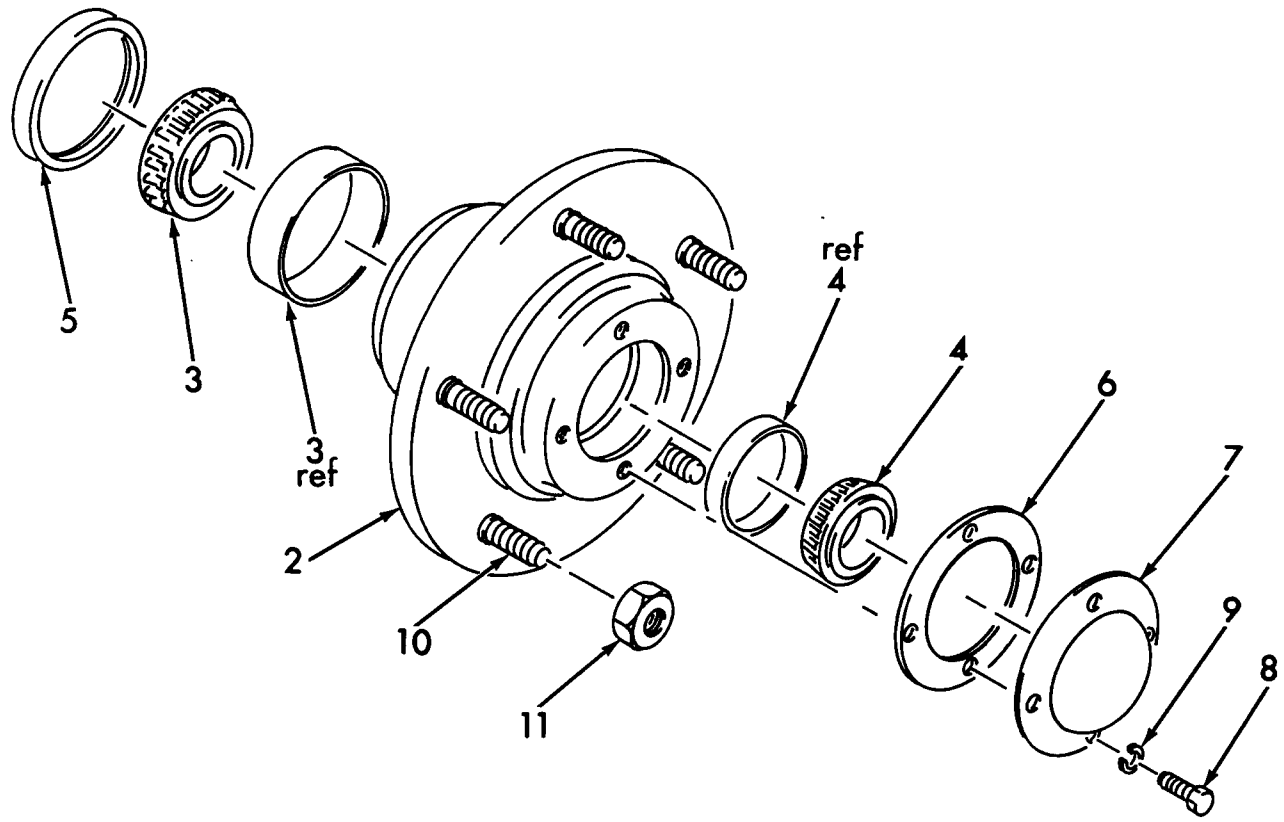


ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140328	ASSEMBLY, R.H. SPINDLE AND YOKE (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	140326	.MACHINING, R.H. STEERING YOKE	1
3	140312	.SPINDLE	1
4	2265	.BEARING, SLEEVE	1
5	64935	.BEARING, SLEEVE	1

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- ITEM NOT ILLUSTRATED

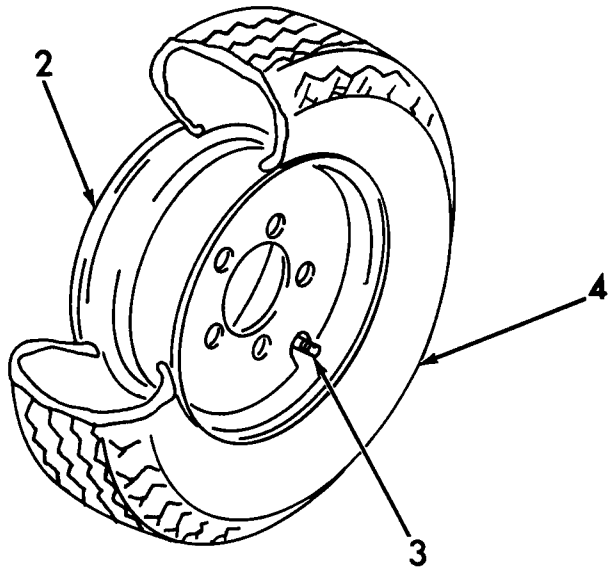
HUB ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140089	ASSEMBLY, HUB (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	67141	.SUB-ASSEMBLY, HUB	1
3	67140	.CONE, INNER BEARING	1
4	67139	.CONE, OUTER BEARING	1
5	67137	.SEAL, GREASE	1
6	67136	.GASKET	1
7	67135	.CAP, GREASE	1
8	67143	.BOLT, HEX HEAD (attaching part)	4
9	67144	.WASHER, LOCK (attaching part)	4
10	65943	.BOLT, WHEEL	5
11	67138	.NUT, WHEEL	5

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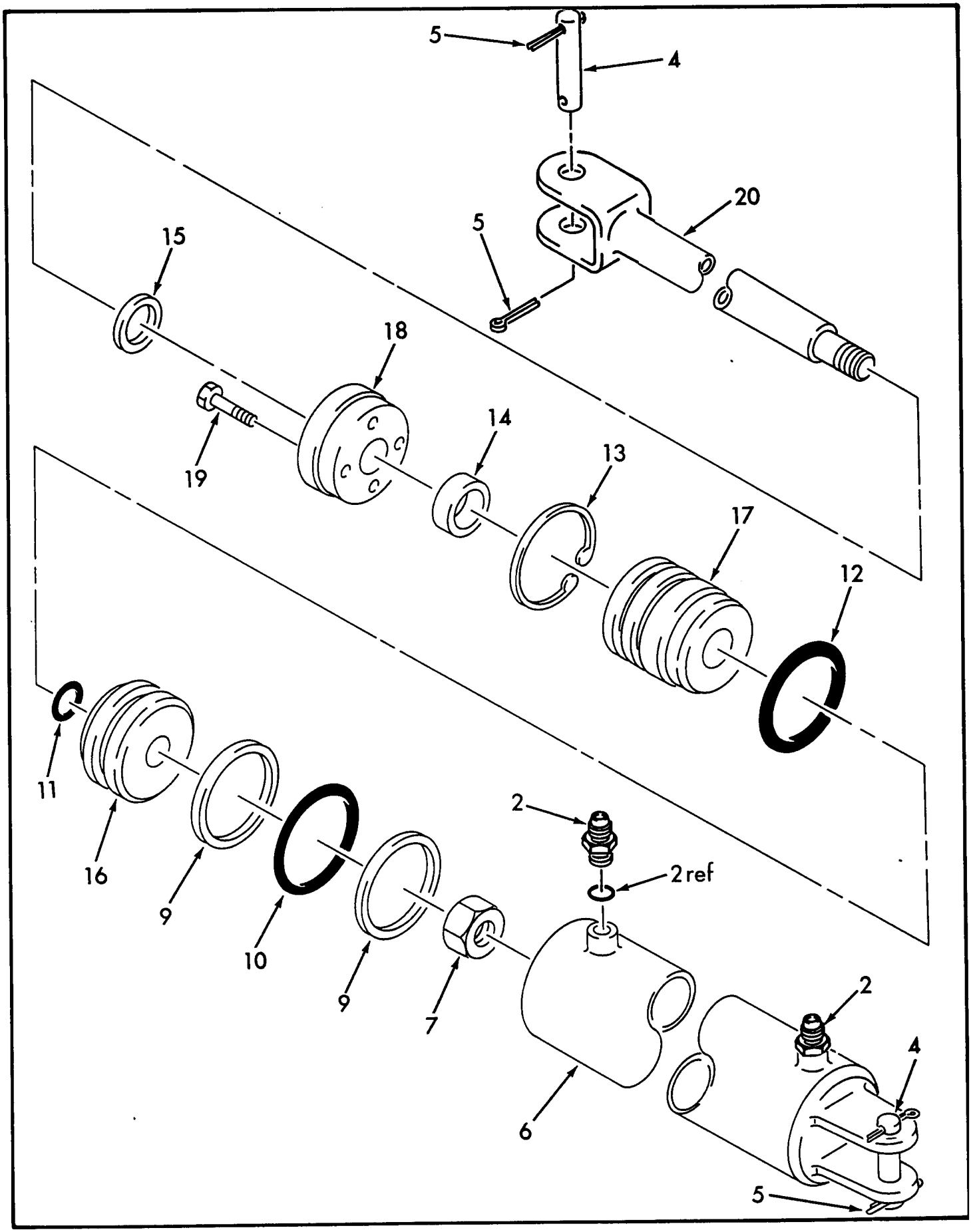
WHEEL ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140167	ASSEMBLY, WHEEL (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	140040	.WHEEL	1
3	140317	.VALVE	1
4	140165	.TIRE	1

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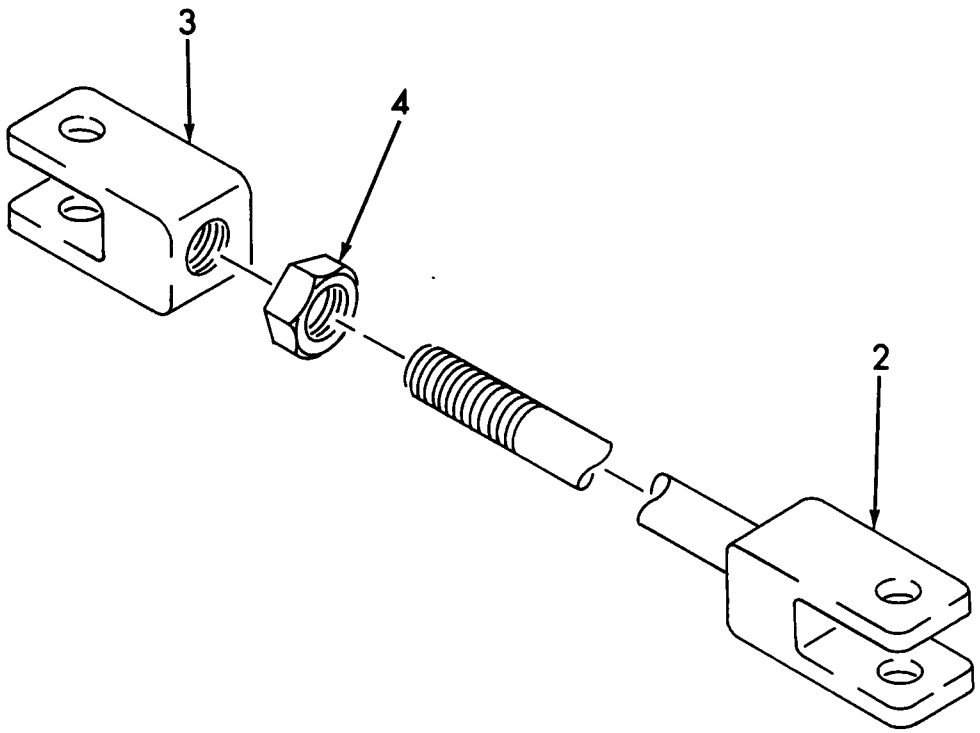
STEERING CYLINDER ASSEMBLY



STEERING CYLINDER ASSEMBLY (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140291	ASSEMBLY, STEERING CYLINDER (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	80004-03	.CONNECTOR, STRAIGHT THREAD	2
-3	140059	.CYLINDER, STEERING	1
4	67196	..PIN, CLEVIS	2
5	16244	..PIN, COTTER	4
6	67192	..ASSEMBLY, BARREL	1
7		..NUT, SELF LOCKING	1
-8	66861	..KIT, SEAL	1
9		...RING, BACK UP	2
10		...SEAL, PISTON	1
11		...O-RING	1
12		...SEAL, GLAND	1
13		...WIRE, SAFETY	1
14		...SEAL, ROD	1
15		...WIPER, ROD	1
16	67194	..PISTON	1
17	67195	..HEAD	1
18		..GLAND, PACKING	1
19		..BOLT, PACKING GLAND	1
20	67193	..ASSEMBLY, ROD	1

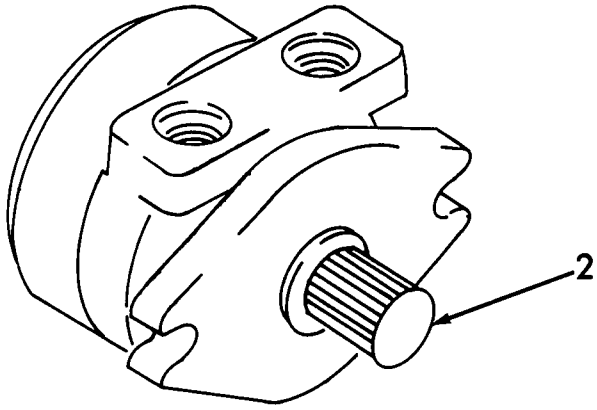
STEERING TIE ROD ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140237	ASSEMBLY, STEERING TIE ROD (See Sect. 3, Fig. 1 or 2 for NHA)	REF
2	140273	.WELDMENT, STEERING TIE ROD	1
3	140270	.YOKE, ADJUSTING TIE ROD	1
4	60902	.NUT, JAM	1

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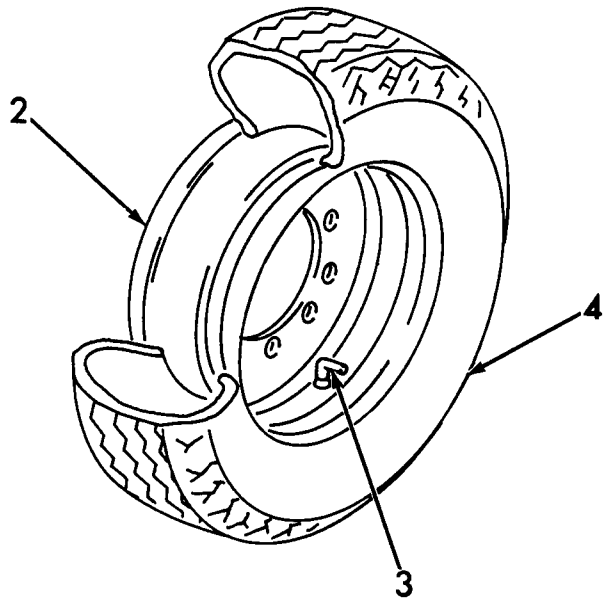
DRIVE MOTOR (45 KBDF)



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	81216	.MOTOR, DRIVE (See Sect. 3, Fig. 1 for NHA) (See Vendor Chap. for more Information)	REF
2	67356	..SHAFT, OUTPUT	1
-3	67357	..KIT, SEAL	1

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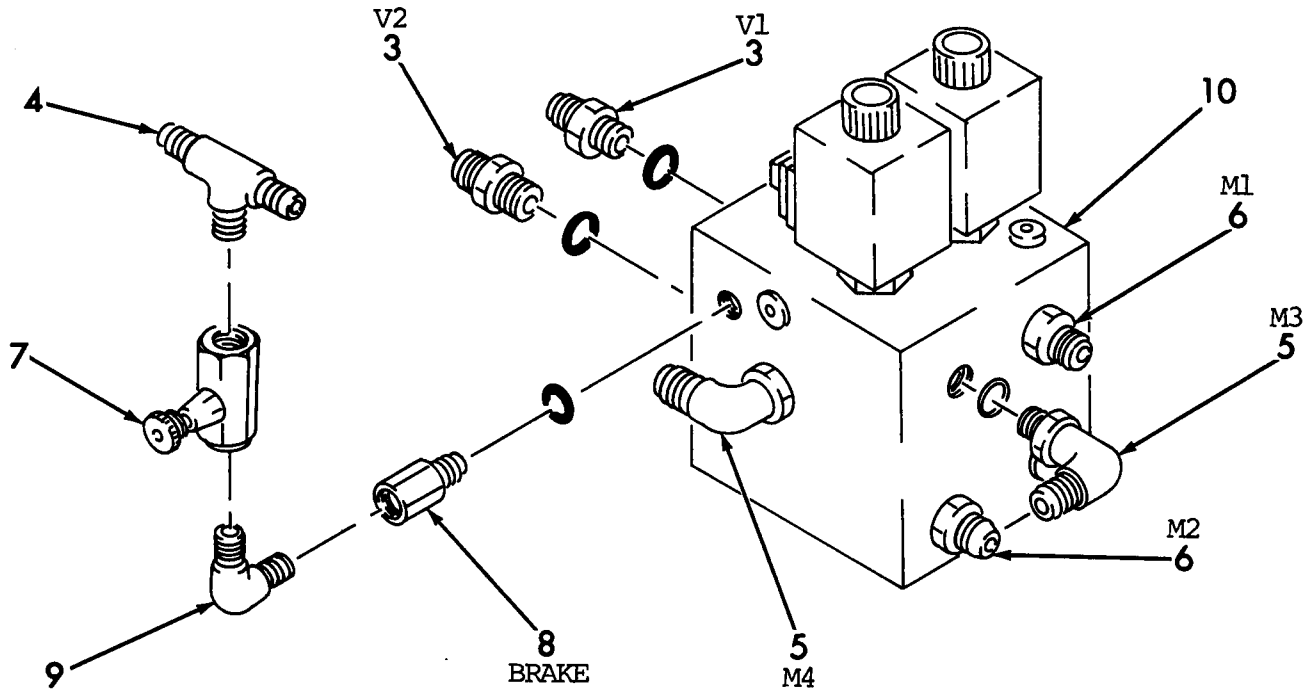
FRONT AXLE WHEEL ASSEMBLY (45 KBDF)

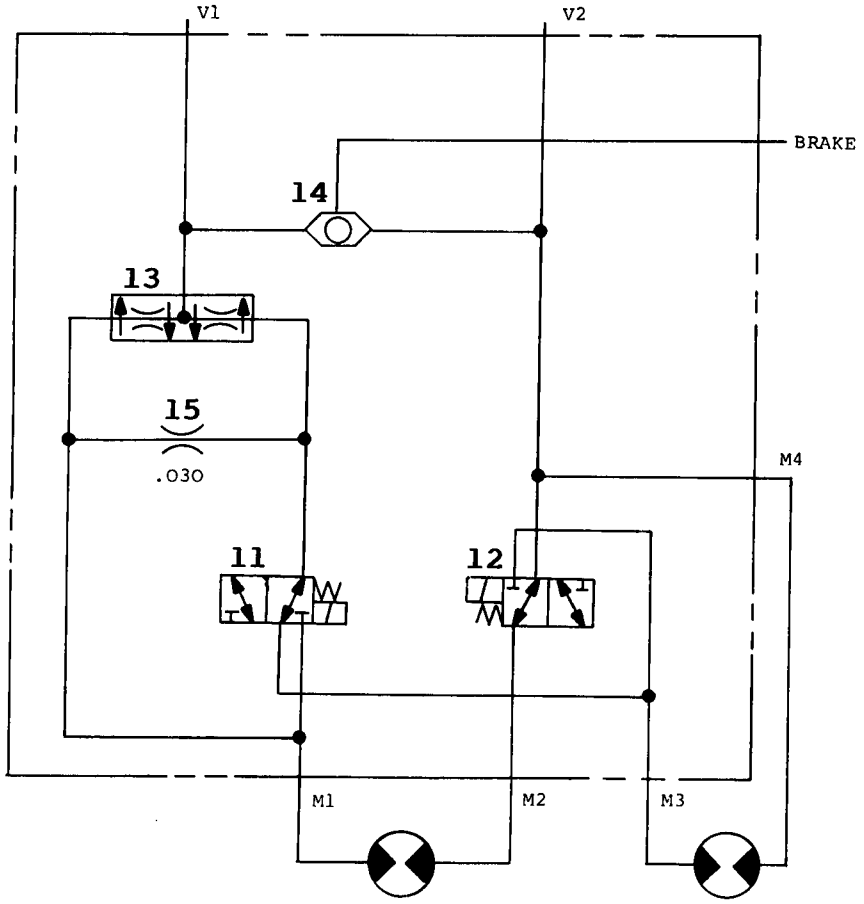


ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140166	ASSEMBLY, FRONT AXLE WHEEL (See Sect. 3, Fig. 1 for NHA)	REF
2	140280	.WHEEL	1
3	140321	.VALVE	1
4	140165	.TIRE	1

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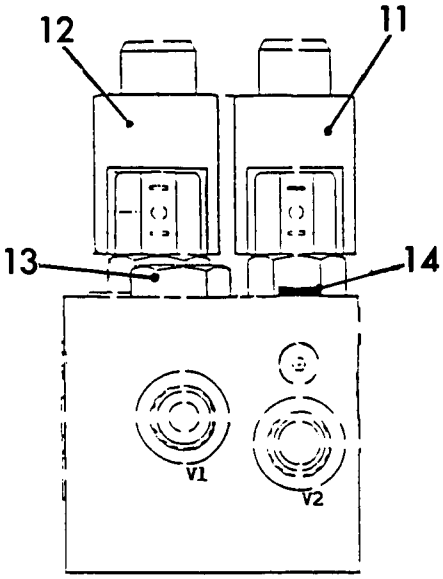
SERIES PARALLEL VALVE ASSEMBLY (45 KBDF)



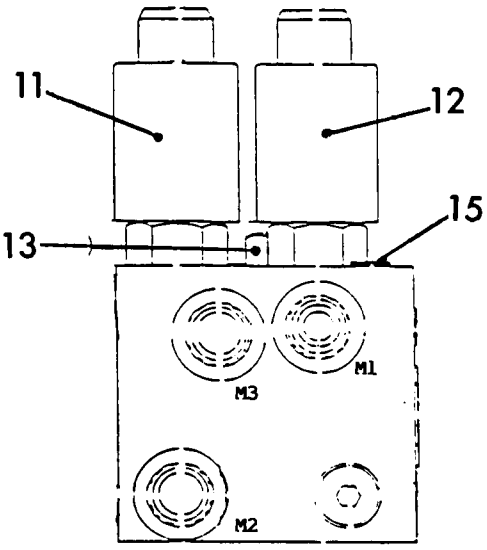


(11)	SERIES/PARALLEL VALVE	P/N 67346
(12)	SERIES/PARALLEL VALVE	P/N 67346
(13)	FLOW DIVIDER COMBINER	P/N 67219
(14)	BRAKE SHUTTLE VALVE	P/N 67241
(15)	ORIFICE PLUG	P/N 67349

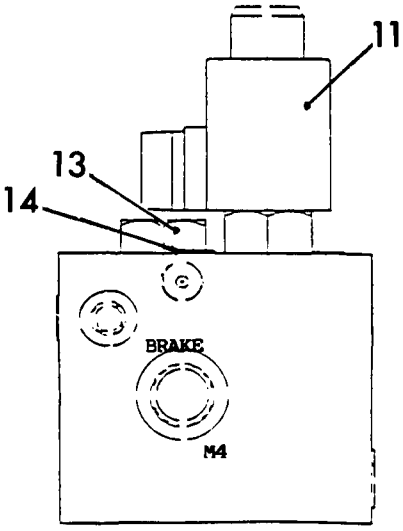
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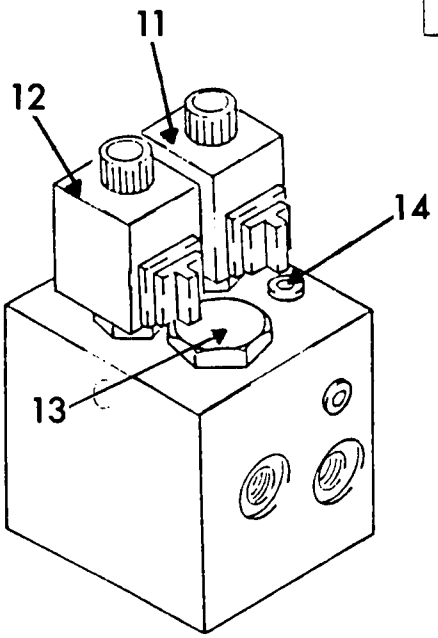
LEFT SIDE VIEW

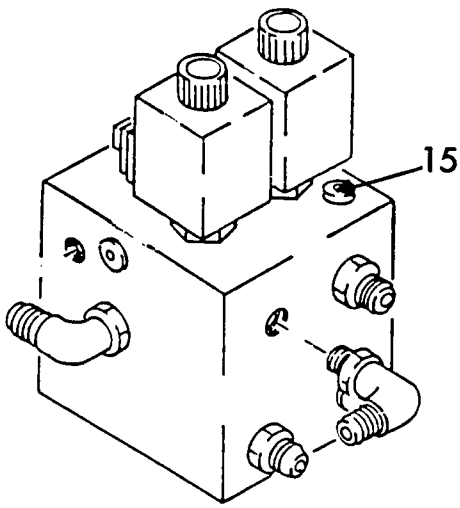


RIGHT SIDE VIEW



FRONT VIEW





(11/12) SERIES PARALLEL VALVE: P/N 67346

These valves operate simultaneously to connect the drive motors in a series circuit for high travel speed. In the low speed (Parallel) forward direction (V2 supply). M1 supplies the right hand drive motor and the left hand motor is supplied across valve "12" by the M2 port. Return flow across the right hand motor comes back into port M3 and is directed across valve "11" to recombine with the return oil flow across the left hand motor from port M1 at the flow divider combiner, where it is returned to tank out port V1. Reverse direction of travel causes oil flow to follow the reverse flow path from that which was just followed. In high speed forward (V2 supply) oil flow is blocked by valve 12 so it is directed out port M4 to the right hand drive motor the flow across the motor is returned through port M3 where it is directed across valve 12 out port M2 to the left hand drive motor, across the left drive motor it is returned to port M1 across valve 11 to the flow divider combiner and out to port V1. Reverse direction of travel is the opposite of what just covered.

(13) FLOW DIVIDER COMBINER.

This valve regulates supply flow for the drive motors, insuring that inlet or return flow is divided or combined equally, thus insuring that maximum torque can be generated at each drive wheel, regardless of the driving surface.

(14) BRAKE SHUTTLE VALVE P/N 67241.

Inlet pressure signal from drive control valve is sensed across the shuttle valve and directed out to the brake release port.

(15) ORIFICE PLUG P/N 67349.

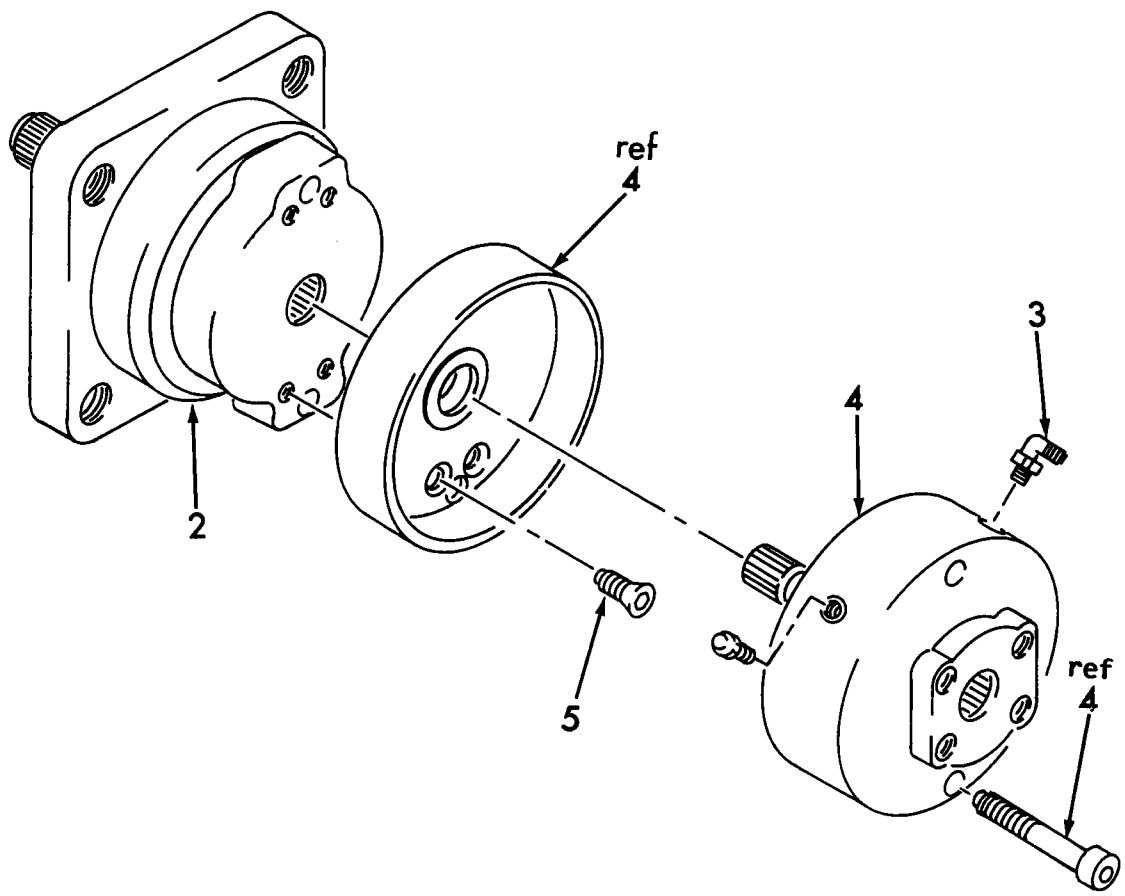
Provides for relief of oil across the flow divider combiner, when a drive motor is cramped into a tight turn, this prevents the tire from scuffing the floor.

SERIES PARALLEL VALVE ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140293	ASSEMBLY, SERIES PARALLEL VALVE (See Sect. 3, Fig. 1 for NHA)	REF
3	80004-15	.CONNECTOR (V1, V2)	2
4	80034-04	.TEE, MALE BRANCH	1
5	80012-13	.ELBOW (M3, M4)	2
6	80004-13	.CONNECTOR (M1, M2)	2
7	20357	.VALVE, NEEDLE	1
8	51903	.FITTING (BRAKE)	1
9	80022-03	.ELBOW, MALE PIPE	1
10	81220	.VALVE, SERIES PARALLEL	1
11	67346	..VALVE, SERIES/PARALLEL	1
12	67346	..VALVE, SERIES/PARALLEL	1
13	67219	..COMBINER, FLOW DIVIDER	1
14	67241	..VALVE, BRAKE SHUTTLE	1
15	67349	..PLUG, ORIFICE	1

- ITEM NOT ILLUSTRATED

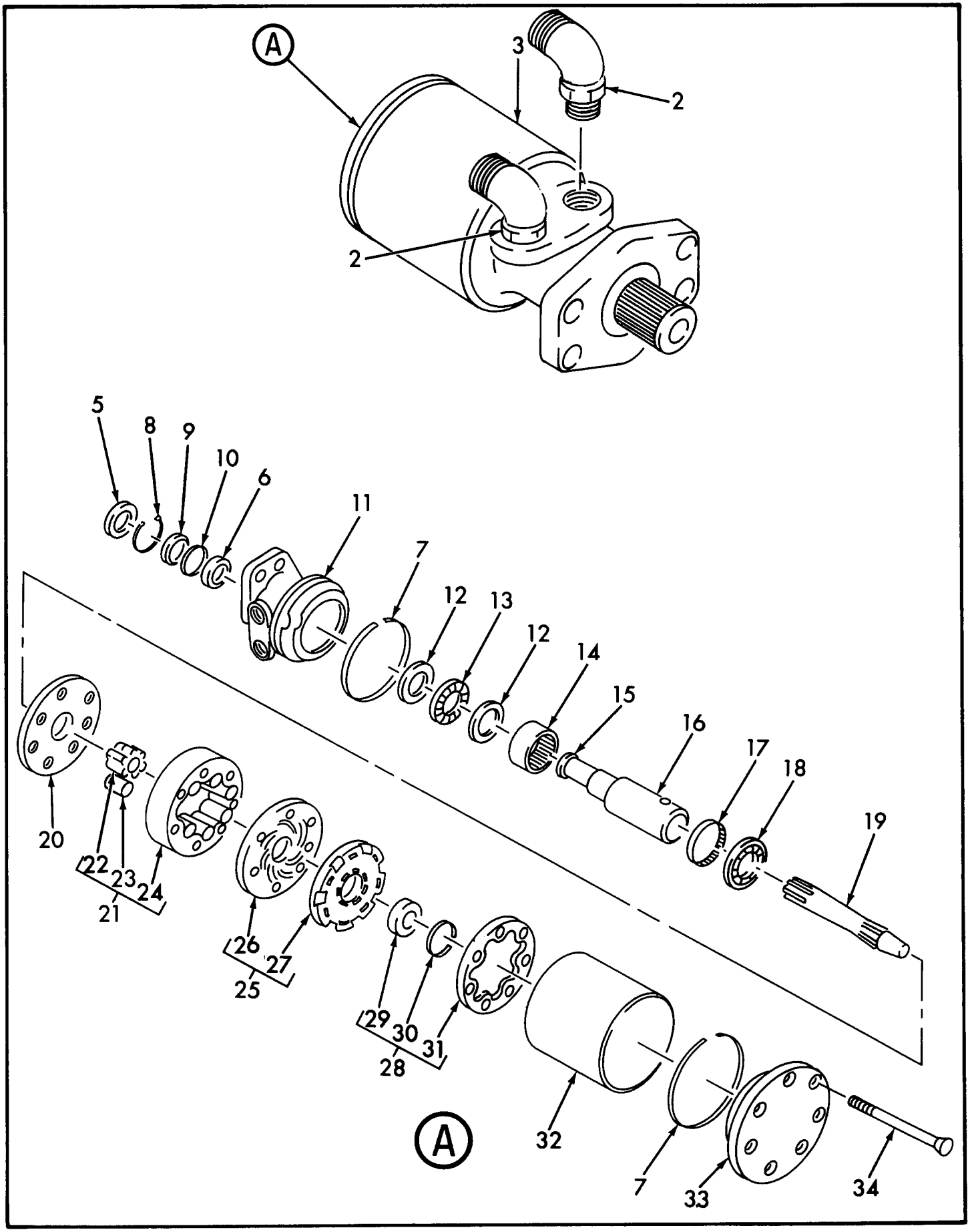
DRIVE/BRAKE MOTOR ASSEMBLY (45 KB)



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140596	ASSEMBLY, DRIVE/BRAKE MOTOR (See Sect. 3, Fig. 2 for NHA)	REF
2	81208	.HUB, TORQUE (See Vendor Chap. for more Information)	1
3	80012-03	.ELBOW, STRAIGHT THREAD	1
4	81207	.BRAKE (See Vendor Chap. for more Information)	1
5	61812	.SCREW, CAP (attaching part)	4

- ITEM NOT ILLUSTRATED

DRIVE MOTOR ASSEMBLY (45 KB)



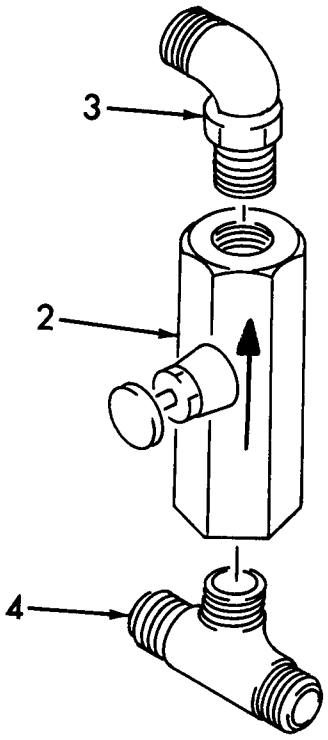
DRIVE MOTOR ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140650	ASSEMBLY, DRIVE MOTOR (See Sect. 3, Fig. 2 for NHA)	REF
2	80012-13	.CONNECTOR, ELBOW	2
3	81206	.MOTOR, DRIVE (See Vendor Chap. for more Information)	1
-4	3036-A	..KIT, SEAL	1
5		...SEAL	1
6		...SEAL	1
7		...RING, SEAL	2
8		..RING, RETAINER	1
9		..WASHER, BACK-UP	1
10		..WASHER	1
11		..HOUSING	1
12		..WASHER, THRUST	2
13		..BEARING, THRUST	1
14		..BEARING	1
15		..WASHER	1
16	67358	..SHAFT, COUPLING	1
17		..BEARING	1
18		..BEARING, THRUST	1
19	67359	..LINK, DRIVE	1
20		..PLATE, WEAR	1
21		..SET, ROTOR	1
22		...ROTOR	1
23		...VALVE	7
24		..STATOR	1
25		..SET, MANIFOLD (FOR MAB TORQMOTORS)	1

DRIVE MOTOR ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
26		...PLATE, MANIFOLD	1
27		...MANIFOLD	1
28		..SET, COMMUTATOR	1
29		...COMMUTATOR	1
30		...RING, SEAL	1
31		...RING, COMMUTATOR	1
32		..SLEEVE	1
33		..ASSEMBLY, END COVER	1
34		..BOLT, SPECIAL	7

BRAKE RELEASE VALVE ASSEMBLY (45 KB)

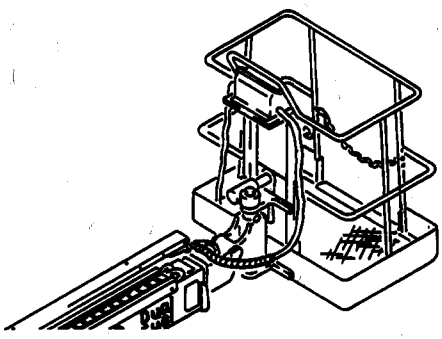


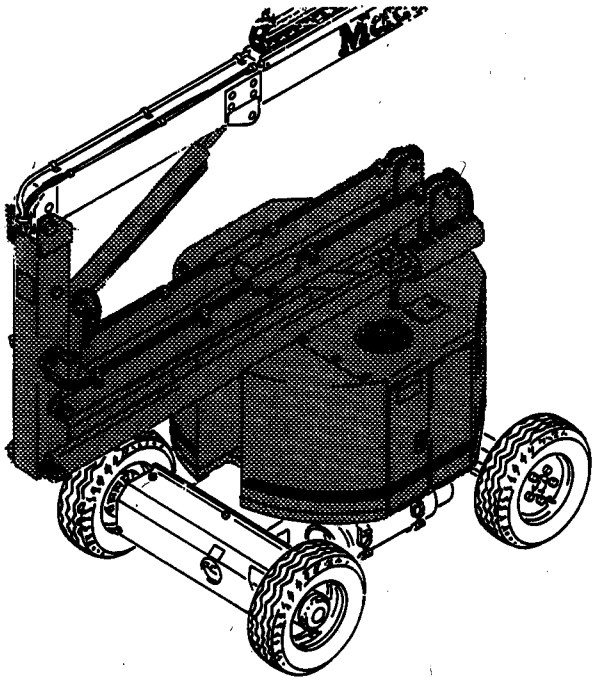
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140651	ASSEMBLY, BRAKE RELEASE VALVE (See Sect. 3, Fig. 2 for NHA)	REF
2	20357	.VALVE, NEEDLE	1
3	80008-04	.CONNECTOR, ELBOW	1
4	80034-04	.TEE, MALE BRANCH	1

- ITEM NOT ILLUSTRATED

THIS **SECTION 4** IS ILLUSTRATED AS

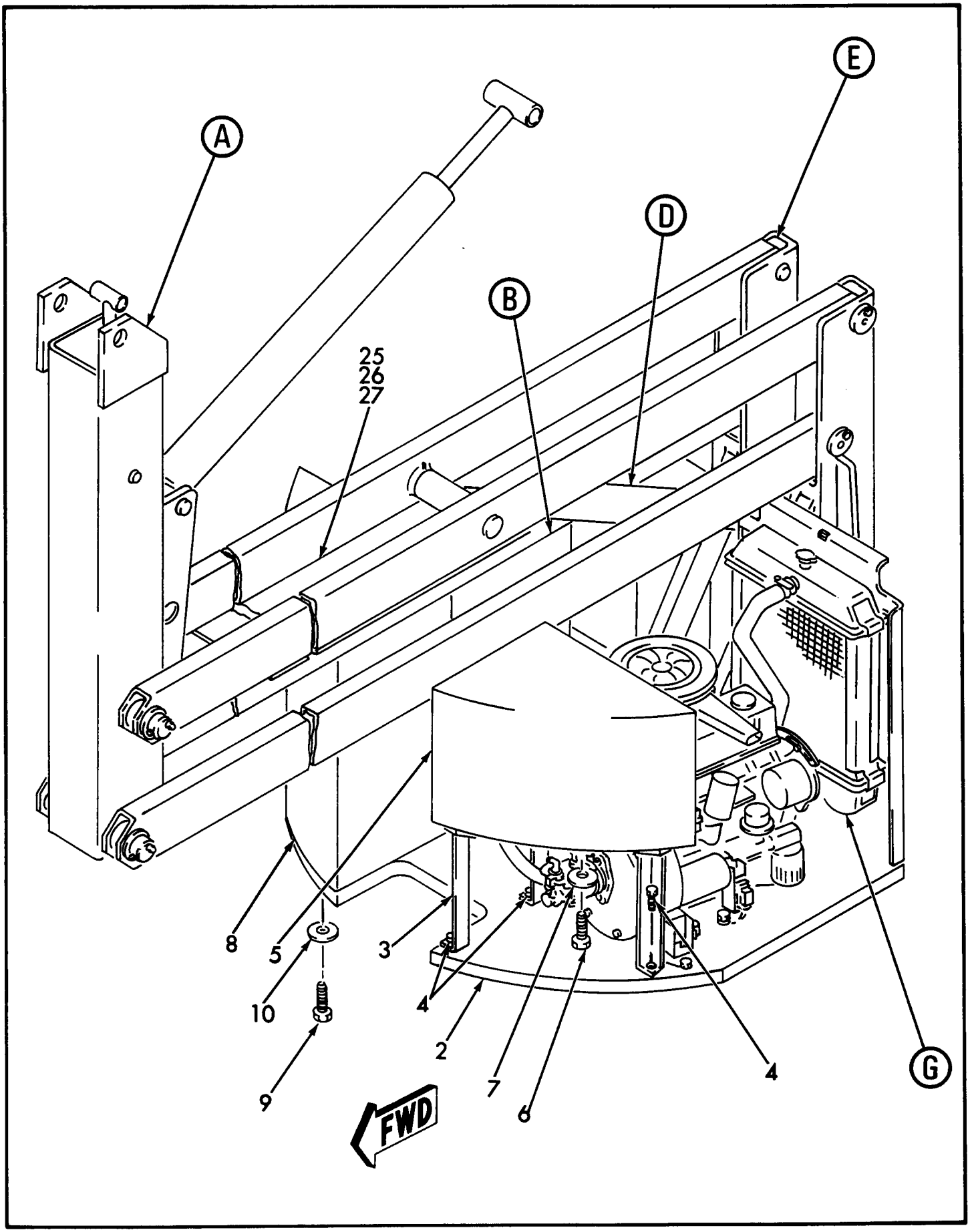
FIGURE 1 TURRET ASSEMBLY (45KBDF)
FIGURE 2 TURRET ASSEMBLY (45KB)
FIGURE 3 MASTER LEVELING CYLINDER ASSEMBLY
FIGURE 4 BOOM/RISER LIFT CYLINDER ASSEMBLY
FIGURE 5 ROTATION GEARBOX/BRACKET ASSEMBLY
FIGURE 6 HYDRAULIC TANK ASSEMBLY (45KBDF)
FIGURE 7 HYDRAULIC TANK ASSEMBLY (45KB)
FIGURE 8 REGENERATIVE VALVE ASSEMBLY
FIGURE 9 FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY(45KBDF)
FIGURE 10 FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KB)
FIGURE 11 EMERGENCY PUMP ASSEMBLY
FIGURE 12 UPPER RIGHT RISER ARM ASSEMBLY
FIGURE 13 UPPER LEFT RISER ARM ASSEMBLY
FIGURE 14 LOWER RISER ARM ASSEMBLY
FIGURE 15 ENGINE AND PUMP ASSEMBLY (45KBDF)
FIGURE 16 SHIFT CYLINDER ASSEMBLY (45KBDF)
FIGURE 17 MOTOR/PUMP ASSEMBLY (45KB) *
FIGURE 18 BATTERY CHARGER ASSEMBLY (45KB)
FIGURE 19 14 INCH FAN ASSEMBLY (45KBDF)
FIGURE 20 HYDRAULIC MOTOR ASSEMBLY
FIGURE 21 DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KBDF)
FIGURE 22 DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KB)

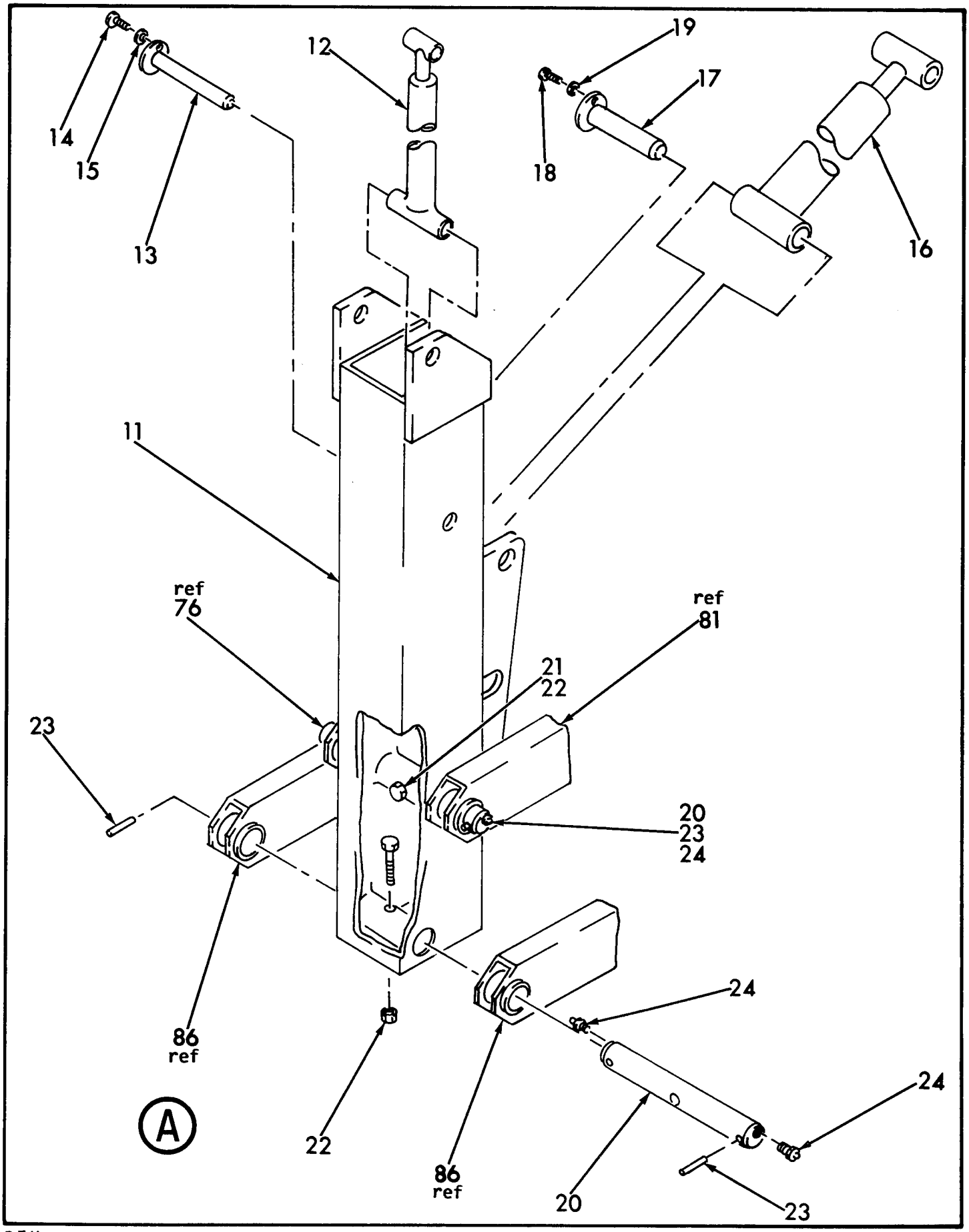




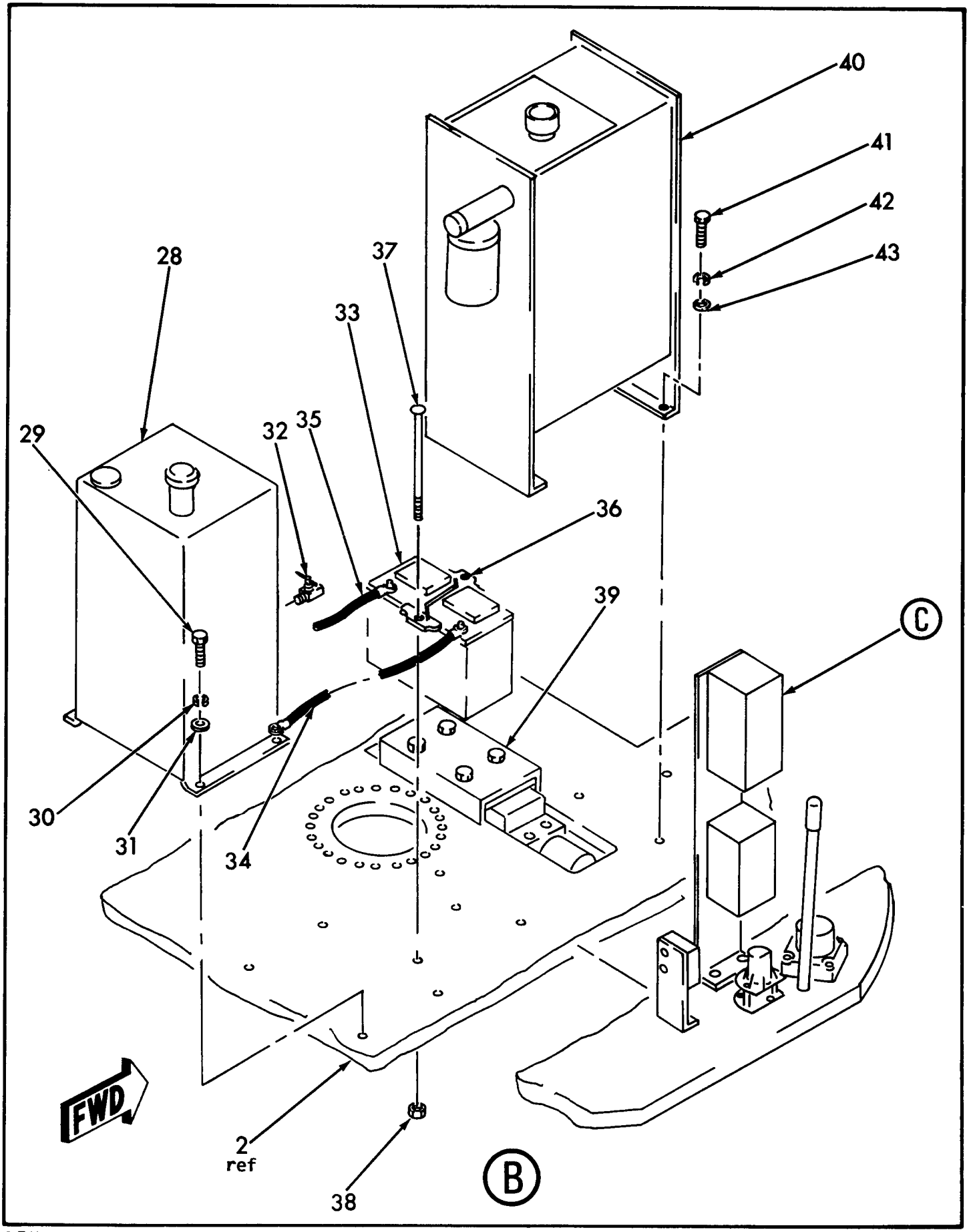
*** DRAWINGS NOT AVAILABLE THIS REVISION**

TURRET ASSEMBLY (45 KBDF)

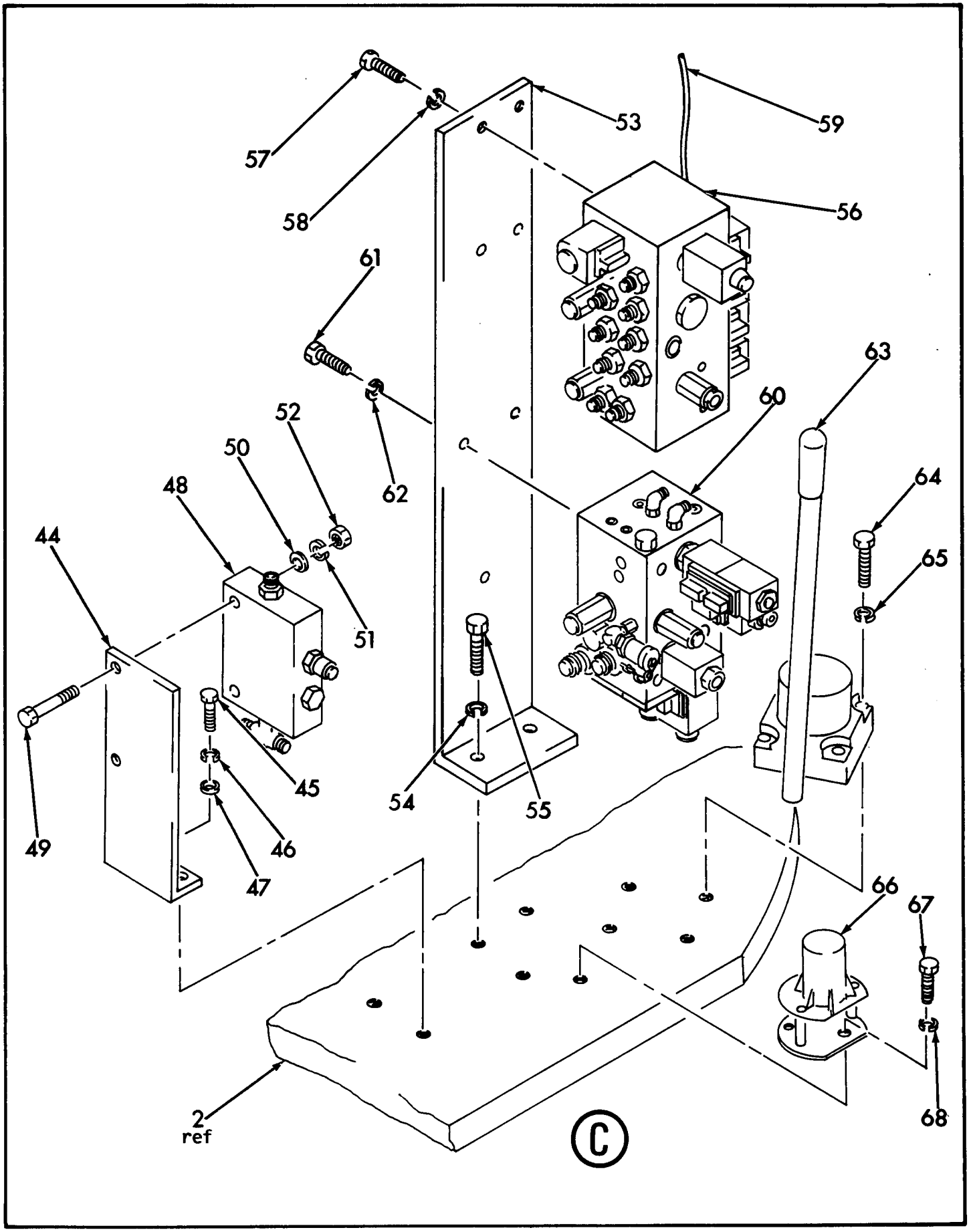



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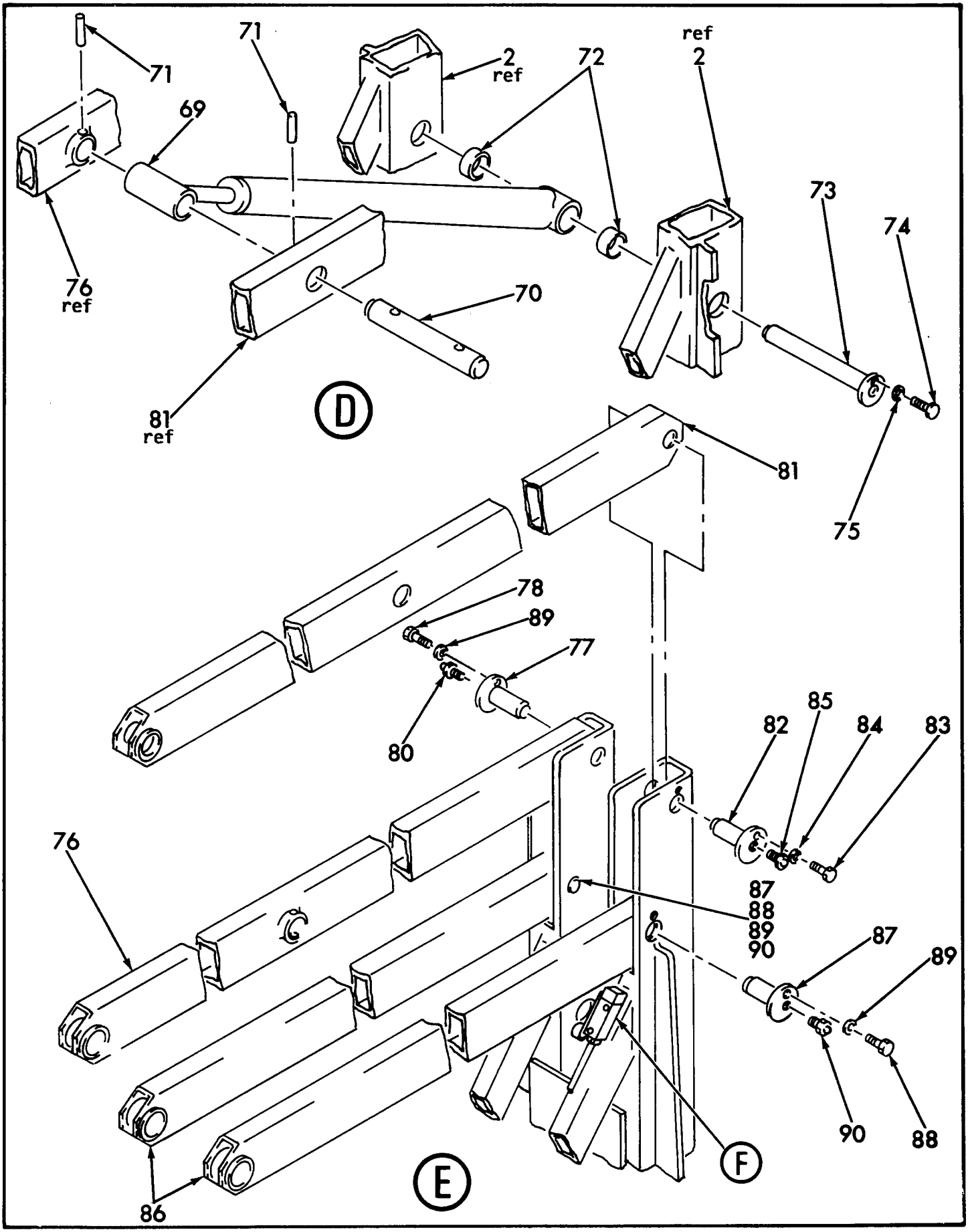
TURRET ASSEMBLY (45 KBDF) (continued)



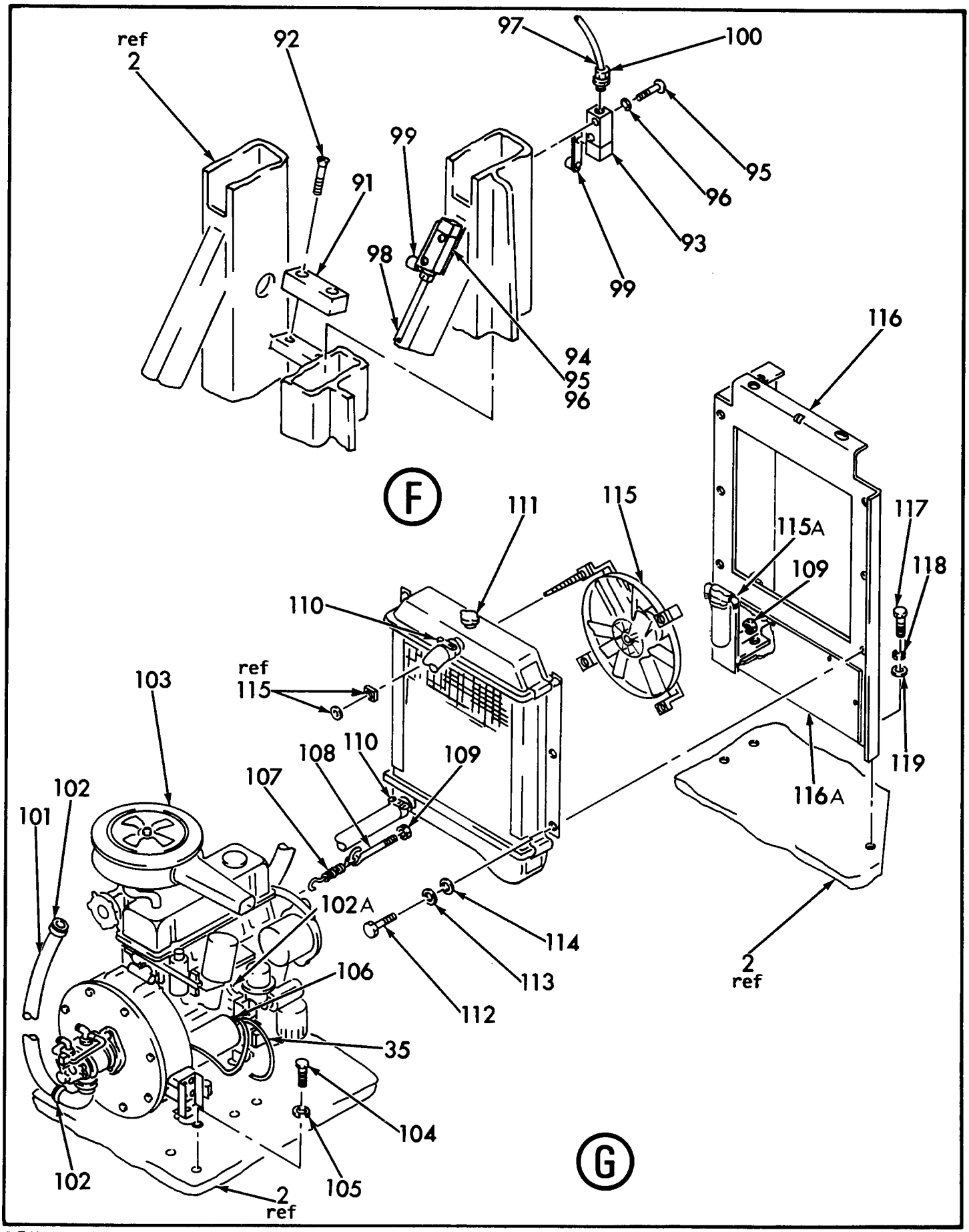
TURRET ASSEMBLY (45 KBDF)
(continued)



TURRET ASSEMBLY (45 KBDF) (continued)



TURRET ASSEMBLY (45 KBDF)
(continued)



TURRET ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140149	ASSEMBLY, TURRET (See Sect. 2, Fig. 1 for NHA)	REF
2	140147	.WELDMENT, TURRET PLATE	1
3	140410	.WELDMENT, COUNTERWEIGHT PEDESTAL	1
4	60602	.SCREW, CAP (attaching part)	3
5	140086	.COUNTERWEIGHT, LEFT SIDE	1
6	60537	.SCREW, CAP (attaching part)	2
7	140517	.WASHER, FLAT (attaching part)	2
8	140088	.COUNTERWEIGHT, RIGHT SIDE	1
9	60369	.SCREW, CAP (attaching part)	2
10	140517	.WASHER, FLAT (attaching part)	2
11	140143	.MACHINING, RISER	1
12	140062	.ASSEMBLY, MASTER LEVELING CYLINDER (See Sect. 4, Fig. 3 for Details)	1
13	140548	.PIN, MASTER CYLINDER	1
14	60539	.SCREW, CAP (attaching part)	1
15	63319	.WASHER, LOCK (attaching part)	1
16	140056	.ASSEMBLY, BOOM LIFT CYLINDER (See Sect. 4, Fig. 4 for Details)	1
17	140430	.PIN, BOOM LIFT	1
18	60539	.SCREW, CAP (attaching part)	1
19	63319	.WASHER, LOCK (attaching part)	1
20	140422	.PIN, ARM/COLUMN	2
21	60614	.SCREW, CAP (attaching part)	2
22	61301	.NUT, HEX (attaching part)	2
23	65967	.PIN, ROLL	4
24	65103	.FITTING, GREASE	2

- ITEM NOT ILLUSTRATED

TURRET ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
25	140206	.PLATE, STIFFENER	1
26	60325	.SCREW, CAP (attaching part)	10
27	63319	.WASHER, LOCK (attaching part)	10
28	140239	.TANK, FUEL	1
29	60372	.SCREW, CAP (attaching part)	4
30	63319	.WASHER, LOCK (attaching part)	4
31	63403	.WASHER, FLAT (attaching part)	4
32	12000	.VALVE, NEEDLE	1
33	4030	.BATTERY	1
34	13226-0180	.ASSEMBLY, BATTERY CABLE	1
35	13226-0760	.ASSEMBLY, BATTERY CABLE	1
36	20375	.CLAMP, BATTERY	1
37	65108	.SCREW, BATTERY HOLD DOWN (attaching part)	2
38	61246	.NUT, HEX (attaching part)	2
39	140608	.ASSEMBLY, ROTATION GEAR BOX/BRACKET (See Sect. 4, Fig. 5 for Details)	1
40	140580	.ASSEMBLY, HYDRAULIC TANK (See Sect. 4, Fig. 6 for Details)	1
41	60372	.SCREW, CAP (attaching part)	4
42	63319	.WASHER, LOCK (attaching part)	4
43	63403	.WASHER, FLAT (attaching part)	4
44	140476	.WELDMENT, REGENERATIVE VALVE BRACKET	1
45	60331	.SCREW, CAP (attaching part)	2
46	63319	.WASHER, LOCK (attaching part)	2
47	63403	.WASHER, FLAT (attaching part)	2
48	140313	.ASSEMBLY, REGENERATIVE VALVE (See Sect. 4, Fig. 8 for Details)	1

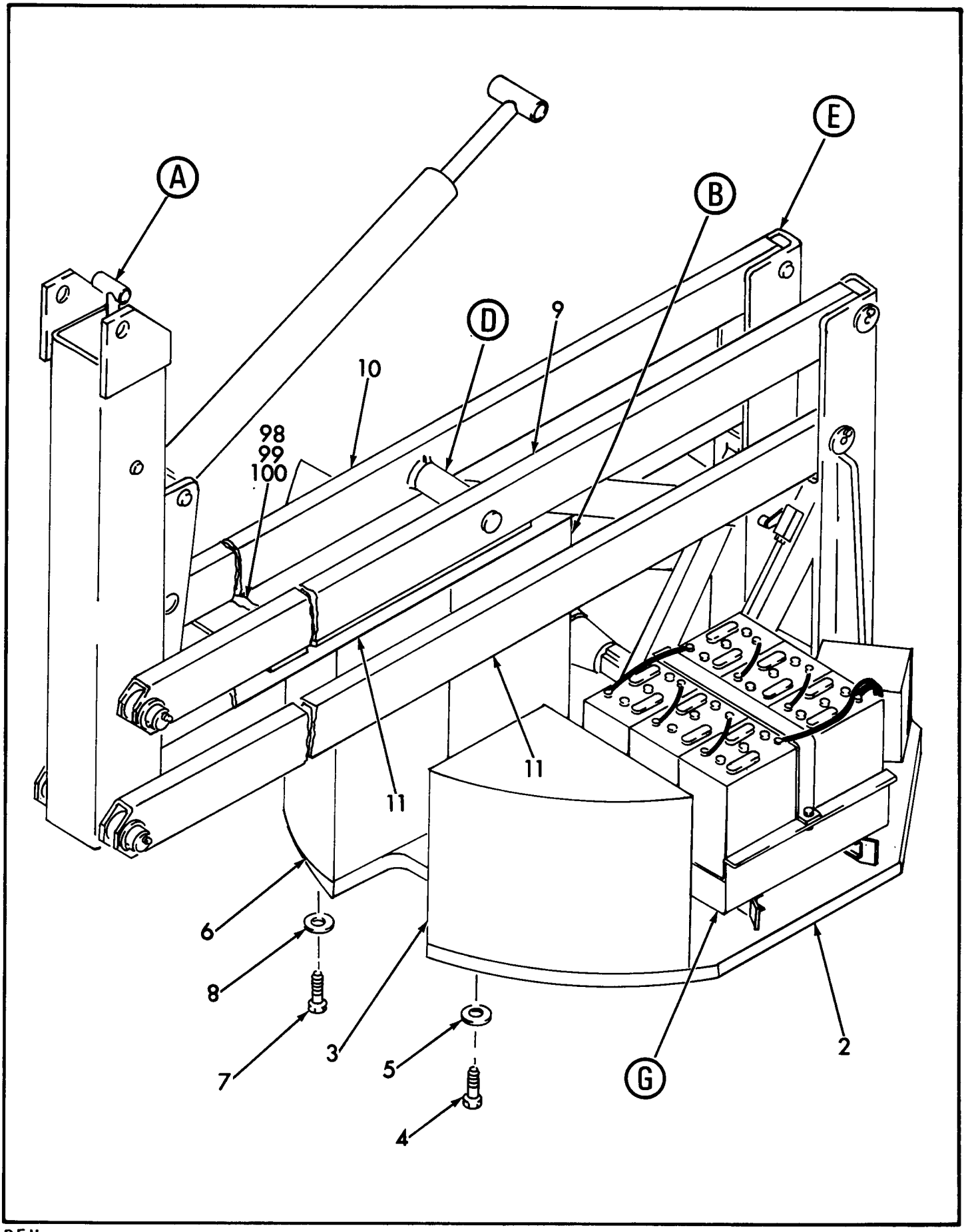
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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
49	66829	.SCREW, CAP (attaching part)	2
50	63402	.WASHER, FLAT (attaching part)	2
51	63302	.WASHER, LOCK (attaching part)	2
52	67202	.NUT, HEX (attaching part)	2
53	140478	.WELDMENT, MANIFOLD BRACKET	1
54	60331	.SCREW, CAP (attaching part)	2
55	63319	.WASHER, LOCK (attaching part)	2
56	140294	.ASSEMBLY, FUNCTIONAL BOOM VALVE PACKAGE (See Sect. 4, Fig. 9 for Details)	1
57	60343	.SCREW, CAP (attaching part)	4
58	63319	.WASHER, LOCK (attaching part)	4
59	70384-1200	.CABLE	1
60	140292	.ASSEMBLY, DRIVE/STEER VALVE PACKAGE (See Sect. 4, Fig. 21 for Details)	1
61	60343	.SCREW, CAP (attaching part)	3
62	63319	.WASHER, LOCK (attaching part)	3
63	140582	.ASSEMBLY, EMERGENCY PUMP (See Sect. 4, Fig. 11 for Details)	1
64	60340	.SCREW, CAP (attaching part)	3
65	63301	.WASHER, LOCK (attaching part)	3
66	21250	.SENSOR, SLOPE	1
67	60342	.SCREW, CAP (attaching part)	2
68	63301	.WASHER, LOCK (attaching part)	2
69	140056	.ASSEMBLY, RISER LIFT CYLINDER (See Sect. 4, Fig. 4 for Details)	1
70	140407	.PIN, ARM CYLINDER	1
71	64216	.PIN, ROLL (attaching part)	2
72	27095	.TUBE, ROD	2

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
73	140421	.PIN, RISER LIFT CYLINDER	1
74	60539	.SCREW, CAP (attaching part)	1
75	63319	.WASHER, LOCK (attaching part)	1
76	140215	.ASSEMBLY, UPPER RIGHT RISER ARM (See Sect. 4, Fig. 12 for Details)	1
77	140423	.PIN, ARM/COLUMN	1
78	60539	.SCREW, CAP (attaching part)	1
79	63319	.WASHER, LOCK (attaching part)	1
80	65103	.FITTING, GREASE	1
81	140209	.ASSEMBLY, UPPER LEFT RISER ARM (See Sect. 4, Fig. 13 for Details)	1
82	140423	.PIN, ARM/COLUMN	1
83	60539	.SCREW, CAP (attaching part)	1
84	63319	.WASHER, LOCK (attaching part)	1
85	65103	.FITTING, GREASE	1
86	140216	.ASSEMBLY, LOWER RISER ARM (See Sect. 4, Fig. 14 for Details)	2
87	140423	.PIN, ARM/COLUMN	2
88	60539	.SCREW, CAP (attaching part)	2
89	63319	.WASHER, LOCK (attaching part)	2
90	65103	.FITTING, GREASE	2
91	140404	.PAD, BOOM REST	1
92	61809	.SCREW, FLAT HEAD (attaching part)	2
93	70173	.SWITCH, LIMIT	1
94	70107	.SWITCH, LIMIT	1
95	62704	.SCREW, CAP (attaching part)	4
96	63313	.WASHER, LOCK (attaching part)	4
97	2912-1560	.CABLE	1

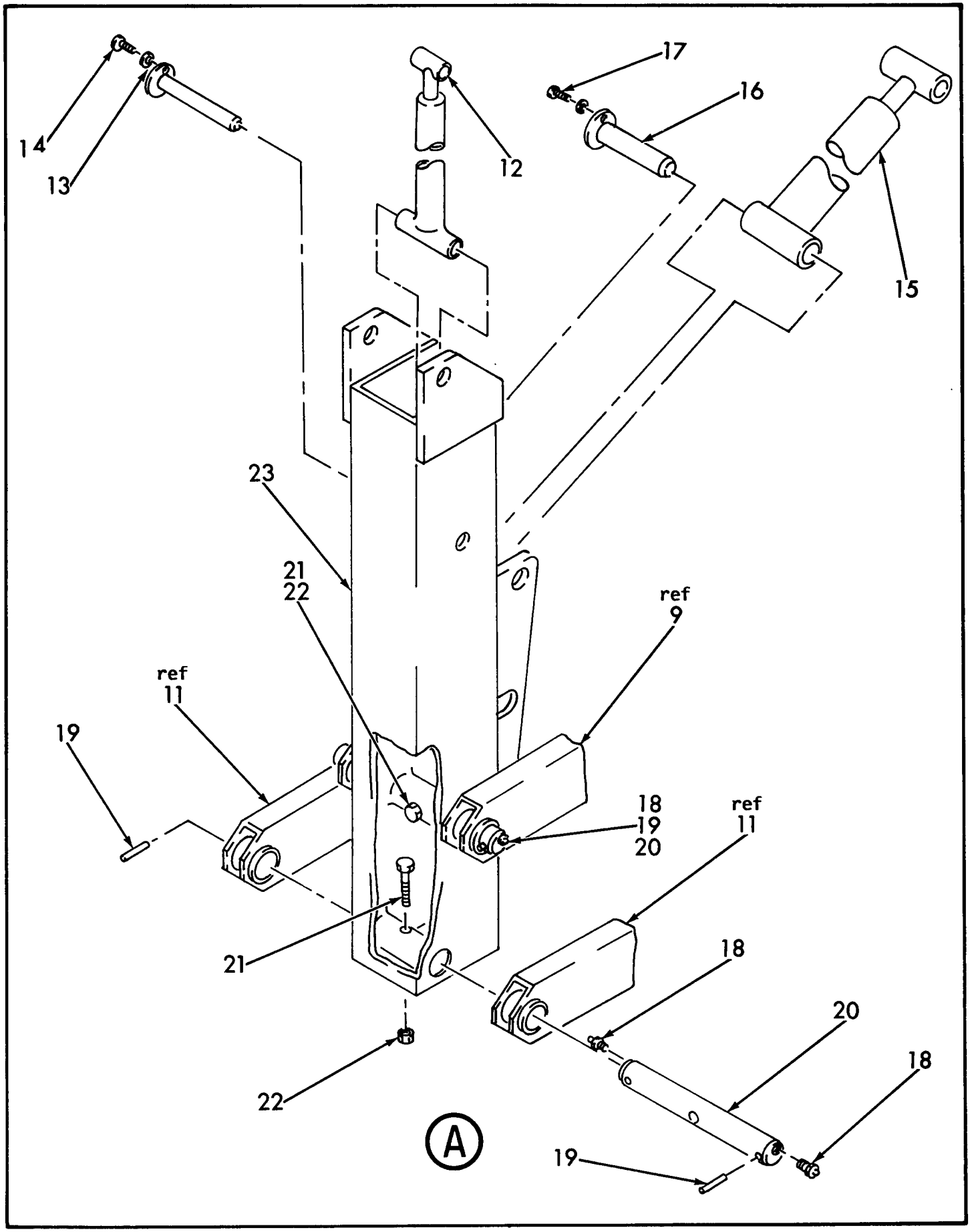
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
98	2912-1200	.CABLE	1
99	70148	.ARM, LEVER	2
100	2806	.RELIEF, STRAIN	2
101	140553	.HOSE, HYDRAULIC SUCTION	1
102	55	.CLAMP, HOSE (attaching part)	2
102A	67396	.FITTING, CONNECTOR	1
103	140064	.ASSEMBLY, ENGINE AND PUMP (See Sect. 4, Fig. 15 for Details)	1
104	60325	.SCREW, CAP (attaching part)	8
105	63319	.WASHER, LOCK (attaching part)	8
106	70386-1440	.CABLE	1
107	65839	.SPRING	1
108	65959	.EYEBOLT (attaching part)	1
109	60703	.NUT, HEX (attaching part)	2
110	16288	.CLAMP, HOSE	4
111	140587	.RADIATOR	1
112	60320	.SCREW, CAP (attaching part)	6
113	63319	.WASHER, LOCK (attaching part)	6
114	63403	.WASHER, FLAT (attaching part)	6
115	65693	.ASSEMBLY, 14" FAN (See Sect. 4, Fig. 19 for Details)	1
115A	67395	.FITTING, ELBOW	1
116	140571	.BRACKET, RADIATOR	1
116A	140674	.BAFFLE	1
117	60322	.SCREW, CAP (attaching part)	3
118	63302	,WASHER, LOCK (attaching part)	3
119	63402	.WASHER, FLAT (attaching part)	3

TURRET ASSEMBLY (45 KB)

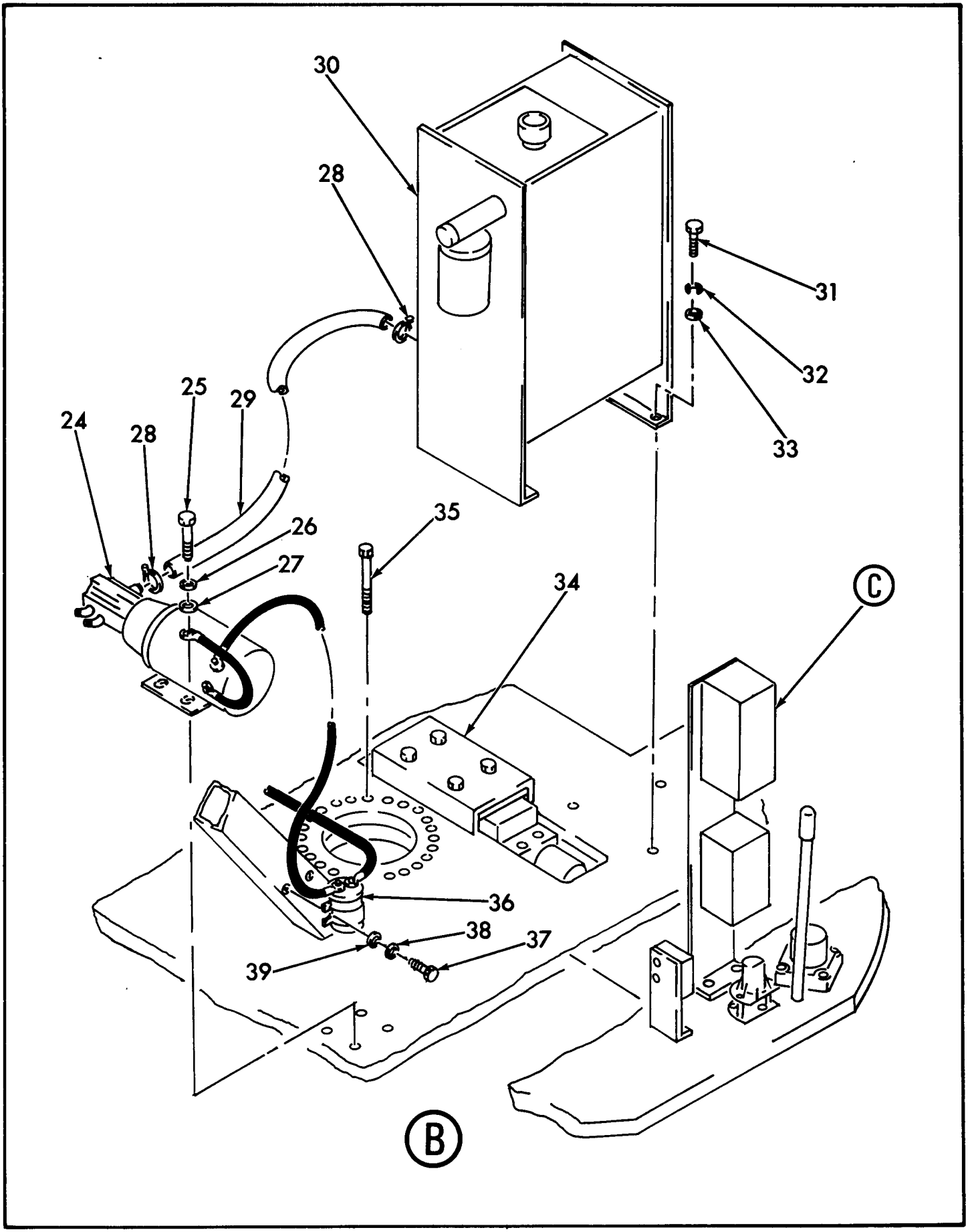


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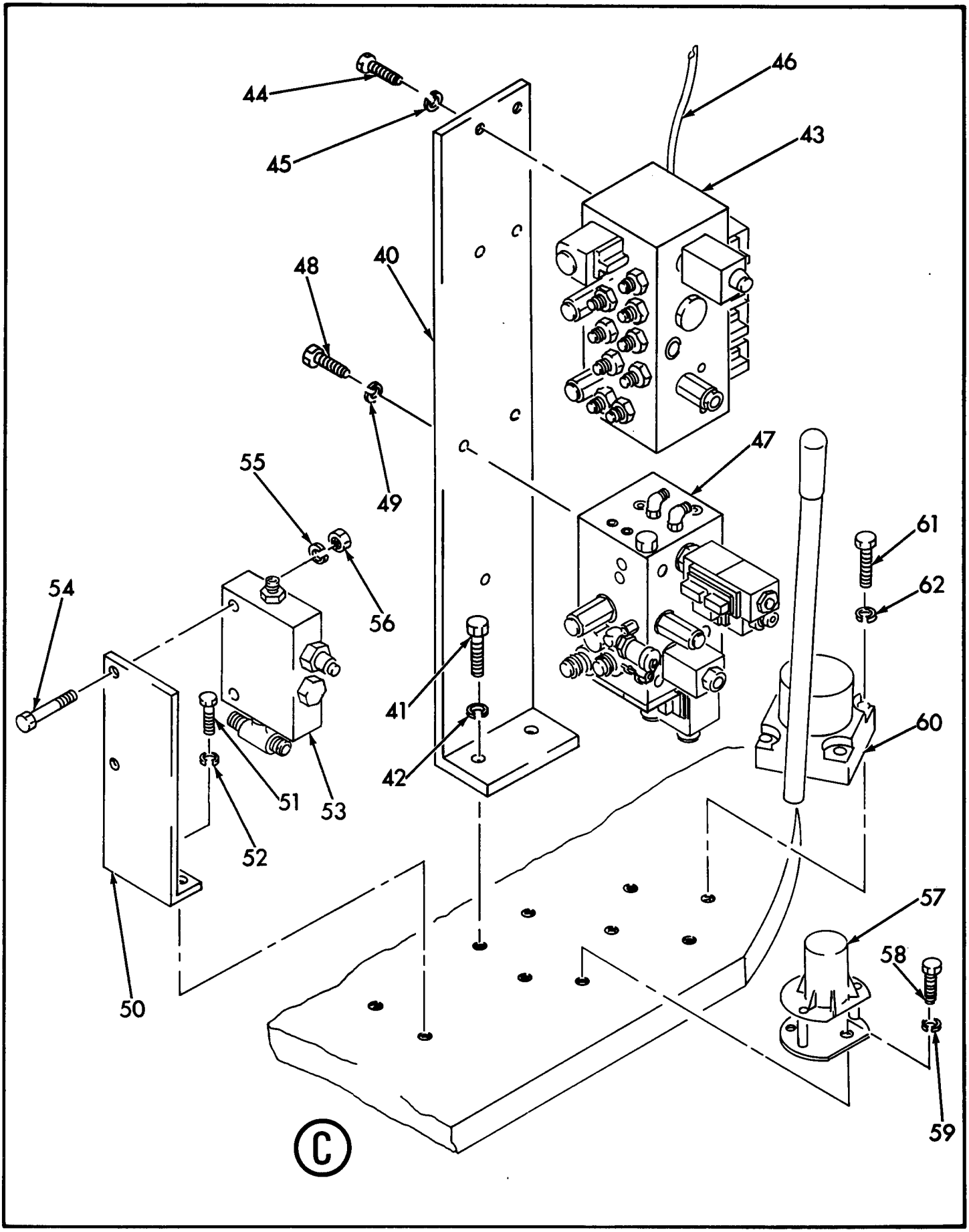
TURRET ASSEMBLY (45 KB)
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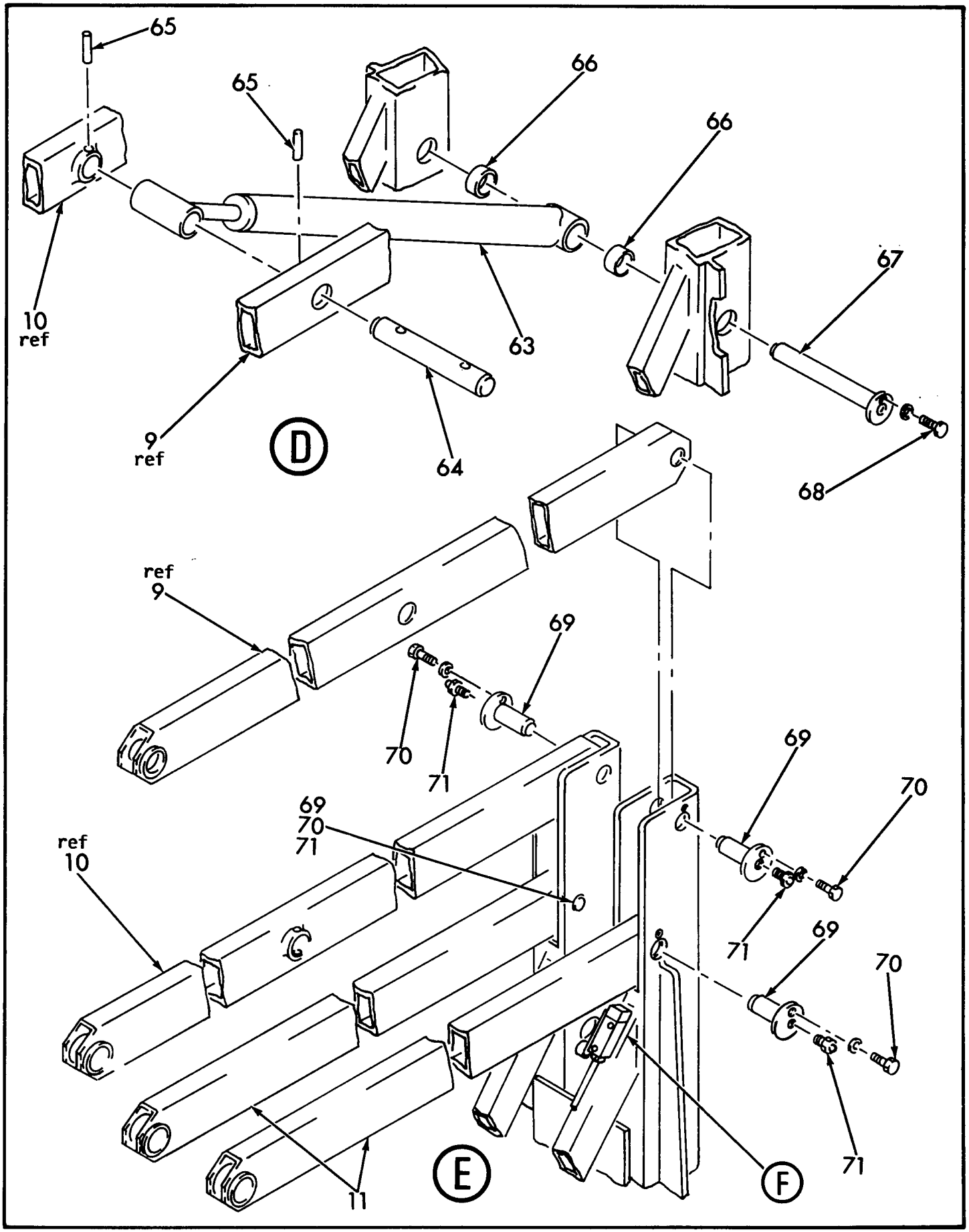
TURRET ASSEMBLY (45 KB)
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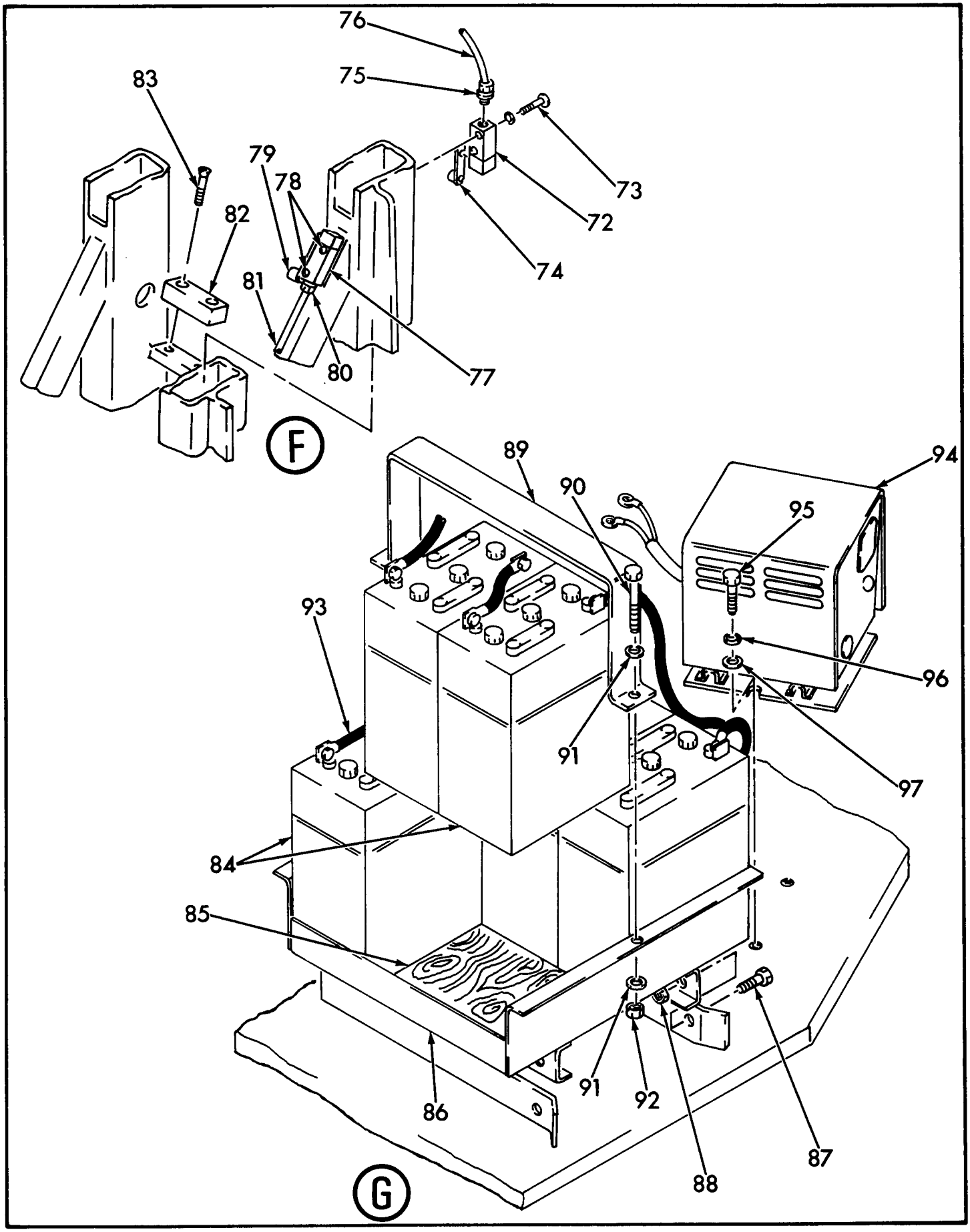


TURRET ASSEMBLY (45 KB)
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TURRET ASSEMBLY (45 KB)
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TURRET ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140309	ASSEMBLY, TURRET (See Sect. 2, Fig. 2 for NHA)	REF
2	140147	.WELDMENT, TURRET PLATE	1
3	140086	.COUNTERWEIGHT, LEFT SIDE	1
4	60369	.SCREW, CAP (attaching part)	2
5	140517	.WASHER, FLAT (attaching part)	2
6	140088	.COUNTERWEIGHT, RIGHT SIDE	1
7	60369	.SCREW, CAP (attaching part)	2
8	140517	.WASHER, FLAT (attaching part)	2
9	140209	.ASSEMBLY, UPPER LEFT RISER ARM (See Sect. 4, Fig. 13 for Details)	1
10	140215	.ASSEMBLY, UPPER RIGHT RISER ARM (See Sect. 4, Fig. 12 for Details)	1
11	140216	.ASSEMBLY, LOWER RISER ARM (See Sect. 4, Fig. 14 for Details)	2
12	140062	.ASSEMBLY, MASTER LEVELING CYLINDER (See Sect. 4, Fig. 3 for Details)	1
13	140548	.PIN, MASTER CYLINDER/RISER	1
14	65984	.SCREW, CAP (attaching part)	1
15	140056	.ASSEMBLY, BOOM LIFT CYLINDER (See Sect. 4, Fig. 4 for Details)	1
16	140430	.PIN, BOOM LIFT/RISER	1
17	54984	.SCREW, CAP (attaching part)	1
18	65103	.FITTING, GREASE	4
19	65967	.PIN, ROLL	4
20	140422	.PIN, RISER ARM	2
21	60614	.SCREW, CAP (attaching part)	2
22	61301	.NUT, LOCK (attaching part)	2

- ITEM NOT ILLUSTRATED

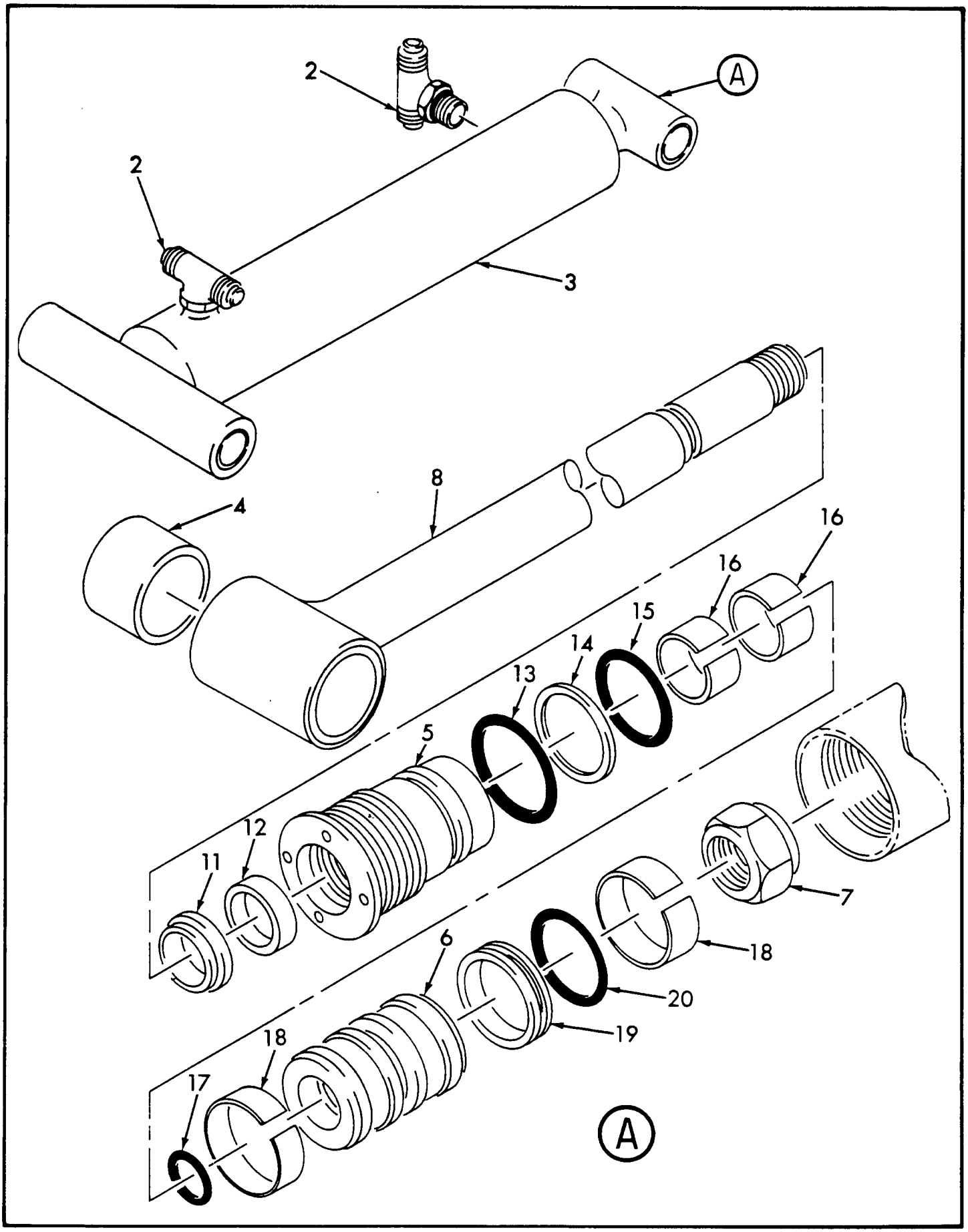
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	140143	.MACHINING, RISER	1
24	140699	.ASSEMBLY, MOTOR/PUMP (See Sect. 4, Fig. 17 for Details)	1
25	60322	.SCREW, CAP (attaching part)	4
26	63302	.WASHER, LOCK (attaching part)	4
27	63402	.WASHER, FLAT (attaching part)	4
28	65983	.CLAMP, HOSE	2
29	140613	.HOSE, HYDRAULIC SUCTION	1
30	140581	.ASSEMBLY, HYDRAULIC TANK (See Sect. 4, Fig. 7 for Details)	1
31	60372	.SCREW, CAP (attaching part)	4
32	63319	.WASHER, LOCK (attaching part)	4
33	63403	.WASHER, FLAT (attaching part)	4
34	140608	.ASSEMBLY, ROTATION GEARBOX/BRACKET (See Sect. 4, Fig. 5 for Details)	1
35	60640	.SCREW, CAP	24
36	70375	.RELAY, POWER	1
37	60342	.SCREW, CAP (attaching part)	2
38	63301	.WASHER, LOCK (attaching part)	2
39	63401	.WASHER, FLAT (attaching part)	2
40	140478	.WELDMENT, MANIFOLD BRACKET	1
41	60331	.SCREW, CAP (attaching part)	2
42	63319	.WASHER, LOCK (attaching part)	2
43	140311	.ASSEMBLY, FUNCTIONAL BOOM VALVE PACKAGE (See Sect. 4, Fig. 10 for Details)	1
44	60343	.SCREW, CAP (attaching part)	4

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
45	63319	.WASHER, LOCK (attaching part)	4
46	70384-1200	.CABLE	1
47	140310	.ASSEMBLY, DRIVE/STEER VALVE PACKAGE (See Sect. 4, Fig. 22 for Details)	1
48	60343	.SCREW, CAP (attaching part)	3
49	63319	.WASHER, LOCK (attaching part)	3
50	140476	.WELDMENT, REGENERATIVE VALVE BRACKET	1
51	60372	.SCREW, CAP (attaching part)	2
52	63319	.WASHER, LOCK (attaching part)	2
53	140313	.ASSEMBLY, REGENERATIVE VALVE (See Sect. 4, Fig. 8 for Details)	1
54	60329	.SCREW, CAP (attaching part)	2
55	63302	.WASHER, LOCK (attaching part)	2
56	60702	.NUT, HEX (attaching part)	2
57	21250	.SENSOR, SLOPE	1
58	60342	.SCREW, CAP (attaching part)	2
59	63301	.WASHER, LOCK (attaching part)	2
60	140582	.ASSEMBLY, EMERGENCY PUMP	1
61	60340	.SCREW, CAP (attaching part)	3
62	63301	.WASHER, LOCK (attaching part)	3
63	140056	.ASSEMBLY, RISER LIFT CYLINDER (See Sect. 4, Fig. 4 for Details)	1
64	140407	.PIN, ARM/CYLINDER	1
65	64216	.PIN, ROLL	2
66	27095	.TUBE, ROUND	2

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
67	140421	.PIN, ARM CYLINDER COLUMN	1
68	65984	.SCREW, CAP (attaching part)	1
69	140423	.PIN, ARM/COLUMN	4
70	65984	.SCREW, CAP (attaching part)	4
71	65103	.FITTING GREASE	4
72	70173	.SWITCH, LIMIT	1
73	62704	.SCREW, CAP (attaching part)	2
74	70148	.ARM, SWITCH LEVER	1
75	2806	.RELIEF, STRAIN	1
76	2912-1560	.CABLE	1
77	70107	.SWITCH, LIMIT	1
78	62704	.SCREW, CAP (attaching part)	2
79	70148	.ARM, SWITCH LEVER	1
80	2806	.RELIEF, STRAIN	1
81	2912-1200	.CABLE	1
82	140404	.PAD, BOOM REST	1
83	61809	.SCREW, FLAT HEAD (attaching part)	2
84	30297	.BATTERY (See Vendor Chapt. for More Information)	6
85	140618	.PLYWOOD	1
86	140466	.WELDMENT, BATTERY TRAY	1
87	60622	.SCREW, CAP (attaching part)	2
88	61305	.NUT, HEX (attaching part)	2

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
89	140467	.STRAP, BATTERY TRAY	1
90	60355	.SCREW, CAP (attaching part)	2
91	63402	.WASHER, FLAT (attaching part)	4
92	60702	.NUT, HEX (attaching part)	2
93	140619	.KIT, BATTERY CABLE	1
94	140615	.ASSEMBLY, BATTERY CHARGER (See Sect. 4, Fig. 18 for Details)	1
95	60325	.SCREW, CAP (attaching part)	2
96	63319	.WASHER, LOCK (attaching part)	2
97	63403	.WASHER, FLAT (attaching part)	2
98	140206	.PLATE, STIFFENER	1
99	60325	.SCREW, CAP (attaching part)	10
100	63319	.WASHER, LOCK (attaching part)	10

MASTER LEVELING CYLINDER ASSEMBLY

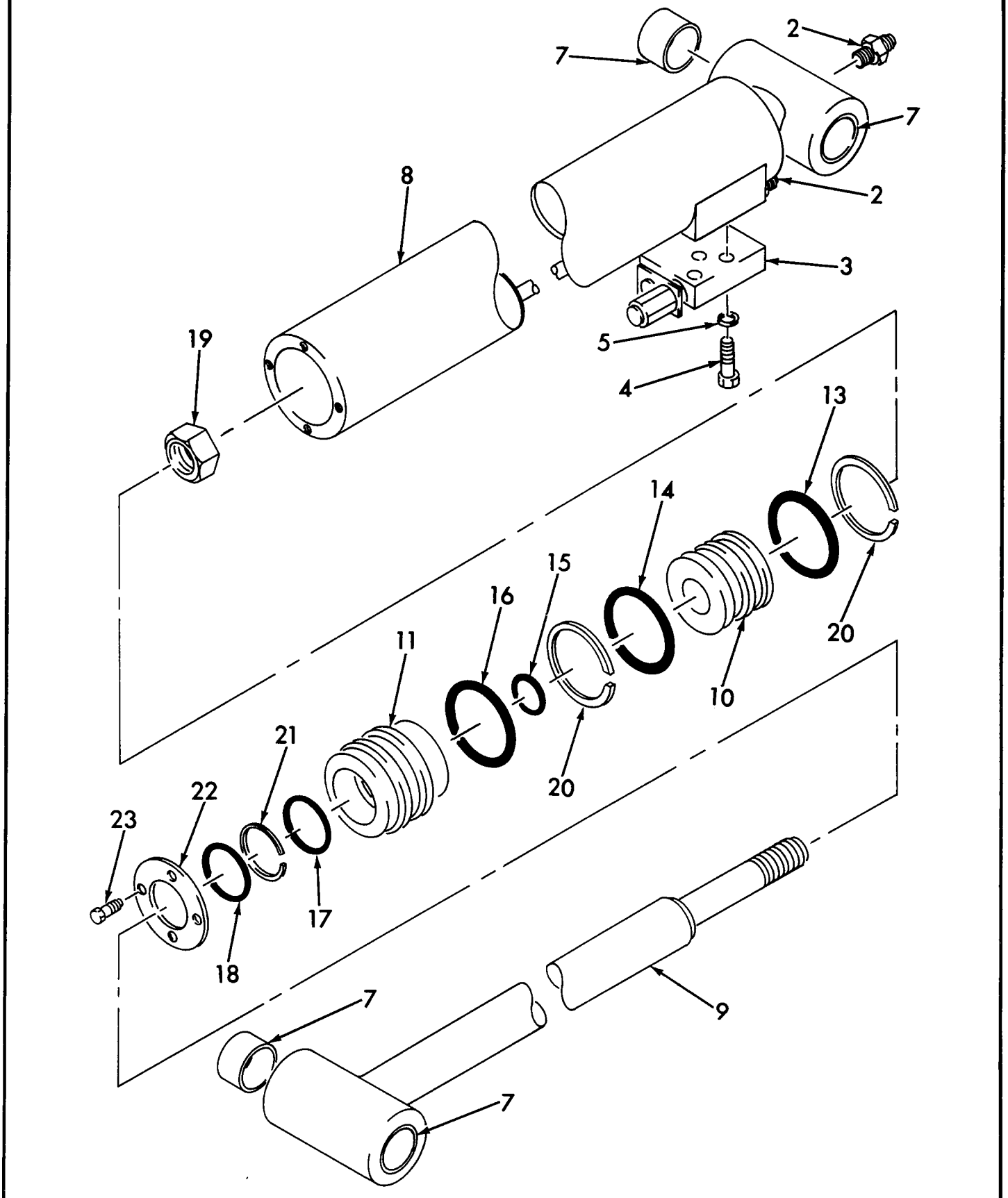


MASTER LEVELING CYLINDER ASSEMBLY (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140062	ASSEMBLY, MASTER LEVELING CYLINDER (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	80036-03	.TEE, STRAIGHT THREAD BRANCH	2
3	140094	.CYLINDER, MASTER	1
4	67191	..BUSHING	4
5	67190	..NUT, GLAND	1
6	67189	..PISTON	1
7		..NUT, LOCK	1
8	67208	..ROD	1
-9	67207	..BARREL	1
-10	67130	..KIT, SEAL	1
11		..WIPER, ROD	1
12		...SEAL, ROD, POLYPAK	1
13		...O-RING	1
14		...RING, BACK-UP	1
15		...O-RING	1
16		...BEARING, WEAR	2
17		...O-RING	1
18		...RING, WEAR (GLASS/NYLON)	2
19		...SEAL, A Q (SQUARE)	1
20		...O-RING	1

- ITEM NOT ILLUSTRATED

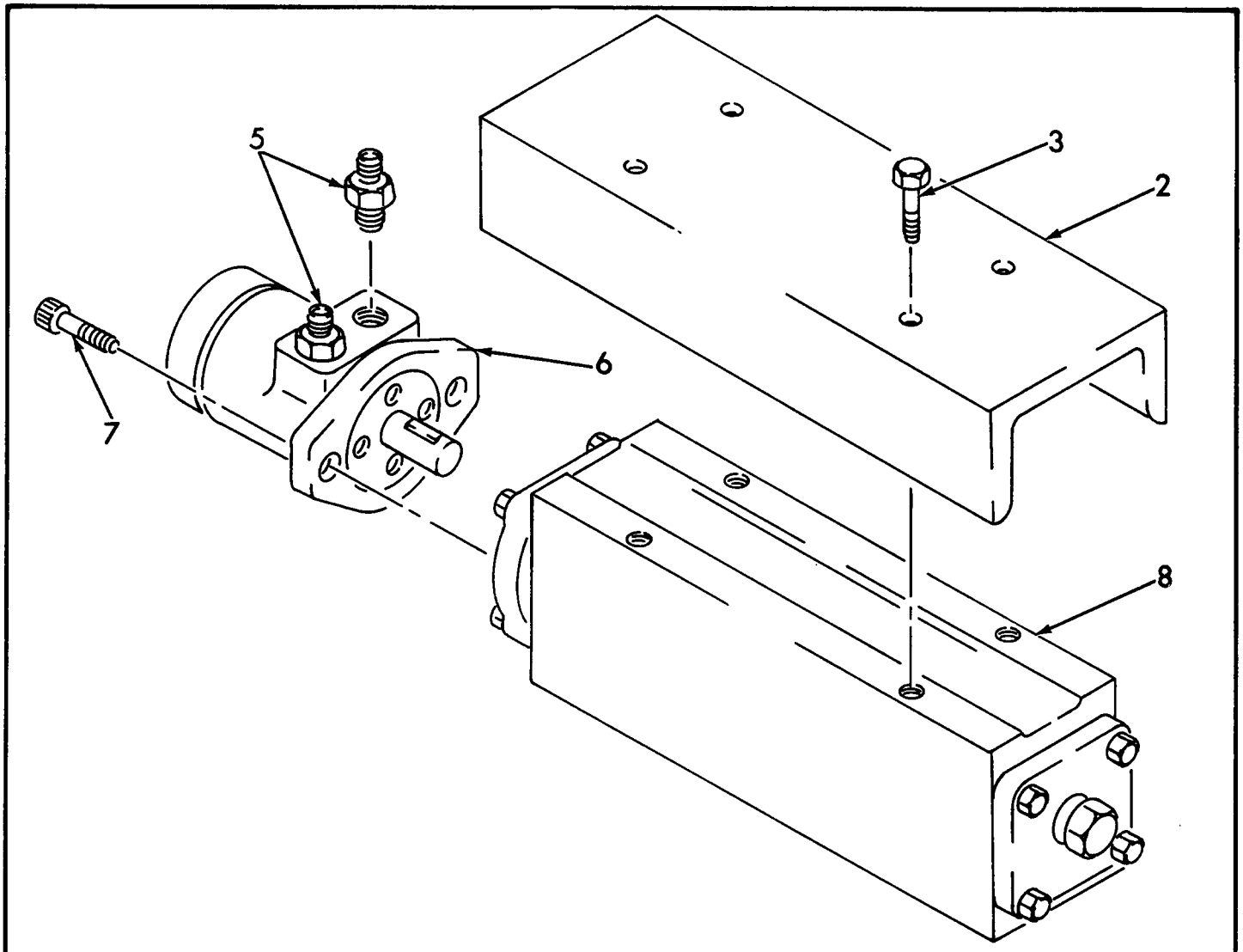
BOOM/RISER LIFT CYLINDER ASSEMBLY



BOOM/RISER LIFT CYLINDER ASSEMBLY (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140056	ASSEMBLY, BOOM/RISER LIFT CYLINDER (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	80004-08	.CONNECTOR, STRAIGHT THREAD	2
3	81205	.VALVE, HOLDING	1
-3A	67394	..KIT, SEAL	1
4	60319	.SCREW, CAP (attaching part)	3
5	63301	.WASHER, LOCK (attaching part)	3
-6	140576	.CYLINDER, LIFT	1
7	67180	..BUSHING, D.U.	4
8	67176	..ASSEMBLY, BARRELL	1
9	67177	..ASSEMBLY, ROD	1
10	67178	..PISTON	1
11	67231	..HEAD, T	1
-12	67230	..KIT, SEAL	1
13		...O-RING	1
14		...O-RING	1
15		...O-RING	1
16		...O-RING	1
17		..O-RING	1
18		...O-RING	1
19		..NUT, LOCK	1
20		..RING, WEAR	2
21		..RING, WEAR	1
22		..CAP	
23		..SCREW, CAP (attaching part)	4

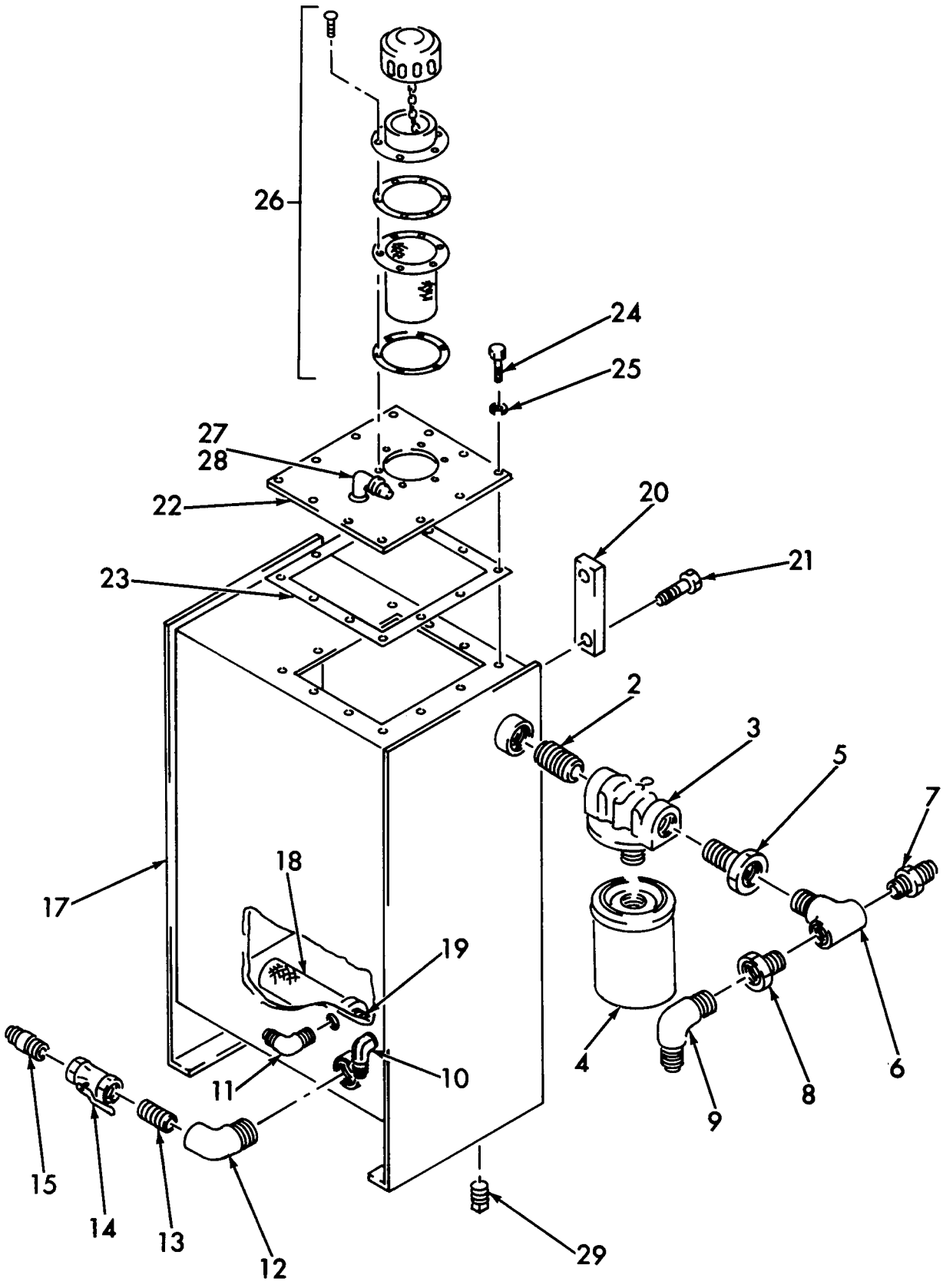
ROTATION GEARBOX/BRACKET ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140608	ASSEMBLY, ROTATION GEARBOX/BRACKET (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	140336	.MACHINING, ROTATION MOUNTING BRACKET	1
3	60640	.SCREW, CAP (attaching part)	4
-4	140600	.ASSEMBLY, ROTATION GEARBOX	1
5	80004-10	..CONNECTOR, STRAIGHT THREAD	2
6	81187	..ASSEMBLY MOTOR, HYDRAULIC (See Sect. 4, Fig. 20 for Details)	1
7	62011	..SCREW, CAP (attaching part)	2
8	23736	..ASSEMBLY, WORM GEAR	1

- ITEM NOT ILLUSTRATED

HYDRAULIC TANK ASSEMBLY (45 KBDF)



REV.

HYDRAULIC TANK ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140580	ASSEMBLY, HYDRAULIC TANK (See Sect. 4, Fig. 1 for NHA)	REF
2	16552	.NIPPLE	1
3	21241	.FILTER, RETURN	1
4	21245	..ELEMENT, FILTER	1
5	53801	.REDUCER, PIPE	1
6	80040-18	.TEE, MALE BRANCH	1
7	80001-21	.CONNECTOR, MALE	1
8	65972	.REDUCER, PIPE THREAD	1
9	80008-18	.ELBOW, MALE	1
10	80008-11	.ELBOW, MALE	1
11	80008-10	.ELBOW, MALE	1
12	52307	.ELBOW, STREET	1
13	65803	.NIPPLE	1
14	65837	.VALVE, BUTTERFLY	1
15	65831	.NIPPLE, COMBINATION	1
-16	140125	.SUB-ASSEMBLY, HYDRAULIC TANK	1
17	140087	..TANK, HYDRAULIC	1
18	81183	..FILTER, SUCTION	1
19	16553	..NIPPLE	1
20	81184	..GAUGE, FLUID LEVEL	1
21		..SCREW, SELF TAPPING (attaching part)	2
22	140126	..COVER, HYDRAULIC TANK	1
23	140127	..GASKET, HYDRAULIC TANK	1
24	60342	..SCREW, CAP (attaching part)	12

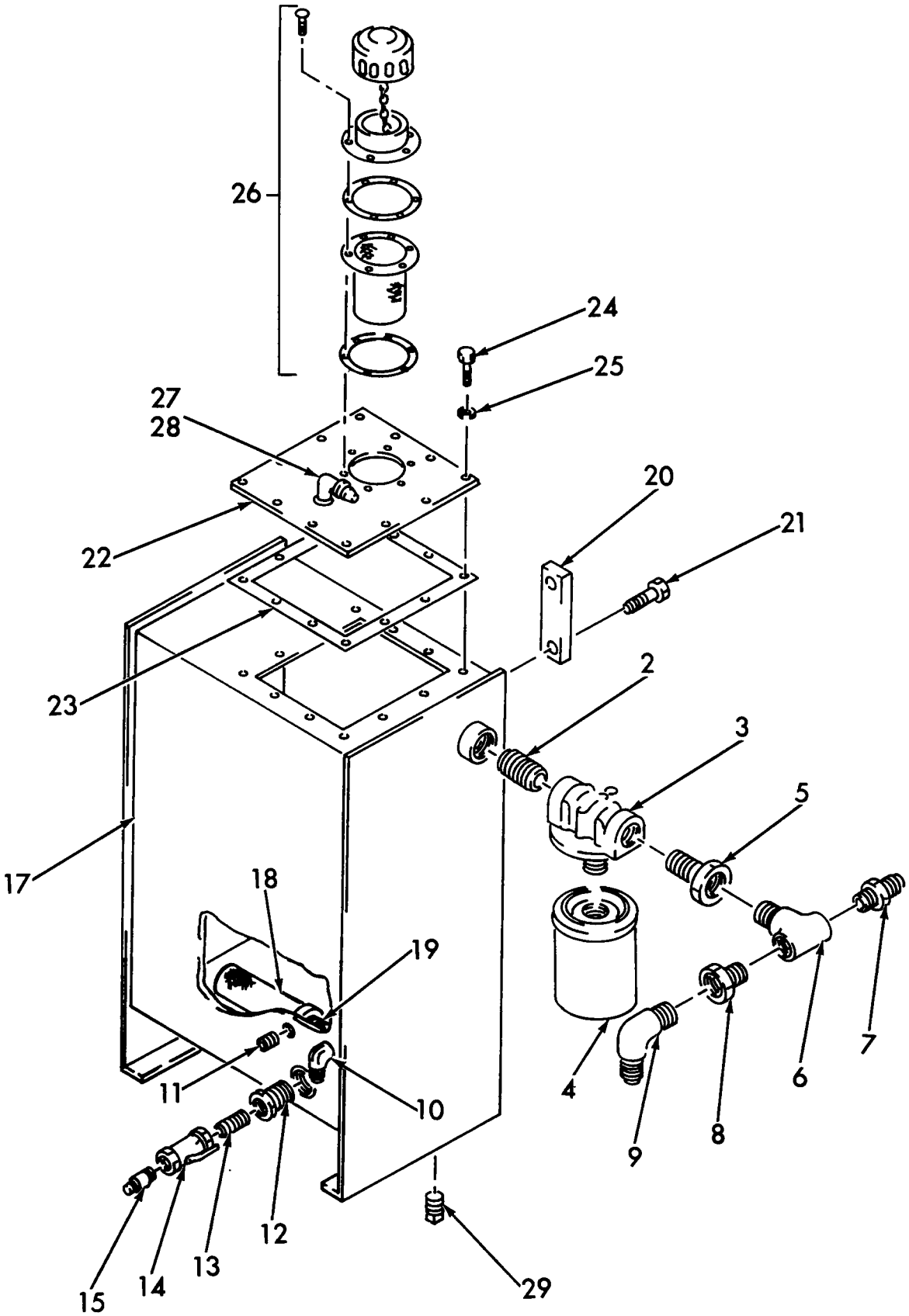
- ITEM NOT ILLUSTRATED

HYDRAULIC TANK ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
25		..WASHER, LOCK (attaching part)	12
26	3005	..ASSEMBLY, BREATHER CAP	1
27	80021-03	..ELBOW, STREET	1
28	65213	..BREATHER 1/4 NPT	1
29	3027	..PLUG, MAGNETIC	1

- ITEM NOT ILLUSTRATED

HYDRAULIC TANK ASSEMBLY (45 KB)



HYDRAULIC TANK ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140581	ASSEMBLY, HYDRAULIC TANK (See Sect. 4, Fig. 2 for NHA)	REF
2	16552	.NIPPLE	1
3	21241	.FILTER, RETURN	1
4	21245	.ELEMENT, FILTER	1
5	53801	.REDUCER, PIPE	1
6	80040-18	.TEE, MALE BRANCH	1
7	80001-21	.CONNECTOR, MALE	1
8	65972	.REDUCER, PIPE THREAD	1
9	80008-18	.ELBOW, MALE	1
10	80008-11	.ELBOW, MALE	1
11	80048-04	.PLUG, HOLLOW HEX	1
12	53800	.REDUCER	1
13	2493	.NIPPLE	1
14	3033	.VALVE, BALL	1
15	65978	.NIPPLE, COMBINATION	1
16	140125	.SUB-ASSEMBLY, HYDRAULIC TANK	1
17	140087	..TANK, HYDRAULIC	1
18	81183	..FILTER, SUCTION	1
19	16553	..NIPPLE	1
20	81184	..GAUGE, FLUID LEVEL	1
21		..SCREW, SELF TAPPING (attaching part)	2
22	140126	..COVER, HYDRAULIC TANK	1
23	140127	..GASKET, HYDRAULIC TANK	1
24	60342	..SCREW, CAP (attaching part)	12

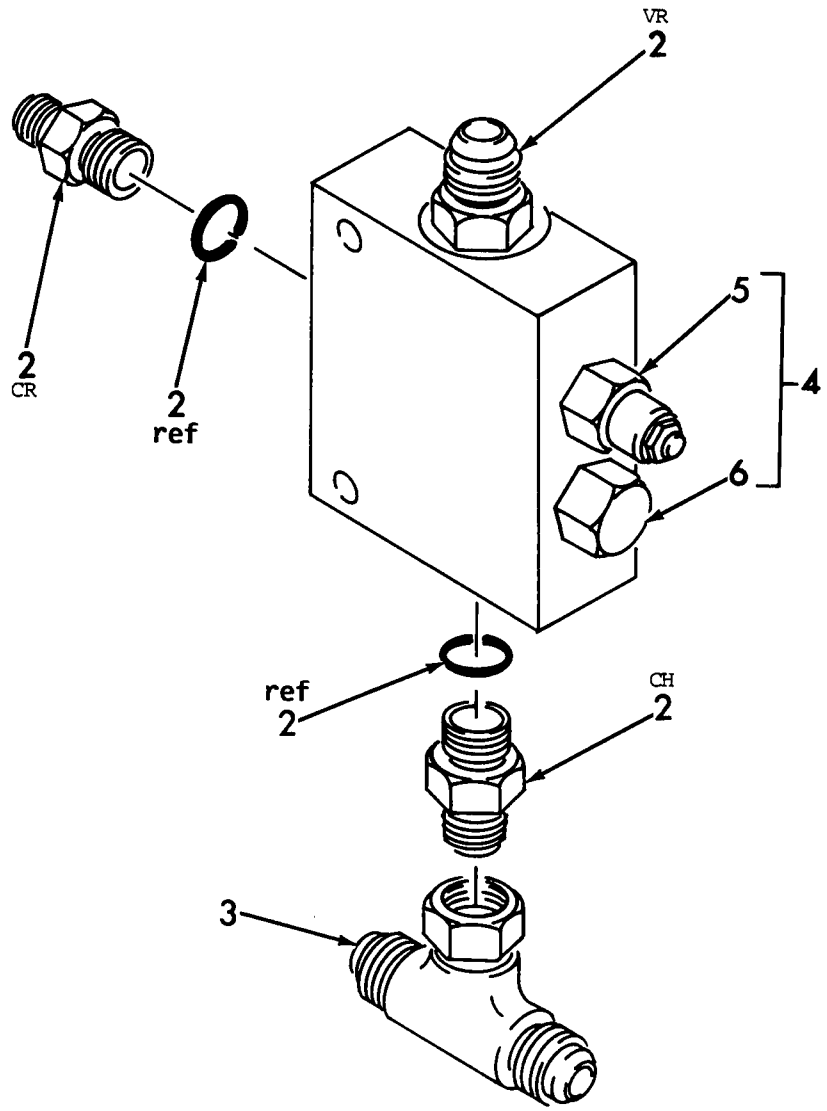
- ITEM NOT ILLUSTRATED

HYDRAULIC TANK ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
25		..WASHER, LOCK (attaching part)	12
26	3005	..ASSEMBLY, BREATHER CAP	1
27	80021-03	..ELBOW, STREET	1
28	65213	..BREATHER 1/4 NPT	1
29	3027	..PLUG, MAGNETIC	1

- ITEM NOT ILLUSTRATED

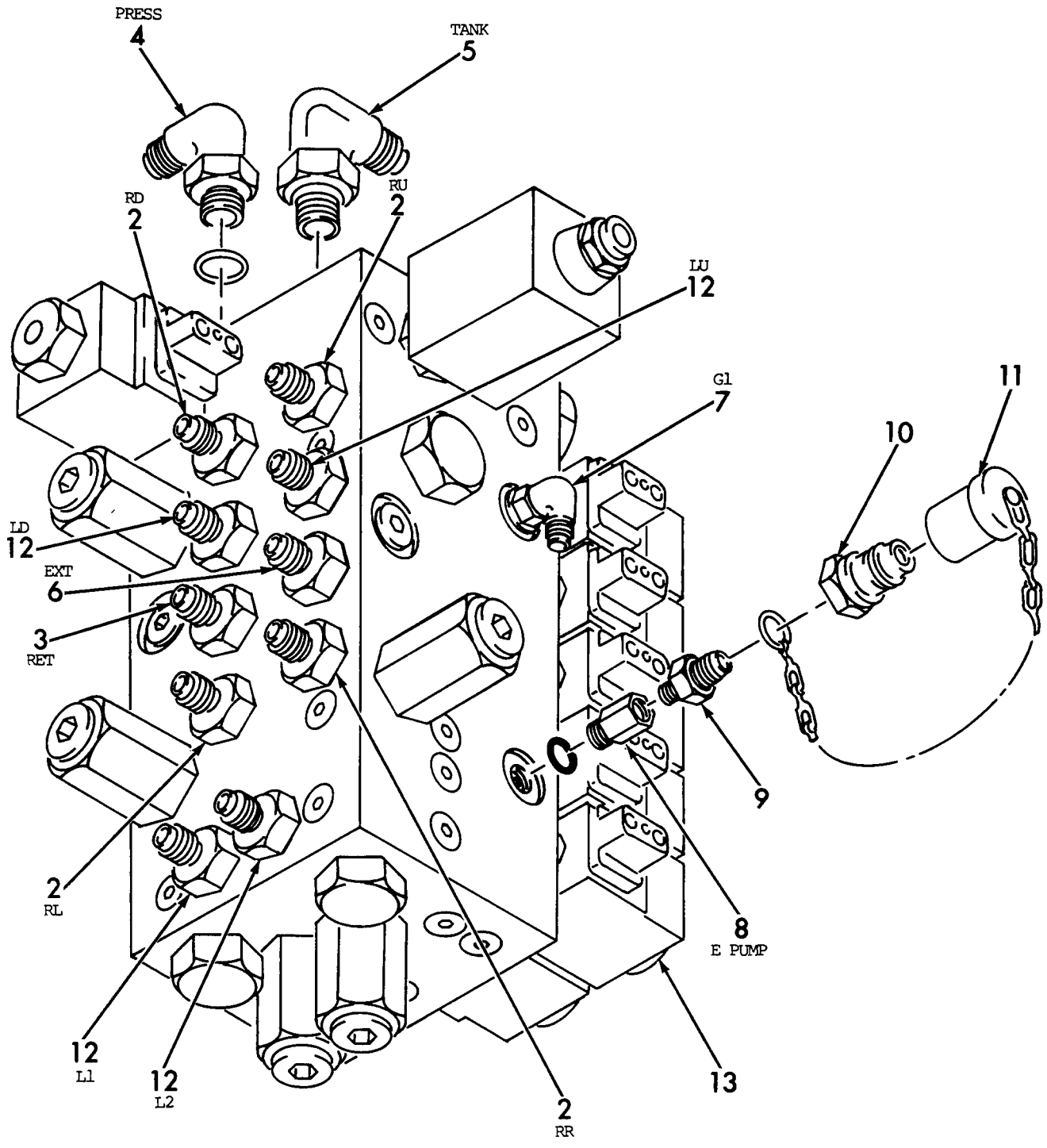
REGENERATIVE VALVE ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140313	ASSEMBLY, REGENERATIVE VALVE (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	80004-13	.CONNECTOR (CH, CR, VR)	3
3	80030-06	.TEE, BRANCH	1
4	81222	.VALVE, REGENERATIVE	1
5	67360	..VALVE, COUNTERBALANCE	1
6	67361	..VALVE, CHECK	1

- ITEM NOT ILLUSTRATED

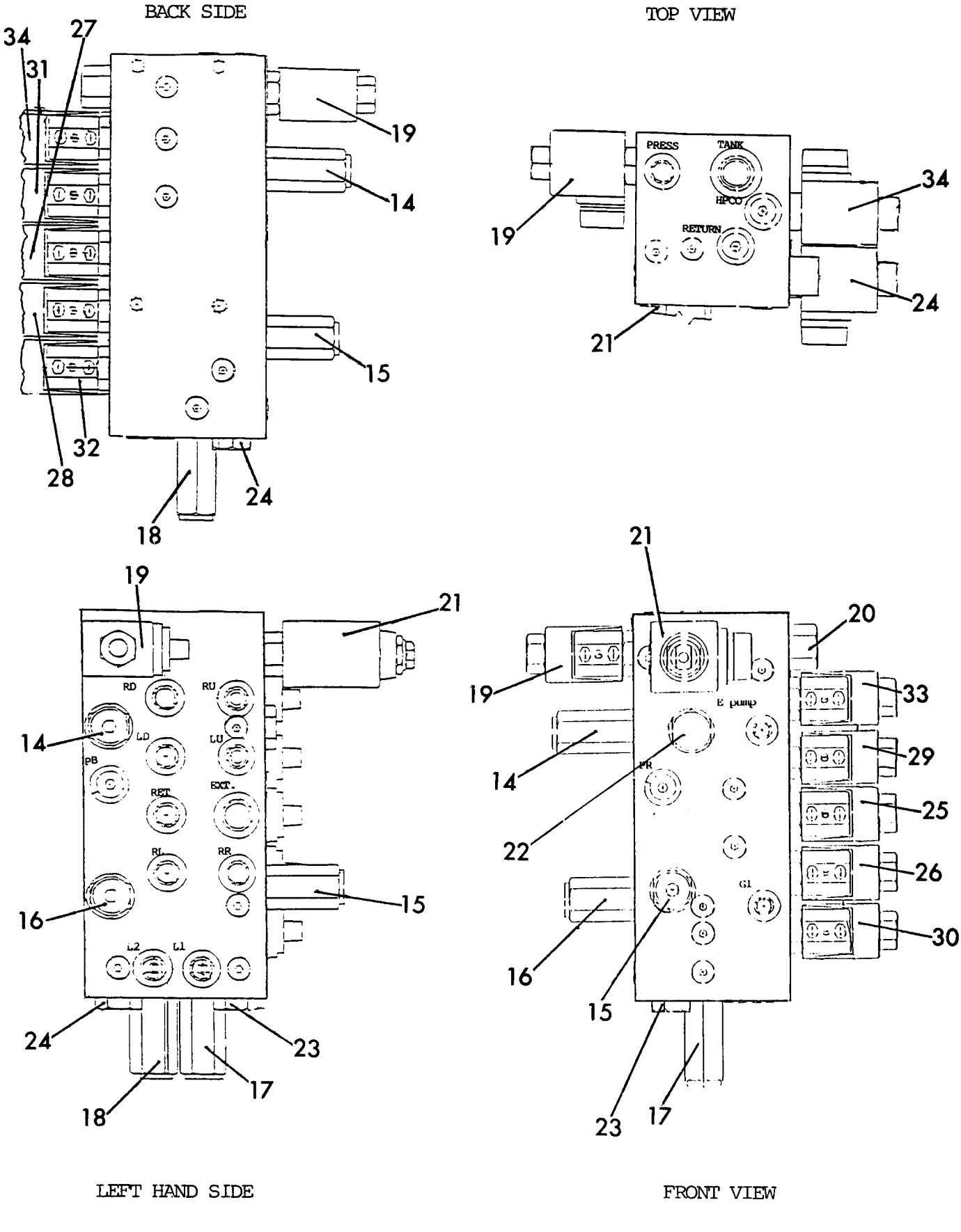
FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45 KBDF)

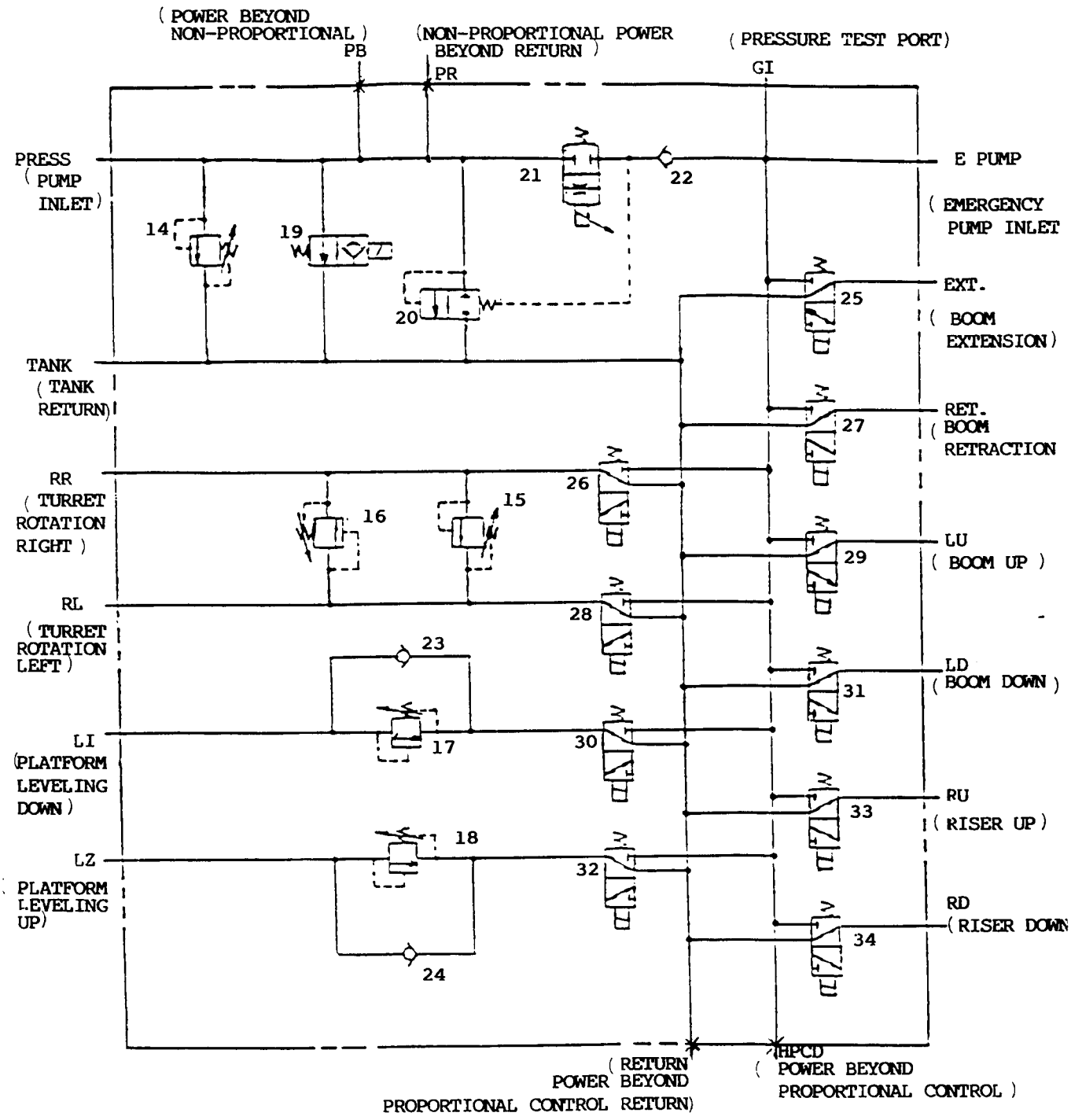


BOTTOM VIEW

REV.

FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45 KBDF) (continued)





14. MAIN SYSTEM RELIEF
16. ROTATION RIGHT RELIEF
15. ROTATION LEFT RELIEF
17. LEVELING 1 RELIEF
18. LEVELING 2 RELIEF
19. UNLOADING VALVE
20. DIFFERENTIAL SENSING VALVE
21. PROPORTIONAL SOLENOID VALVE
22. CHECK VALVE
23. LEVELING 1 CHECK VALVE
24. LEVELING 2 CHECK VALVE
25. EXTENSION VALVE
26. TURRET ROTATION RIGHT VALVE
27. RETRACTION VALVE
28. TURRET ROTATION LEFT VALVE
29. LIFT UP VALVE
30. LEVELING VALVE (DOWN)
31. LIFT DOWN VALVE
32. LEVELING 2 valve (UP)
33. RISER UP VALVE
34. RISER DOWN VALVE

14 **MAIN SYSTEM RELIEF 67335.**

Establishes maximum inlet pressure for valve operation. Relief setting is accomplished by adjusting Allen head plug inside cartridge. Relief valve does not affect circuit unless system unloading valve (item 19) is closed.

15 **RELIEF VALVE: TURRET ROTATION CROSSPORT (LEFT) 67336.**

Establishes maximum outlet pressure to turret rotation orbit motor for turret rotation to the right. When turret hits rotation stop on base, relief valve opens up exhausting inlet flow across turret rotation left solenoid valve to be returned to tank.

16 **RELIEF VALVE: TURRET ROTATION CROSSPORT (RIGHT) 67336.**

Same as '15' above, except relieves rotation right.

17 **RELIEF VALVE: PLATFORM LEVELING (DOWN) 66916.**

Establishes maximum closed circuit pressure in platform down mode. When slave cylinder is bottomed out and boom is lowered, fluid pressure trapped within the leveling circuit will open the relief valve and be exhausted back to tank across the platform leveling down solenoid valve (item 30).

18 **RELIEF VALVE: PLATFORM LEVELING (UP) 66916.**

Same as '17' above except relieves platform leveling up.

19 **SYSTEM UNLOADING VALVE 66920**

Operates only when directional controller is moved for operation. In its normally open state it allows inlet flow from the pump to be exhausted back to tank without creating or generating a load on the engine, while a function is not being operated.

20 **DIFFERENTIAL PRESSURE SENSING VALVE 667024**

Valve acts as secondary unloading valve until proportional control valve is energized by control card on controller. Prevents engine from operating under unnecessary load by permitting unused pump flow to be directed back to tank without being forced to exhaust across relief valve (Item 14) Difference in pressure generated in sense lines across 21 regulates opening and closing the valve.

21 PROPORTIONAL CONTROL VALVE 67224

This valve regulates inlet flow to the function control valves (items 25 through 34), flow rate is controlled by controller handle position; ie; as handle is moved further off center, valve opens further permitting more flow too selected function valve.

22 CHECK VALVE: EMERGENCY PUMP INLET 66997-66621

Insures that hydraulic fluid delivery from the emergency pump is directed to the selected function valve without being affected by system relief or the unloading valve.

23 CHECK VALVE: Platform leveling (DOWN) 66997-66621

Allows flow for platform leveling down function to by pass the relief valve (item 17) unhindered.

24 CHECK VALVE: PLATFORM LEVELING (UP) 66997-66621
Same as '23' above, except installed in platform leveling up circuit.

25 SOLENOID VALVE: BOOM (Extension) 66900.

When operated by function select switch, valve closes connecting proportional supply flow (across 21) to boom extension port.
NOTE: Valve in its normal (unenergized) state is connected to tank return.

26 SOLENOID VALVE: TURRET ROTATION (RIGHT) 66900.

Same as '25' except selects turret rotation to the right.

27 SOLENOID VALVE: BOOM (RETRACT) 66900.

Same as '25' except selects boom retract function.

28 SOLENOID VALVE: TURRET ROTATION (LEFT) 66900.

Same as '25' except selects turret rotation to the left.

29 SOLENOID VALVE: BOOM (LIFT) 66900.

Same as '25' except selects boom lift/up function.

30 SOLENOID VALVE: PLATFORM LEVELING (DOWN) 66900.

Same as '25' except selects platform leveling down.

31 SOLENOID VALVE: BOOM (DOWN) 66900.

Same as '25' except selects boom down/descent function.

32 SOLENOID VALVE: PLATFORM LEVELING (UP) 66900.

Same as '25' except selects platform leveling up.

33 SOLENOID VALVE: RISER (UP) 66900.

Same as '25' except selects riser up/lift function.

34 SOLENOID VALVE: RISER (DOWN) 66900.

Same as '25' except selects riser down/descent function.

PRESS PORT
Pump inlet port, connected to P2 pump.

TANK PORT
Tank return from function or relief valves.

RR PORT
Turret rotation to the right supply port.

RL PORT
Turret rotation to the left supply port.

LI PORT
Platform leveling down supply port.

L2 PORT
Platform leveling up supply port.

PB PORT
Power beyond port for optional functions.

NOTE:
Plug must be installed between PB & RP, for operation Optional function valve must be open center.

PR. PORT
Power beyond return port, return for optional functions.

G1 PORT.
Pressure test port for system relief valve (item 14).

E PUMP PORT.
Emergency pump inlet/supply port.

EXT. PORT.
Boom extension supply port.

RET. PORT.
Boom retraction supply port.

LU PORT
Boom lift supply port.

LD PORT.
Boom down supply port.

RU PORT.
Riser lift/up supply port.

RD PORT
Riser down/descent supply port.

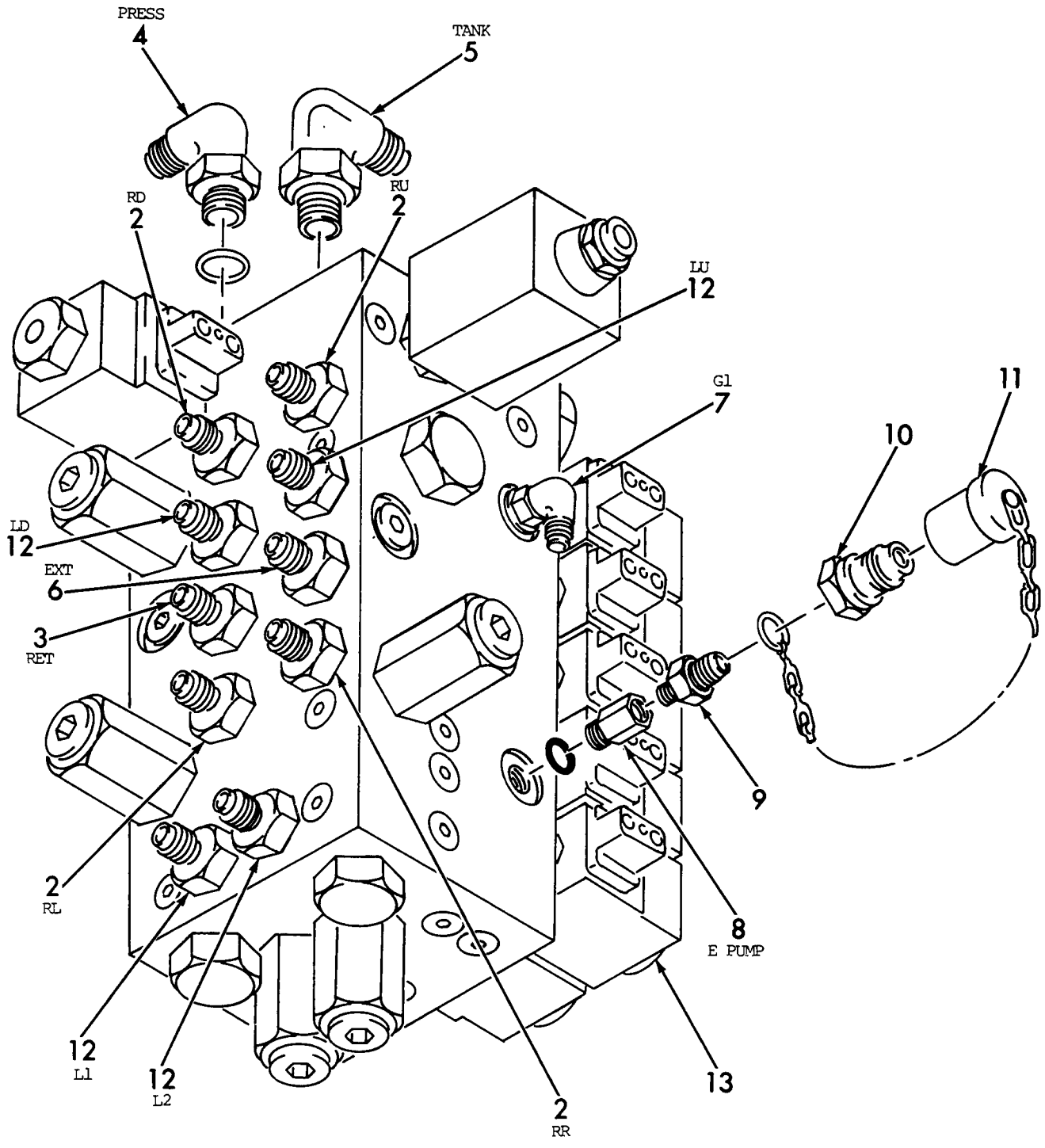
FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KBDF)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140294	ASSEMBLY, FUNCTIONAL BOOM VALVE PACKAGE (See Sect. 4, Fig. 1 for NHA)	REF
2	80004-08	.CONNECTOR (RD, RL, RR, RU)	4
3	80004-12	.CONNECTOR (RET)	1
4	80012-12	.ELBOW (PRESS)	1
5	80012-15	.ELBOW (TANK)	1
6	80004-11	.CONNECTOR (EXT)	1
7	80012-03	.ELBOW (G1)	1
8	51903	.ADAPTER (E PUMP)	1
9	80052-03	.NIPPLE, PIPE	1
10	2527	.COUPLING, QUICK	1
11	845	.CAP, QUICK	1
12	80004-05	.CONNECTOR (L1, L2, LD, LU)	4
13	81221	.VALVE PACKAGE, FUNCTIONAL BOOM	1
14	67335	..VALVE, MAIN SYSTEM RELIEF	1
15	67336	..VALVE, TURRET ROTATION LEFT RELIEF	1
16	67336	..VALVE, TURRET ROTATION RIGHT RELIEF	1
17	66916	..VALVE, PLATFORM LEVELING DOWN RELIEF	1
18	66916	..VALVE, PLATFORM LEVELING UP RELIEF	1
19	66920	..VALVE, SYSTEM UNLOADING	1
20	67338	..VALVE, DIFFERENTIAL PRESSURE SENSING	1
21	67224	..VALVE, PROPORTIONAL CONTROL	1
22	67339	..VALVE, EMERGENCY PUMP INLET CHECK	1

FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KBDF)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	67339	..VALVE, PLATFORM LEVELING DOWN CHECK	1
24	67339	..VALVE, PLATFORM LEVELING UP CHECK	1
25	66900	..VALVE, BOOM EXTENSION SOLENOID	1
26	66900	..VALVE, TURRET ROTATION RIGHT SOLENOID	1
27	66900	..VALVE, BOOM RETRACTION SOLENOID	1
28	66900	..VALVE, TURRET ROTATION LEFT SOLENOID	1
29	66900	..VALVE, BOOM LIFT SOLENOID	1
30	66900	..VALVE, PLATFORM LEVELING DOWN SOLENOID	1
31	66900	..VALVE, BOOM DOWN SOLENOID	1
32	66900	..VALVE, PLATFORM LEVELING UP SOLENOID	1
33	66900	..VALVE, RISER UP SOLENOID	1
34	66900	..VALVE, RISER DOWN SOLENOID	1

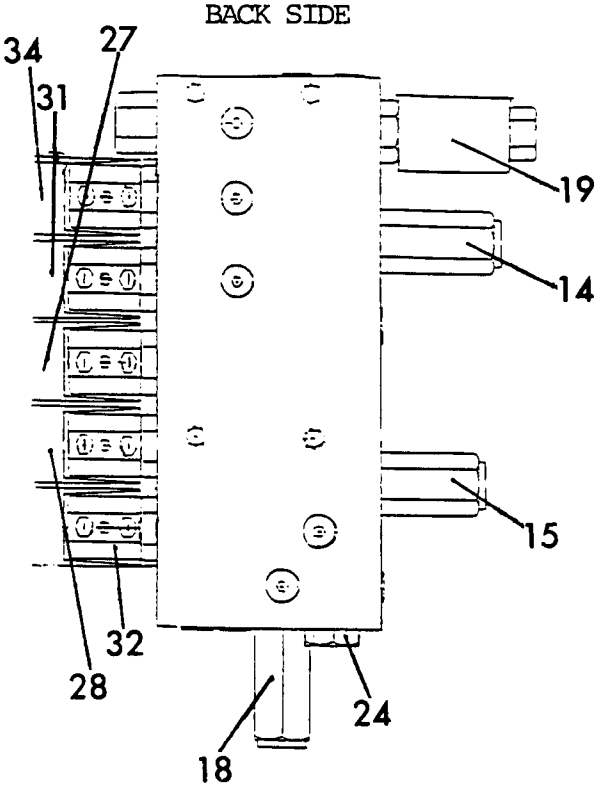
FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45 KB)



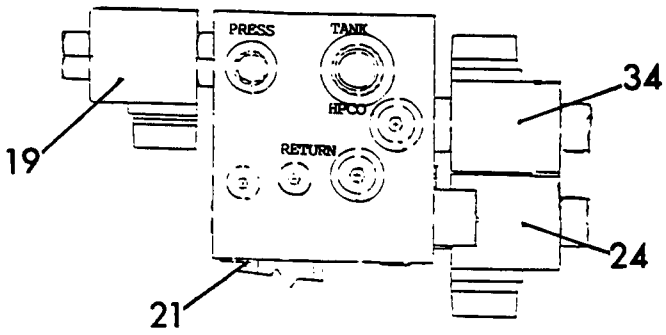
BOTTOM VIEW

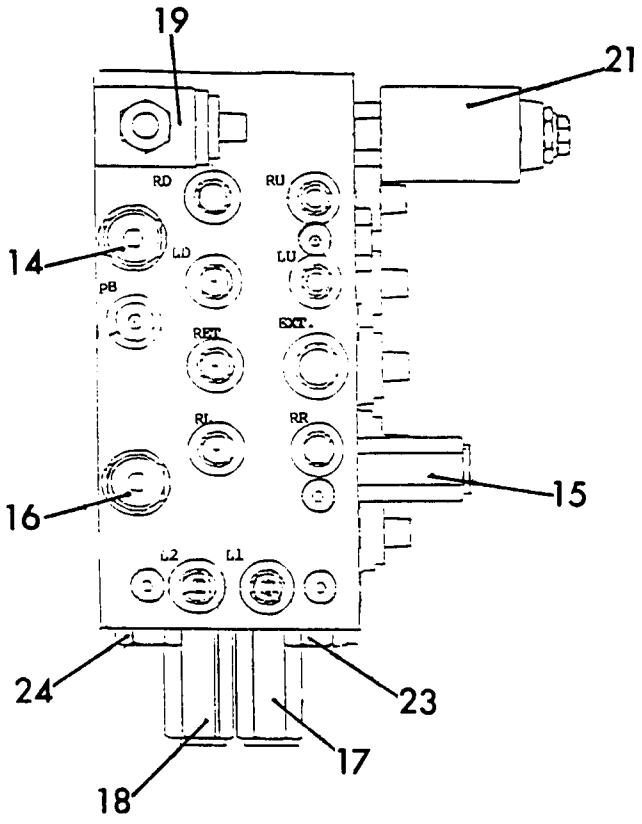
FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45KB) (continued)

BACK SIDE

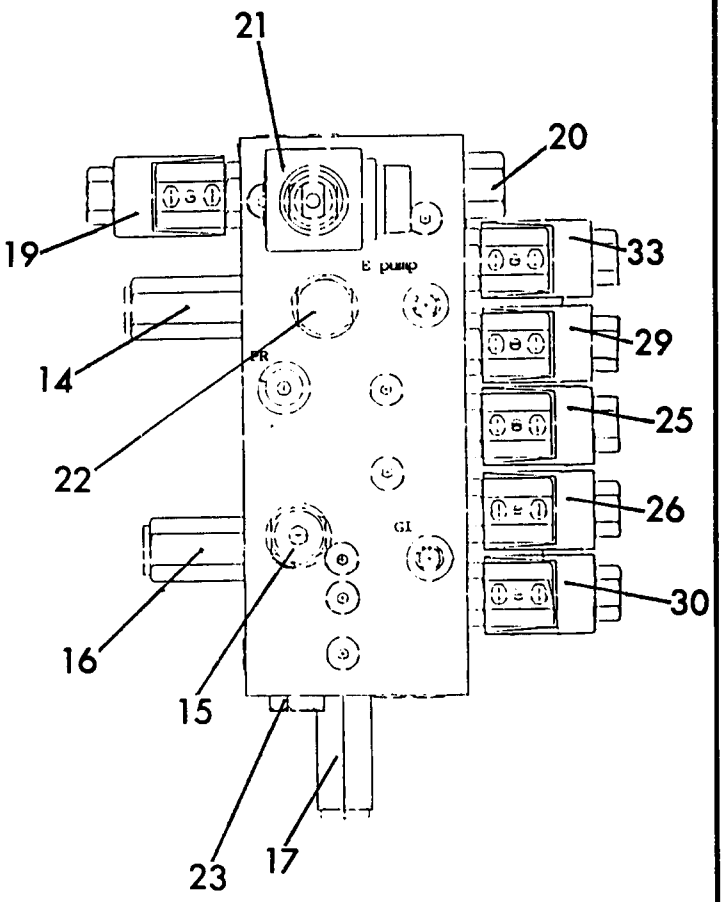


TOP VIEW

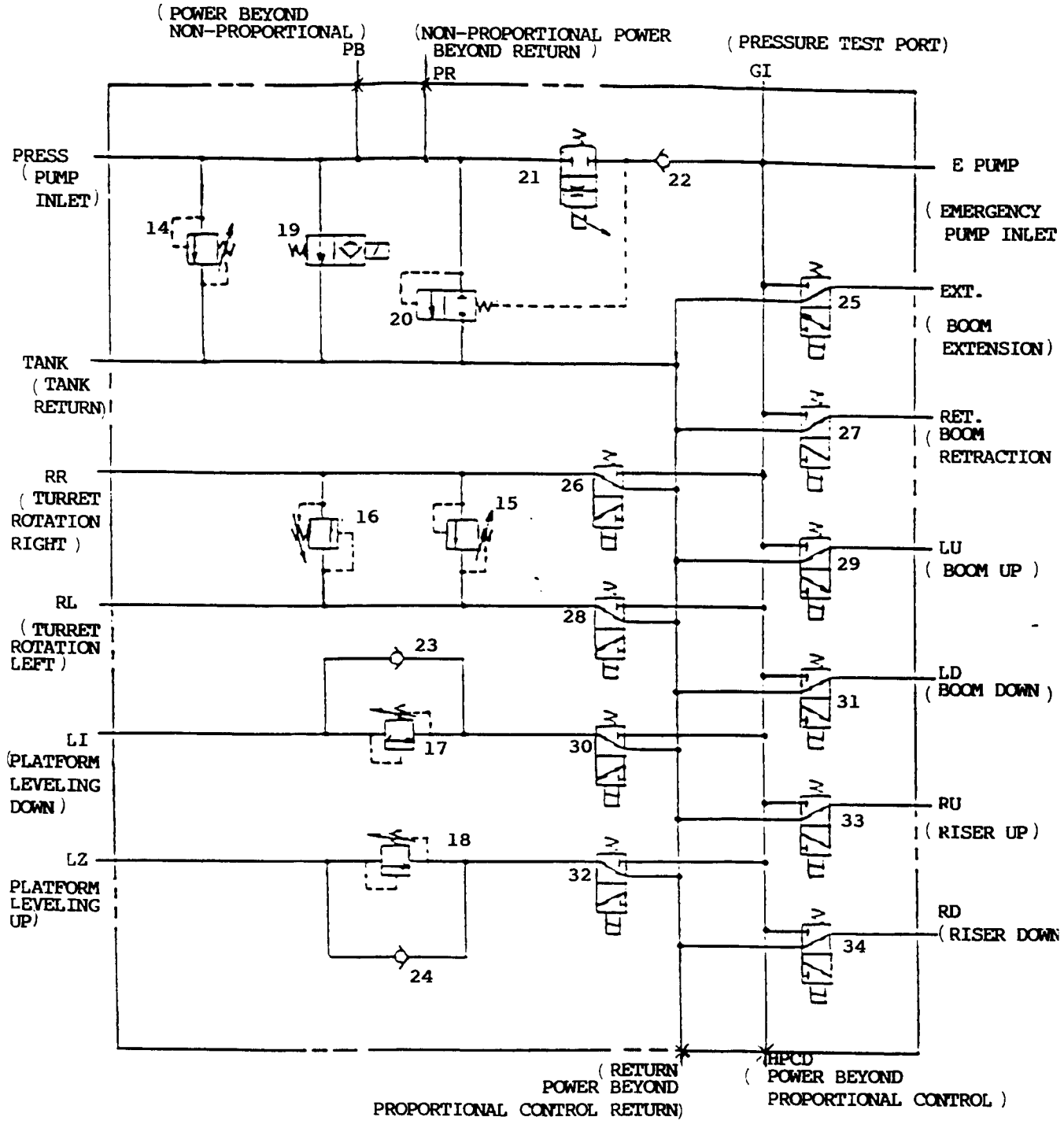




LEFT HAND SIDE



FRONT VIEW



14. MAIN SYSTEM RELIEF
16. ROTATION RIGHT RELIEF
15. ROTATION LEFT RELIEF
17. LEVELING 1 RELIEF
18. LEVELING 2 RELIEF
19. UNLOADING VALVE
20. DIFFERENTIAL SENSING VALVE
21. PROPORTIONAL SOLENOID VALVE
22. CHECK VALVE
23. LEVELING 1 CHECK VALVE
24. LEVELING 2 CHECK VALVE
25. EXTENSION VALVE
26. TURRET ROTATION RIGHT VALVE
27. RETRACTION VALVE
28. TURRET ROTATION LEFT VALVE
29. LIFT UP VALVE
30. LEVELING VALVE (DOWN)
31. LIFT DOWN VALVE
32. LEVELING 2 valve (UP)
33. RISER UP VALVE
34. RISER DOWN VALVE

14 **MAIN SYSTEM RELIEF 67335.**

Establishes maximum inlet pressure for valve operation. Relief setting is accomplished by adjusting Allen head plug inside cartridge. Relief valve does not affect circuit unless system unloading valve (item 19) is closed.

15 **RELIEF VALVE: TURRET ROTATION CROSSPORT (LEFT) 67336.**

Establishes maximum outlet pressure to turret rotation orbit motor for turret rotation to the right. When turret hits rotation stop on base, relief valve opens up exhausting inlet flow across turret rotation left solenoid valve to be returned to tank.

16 **RELIEF VALVE: TURRET ROTATION CROSSPORT (RIGHT) 67336.**

Same as '15' above, except relieves rotation right.

17 **RELIEF VALVE: PLATFORM LEVELING (DOWN) 66916.**

Establishes maximum closed circuit pressure in platform down mode. When slave cylinder is bottomed out and boom is lowered, fluid pressure trapped within the leveling circuit will open the relief valve and be exhausted back to tank across the platform leveling down solenoid valve (item 30).

18 **RELIEF VALVE: PLATFORM LEVELING (UP) 66916.**

Same as '17' above except relieves platform leveling up.

19 **SYSTEM UNLOADING VALVE 66676.**

Operates only when directional controller is moved for operation. In its normally open state it allows inlet flow from the pump to be exhausted back to tank without creating or generating a load on the engine, while a function is not being operated.

20 **DIFFERENTIAL PRESSURE SENSING VALVE 67338.**

Valve acts as secondary unloading valve until proportional control valve is energized by control card on controller. Prevents engine from operating under unnecessary load by permitting unused pump flow to be directed back to tank without being forced to exhaust across relief valve (Item 14) Difference in pressure generated in sense lines across '21' regulates opening and closing the valve.

21 PROPORTIONAL CONTROL VALVE 67225

This valve regulates inlet flow to the function control valves (items 25 through 34), flow rate is controlled by controller handle position; ie; as handle is moved further off center, valve opens further permitting more flow too selected function valve.

22 CHECK VALVE: EMERGENCY PUMP INLET 67339.

Insures that hydraulic fluid delivery from the emergency pump is directed to the selected function valve without being affected by system relief or the unloading valve.

23 CHECK VALVE: Platform leveling (DOWN) 67339.

Allows flow for platform leveling down function to by pass the relief valve (item 17) unhindered.

24 CHECK VALVE: PLATFORM LEVELING (UP) 67339.

Same as '23' above, except installed in platform leveling up circuit.

25 SOLENOID VALVE: BOOM (Extension) 67220.

When operated by function select switch, valve closes connecting proportional supply flow (across 21) to boom extension port.
NOTE: Valve in its normal (unenergized) state is connected to tank return.

26 SOLENOID VALVE: TURRET ROTATION (RIGHT) 67220.

Same as '25' except selects turret rotation to the right.

27 SOLENOID VALVE: BOOM (RETRACT) 67220.

Same as '25' except selects boom retract function.

28 SOLENOID VALVE: TURRET ROTATION (LEFT) 67220.

Same as '25' except selects turret rotation to the left.

29 SOLENOID VALVE: BOOM (LIFT) 67220.

Same as '25' except selects boom lift/up function.

30 SOLENOID VALVE: PLATFORM LEVELING (DOWN) 67220.

Same as '25' except selects platform leveling down.

31 SOLENOID VALVE: BOOM (DOWN) 67220.

Same as '25' except selects boom down/descent function.

32 SOLENOID VALVE: PLATFORM LEVELING (UP) 67220.

Same as '25' except selects platform leveling up.

33 SOLENOID VALVE: RISER (UP) 67220.

Same as '25' except selects riser up/lift function.

34 SOLENOID VALVE: RISER (DOWN) 67220.

Same as '25' except selects riser down/descent function.

PRESS PORT
Pump inlet port, connected to P2 pump.

TANK PORT
Tank return from function or relief valves.

RR PORT
Turret rotation to the right supply port.

RL PORT
Turret rotation to the left supply port.

LI PORT
Platform leveling down supply port.

L2 PORT
Platform leveling up supply port.

PB PORT
Power beyond port for optional functions.

NOTE:
Plug must be installed between PB & RP, for operation Optional function valve must be open center.

PR. PORT
Power beyond return port, return for optional functions.

G1 PORT.
Pressure test port for system relief valve (item14).

E PUMP PORT.
Emergency pump inlet/supply port.

EXT. PORT.
Boom extension supply port.

RET. PORT.
Boom retraction supply port.

LU PORT
Boom lift supply port.

LD PORT.
Boom down supply port.

RU PORT.
Riser lift/up supply port.

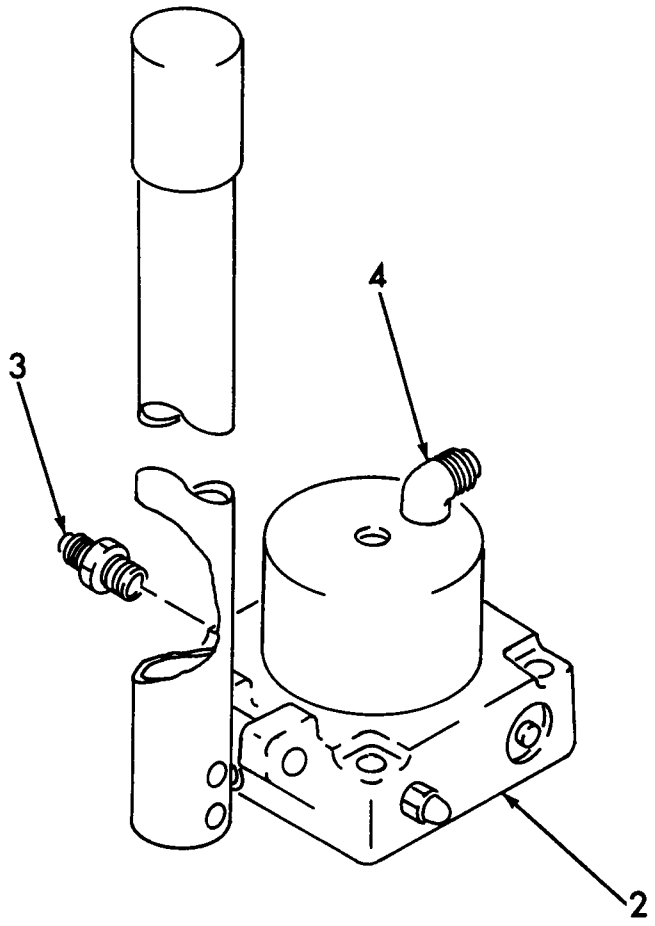
RD PORT
Riser down/descent supply port.

FUNCTIONAL BOOM VALVE PACKAGE ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140311	ASSEMBLY, FUNCTIONAL BOOM VALVE PACKAGE (See Sect. 4, Fig. 2 for NHA)	REF
2	80004-08	.CONNECTOR (RD, RL, RR, RU)	4
3	80004-12	.CONNECTOR (RET)	1
4	80012-12	.ELBOW (PRESS)	1
5	80012-16	.ELBOW (TANK)	1
6	80004-11	.CONNECTOR (EXT)	1
7	80012-03	.ELBOW (G1)	1
8	51903	.ADAPTER (E PUMP)	1
9	80052-03	.NIPPLE, PIPE	1
10	2527	.COUPLING, QUICK	1
11	845	.CAP, QUICK	1
12	80004-05	.CONNECTOR (L1, L2, LD, LU)	4
13	81213	.VALVE PACKAGE, FUNCTIONAL BOOM	1
14	67335	..VALVE, MAIN SYSTEM RELIEF	1
15	67336	..VALVE, TURRET ROTATION LEFT RELIEF	1
16	67336	..VALVE, TURRET ROTATION RIGHT RELIEF	1
17	66916	..VALVE, PLATFORM LEVELING DOWN RELIEF	1
18	66916	..VALVE, PLATFORM LEVELING UP RELIEF	1
19	67337	..VALVE, SYSTEM UNLOADING	1
20	67338	..VALVE, DIFFERENTIAL PRESSURE SENSING	1
21	67225	..VALVE, PROPORTIONAL CONTROL	1
22	67339	..VALVE, EMERGENCY PUMP INLET CHECK	1

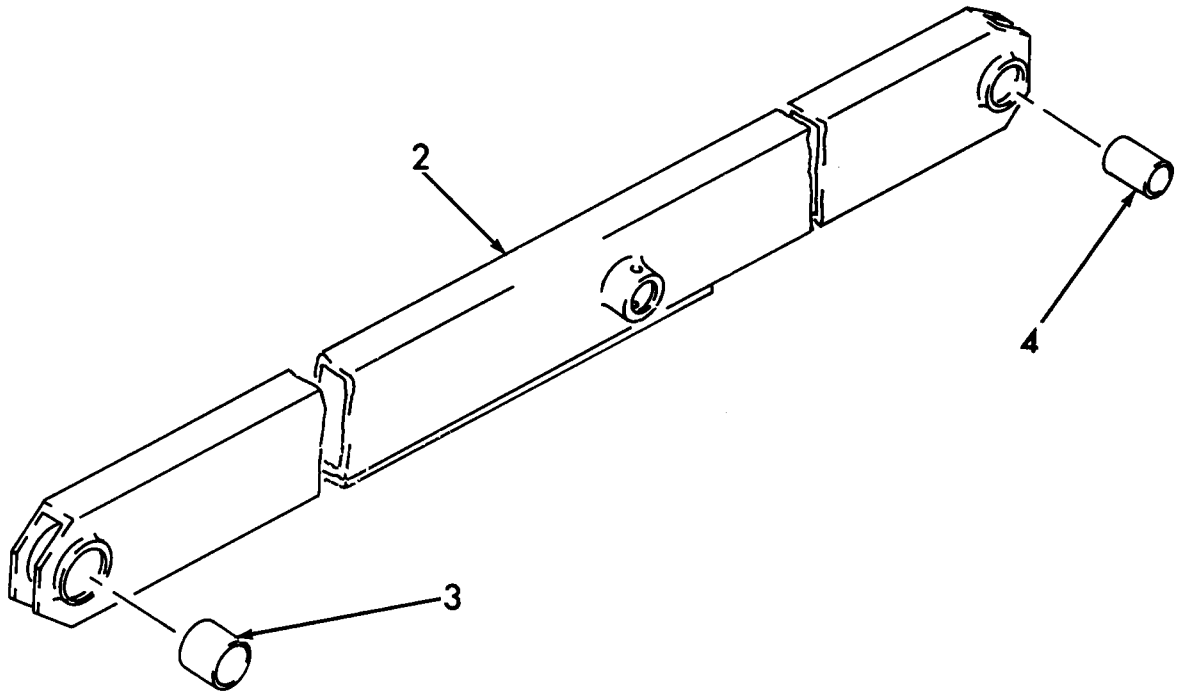
- ITEM NOT ILLUSTRATED

EMERGENCY PUMP ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140582	ASSEMBLY, EMERGENCY PUMP (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	81215	.PUMP, EMERGENCY	1
3	80001-04	.CONNECTOR	1
4	80008-04	.ELBOW	1

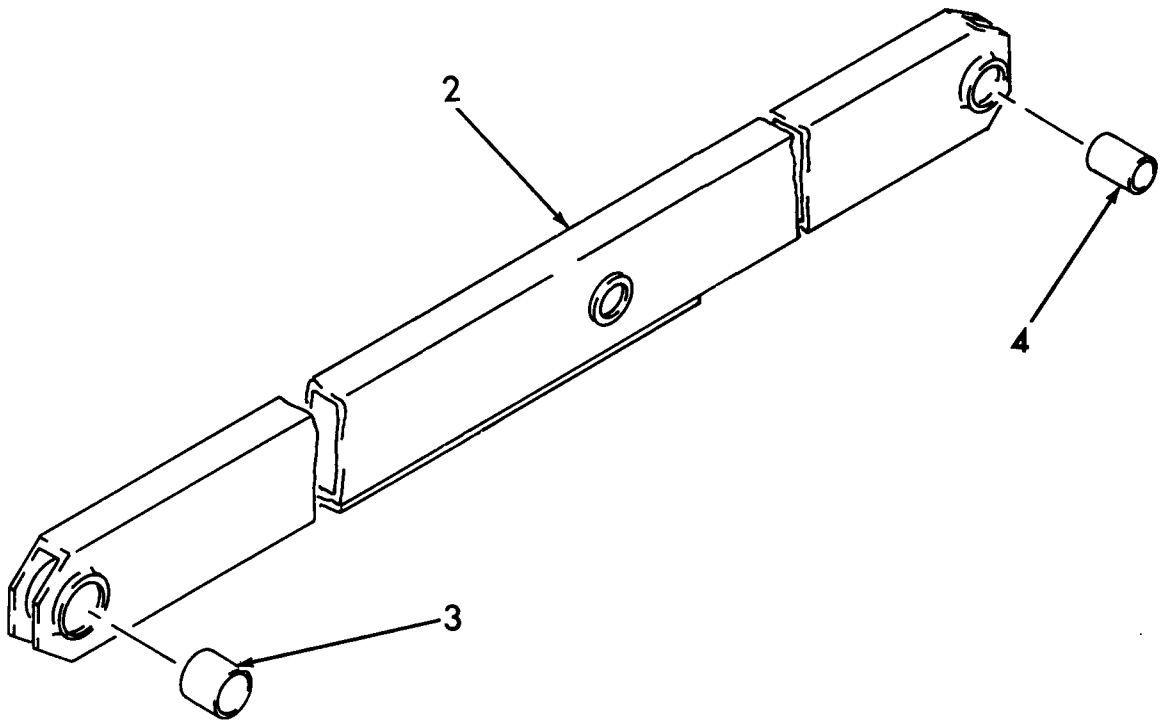
UPPER RIGHT RISER ARM ASSEMBLY



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140215	ASSEMBLY, UPPER RIGHT RISER ARM (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	140191	.WELDMENT, RISER ARM UPPER RIGHT	1
3	140385	.BUSHING, RISER	1
4	140386	.BUSHING COLUMN	1

- ITEM NOT ILLUSTRATED

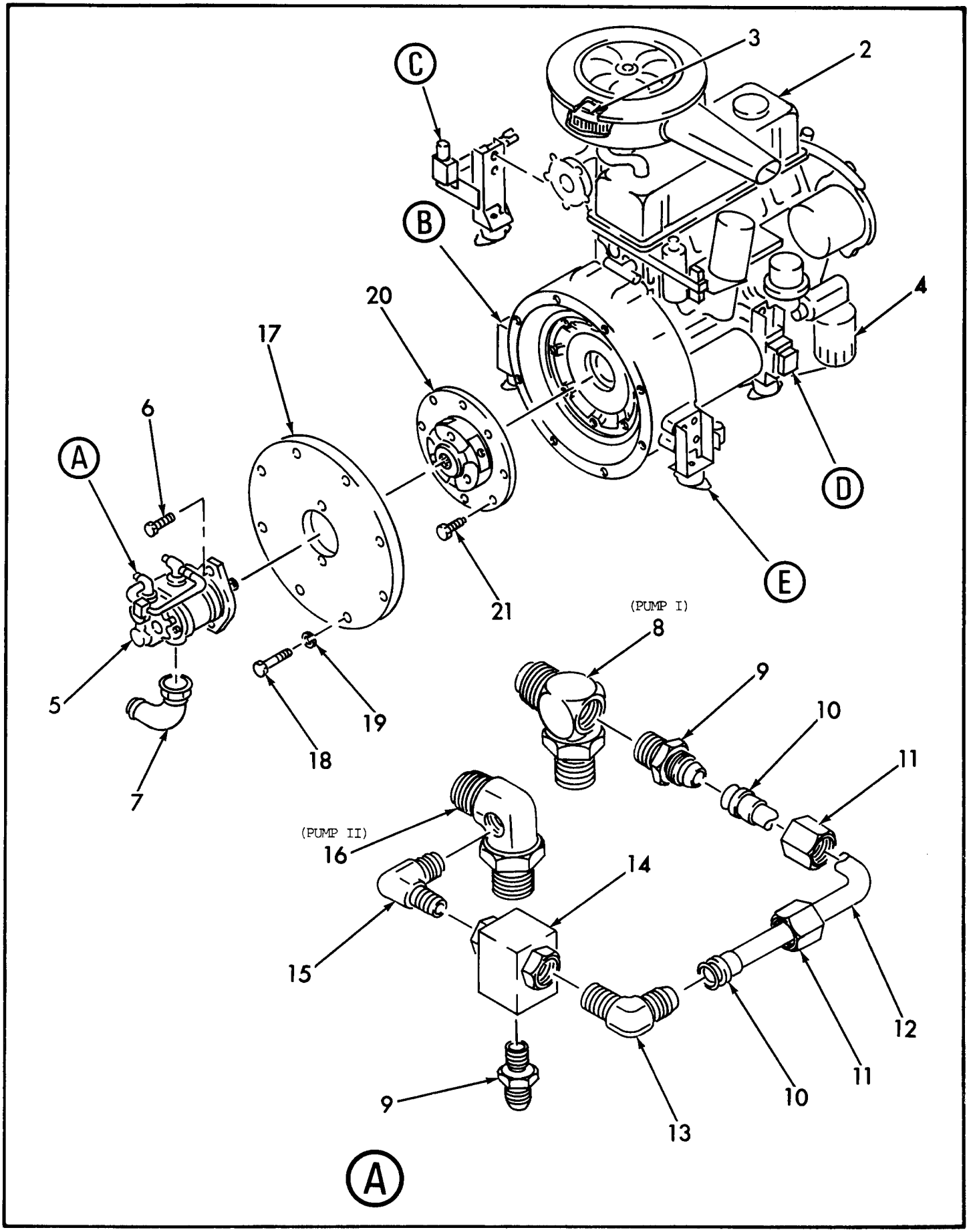
UPPER LEFT RISER ARM ASSEMBLY



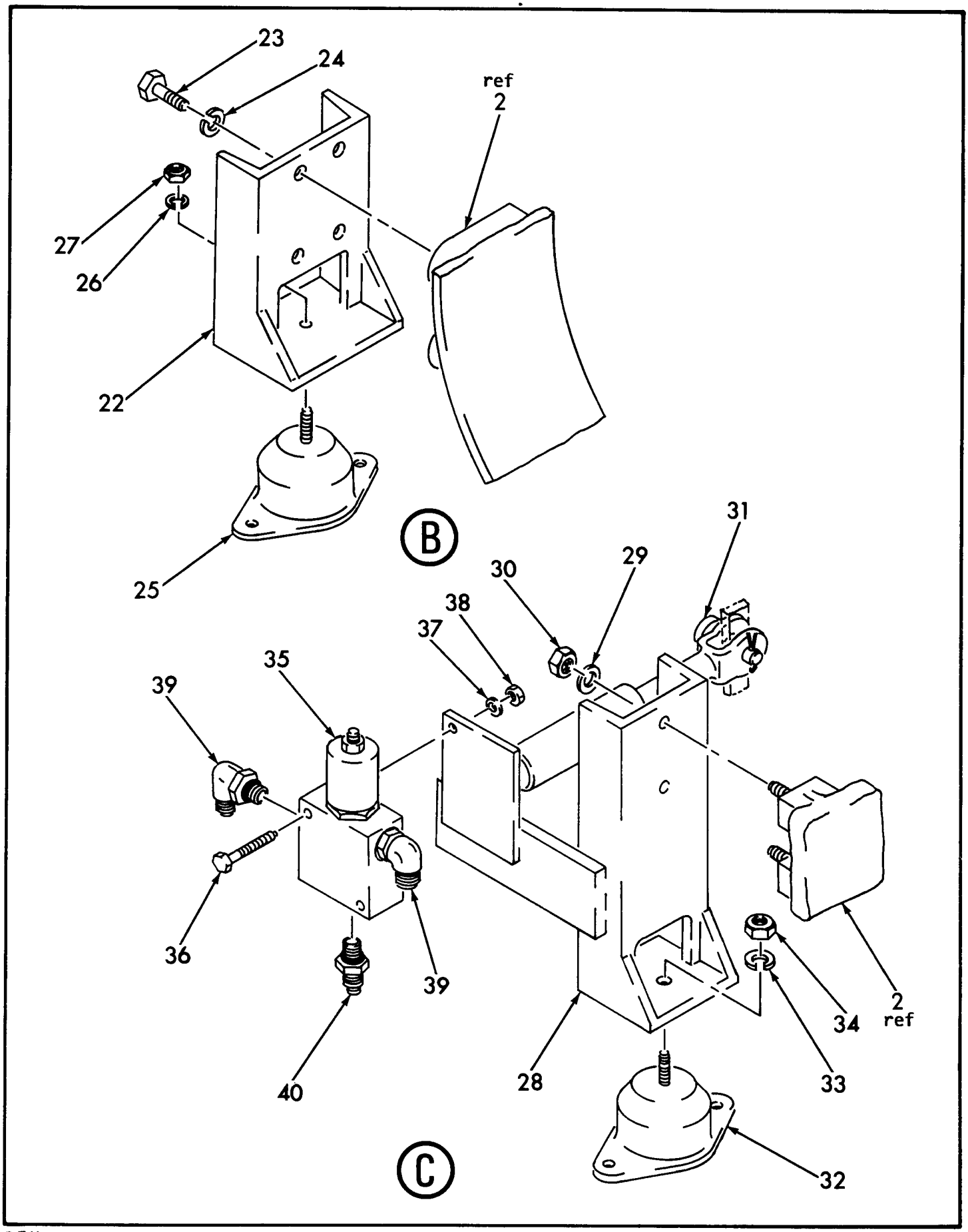
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140209	ASSEMBLY, UPPER LEFT RISER ARM (See Sect. 4, Fig. 1 or 2 for NHA)	REF
2	140192	.WELDMENT, RISER ARM UPPER RIGHT	1
3	140385	.BUSHING, RISER	1
4	140386	.BUSHING, COLUMN	1

- ITEM NOT ILLUSTRATED

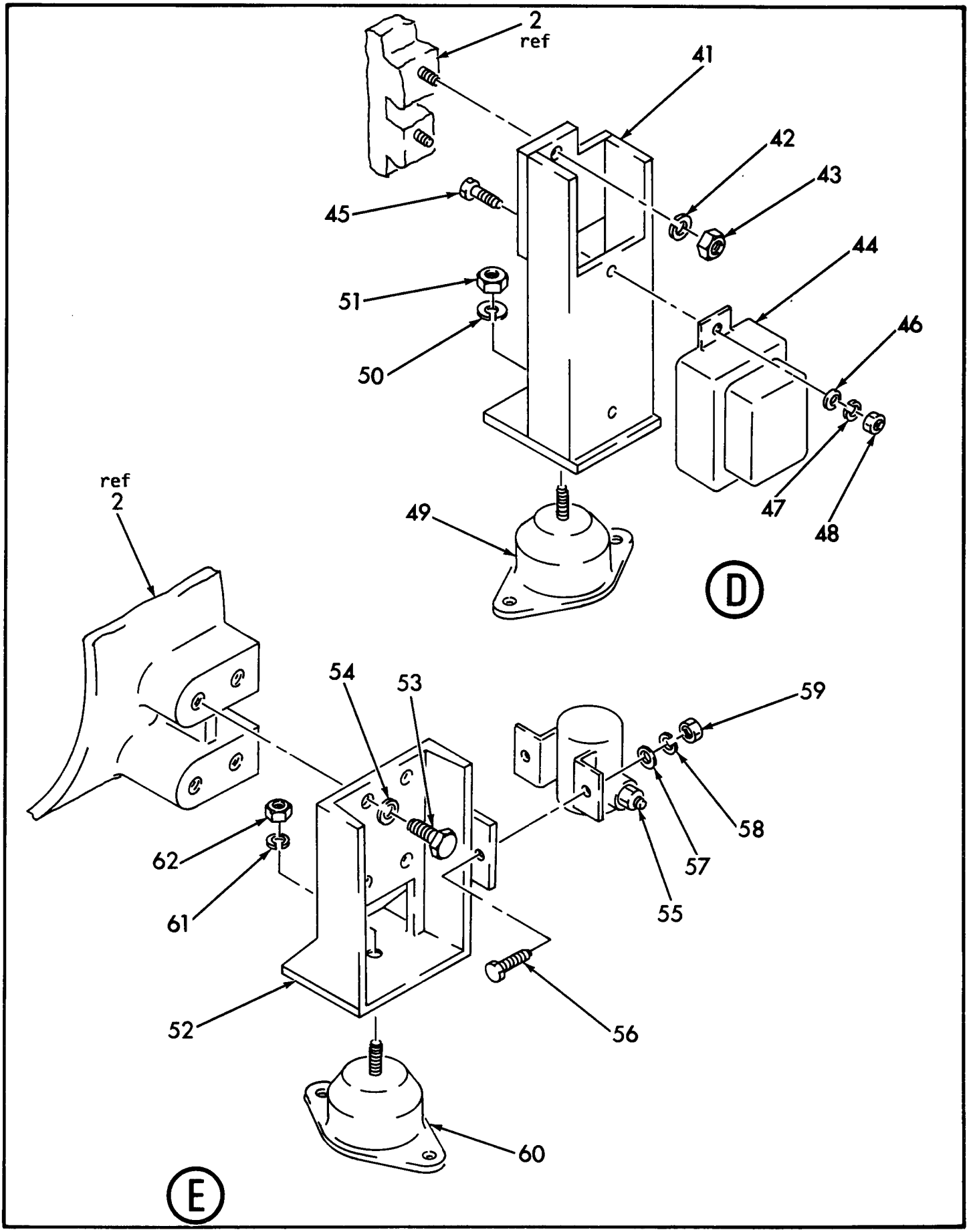
ENGINE AND PUMP ASSEMBLY (45 KBDF)



ENGINE AND PUMP ASSEMBLY (45 KBDF)
(continued)



ENGINE AND PUMP ASSEMBLY (45 KBDF)
(continued)



ENGINE AND PUMP ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140064	ASSEMBLY, ENGINE/PUMP (See Sect. 4, Fig. 1 for NHA)	REF
2	21049	.ASSEMBLY, ENGINE (See Vendor Chap. for more Information)	1
3		..ELEMENT, AIR CLEANER	1
4		..ELEMENT, OIL FILTER	1
5	81115	.ASSEMBLY, DOUBLE GEAR PUMP	1
-5A	66869	..SEAL KIT	1
6	65950	.SCREW, CAP (attaching part)	2
7	81197	.TUBE, ELBOW	1
8	140507	.ELBOW (PUMP I)	1
9	80001-04	.CONNECTOR, MALE	2
10	80062-03	.SLEEVE	2
11	80060-04	.NUT (attaching part)	2
12	27329	.TUBE, RD	1
13	80008-04	.ELBOW, MALE	1
14	20356	.VALVE, SHUTTLE	1
15	80022-04	.ELBOW, MALE PIPE	1
16	140508	.ELBOW (PUMP II)	1
17	140241	.ADAPTER, PUMP	1
18	60354	.SCREW, CAP (attaching part)	8
19	63319	.WASHER, LOCK (attaching part)	8
20	140242	.COUPLING	1
21	65949	.SCREW, CAP (attaching part)	8
22	140320	.WELDMENT, L.H. FRONT ENGINE MOUNT	1
23	65976	.SCREW, CAP (attaching part)	4
24	63327	.WASHER, LOCK (attaching part)	4

- ITEM NOT ILLUSTRATED

ENGINE AND PUMP ASSEMBLY (45 KBDF) (continued)

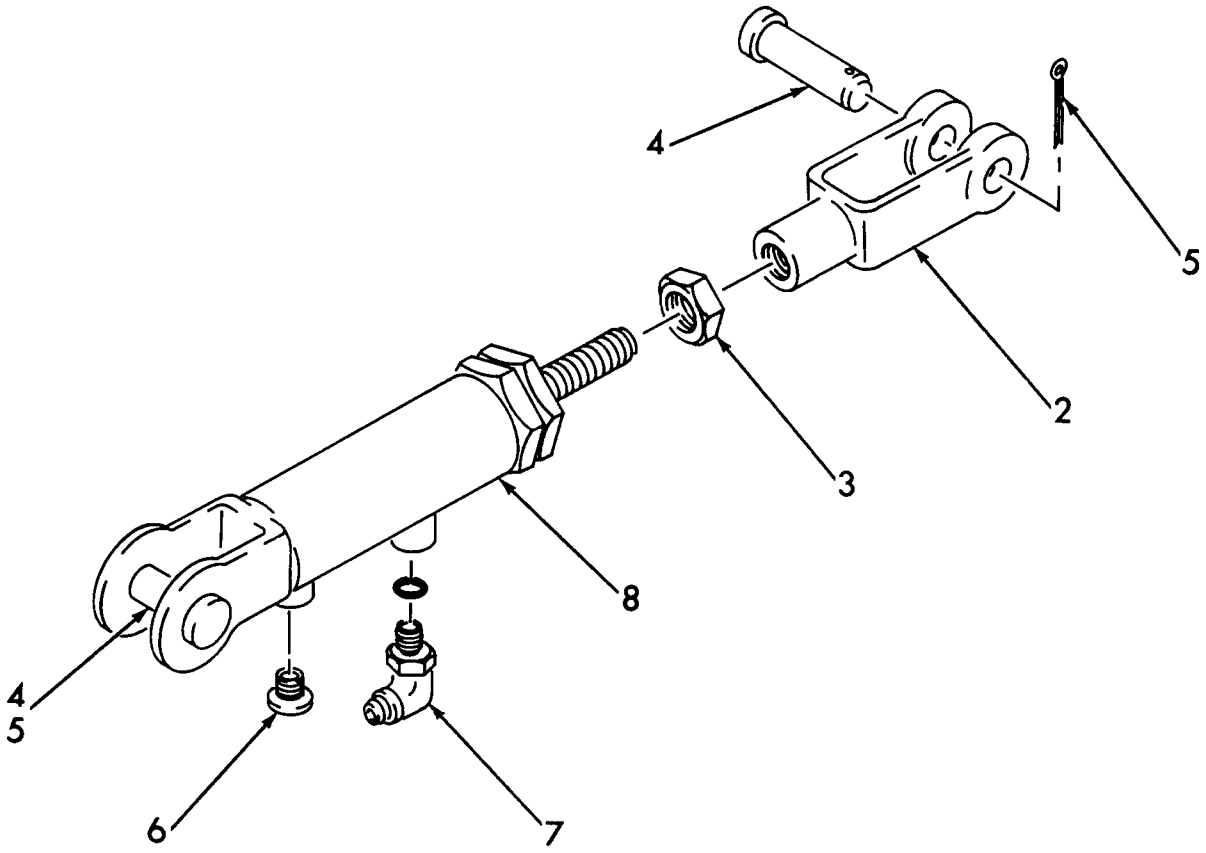
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
25	65858	.MOUNT, FRONT MOTOR	1
26	63326	.WASHER, LOCK (attaching part)	1
27	60719	.NUT, HEX (attaching part)	1
28	140319	.WELDMENT, L.H. REAR ENGINE MOUNT	1
29	63442	.WASHER, LOCK (attaching part)	2
30	65357	.NUT, HEX (attaching part)	2
31	140578	.ASSEMBLY, SHIFT CYLINGER (See Sect. 4, Fig. 16 for Details)	1
32	65858	.MOUNT, FRONT MOTOR	1
33	63326	.WASHER, LOCK (attaching part)	1
34	60719	.NUT, HEX (attaching part)	1
35	20844	.ASSEMBLY, THREE WAY SOL. VALVE	1
36	60340	.SCREW, CAP (attaching part)	2
37	63301	.WASHER, LOCK (attaching part)	2
38	63701	.NUT, HEX (attaching part)	2
39	80012-05	.ELBOW, STRAIGHT	2
40	80004-05	.CONNECTOR, STRAIGHT	1
41	140318	.WELDMENT, R.H. REAR ENGINE MOUNT	1
42	63442	.WASHER, LOCK (attaching part)	2
43	65357	.NUT, HEX (attaching part)	2
44		.REGULATOR	1
45	60342	.SCREW, CAP (attaching part)	2
46	63401	.WASHER, FLAT (attaching part)	2
47	63301	.WASHER, LOCK (attaching part)	2
48	63701	.NUT, HEX (attaching part)	2
49	65858	.MOUNT, FRONT MOTOR	1

- ITEM NOT ILLUSTRATED

ENGINE AND PUMP ASSEMBLY (45 KBDF)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
50	63326	.WASHER, LOCK (attaching part)	1
51	60719	.NUT, HEX (attaching part)	1
52	140556	.WELDMENT, R.H. FRONT ENGINE MOUNT	1
53	65976	.SCREW, CAP (attaching part)	4
54	63327	.WASHER, LOCK (attaching part)	4
55	70209	.SOLENOID, STARTER	1
56	60342	.SCREW, CAP (attaching part)	2
57	63401	.WASHER, FLAT (attaching part)	2
58	63301	.WASHER, LOCK (attaching part)	2
59	63701	.NUT, HEX (attaching part)	2
60	65858	.MOUNT, FRONT MOTOR	1
61	63326	.WASHER, LOCK (attaching part)	1
62	60719	.NUT, HEX (attaching part)	1

SHIFT CYLINDER ASSEMBLY (45 KBDF)



ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140578	ASSEMBLY, SHIFT CYLINDER (See Sect. 4, Fig. 15 for NHA)	REF
2	20789	.CLEVIS	1
3	60901	.NUT, JAM	1
4	64106	.PIN, CLEVIS	2
5	64317	.PIN, COTTER	2
6	23650	.PLUG, MODIFIED STRAIGHT THREAD	1
7	80012-03	.ELBOW, STRAIGHT THREAD	1
8	20713	.CYLINDER, SHIFT	1
-9	66793	..SEAL KIT	1

- ITEM NOT ILLUSTRATED

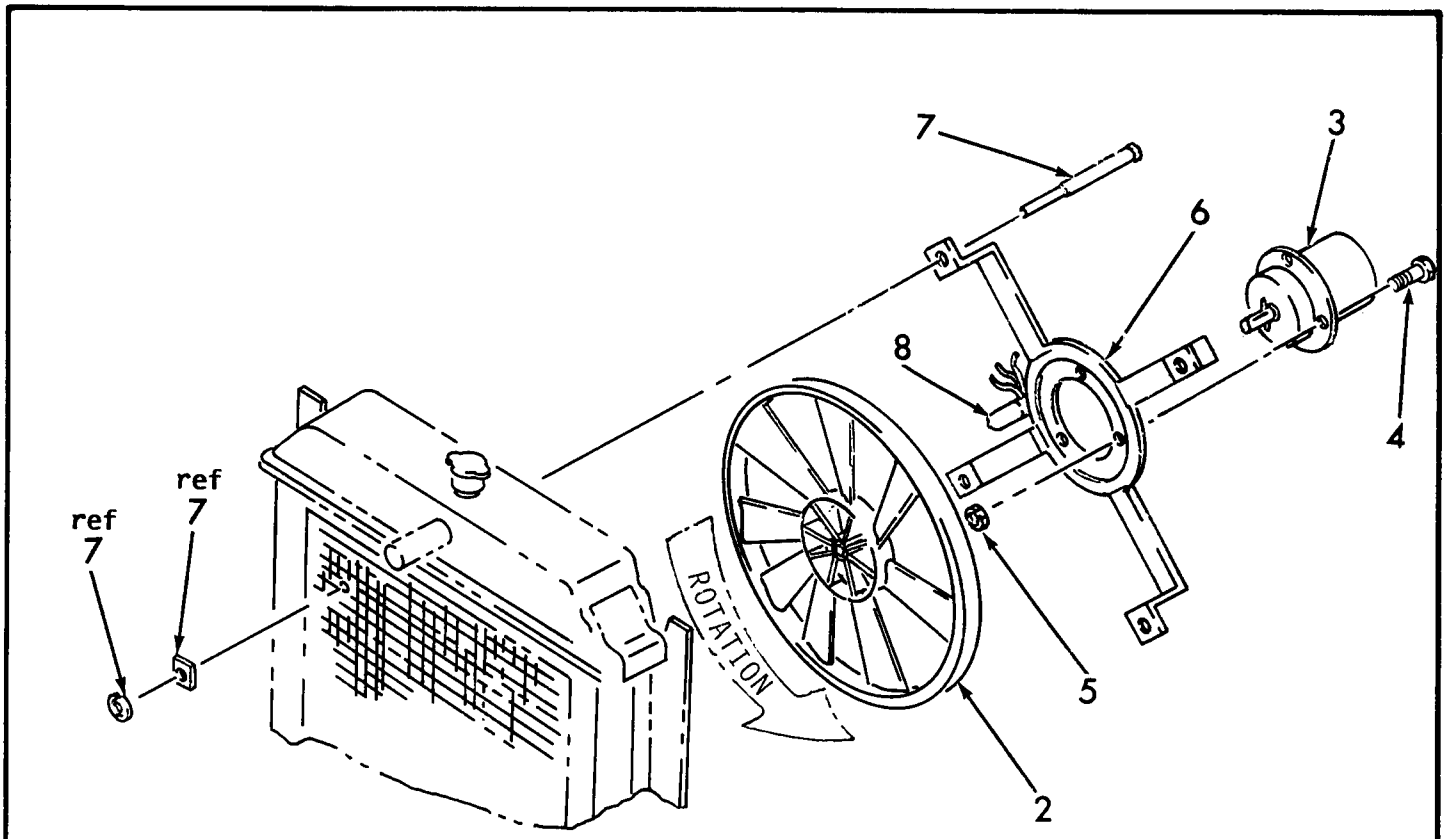
MOTOR/PUMP ASSEMBLY (45 KB)

DRAWINGS NOT AVAILABLE THIS REVISION

BATTERY CHARGER ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140615	ASSEMBLY, BATTERY CHARGER (See Sect. 4, Fig. 2 for NHA)	REF
2	70255	.TERMINAL	2
3	140559	.PLATE, BATTERY CHARGER MOUNTING	1
4	62401	.SCREW, CAP (attaching part)	4
5	60711	.NUT, HEX (attaching part)	4
-6	70370	.CHARGER, BATTERY	1
7		..BASE	1
8		..COVER	1
9	67174	..ASSEMBLY, TRANSFORMER	1
10		..MOUNT	2
11		..SCREW (attaching part)	4
12		..NUT, HEX (attaching part)	4
13	66750	..CAPACITOR	1
14		..SCREW (attaching part)	2
15		..NUT, HEX (attaching part)	2
16	67173	..KIT, ELECTRONIC TIMER	1
17		..SCREW (attaching part)	3
18	66730	..ASSEMBLY, HEATSINK (with diodes)	1
19		..SCREW (attaching part)	2
20	66726	..ASSEMBLY, FUSE	1
21		..SCREW (attaching part)	2
22	66747	..AMMETER	1
23	66734	..ASSEMBLY, D.C. RECEPTACLE	1
-24	67175	..SET, D.C. CORD (No Plug)	1

14 INCH FAN ASSEMBLY (45 KBDF)

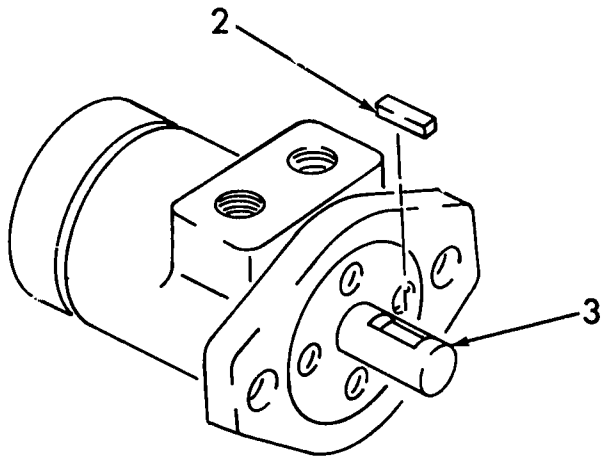


ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	65693	ASSEMBLY, 14 INCH FAN (See Sect. 4 , Fig.1 for NHA)	REF
2	67322	.FAN, 14 INCH	1
3	67323	.MOTOR, 12 VOLT	1
4		.SCREW, CAP (attaching part)	4
5		.NUT (attaching part)	4
6	67324	.GUARD, FAN	1
7	67321	.KIT, MOUNTING	1
8	67320	.ASSEMBLY, TEMPERATURE CONTROL	1

REV.

- ITEM NOT ILLUSTRATED

HYDRAULIC MOTOR ASSEMBLY

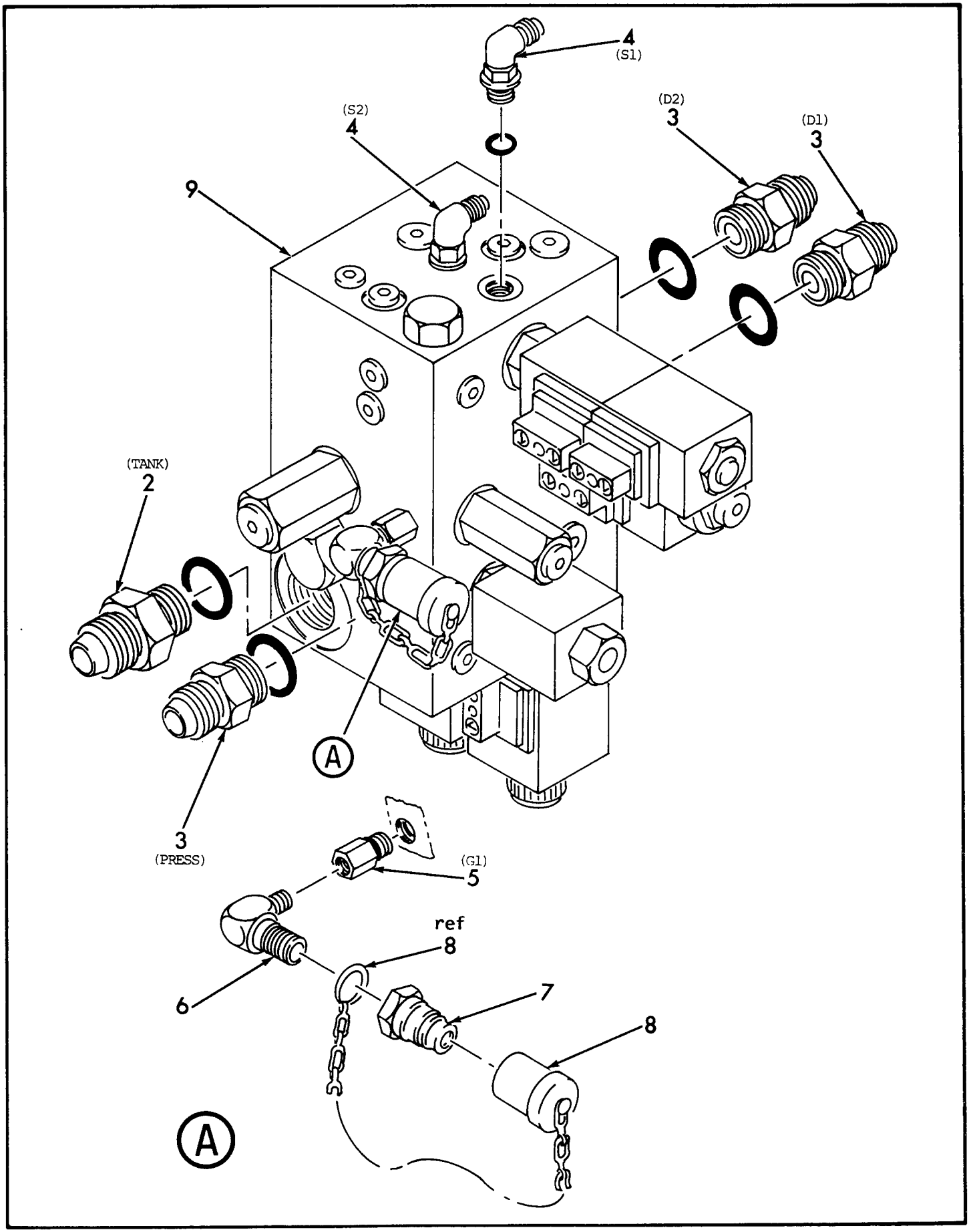


ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	81187	ASSEMBLY, HYDRAULIC MOTOR (See Sect. 4, Fig. 5 for NHA)	REF
-2	67354	.LINK, DRIVE	1
3	67353	.SHAFT, COUPLING	1
-4	67355	.KIT, SEAL	1
5		.KEY	1

REV.

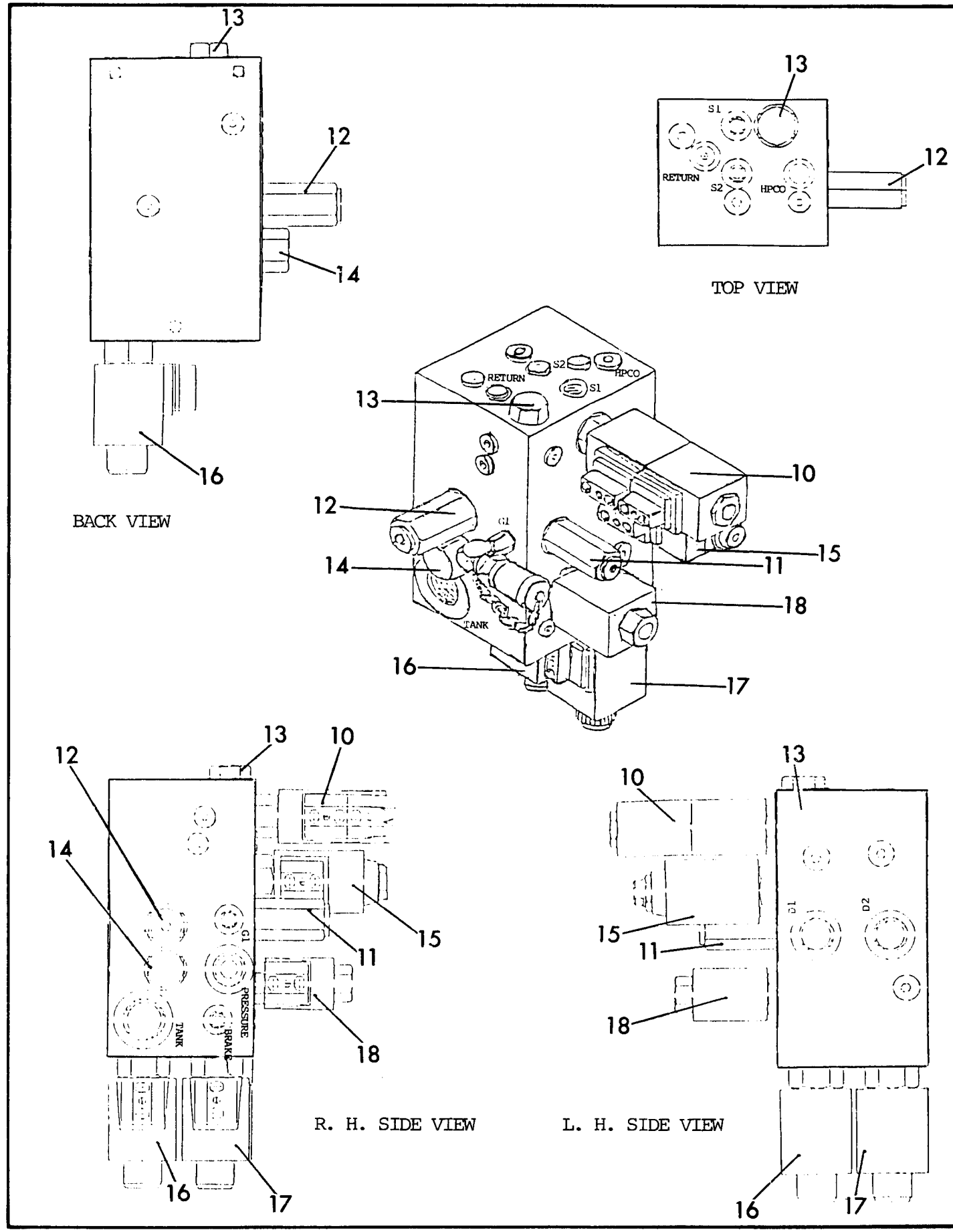
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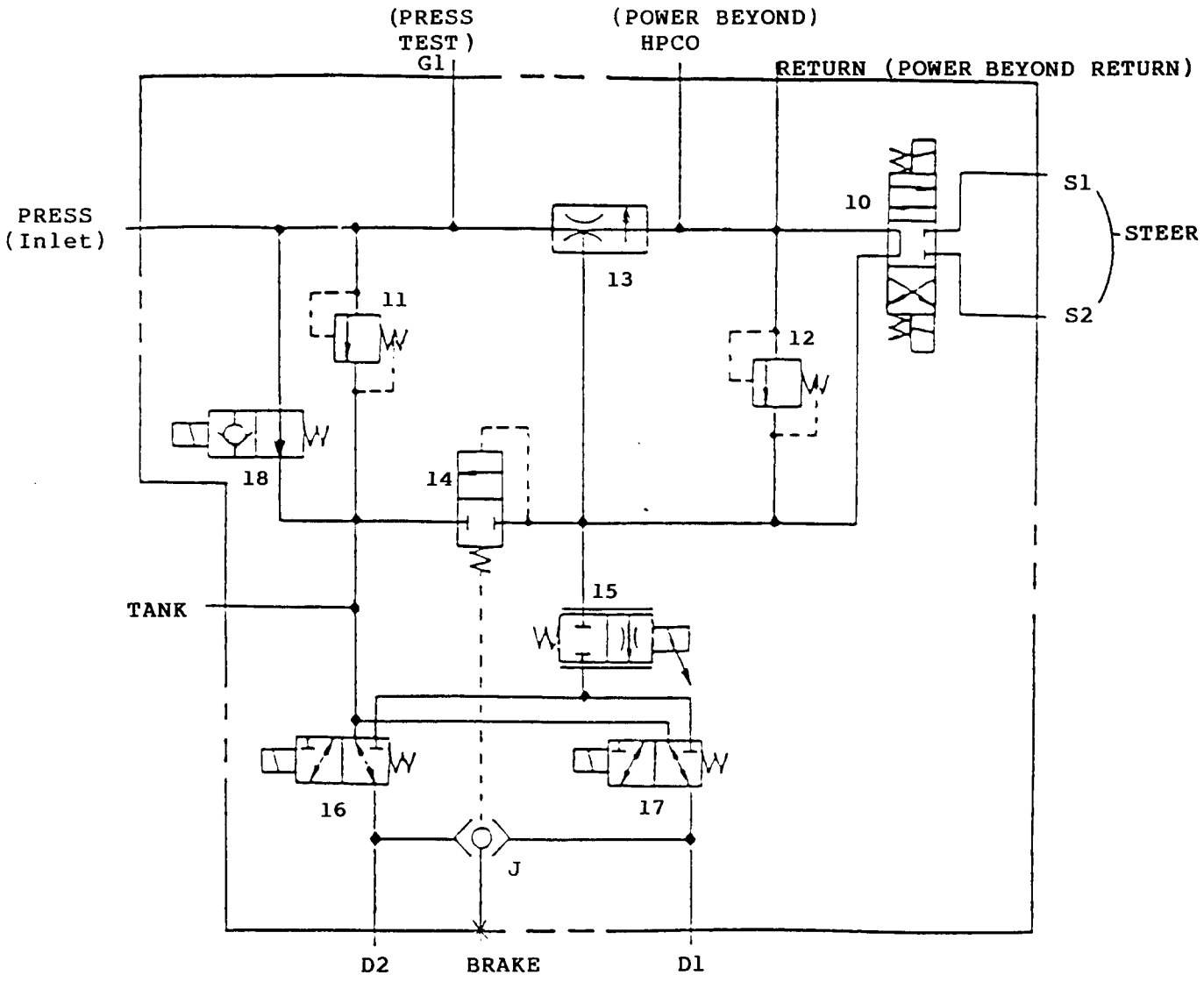
DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KBDF)



REV.

DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KBDF) (continued)





(10)	STEERING DIRECTIONAL CONTROL VALVE	P/N 67223
(11)	RELIEF VALVE: DRIVE FUNCTION	P/N 67342
(12)	RELIEF VALVE: STEERING FUNCTION	P/N 67926
(13)	PRIORITY FLOW REGULATOR: STEERING	P/N 67343
(14)	DIFFERENTIAL PRESSURE SENSING VALVE	P/N 67334
(15)	PROPORTIONAL CONTROL VALVE: DRIVE	P/N 67345
(16)	SOLENOID VALVE: REVERSE DRIVE	P/N 67221
(17)	SOLENOID VALVE: FORWARD DRIVE	P/N 67221
(J)	SHUTTLE VALVE: BRAKE (NOT USED)	
(18)	SYSTEM UNLOADING/DUMP VALVE	P/N 66920

10 STEERING DIRECTIONAL CONTROL VALVE P/N 67223.

Provides directional control of steering cylinder for left or right turn by supplying flow to S1 or S2 (steering cylinder ports) depending upon which coil is energized.

11 RELIEF VALVE: DRIVE FUNCTION P/N 67342.

Establishes maximum pressure for drive operation drive relief does not affect circuit operation unless system unloading/dump valve is closed, proportional control valve is open to inlet flow and flow through drive circuit stalls out.

12 RELIEF VALVE: STEERING FUNCTION : P/N 67926

Establishes maximum pressure of steering circuit. Inlet flow in excess of relief valve setting is recombined with secondary inlet flow for other functions or returned to tank if proportional control valve is not operated.

13 PRIORITY FLOW REGULATOR: STEERING P/N 67343

Insures that a guaranteed amount of flow is supplied for steering operation and is not affected by demands for other operations.

14 DIFFERENTIAL PRESSURE SENSING VALVE P/N 67334

Valve acts as system unloading valve until proportional control valve is energized, allows steering circuit return flow to be exhausted back to tank.

15 PROPORTIONAL CONTROL VALVE: DRIVE P/N 67345

This valve regulates inlet flow to the drive circuit, the flow rate across the valve is controlled by the position of the controller; ie; as the handle is moved further off center, the valve opens further permitting greater flow to the selected directional valve.

16 SOLENOID VALVE: REVERSE DRIVE P/N 67221

When operated by micro-switch on controller, valve shifts connecting inlet flow across proportional control valve to high/low (series/parallel) speed control valve (P/N 81220)

17 SOLENOID VALVE: FORWARD DRIVE P/N 67221

Same as '16' except selects forward direction of travel.

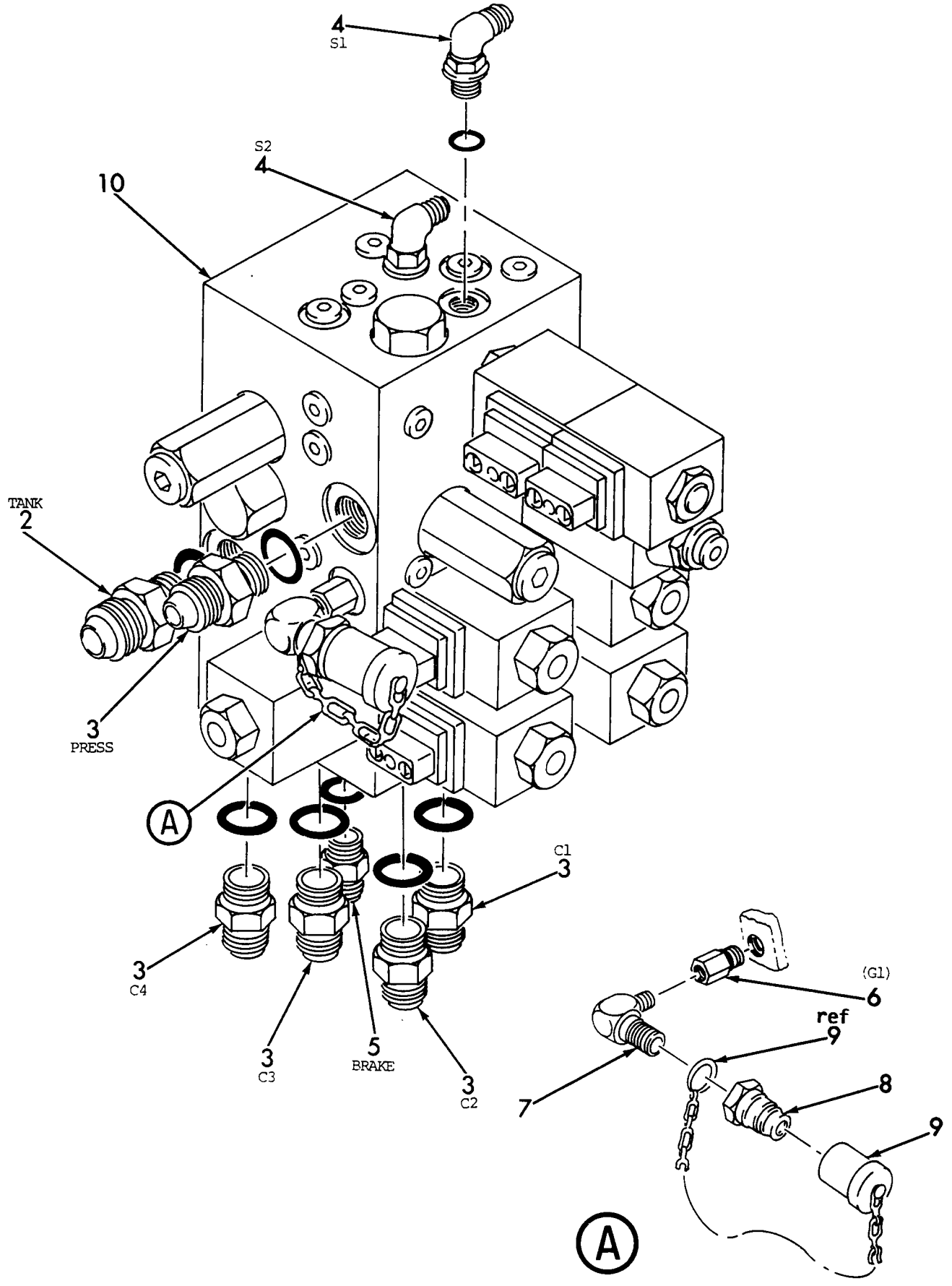
18 SYSTEM UNLOADING/DUMP VALVE P/N 66920

This valve is operated by micro-switch on controller, when closed it will insure that pump flow is delivered to the selected function. When not operated it allows pump flow to be exhausted back to tank without being affected.

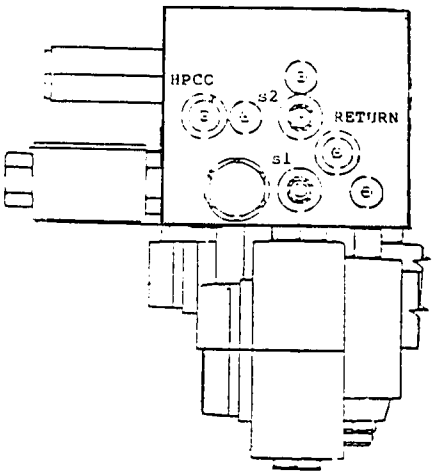
DRIVE/STEER VALVE PACKAGE ASSEMBLY (45KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140292	ASSEMBLY, DRIVE/STEER VALVE PACKAGE (See Sect. 4, Fig. 1 for NHA)	REF
2	80004-18	.CONNECTOR, STRAIGHT THREAD (TANK)	1
3	80004-15	.CONNECTOR, STRAIGHT THREAD (PRESS, D1, D2)	3
4	80012-03	.ELBOW, STRAIGHT THREAD (S1, S2)	2
5	51903	.ADAPTER, FEMALE PIPE	1
6	80022-03	.ELBOW, MALE PIPE	1
7	2527	.COUPLING, QUICK DISCONNECT	1
8	845	.CAP, QUICK DISCONNECT	1
9	81219	.PACKAGE, PROPORTIONAL DRIVE/STEER VALVE	1
10	67341	..VALVE, STEERING DIRECTIONAL CONTROL	1
11	67342	..VALVE, DRIVE FUNCTION RELIEF	1
12	67926	..VALVE, STEERING FUNCTION RELIEF	1
13	67343	..REGULATOR, STEERING PRIORITY FLOW	1
14	67344	..VALVE, DIFFERENTIAL PRESSURE SENSING	1
15	67224	..VALVE, DRIVE PROPORTIONAL CONTROL	1
16	67346	..VALVE, REVERSE DRIVE SOLENOID	1
17	67346	..VALVE, FORWARD DRIVE SOLENOID	1
18	66920	..VALVE, SYSTEM UNLOADING/DUMP	1

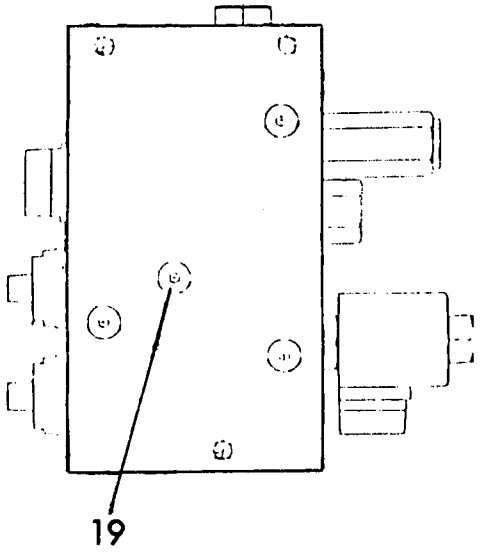
DRIVE/STEER VALVE PACKAGE ASSEMBLY (45 KB)



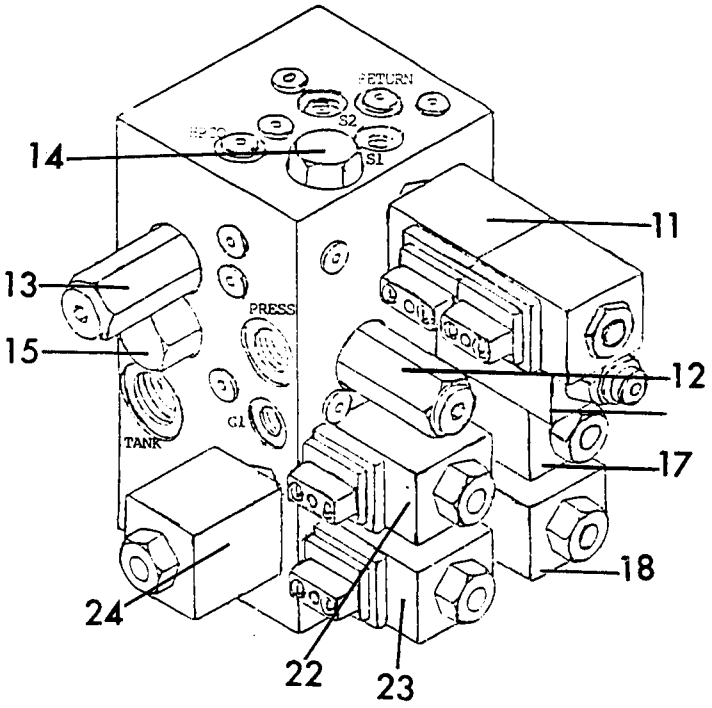
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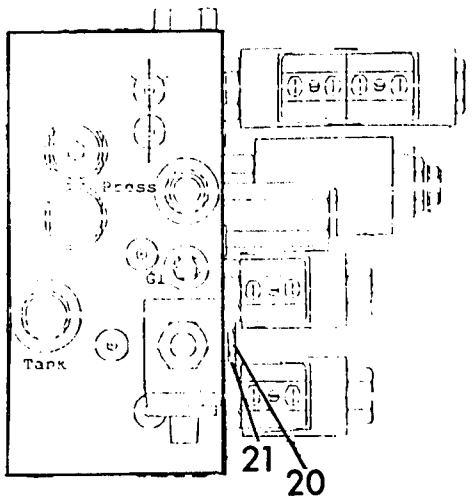


FRONT VIEW MOTOR END

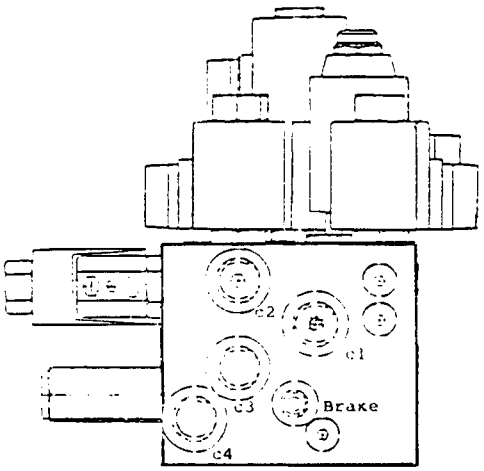


BOTTOM VIEW MOTOR END



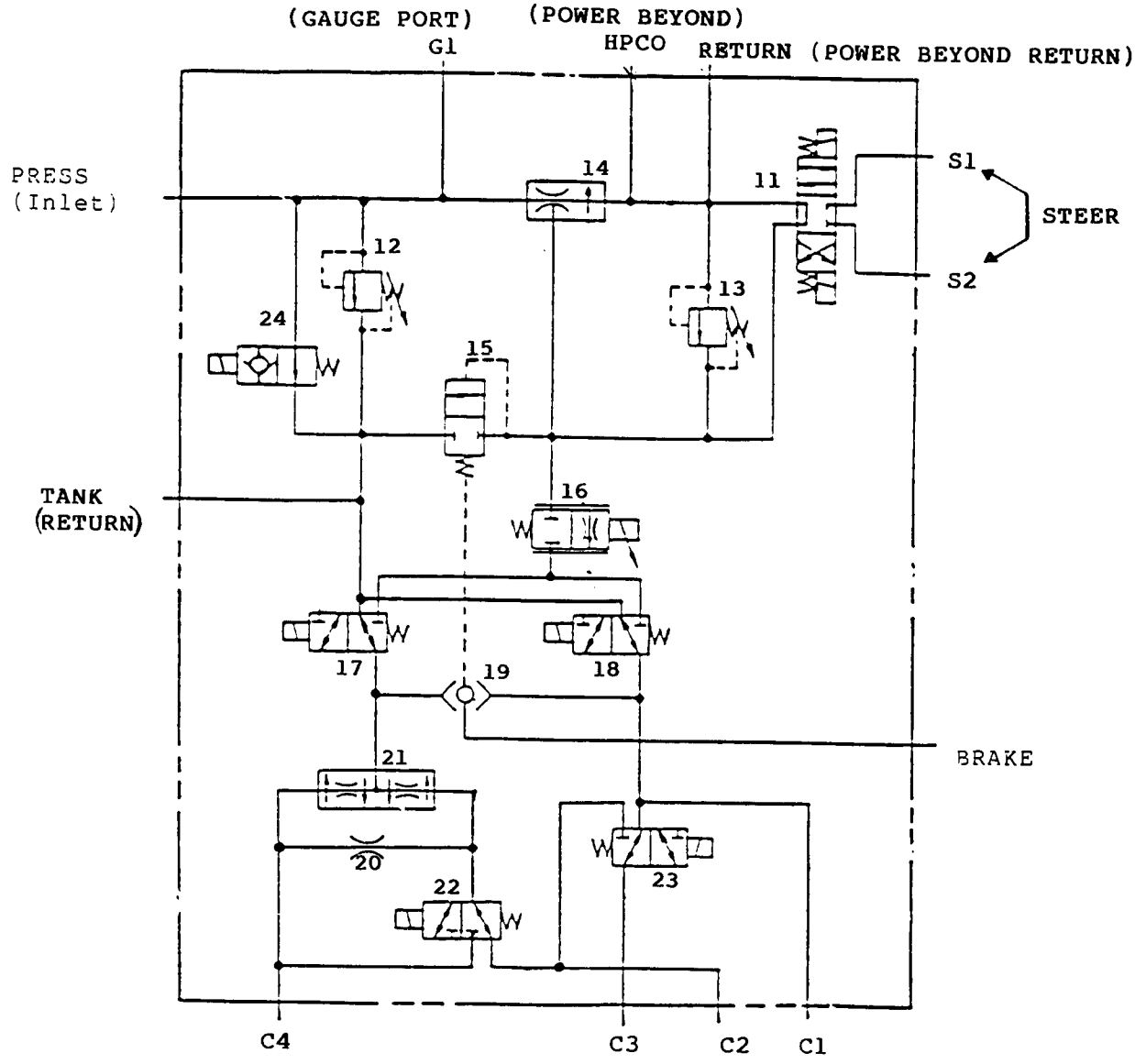


LEFT SIDE MOTOR END



END VIEW MOTOR END

DRIVE/STEER VALVE PACKAGE ASSEMBLY (45 KB)
(continued)



(11) STEERING D.C.V
(12) DRIVE RELIEF
(13) STEERING RELIEF (LEFT & RIGHT)
(14) STEERING FLOW REGULATOR
(15) DIFFERENTIAL SENSING VALVE
(16) DRIVE PROPORTIONAL VALVE

(17) REVERSE VALVE
(18) FORWARD VALVE
(19) BRAKE SHUTTLE
(24) UNLOADING VALVE
(21) FLOW DIVIDER
(20) ORIFICE PLUG
(22) SERIES PARALLEL
(23) SERIES PARALLEL

LOW SPEED FORWARD (PARALLEL) C4 & C2
LOW SPEED REVERSE (PARALLEL) C3 & C1
HIGH SPEED FORWARD(SERIES) C3 & C4(BLOCKED)
HIGH SPEED REVERSE(SERIES) C1 & C2(BLOCKED)

11 STEERING DIRECTIONAL CONTROL P/N 67341

Provides directional control of steering cylinder for right or left turn by supplying flow to S1 or S2 cylinder ports depending upon which coil is energized.

12 RELIEF VALVE: DRIVE FUNCTION P/N 67335.

Establishes maximum pressure for drive operation. Drive relief valve does not affect circuit operation unless system unloading dump valve is closed, proportional control valve is open to inlet flow and flow through drive circuit stalls out.

13 RELIEF VALVE: STEERING FUNCTION P/N 67926.

Establishes maximum pressure of steering circuit. Inlet flow in excess of relief valve setting is recombined with secondary inlet flow, for other functions or returned to tank if proportional control valve (item F) is not energized.

14 PRIORITY FLOW REGULATOR: STEERING P/N 67343 or 66229

Insures that a guaranteed amount of flow is supplied for steering operation and is not affected by demands for other operations.

15 DIFFERENTIAL PRESSURE SENSING VALVE P/N 67344

Valve acts as system unloading valve until proportional control valve is energized, allows steering circuit return flow to be exhausted back to tank.

16 PROPORTIONAL CONTROL VALVE: DRIVE P/N 67224

This valve regulates inlet flow to the drive function selector valves (G & H), the flow rate across the valve is controlled by the position of the controller handle; ie: as the handle is moved further off center, the valve opens further permitting greater flow to the selected function valve.

17 SOLENOID VALVE: REVERSE DRIVE P/N 67220

When operated by micro-switch on controller, valve shifts connecting inlet flow across proportional control valve (Item F) to drive function supply ports (C4 and C2 in low speed/C2 in nigh speed.)

18 SOLENOID VALVE: FORWARD DRIVE P/N 67220

Same as "G" except selects forward direction of travel(C3 and C1 in low speed/C1 in high speed)

19 BRAKE SHUTTLE VALVE.67240

Pressure signal from drive direction select solenoid valves (G & H) is directed out to brake release port and to spring chamber of differential pressure sensing valve (Item E) this forces the valve closed increasing inlet flow to the drive proportional control valve (Item F).

20 ORIFICE PLUG P/N 67349

Provides for relief of oil flow across flow divider combiner (Item L) when drive wheel motor is cramped in tight turn, prevents tire from scuffing while turning.

21 FLOW DIVIDER COMBINER P/N 67219

This valve regulates supply flow to the drive motors insuring that inlet or return flow is divided or combined equally and thus insuring that maximum torque can be generated at each drive wheel irregardless of the driving surface.

22 23 SOLENOID VALVE: (HIGH/LOW SPEED) SERIES PARALLEL P/N 67220

These valves operate simultaneously to connect the drive motors in a series circuit for high travel speed. In the forward direction C1 is the supply port, crosses the motor, returns at C2 to supply the second motor down stream through C3 and then returns across the motor to C4 and subsequently back to tank. This flow is reversed when drive is reversed. In a parallel circuit (forward direction of travel) supply ports C1 and C3 provide flow to both motors simultaneously ports C2 and C4 are return to tank. This flow is reversed when reverse low speed drive is selected

24 SYSTEM UNLOADING/DUMP VALVE.66676

This valve is operated by the micro-switch on the controller handle, when closed it insures full pump flow is delivered to the selected function. When not operated it allows pump flow to be exhausted back to tank without being affected by the system relief valve.

DRIVE/STEER VALVE PACKAGE ASSEMBLY (45 KB) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140310	ASSEMBLY, DRIVE/STEER VALVE PACKAGE (See Sect. 4, Fig. 2 for NHA)	REF
2	80004-03	.CONNECTOR, STRAIGHT THREAD (TANK)	1
3	80004-11	.CONNECTOR, STRAIGHT THREAD (C1, C2, C3, C4 & PRESS)	5
4	80012-03	.ELBOW, STRIAGHT THREAD (S1, S2)	2
5	80004-03	.CONNECTOR, STRAIGHT THREAD (BRAKE)	1
6	51903	.ADAPTER, FEMALE PIPE	1
7	80052-03	.NIPPLE, PIPE	1
8	2527	.COUPLING, QUICK DISCONNECT	1
9	845	.CAP, QUICK DISCONNECT	1
10	81212	.PACKAGE, PROPORTIONAL DRIVE/STEER VALVE	1
11	67341	..VALVE, STEERING DIRECTIONAL CONTROL	1
12	67335	..VALVE, DRIVE FUNCTION RELIEF	1
13	67926	..VALVE, STEERING FUNCTION RELIEF	1
14	67343 66229	..REGULATOR, STEERING PRIORITY FLOW	1
15	67344	..VALVE, DIFFERENTIAL PRESSURE SENSING	1
16	67224	..VALVE, DRIVE PROPORTIONAL CONTROL	1
17	67220	..VALVE, REVERSE DRIVE SOLENOID	1
18	67220	..VALVE, FORWARD DRIVE SOLENOID	1
19	67240	..VALVE, BRAKE SHUTTLE	1
20	67349	..PLUG, ORIFICE	1
21	67219	..COMBINER, FLOW DIVIDER	1
22	67220	..VALVE, HIGH/LOW SPEED SOLENOID	1
23	67346	..VALVE, HIGH/LOW SPEED SOLENOID	1
24	66676	..VALVE, SYSTEM UNLOADING/DUMP	1

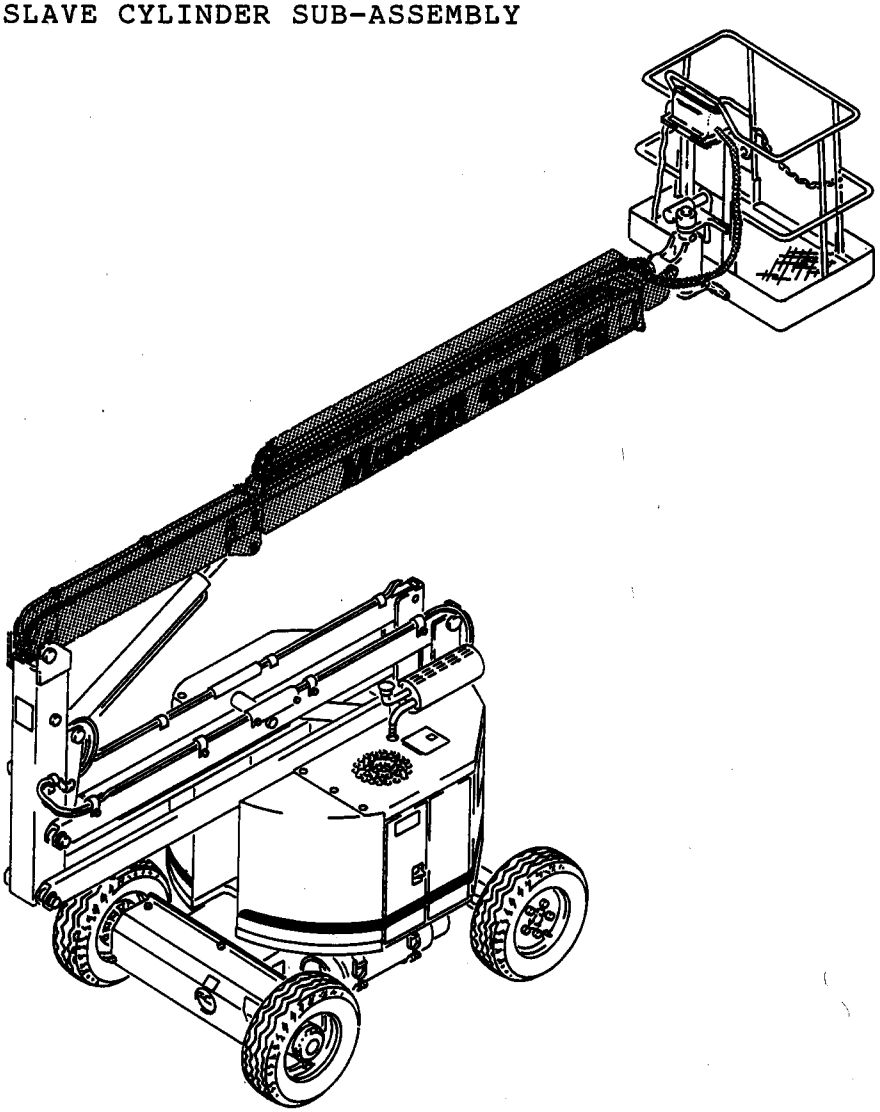
THIS **SECTION 5** IS ILLUSTRATED AS:

FIGURE 1 FINAL BOOM ASSEMBLY

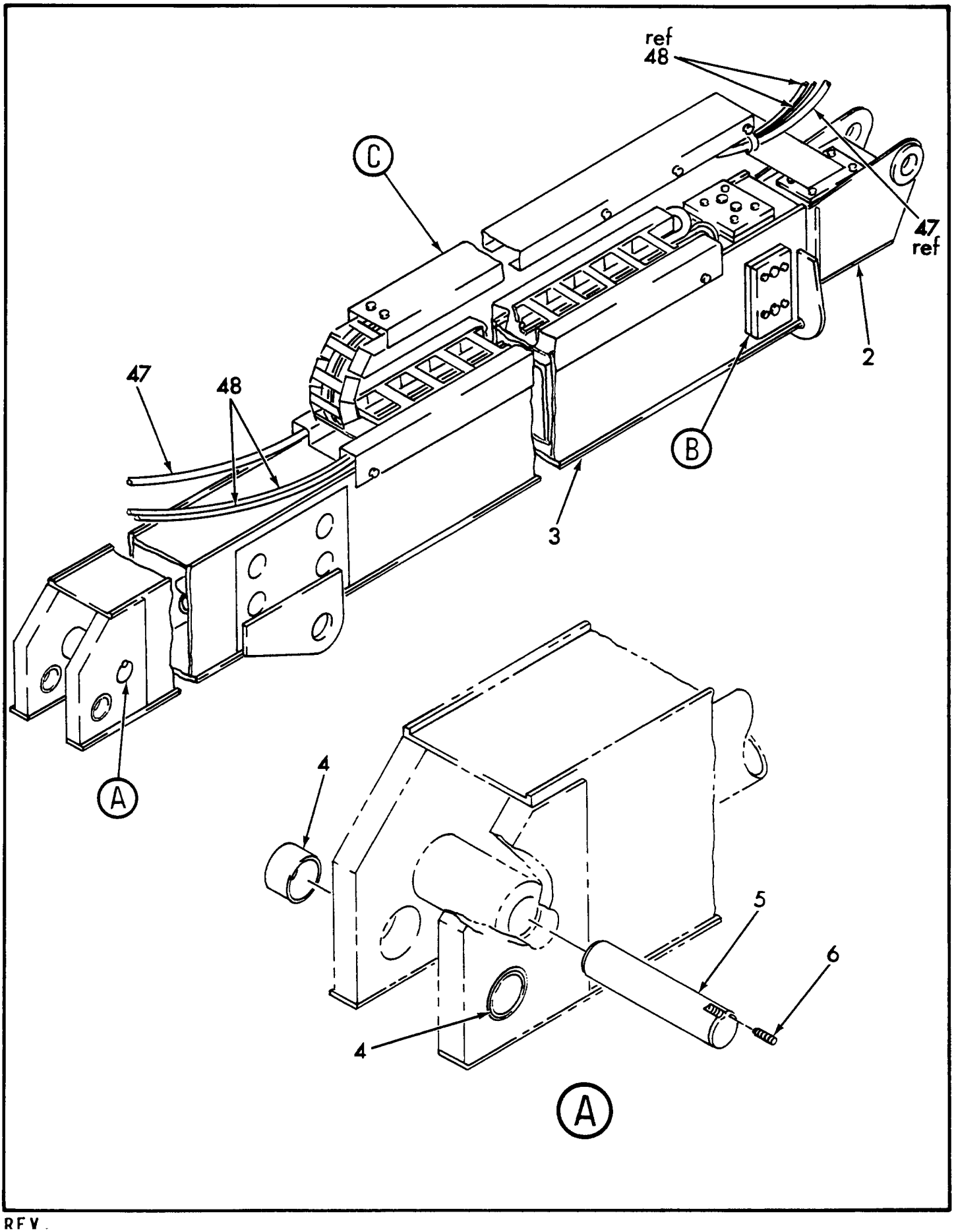
FIGURE 2 INNER BOOM SUB-ASSEMBLY

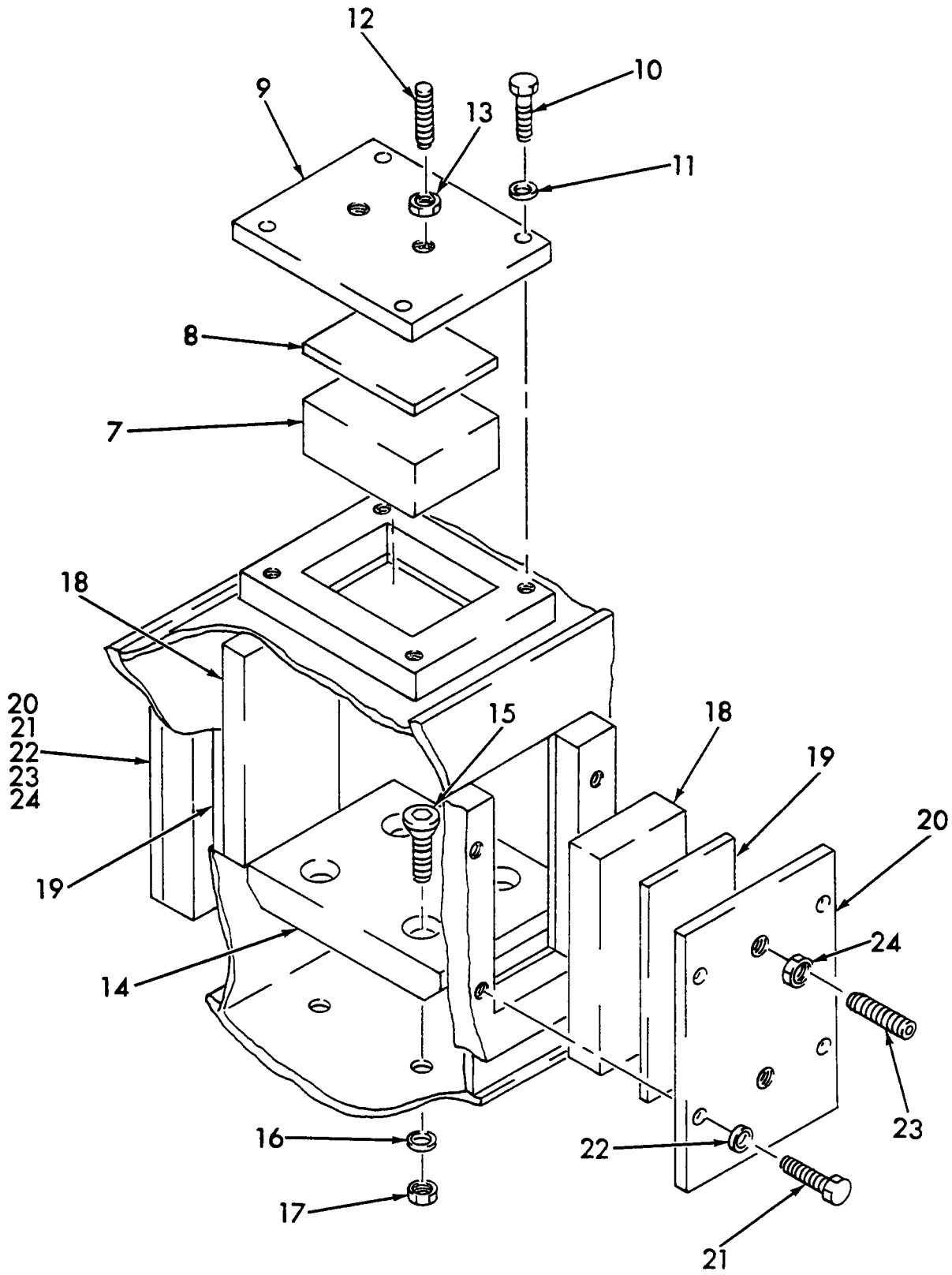
FIGURE 3 EXTENSION CYLINDER ASSEMBLY

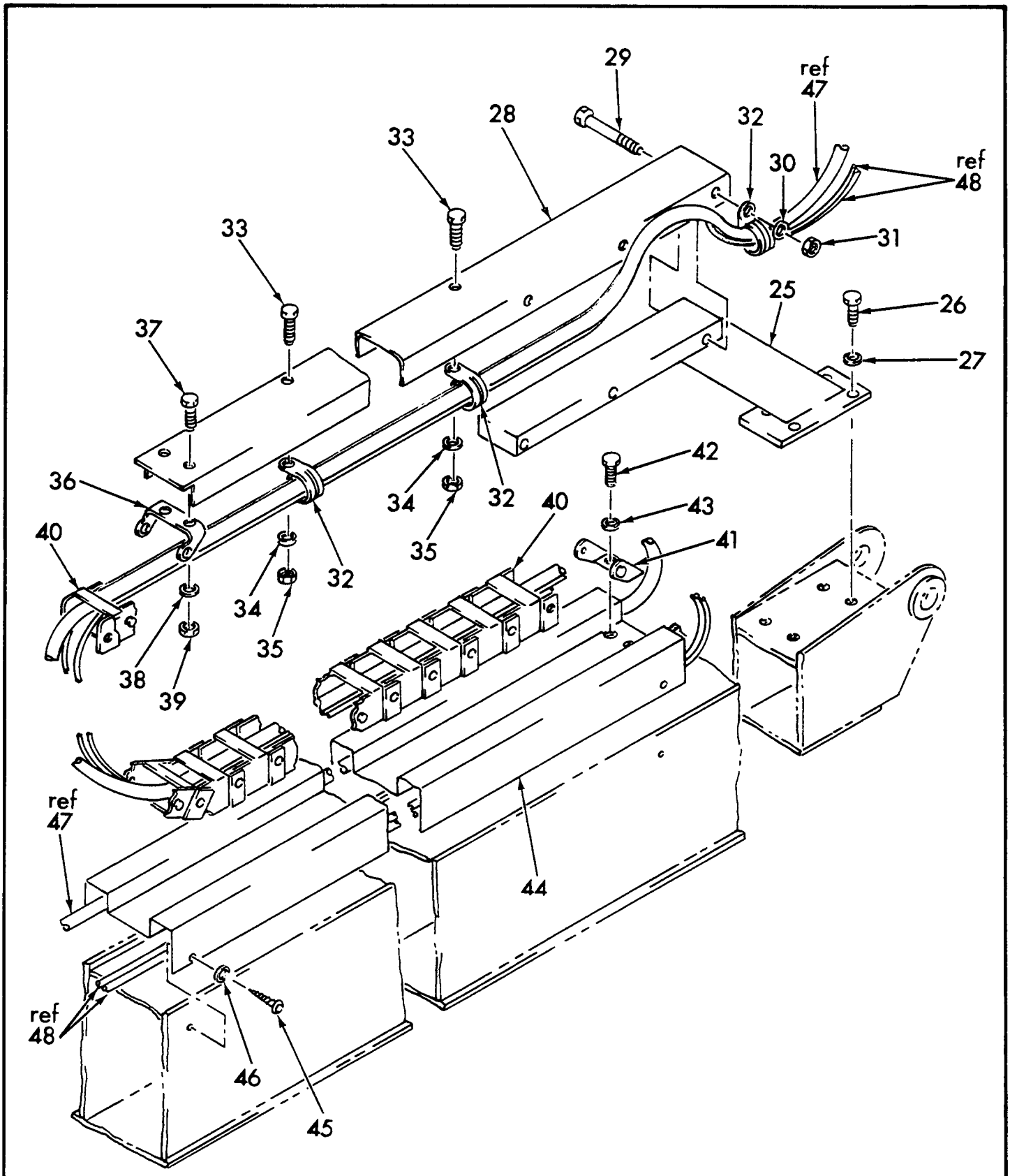
FIGURE 4 SLAVE CYLINDER SUB-ASSEMBLY



FINAL BOOM ASSEMBLY




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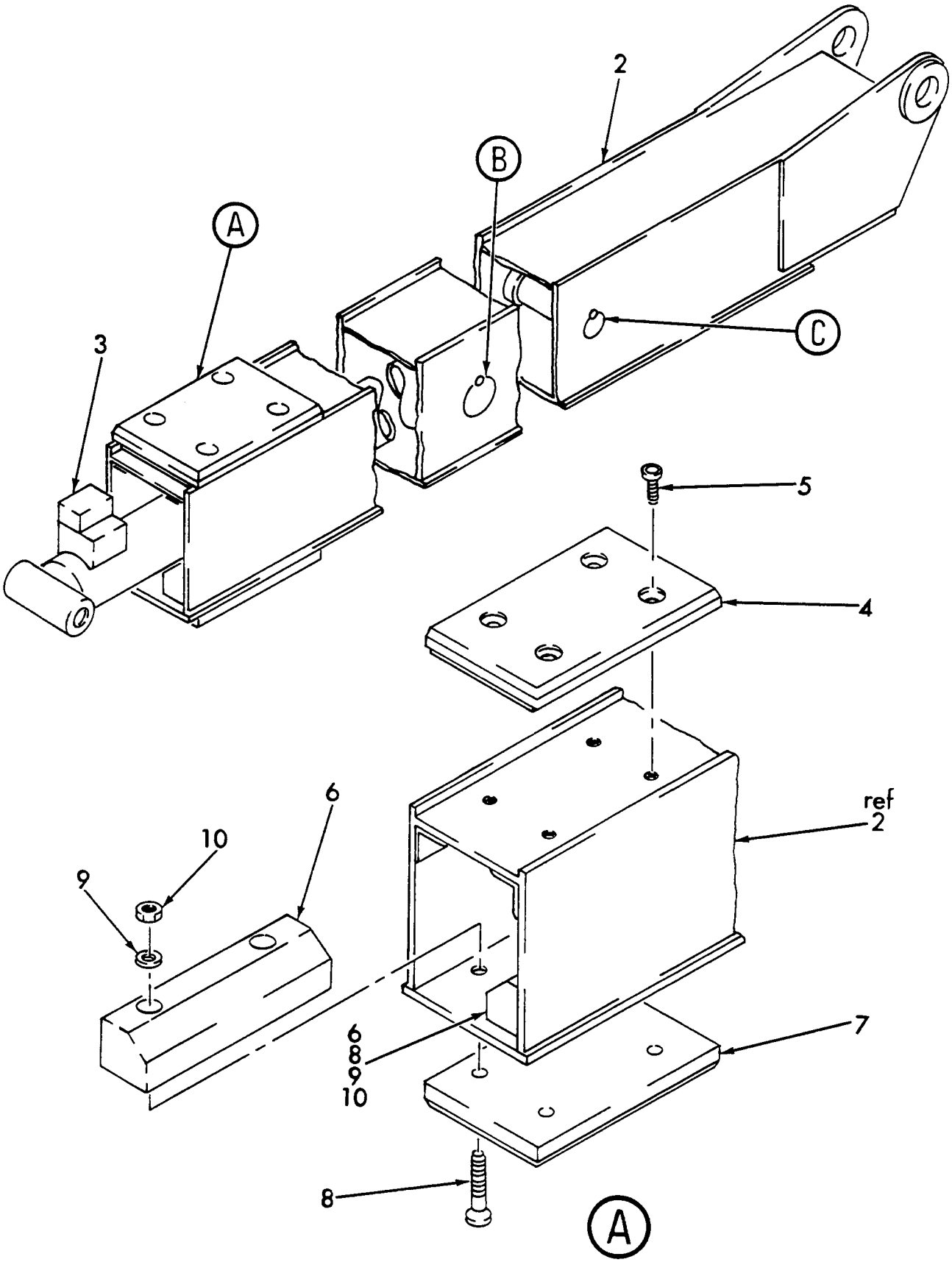

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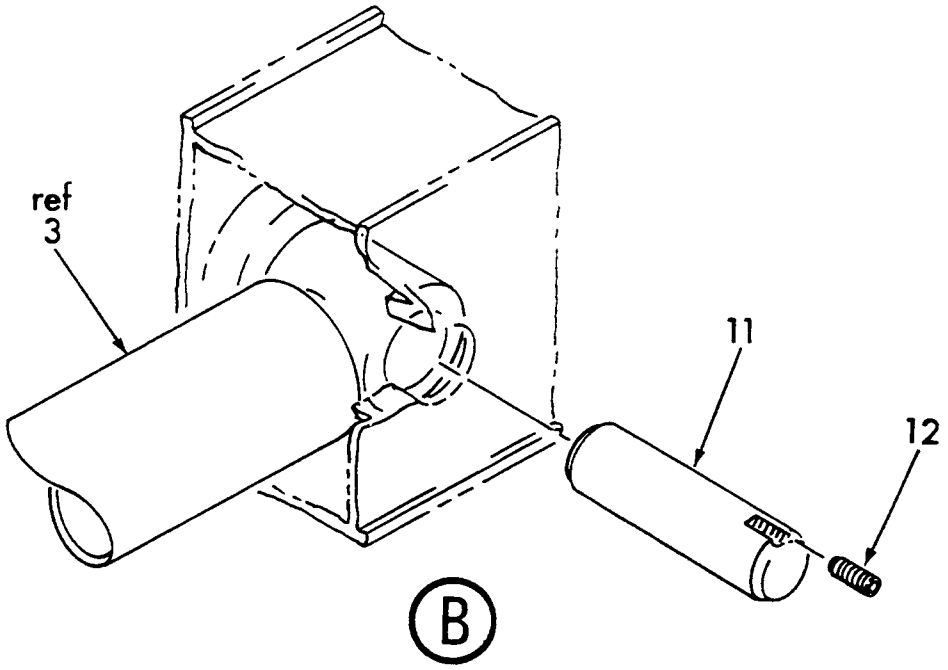
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ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140122	ASSEMBLY, FINAL BOOM (See Sect. 2, Fig. 1 or 2 for NHA)	REF
2	140120	.SUB-ASSEMBLY, INNER BOOM (See Sect. 5, Fig. 2 for Details)	1
3	140029	.MACHINING, OUTER BOOM	1
4	140121	..BUSHING	2
5	140429	.PIN, EXTENSION CYLINDER CAP END	1
6	62234	.SCREW, SET	1
7	140405	.PAD, TOP WEAR	1
8	27259	.STRIP	1
9	140406	.PLATE, TOP COVER	1
10	60338	.SCREW, CAP (attaching part)	4
11	63302	.WASHER, LOCK (attaching part)	4
12	62210	.SCREW, SET	2
13	60901	.NUT, JAM	2
14	140396	.PAD, BOTTOM/OUTER BOOM WEAR	1
15	61821	.SCREW, CAP (attaching part)	4
16	63319	.WASHER, LOCK (attaching part)	4
17	60703	.NUT, HEX (attaching part)	4
18	140403	.PAD, SIDE WEAR	2
19	27258	.STRIP	2
20	140402	.PLATE, SIDE COVER	2
21	60338	.SCREW, CAP (attaching part)	8
22	63302	.WASHER, LOCK (attaching part)	8
23	62210	.SCREW, SET	4

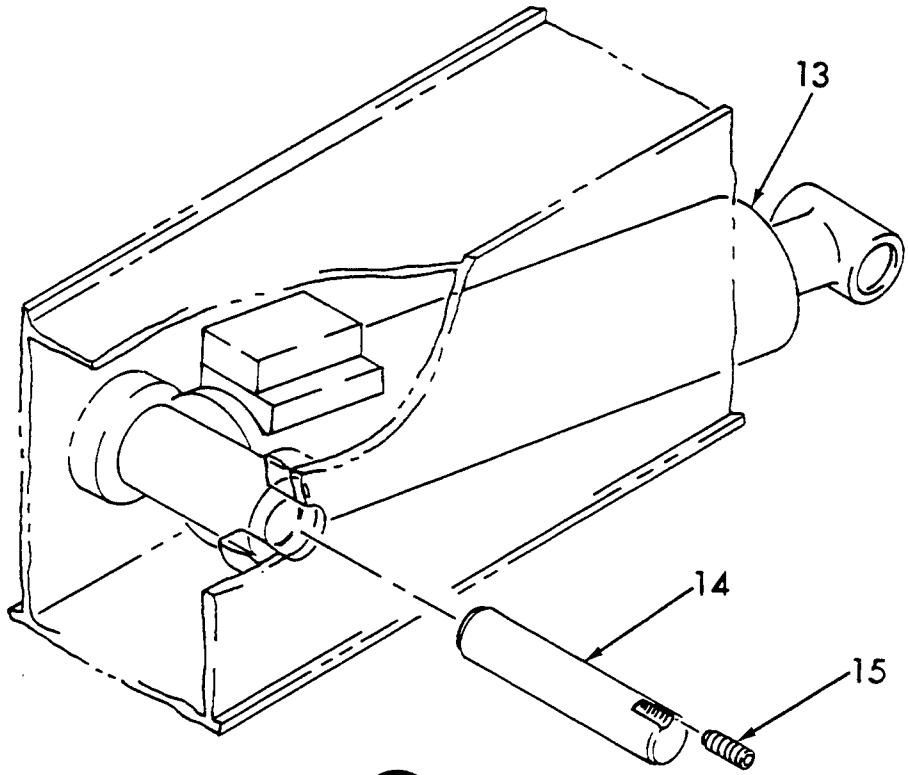
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
24	60901	.NUT, JAM	4
25	140399	.WELDMENT, POWER TRACK BRACKET	1
26	60367	.SCREW, CAP (attaching part)	4
27	63302	.WASHER, LOCK (attaching part)	4
28	140347	.SUPPORT, POWER TRACK	1
29	60429	.SCREW, CAP (attaching part)	3
30	63429	.WASHER, FLAT (attaching part)	3
31	61322	.NUT, LOCK (attaching part)	3
32	65867	.CLAMP	4
33	60353	.SCREW, CAP (attaching part)	3
34	63433	.WASHER, FLAT (attaching part)	3
35	61227	.NUT, LOCK (attaching part)	3
36	23874	.BRACKET, MOVEABLE	1
37	60353	.SCREW, CAP	2
38	63433	.WASHER, FLAT	2
39	61227	.NUT, LOCK	2
40	23824	..TRACK, POWER (45 Links)	1
41	23875	.BRACKET, STATIONARY	1
42	60422	.SCREW, CAP (attaching part)	2
43	63433	.WASHER, FLAT (attaching part)	2
44	140201	.GUIDE, POWER TRACK	1
45	61729	.SCREW, MACHINE (attaching part)	4
46	63313	.WASHER, LOCK (attaching part)	4
47	20802	.CABLE, CONDUCTOR (65 Ft.)	1
48	2568-35	.HOSE	2

INNER BOOM SUB-ASSEMBLY





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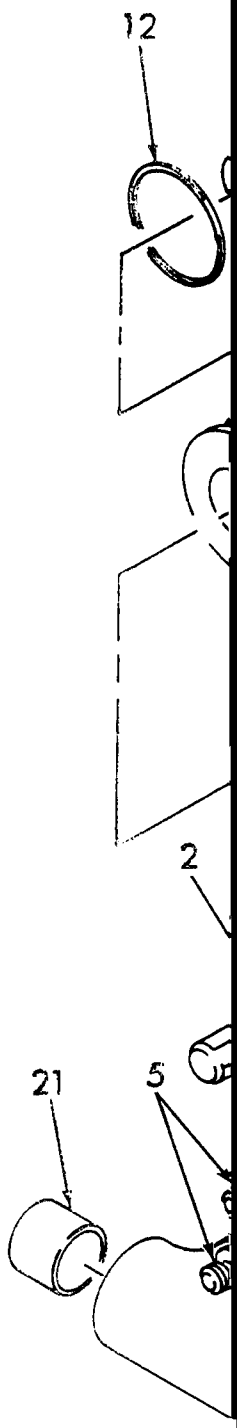


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INNER BOOM SUB-ASSEMBLY
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140120	SUB-ASSEMBLY, INNER BOOM (See Sect. 5, Fig. 1 for NHA)	REF
2	140124	.MACHINING, INNER BOOM	1
3	140055	.ASSEMBLY, EXTENSION CYLINDER (See Sect. 5, Fig. 3 for Details)	1
4	140398	.PAD, INNER BOOM TOP WEAR	1
5	61829	.SCREW, CAP (attaching part)	4
6	140395	.PAD, EXTENSION CYLINDER WEAR	2
7	140397	.PAD, INNER BOOM BOTTOM WEAR	1
8	61824	.SCREW, CAP (attaching part)	4
9	63403	.WASHER, FLAT	4
10	61318	.NUT, LOCK (attaching part)	4
11	140424	.PIN, ROD END EXTENSION CYLINDER	1
12	62234	.SCREW, SET	1
13	140058	.SUB-ASSEMBLY, SLAVE CYLINDER (See Sect. 5, Fig. 4 for Details)	1
14	140415	.PIN, CAP END SLAVE CYLINDER	1
15	62201	.SCREW, SET	1

- ITEM NOT ILLUSTRATED

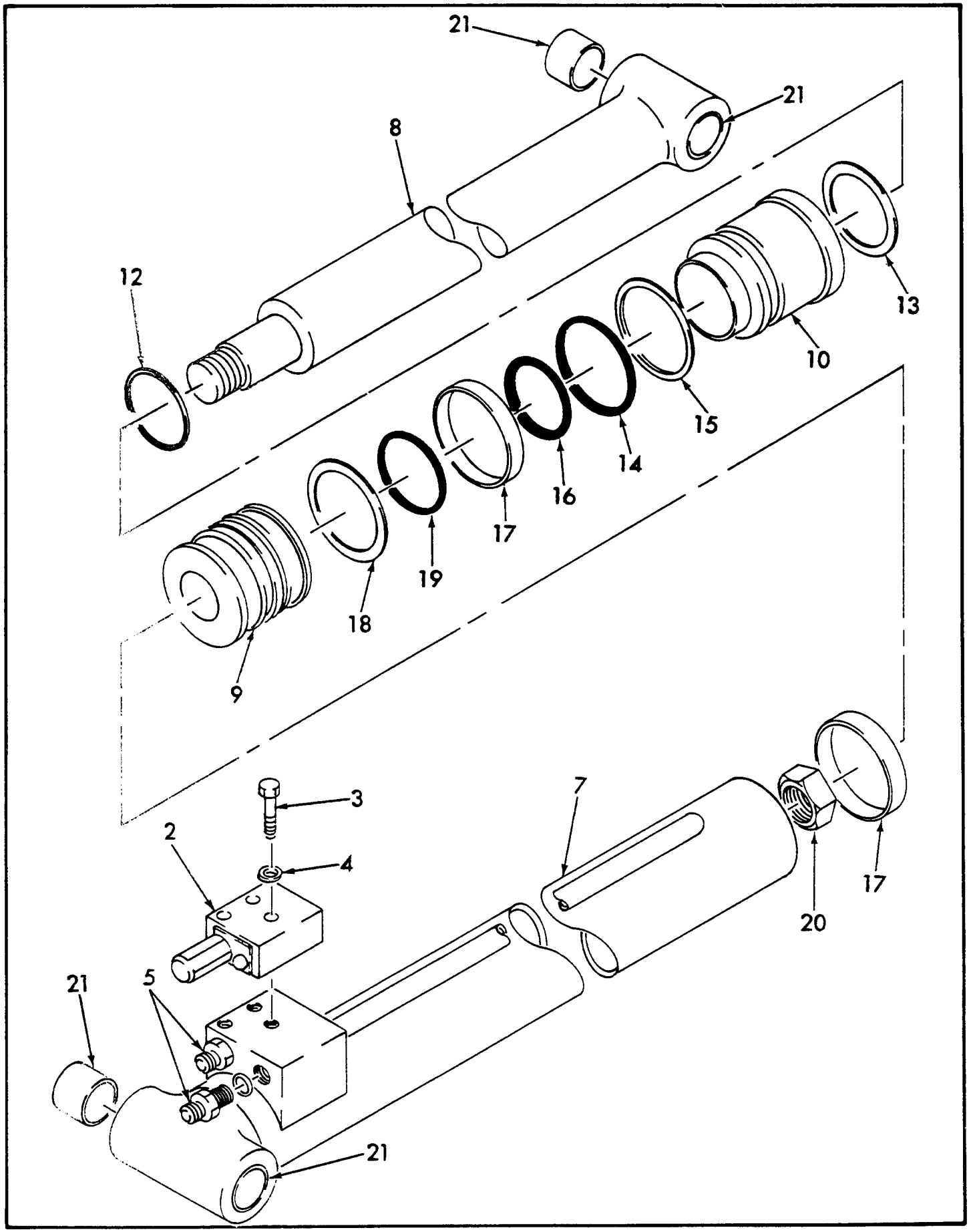

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EXTENSION CYLINDER ASSEMBLY (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140055	ASSEMBLY, EXTENSION CYLINDER (See Sect. 5, Fig. 2 for NHA)	REF
2	81205	.VALVE, HOLDING	1
-2A	67394	..KIT, SEAL	1
3	60319	.SCREW, CAP (attaching part)	3
4	63301	.WASHER, LOCK (attaching part)	3
5	80004-11	.CONNECTOR, STRAIGHT THREAD	2
-6	140054	.CYLINDER, EXTENSION	1
7	67182	..BARREL	1
8	67183	..ROD	1
9	67184	..PISTON	1
10	67185	..HEAD	1
-11	67186	..KIT, SEAL	1
12		...WIPER, ROD	1
13		...SEAL, ROD	1
14		...O-RING, HEAD	1
15		...RING, BACK-UP	1
16		...O-RING, ROD	1
17		..RING, PISTON WEAR	2
18		..RING, SHAMBAN GLYD	1
19		..O-RING AND BACK-UP, SHAMBAN	1
20		..NUT, JAM	1
21	67180	..BUSHING, D.U.	4

- ITEM NOT ILLUSTRATED

SLAVE CYLINDER SUB-ASSEMBLY

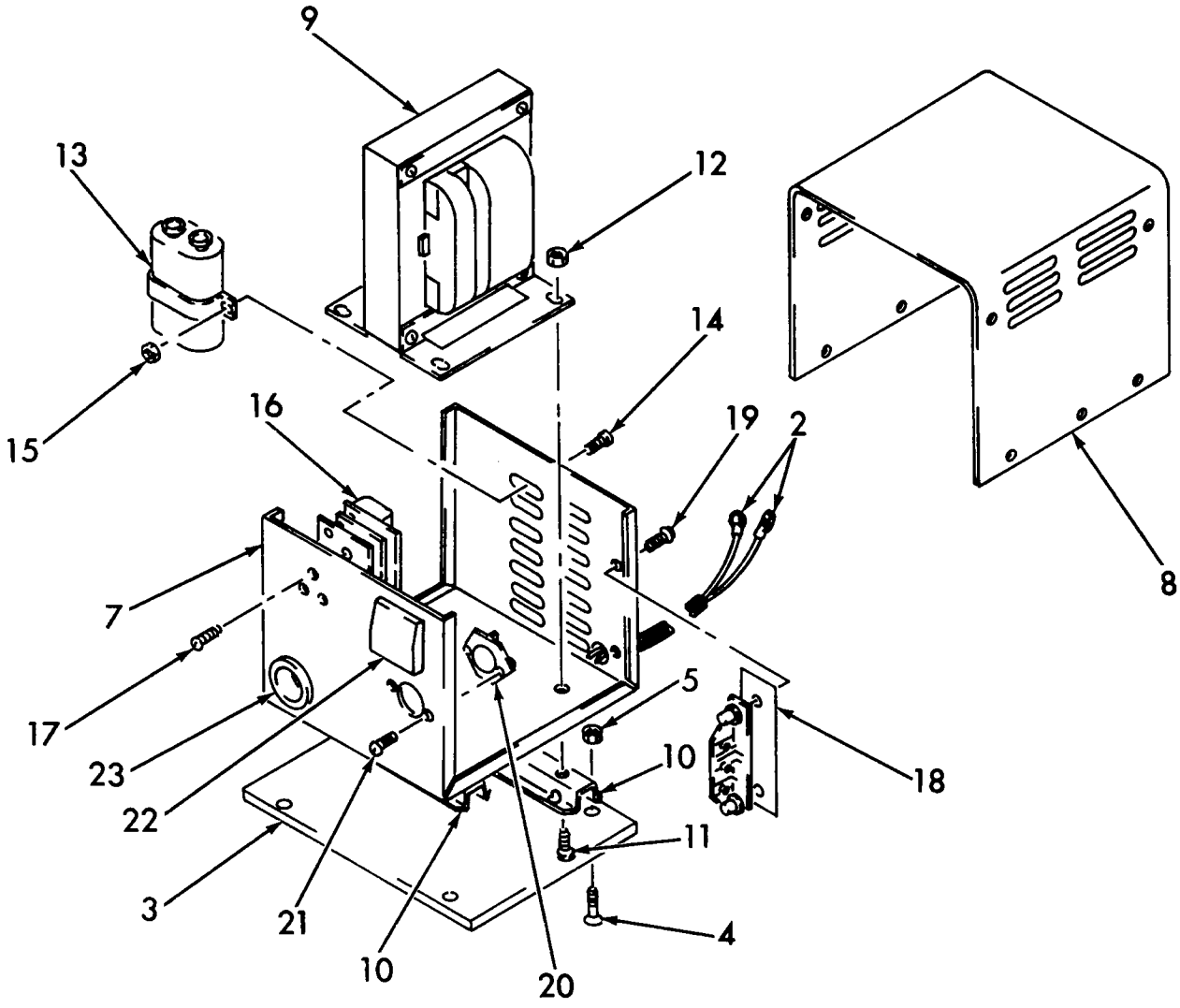


SLAVE CYLINDER SUB-ASSEMBLY (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140058	SUB-ASSEMBLY, SLAVE CYLINDER (See Sect. 5, Fig. 2 for NHA)	REF
2	81205	.VALVE, HOLDING	1
-2A	67394	..KIT, SEAL	1
3	60319	.SCREW, CAP (attaching part)	3
4	63301	.WASHER, LOCK (attaching part)	3
5	80004-03	.CONNECTOR, STRAIGHT THREAD	2
6	140057	.CYLINDER, SLAVE	1
7	67187	..BARREL	1
8	67188	..ROD	1
9	67189	..PISTON	1
10	67190	..HEAD	1
-11	67130	..KIT, SEAL	1
12		...WIPER, ROD	1
13		...SEAL, ROD	1
14		...O-RING, HEAD	1
15		...RING, BACK-UP	1
16		...O-RING, ROD	1
17		..RING, PISTON WEAR	2
18		..RING, SHAMBAN GLYD	1
19		..O-RING, AND BACK-UP, SHAMBAN	1
20		..NUT, JAM	1
21	67191	..BUSHING, D.U.	4

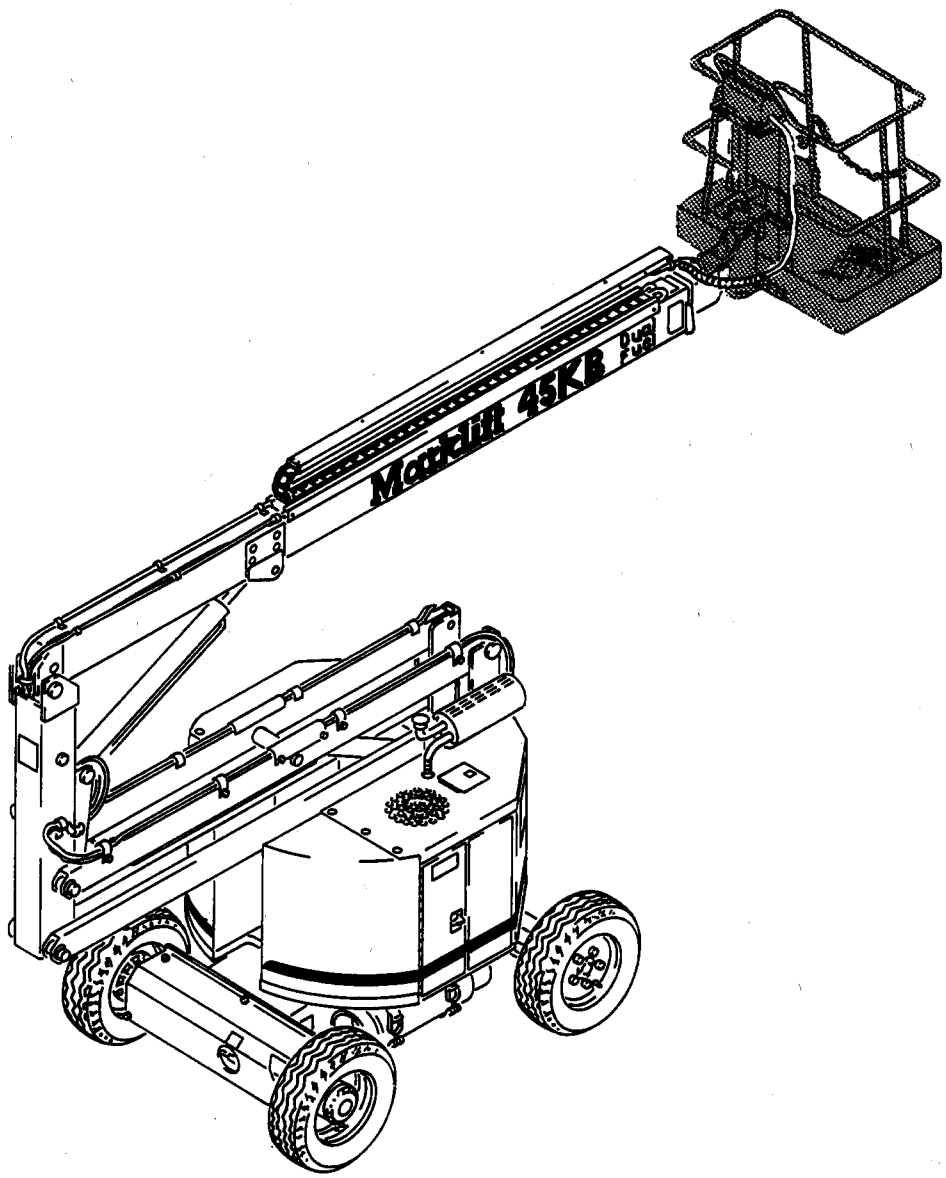
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BATTERY CHARGER ASSEMBLY (45 KB)

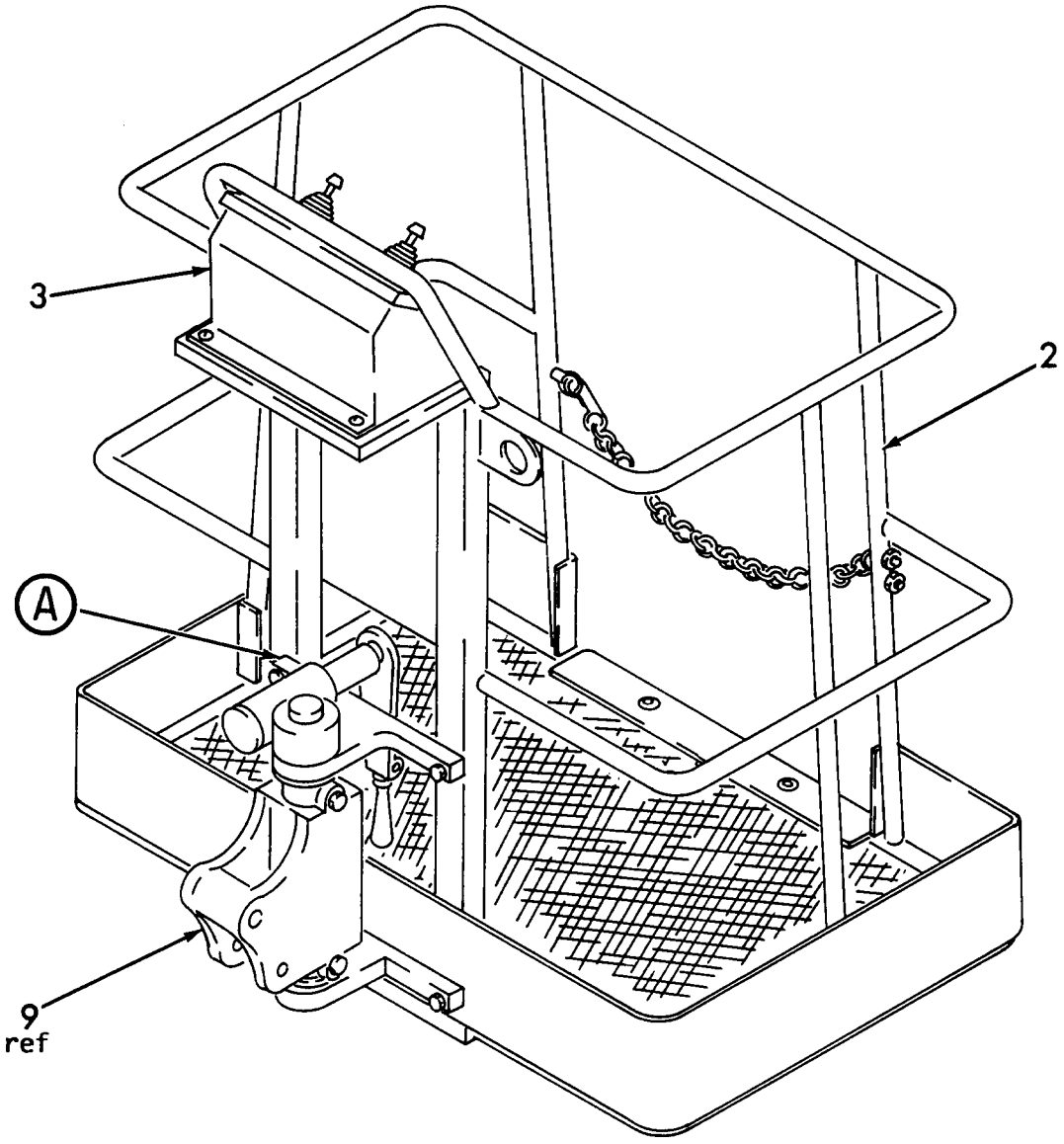


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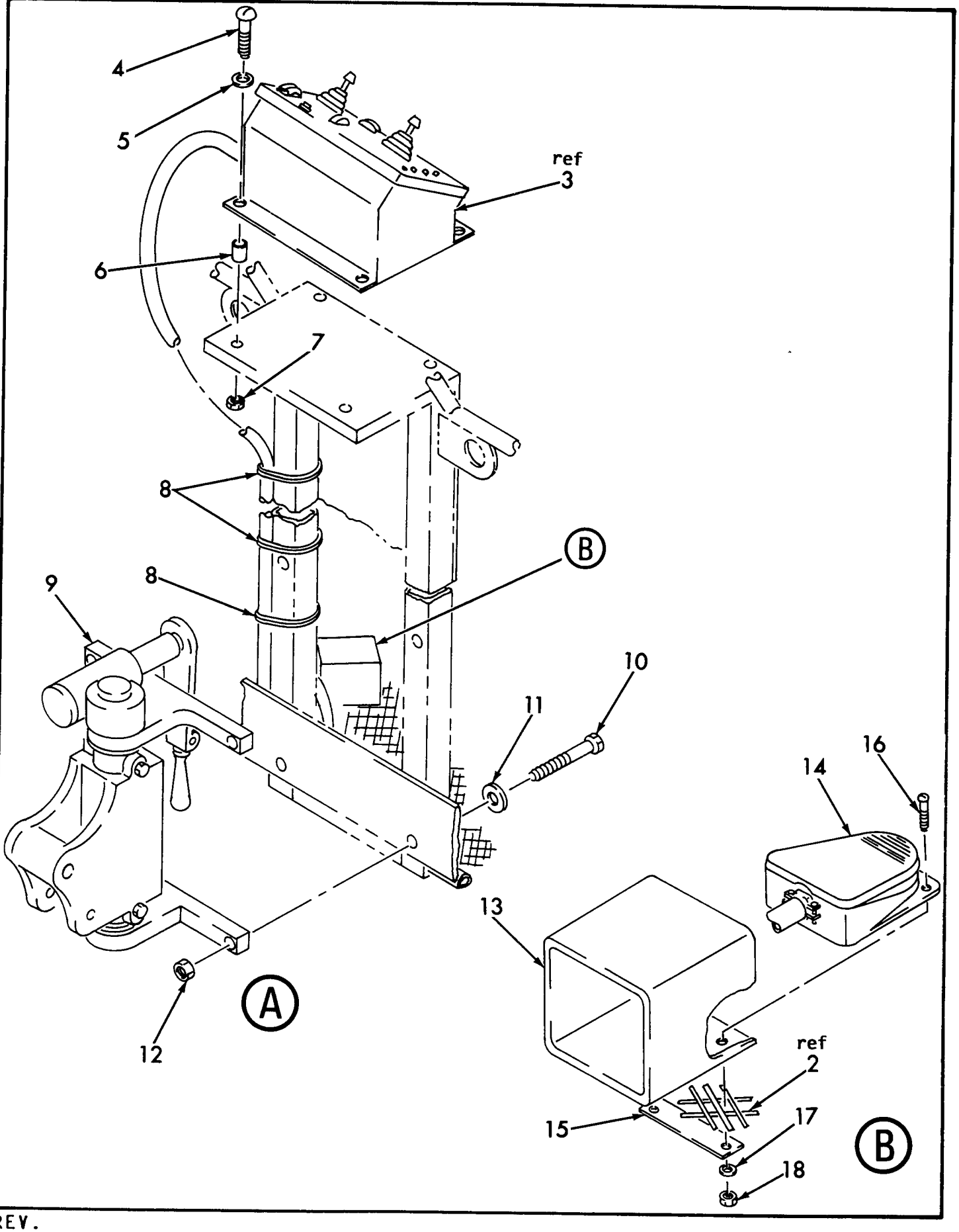
FIGURE 1	PLATFORM ASSEMBLY (45KBDF)
FIGURE 2	PLATFORM ASSEMBLY (45KB)
FIGURE 3A	AERIAL CONTROL BOX ASSEMBLY (45KBDF) (BEF. MAR. '88)
FIGURE 3B	AERIAL CONTROL BOX ASSEMBLY (45KBDF) (AFT. MAR. '88)
FIGURE 4A	AERIAL CONTROL BOX ASSEMBLY (45KB) (BEF. MAR. '88)
FIGURE 4B	AERIAL CONTROL BOX ASSEMBLY (45KB) (AFT. MAR. '88)



PLATFORM ASSEMBLY (45 KBDF)



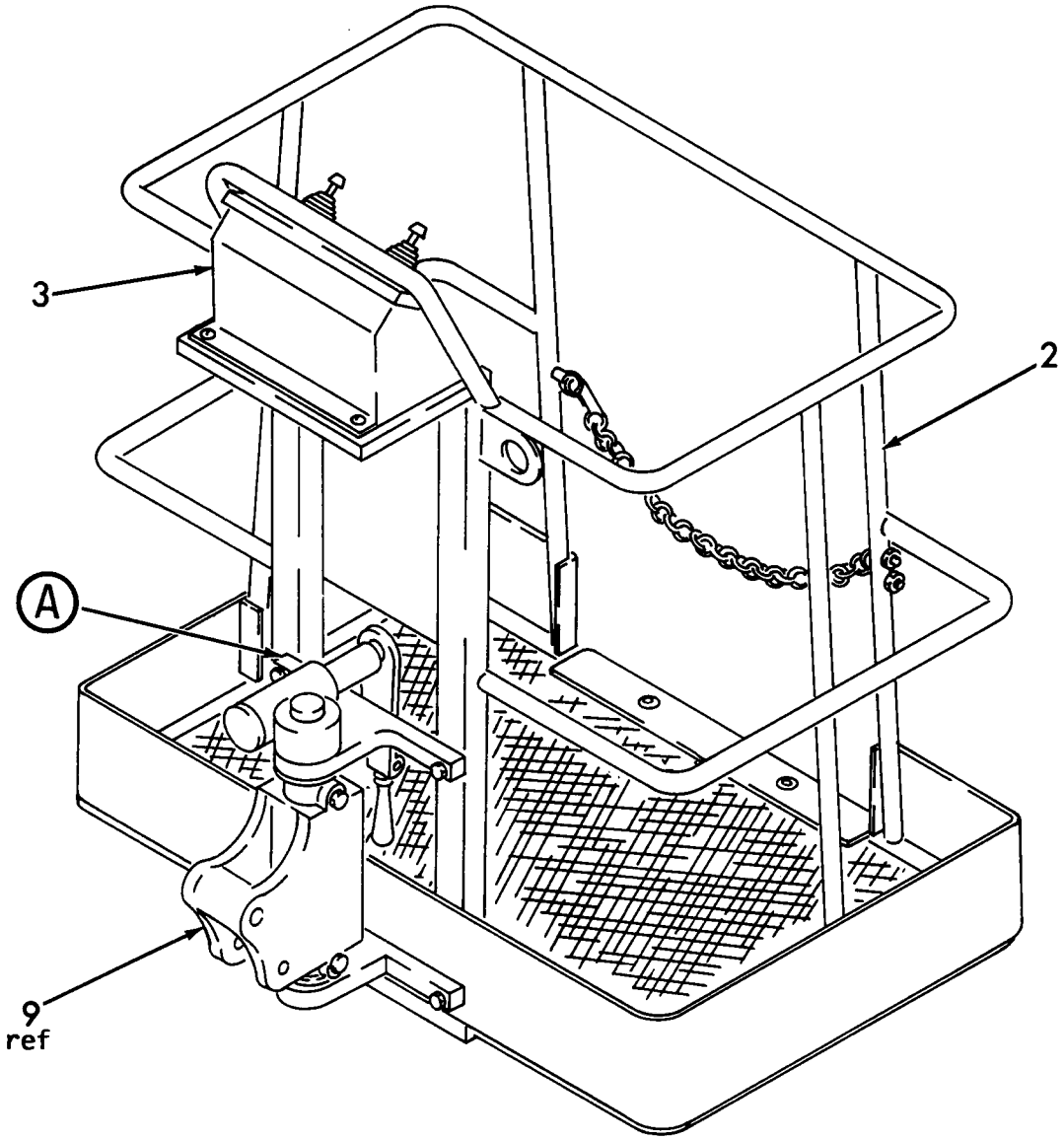
PLATFORM ASSEMBLY (45 KBDF) (continued)



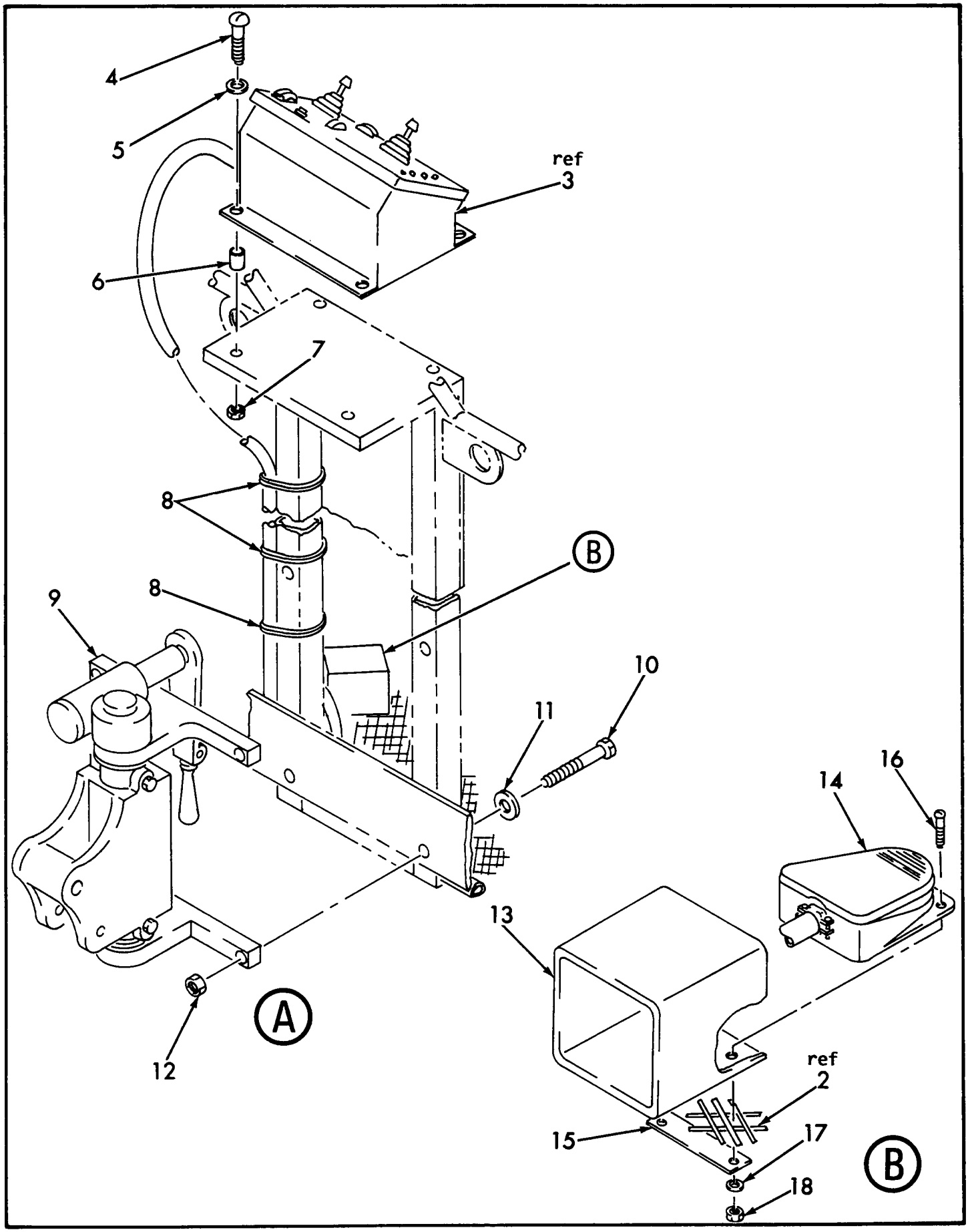
PLATFORM ASSEMBLY (45 KBDF) (continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140164	ASSEMBLY, PLATFORM (See Sect. 2, Fig. 1 for NHA)	REF
2	140084	.WELDMENT, PLATFORM	1
3	140243	.ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 3A for BEF. MAR. 88 Details)(See Sect. 6, Fig. 3B for AFT. MAR. 88 Details)	1
4	62607	.SCREW, MACHINE (attaching part)	4
5	63413	.WASHER, FLAT (attaching part)	4
6	27409	.TUBE, ROUND (attaching part)	4
7	61247	.NUT, LOCK (attaching part)	4
8	65343	.TY-RAP	4
9	140075	.ROTATOR, ACTUATOR	1
10	60549	.SCREW, CAP (attaching part)	4
11	63419	.WASHER, FLAT (attaching part)	4
12	61305	.NUT, HEX (attaching part)	4
13	23846	.COVER, FOOT SWITCH	1
14	92202	.SWITCH, FOOT	1
15	23753	.PLATE, DEADMAN SWITCH BACKING	1
16	62714	.SCREW, MACHINE (attaching part)	2
17	63413	.WASHER, FLAT (attaching part)	2
18	61247	.NUT, LOCK (attaching part)	2

PLATFORM ASSEMBLY (45 KB)



PLATFORM ASSEMBLY (45 KB)
(continued)



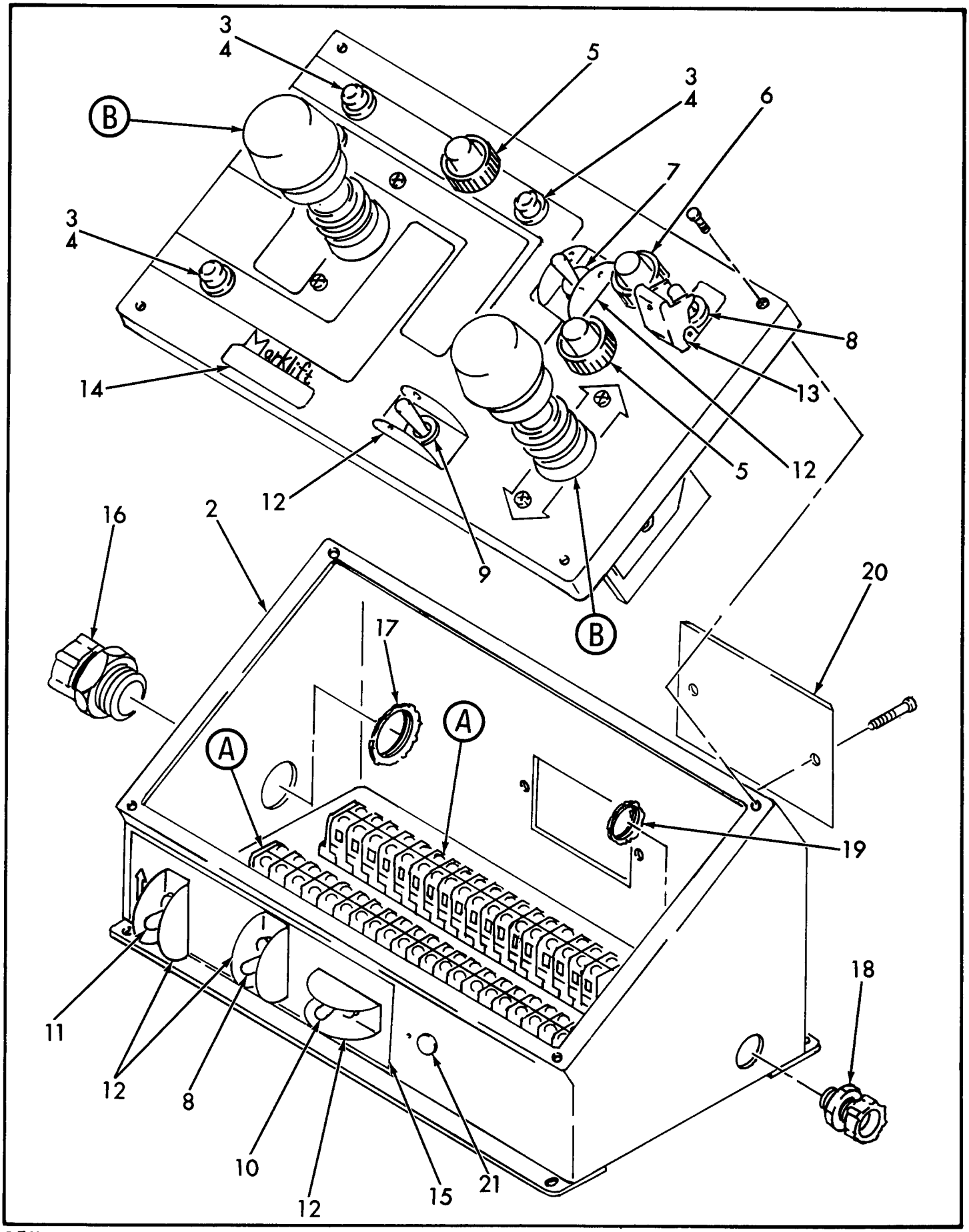
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PLATFORM ASSEMBLY (45 KB) (continued)

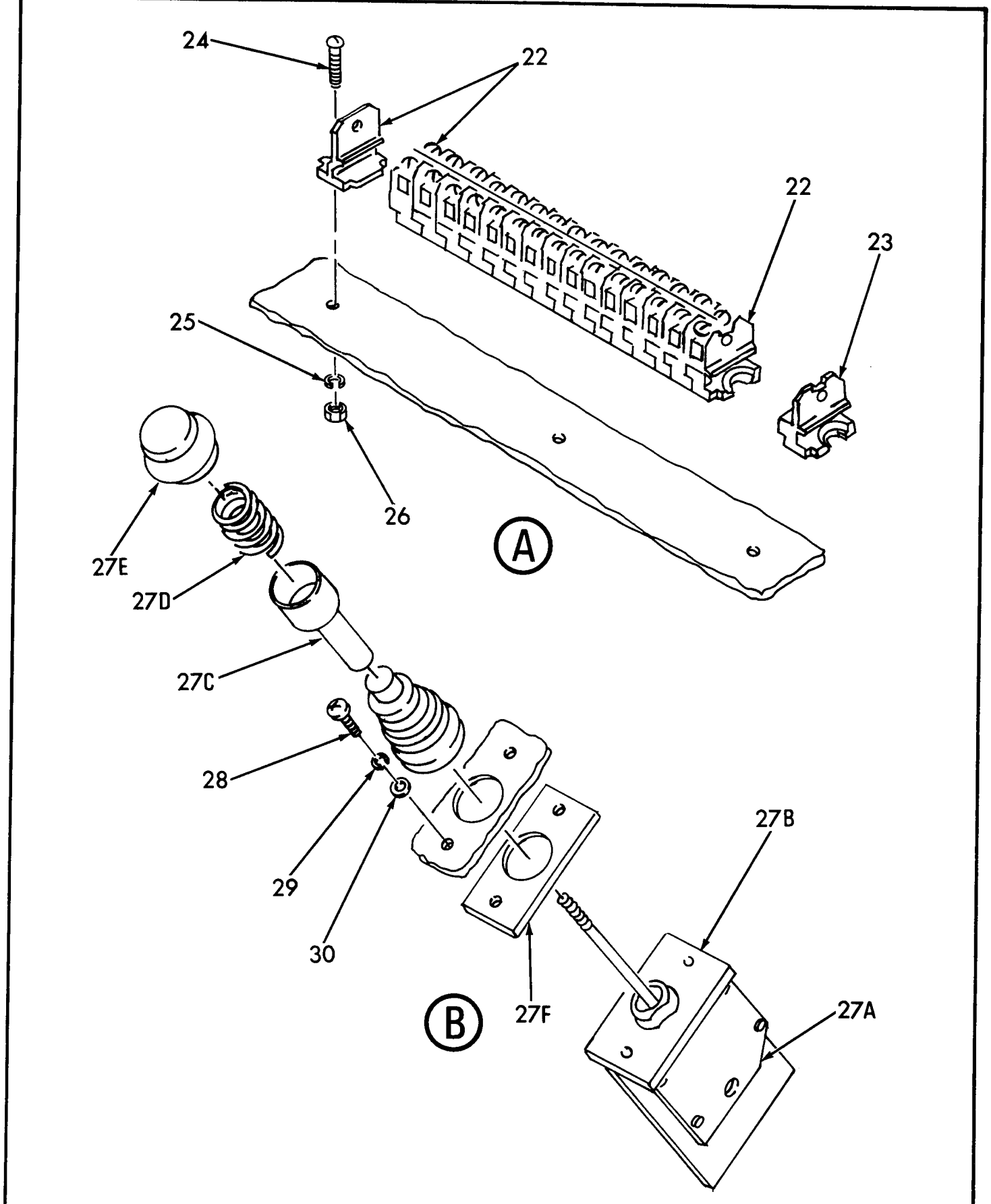
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140306	ASSEMBLY, PLATFORM (See Sect. 2, Fig. 2 for NHA)	REF
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3	140307	.ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 4A for BEF. MAR. 88 Details)(See Sect. 6, Fig. 4B for AFT. MAR. 88 Details)	1
4	62607	.SCREW, MACHINE (attaching part)	4
5	63413	.WASHER, FLAT (attaching part)	4
6	27409	.TUBE, ROUND (attaching part)	4
7	61247	.NUT, LOCK (attaching part)	4
8	65343	.TY-RAP	4
9	140075	.ROTATOR, ACTUATOR	1
10	60549	.SCREW, CAP (attaching part)	4
11	63419	.WASHER, FLAT (attaching part)	4
12	61305	.NUT, HEX (attaching part)	4
13	23846	.COVER, FOOT SWITCH	1
14	182705	.SWITCH, FOOT	1
15	23753	.PLATE, DEADMAN SWITCH BACKING	1
16	62714	.SCREW, MACHINE (attaching part)	2
17	63413	.WASHER, FLAT (attaching part)	2
18	61247	.NUT, LOCK (attaching part)	2

- ITEM NOT ILLUSTRATED

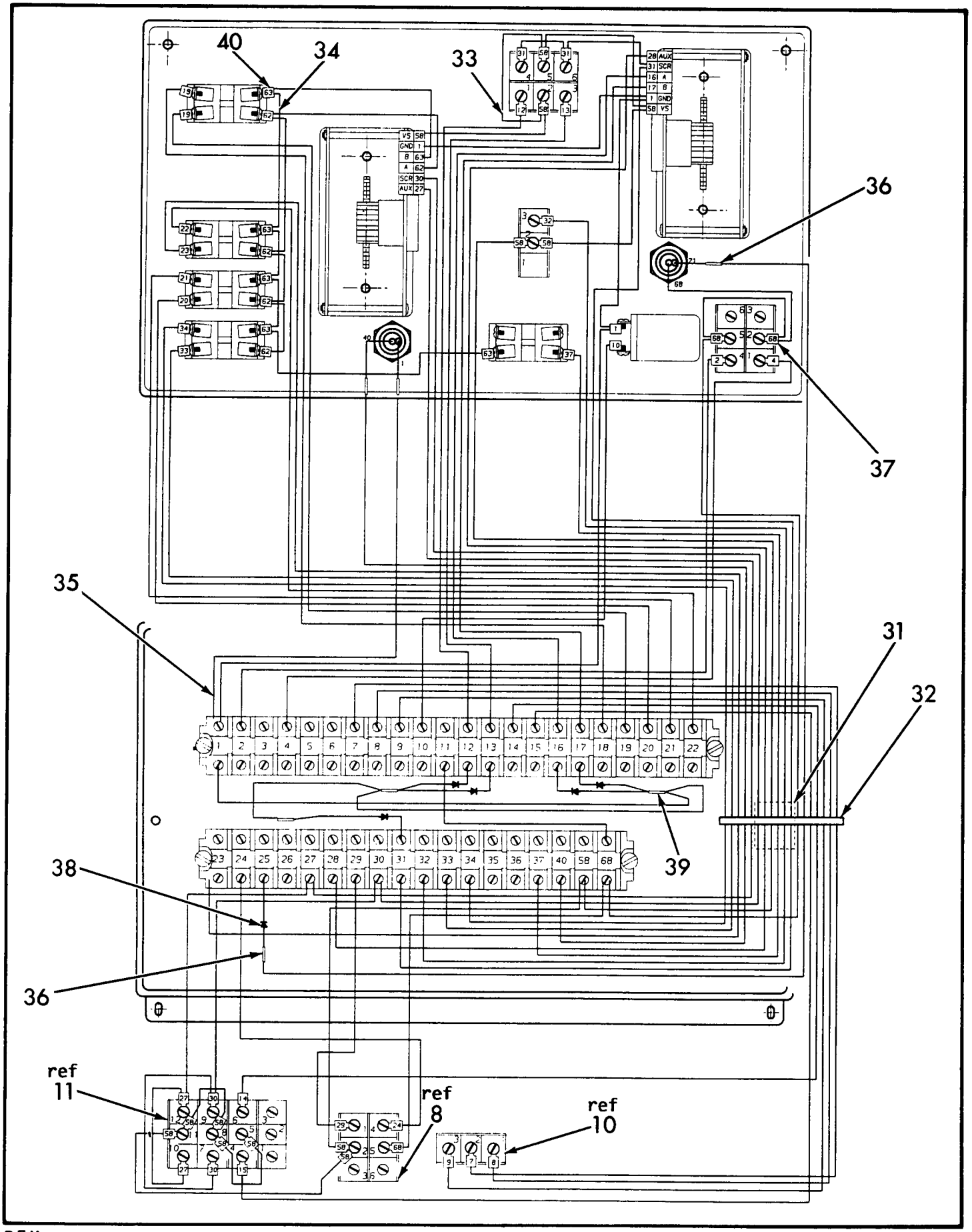
AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(BEF. MAR. 88)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(BEF. MAR. 88)
(continued)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(BEF. MAR. 88)
(continued)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(BEF. MAR. 88)
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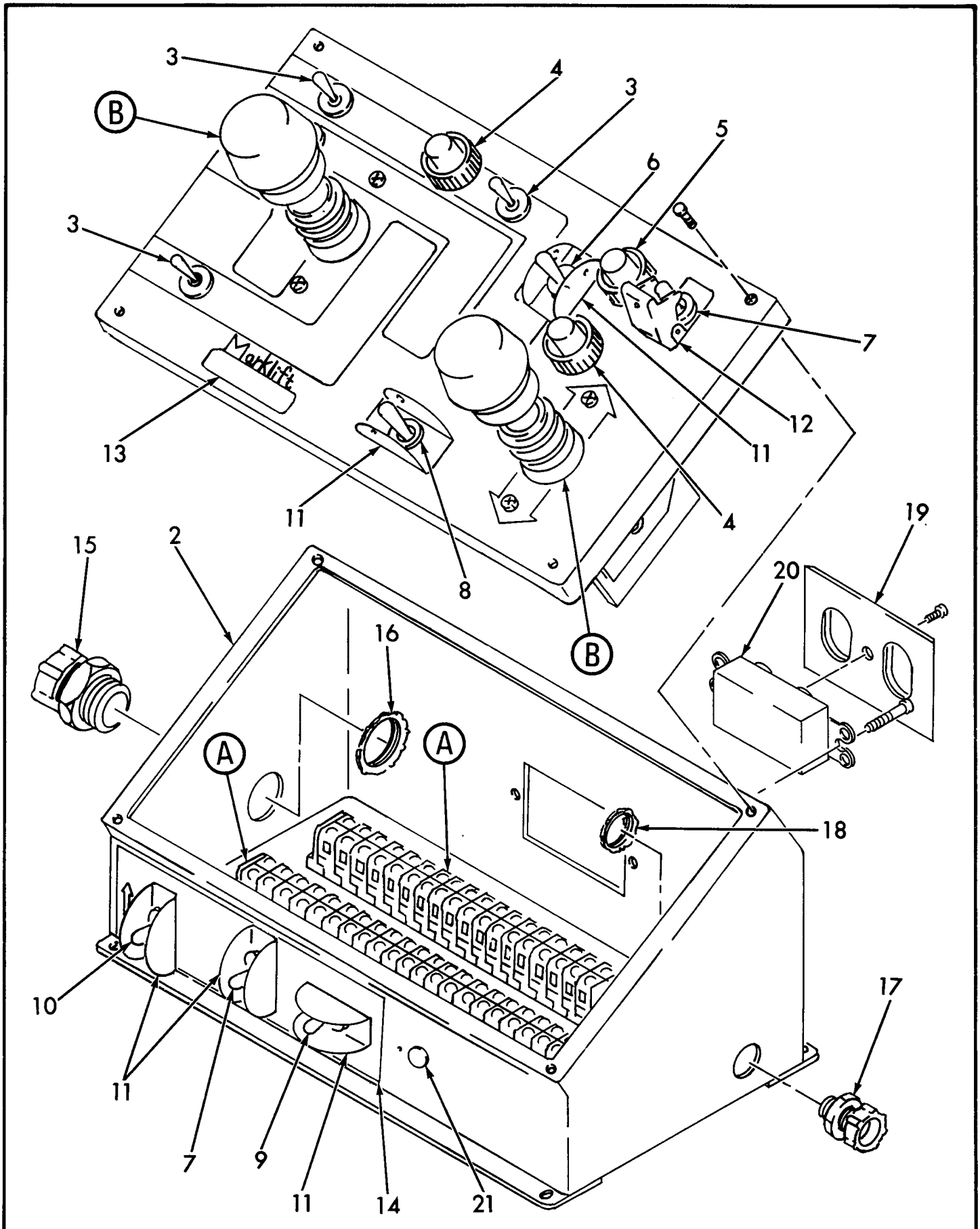
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140243	ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 1 for NHA)	REF
2	140315	.MACHINING, AERIAL CONTROL BOX	1
3	70372	.SWITCH, PUSH BUTTON	5
4	70373	.BOOT, PUSH BUTTON	5
5	70195	.LIGHT, INDICATOR	2
6	20805	.ALARM, BUZZER	1
7	4017	.SWITCH, TOGGLE	1
8	70304	.SWITCH, TOGGLE	2
9	20481	.SWITCH, TOGGLE	1
10	4019	.SWITCH	1
11	70383	.SWITCH, LEVELING	1
12	20884	.GUARD, SWITCH	5
13	70303	.GUARD, SWITCH	1
14	140579	.DECAL, UPPER CONTROL	1
15	140550	.DECAL, AERIAL CONTROL SWITCH	1
16	16215	.RELIEF, STRAIN	1
17	16105	.NUT, LOCK	1
18	2806	.RELIEF, STRAIN	1
19	2808	.NUT, LOCK	1
20	902	.PLATE, COVER	1
21	771	.PLUG	1
22	4027	.BLOCK, TERMINAL	40

AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(BEF. MAR. 88)
(continued)

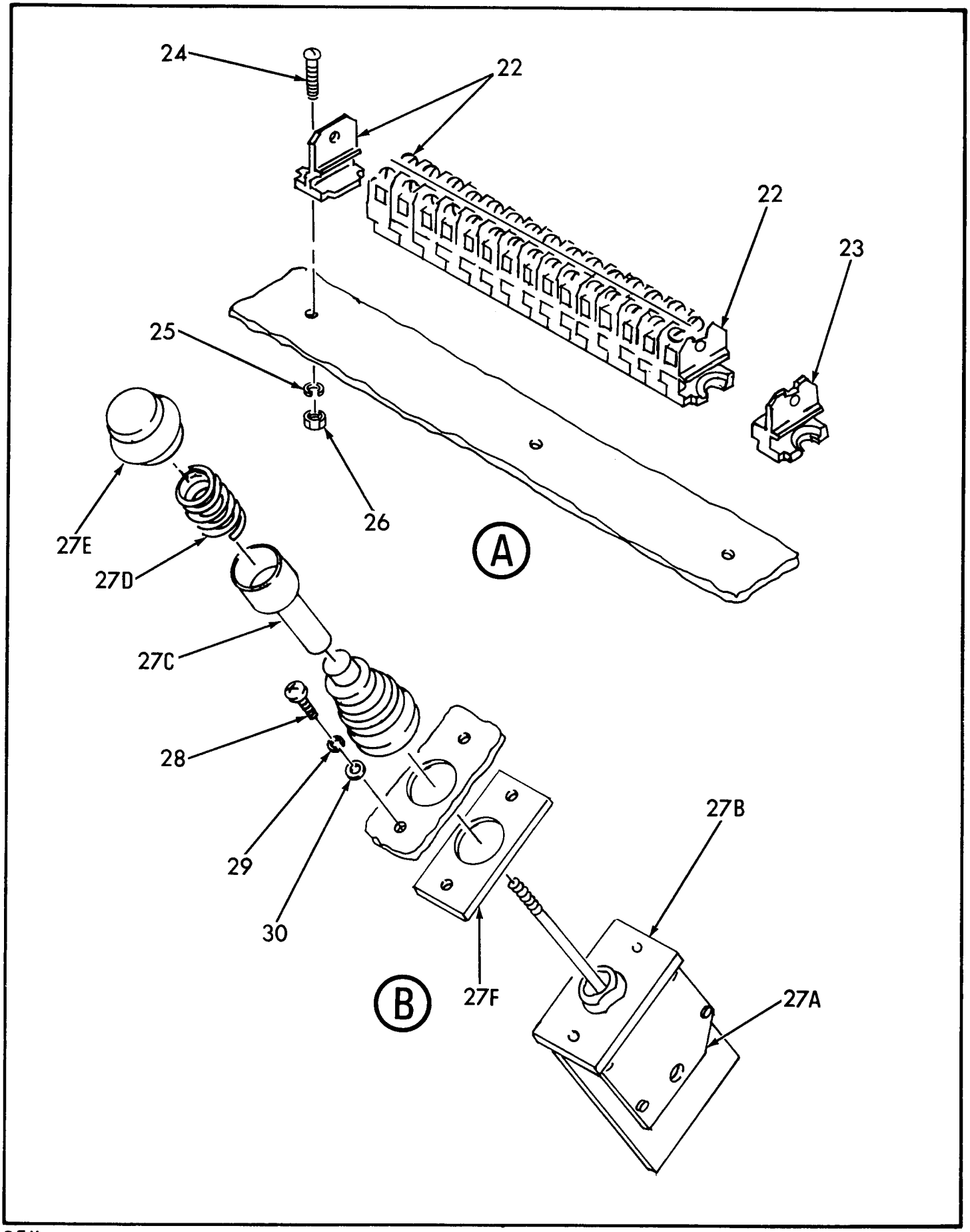
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	117-A	.END, TERMINAL BLOCK	2
24	62612	.SCREW, CAP (attaching part)	6
25	63312	.WASHER, LOCK (attaching part)	6
26	61502	.NUT, HEX (attaching part)	6
-27	70369	.ASSEMBLY, CONTROLLER	1
27A	67386	..ASSEMBLY, ELECTRICAL	1
27B	67385	..ASSEMBLY, HOUSING & HANDLE	1
27C	67371	..ASSEMBLY, SLIDE LOCK	1
27D	67372	..SPRING, COMPRESSION	1
27E	67373	..KNOB, UPPER (TAPPED)	1
27F	67374	..GASKET	1
28	62703	.SCREW, CAP (attaching part)	4
29	63313	.WASHER, LOCK (attaching part)	4
30	63413	.WASHER, FLAT (attaching part)	4
31	16214	.MOUNT	5
32	256	.TIE, CABLE	35
33	2991	.WIRE	10
34	2990	.WIRE	90
35	70098	.WIRE	5
36	117-D	.CONNECTOR, BUTT	5
37	117-C	.CONNECTOR, RING	40
38	4045	.DIODE	9
39	70162	.TERMINAL, BUTT	2
40	16213	.CONNECTOR	8

- ITEM NOT ILLUSTRATED

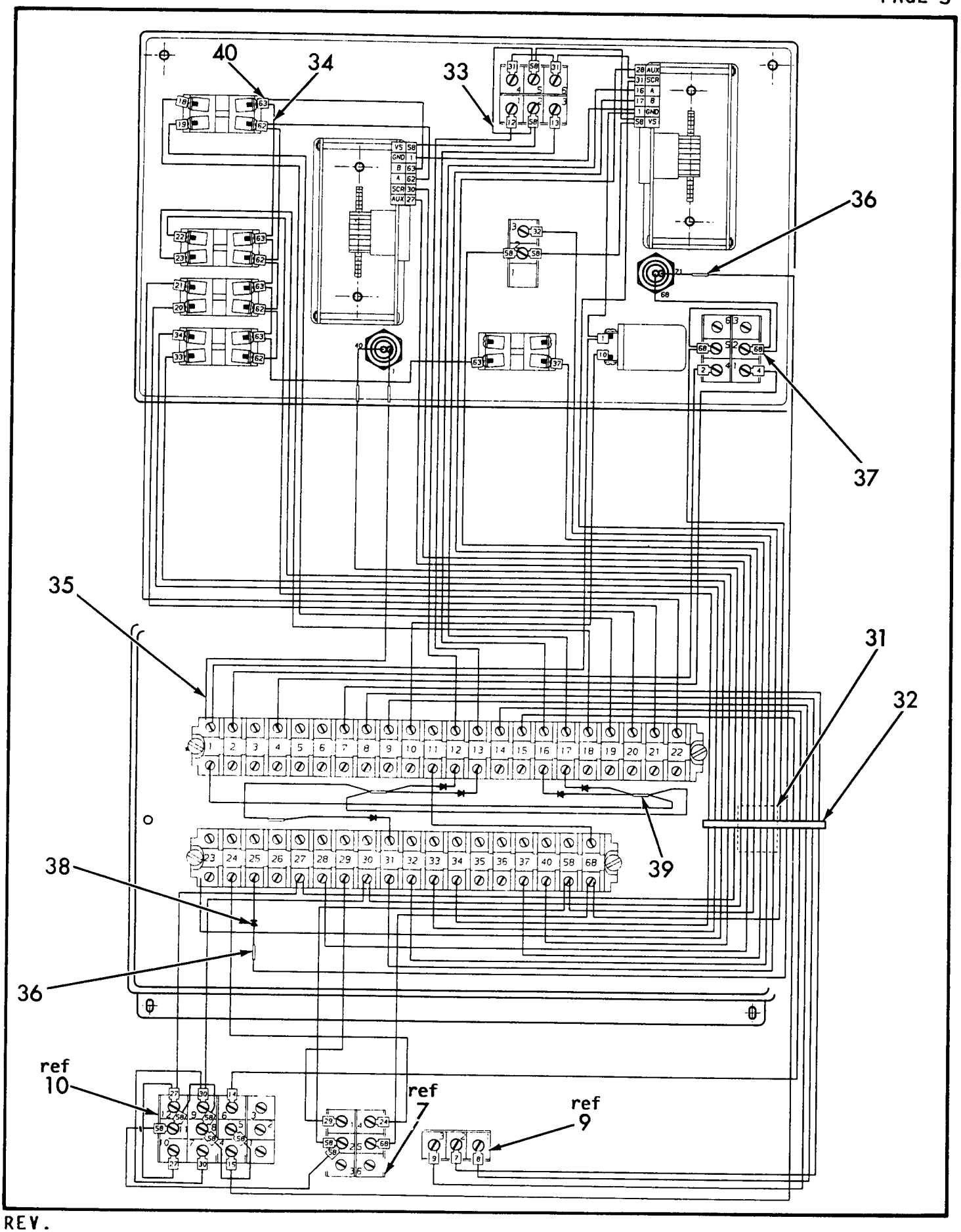
AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(AFT. MAR. 88)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(AFT. MAR. 88)
(continued)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(AFT. MAR. 88)
(continued)



AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(AFT. MAR. 88)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140320	ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 1 for NHA)	REF
2	140315	.MACHINING, AERIAL CONTROL BOX	1
3	70417	.SWITCH, TOGGLE	5
4	70195	..LIGHT, INDICATOR	2
5	20805	.ALARM, BUZZER	1
6	4017	.SWITCH, TOGGLE	1
7	70304	.SWITCH, TOGGLE	2
8	20481	.SWITCH, TOGGLE	1
9	4019	.SWITCH	1
10	70383	.SWITCH, LEVELING	1
11	20884	.GUARD, SWITCH	5
12	70303	.GUARD, SWITCH	1
13	140579	.DECAL, UPPER CONTROL	1
14	140550	.DECAL, AERIAL CONTROL SWITCH	1
15	16215	.RELIEF, STRAIN	1
16	16105	.NUT, LOCK	1
17	2806	.RELIEF, STRAIN	1
18	2808	.NUT, LOCK	1
19	70392	.COVER, RECEPTACLE	1
20	70391	.RECEPTACLE, G.F.C.I.	1
-20A	70394	.CONNECTOR, TWIST-ON WIRE	2
21	771	.PLUG	1
22	4027	.BLOCK, TERMINAL	40

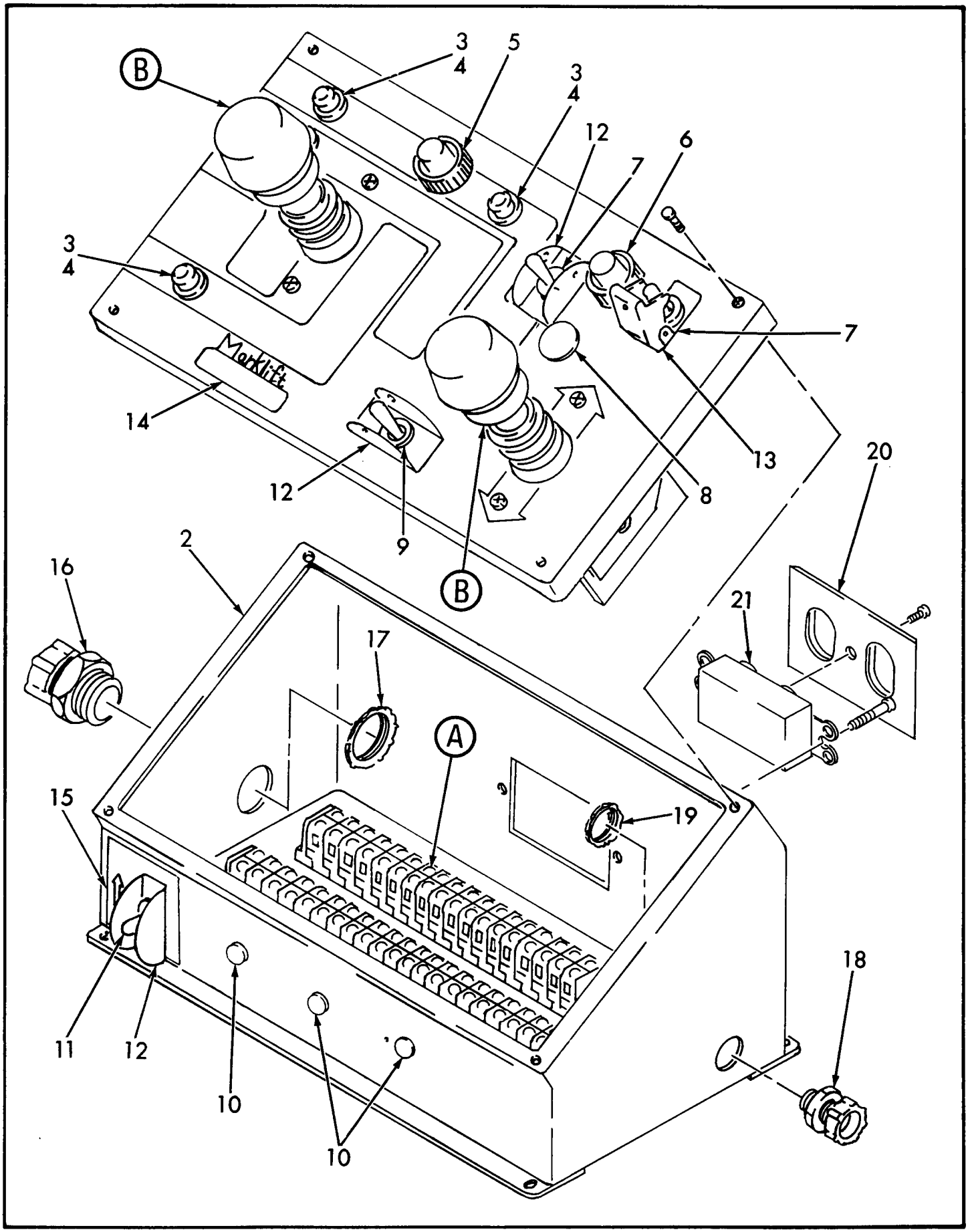
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AERIAL CONTROL BOX ASSEMBLY (45 KBDF)
(AFT. MAR. 88)
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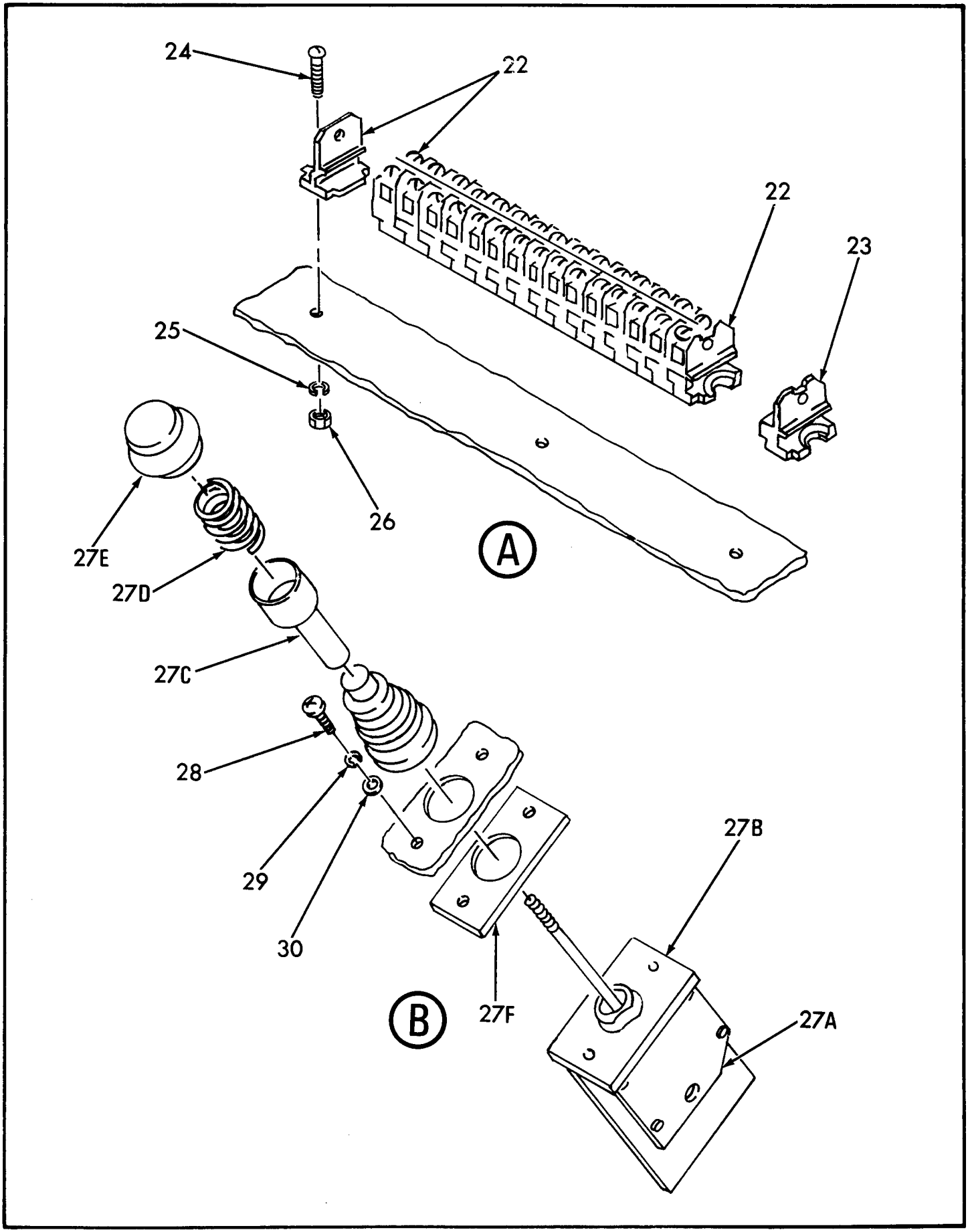
ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	117-A	.END, TERMINAL BLOCK	2
24	62612	.SCREW, CAP (attaching part)	6
25	63312	.WASHER, LOCK (attaching part)	6
26	61502	.NUT, HEX (attaching part)	6
-27	70369	.ASSEMBLY, CONTROLLER	1
27A	67386	..ASSEMBLY, ELECTRICAL	1
27B	67385	..ASSEMBLY, HOUSING & HANDLE	1
27C	67371	..ASSEMBLY, SLIDE LOCK	1
27D	67372	..SPRING, COMPRESSION	1
27E	67373	..KNOB, UPPER (TAPPED)	1
27F	67374	..GASKET	1
28	62703	.SCREW, CAP (attaching part)	4
29	63313	.WASHER, LOCK (attaching part)	4
30	63413	.WASHER, FLAT (attaching part)	4
31	16214	.MOUNT	5
32	256	.TIE, CABLE	37
33	2991	.WIRE	10
34	2990	.WIRE	90
35	70098	.WIRE	5
36	117-D	.CONNECTOR, BUTT	5
37	117-C	.CONNECTOR, RING	41
38	4045	.DIODE	6
39	70162	.TERMINAL, BUTT	4
40	16213	.CONNECTOR	8

- ITEM NOT ILLUSTRATED

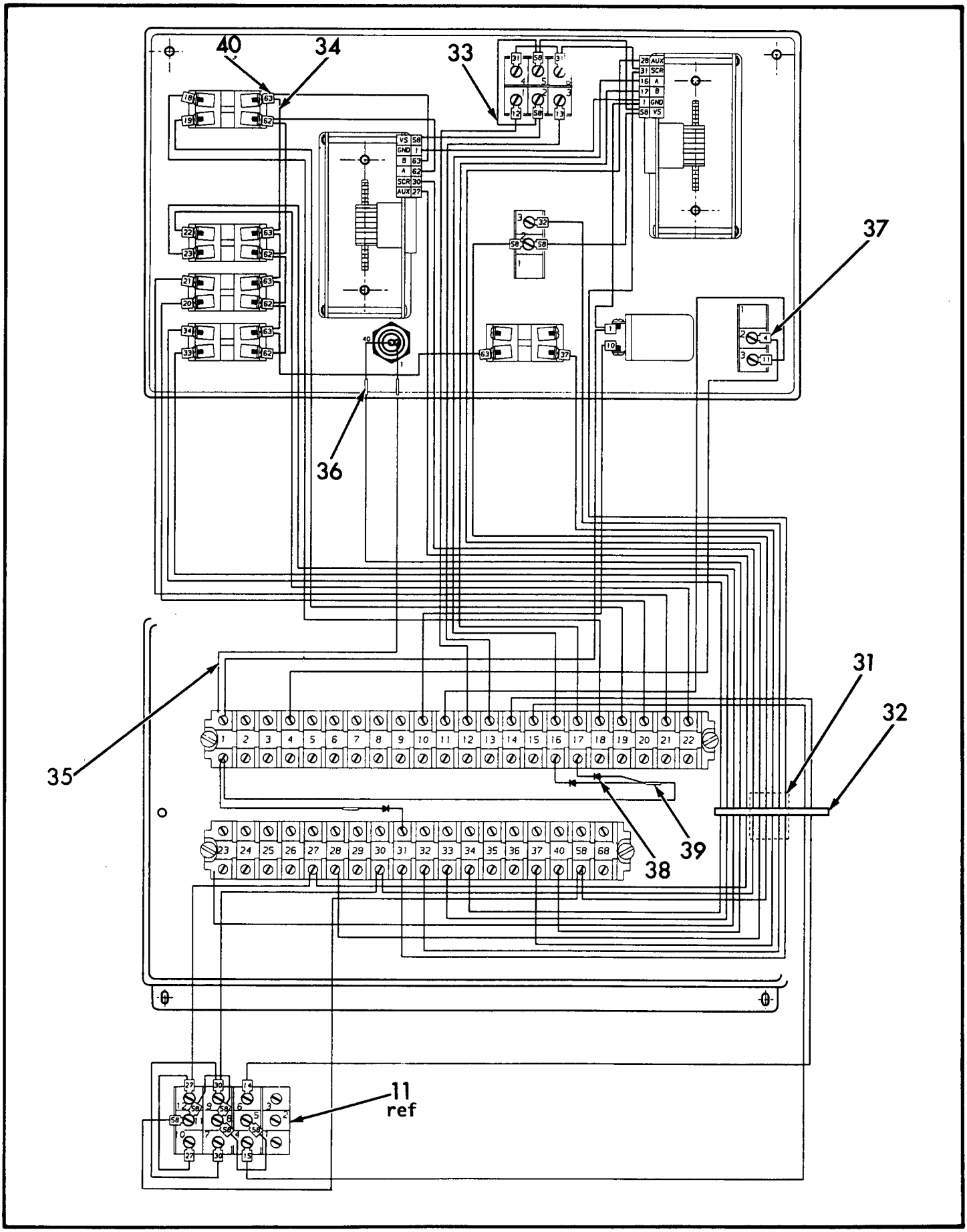
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(BEF. MAR. 88)



AERIAL CONTROL BOX ASSEMBLY (45 KB)
(BEF. MAR. 88)
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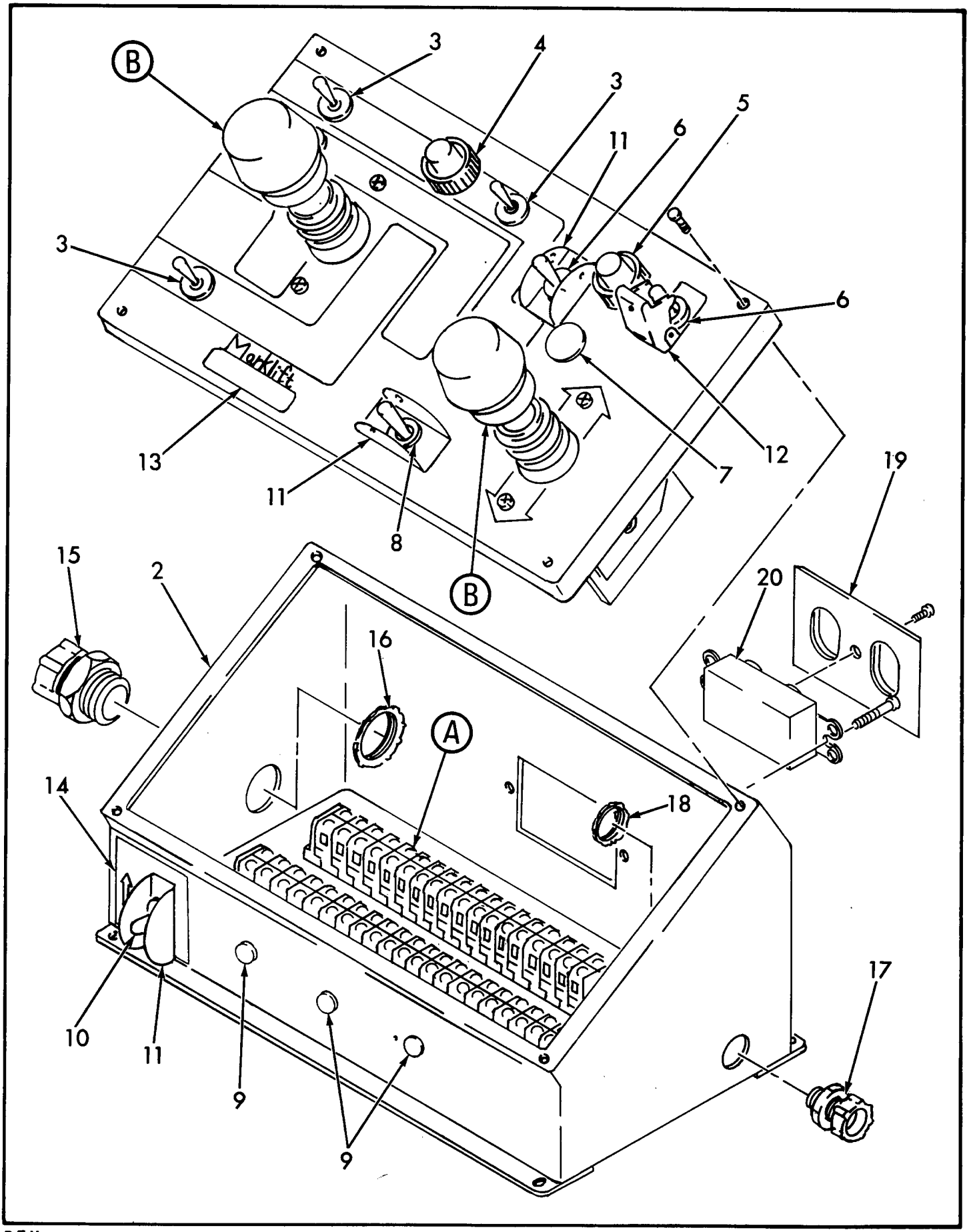
AERIAL CONTROL BOX ASSEMBLY (45 KB)
(BEF. MAR. 88)
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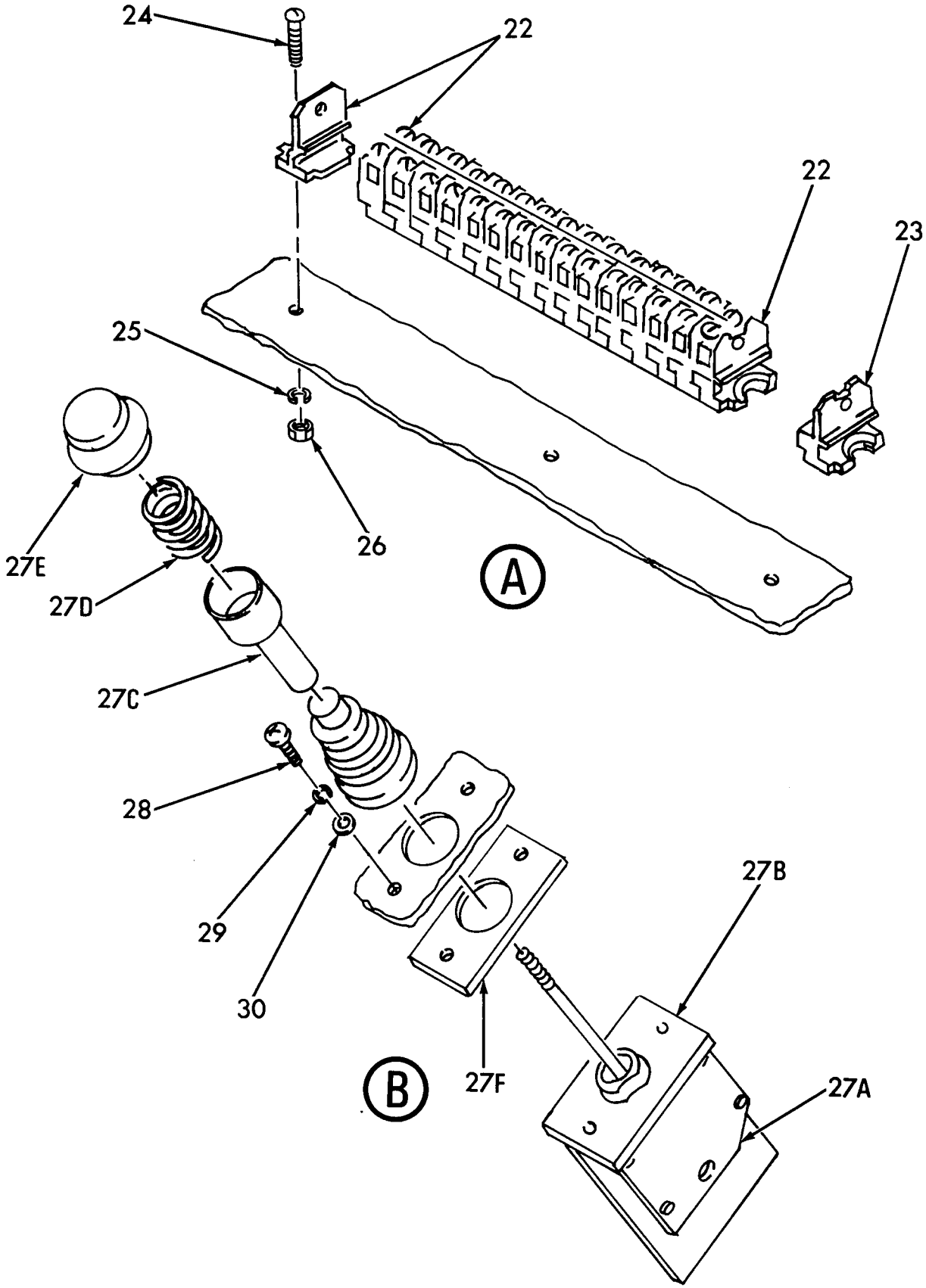
AERIAL CONTROL BOX ASSEMBLY (45 KB)
(BEF. MAR. 88)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140307	ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 2 for NHA)	REF
2	140315	.MACHINING, AERIAL CONTROL BOX	1
3	70372	.SWITCH, PUSH BUTTON	5
4	70373	.BOOT, PUSH BUTTON	5
5	70195	.LIGHT, INDICATOR	1
6	20805	.ALARM, BUZZER	1
7	4017	.SWITCH, TOGGLE	2
8	772	.PLUG	1
9	20481	.SWITCH, TOGGLE	1
10	771	.PLUG	3
11	70383	.SWITCH, LEVELING	1
12	20884	.GUARD, SWITCH	3
13	70303	.GUARD, SWITCH	1
14	140579	.DECAL, UPPER CONTROL	1
15	182703	.DECAL, PLATFORM LEVELING SWITCH	1
16	16215	.RELIEF, STRAIN	1
17	16105	.NUT, LOCK	1
18	2806	.RELIEF, STRAIN	1
19	2808	.NUT, LOCK	1
20	288	.PLATE, COVER SNAP	1
21	70126	.RECEPTACLE, DOUBLE	1
22	4027	.BLOCK, TERMINAL	40

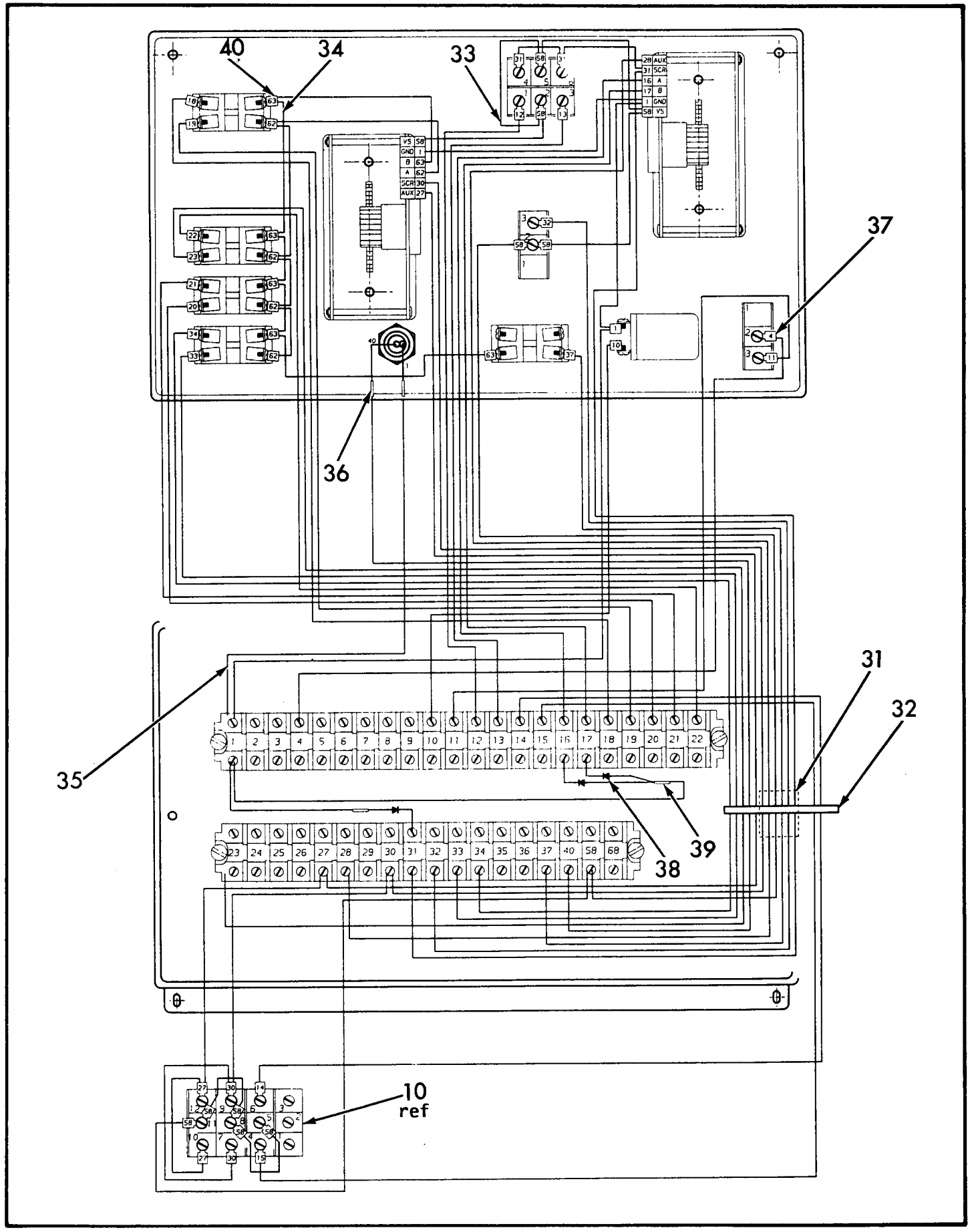
AERIAL CONTROL BOX ASSEMBLY (45 KB)
(AFT. MAR. 88)



AERIAL CONTROL BOX ASSEMBLY (45 KB)
(AFT. MAR. 88)
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AERIAL CONTROL BOX ASSEMBLY (45 KB)
(AFT. MAR. 88)
(continued)



AERIAL CONTROL BOX ASSEMBLY (45 KB)
(AFT. MAR. 88)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
-1	140307	ASSEMBLY, AERIAL CONTROL BOX (See Sect. 6, Fig. 2 for NHA)	REF
2	140315	.MACHINING, AERIAL CONTROL BOX	1
3	70417	.SWITCH, TOGGLE	5
4	70195	.LIGHT, INDICATOR	1
5	20805	.ALARM, BUZZER	1
6	4017	.SWITCH, TOGGLE	2
7	772	.PLUG	1
8	20481	.SWITCH, TOGGLE	1
9	771	.PLUG	3
10	70383	.SWITCH, LEVELING	1
11	20884	.GUARD, SWITCH	3
12	70303	.GUARD, SWITCH	1
13	140579	.DECAL, UPPER CONTROL	1
14	182703	.DECAL, PLATFORM LEVELING SWITCH	1
15	16215	.RELIEF, STRAIN	1
16	16105	.NUT, LOCK	1
17	2806	.RELIEF, STRAIN	1
18	2808	.NUT, LOCK	1
19	70392	.COVER, RECEPTACLE	1
20	70391	.RECEPTACLE, G.F.C.I.	1
-21	70394	.CONNECTOR, TWIST-ON WIRE	2
22	4027	.BLOCK, TERMINAL	40

- ITEM NOT ILLUSTRATED

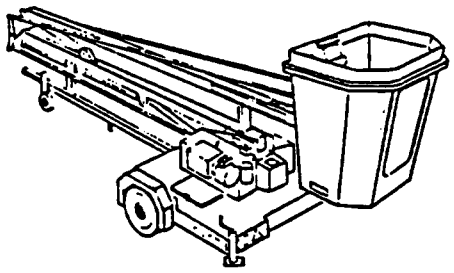
AERIAL CONTROL BOX ASSEMBLY (45 KB)
(AFT. MAR. 88)
(continued)

ITEM	PART NUMBER	DESCRIPTION 1234567	UNIT PER ASSY.
23	117-A	.END, TERMINAL BLOCK	2
24	62612	.SCREW, CAP (attaching part)	6
25	63312	.WASHER, LOCK (attaching part)	6
26	61502	.NUT, HEX (attaching part)	6
-27	70369	.ASSEMBLY, CONTROLLER	1
27A	67386	..ASSEMBLY, ELECTRICAL	1
27B	67385	..ASSEMBLY, HOUSING & HANDLE	1
27C	67371	..ASSEMBLY, SLIDE LOCK	1
27D	67372	..SPRING, COMPRESSION	1
27E	67373	..KNOB, UPPER (TAPPED)	1
27F	67374	..GASKET	1
28	62703	.SCREW, CAP (attaching part)	4
29	63313	.WASHER, LOCK (attaching part)	4
30	63413	.WASHER, FLAT (attaching part)	4
31	16214	.MOUNT	5
32	256	.TIE, CABLE	35
33	2991	.WIRE	10
34	2990	.WIRE	90
35	70098	.WIRE	5
36	117-D	.CONNECTOR, BUTT	3
37	117-C	.CONNECTOR, RING	33
38	4045	.DIODE	3
39	70162	.TERMINAL, BUTT	3
40	16213	.CONNECTOR	8

- ITEM NOT ILLUSTRATED

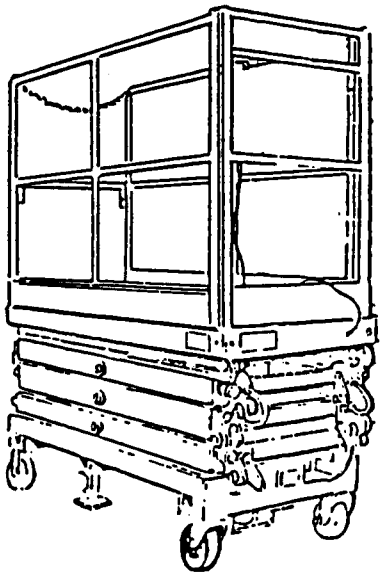
SECTION 7

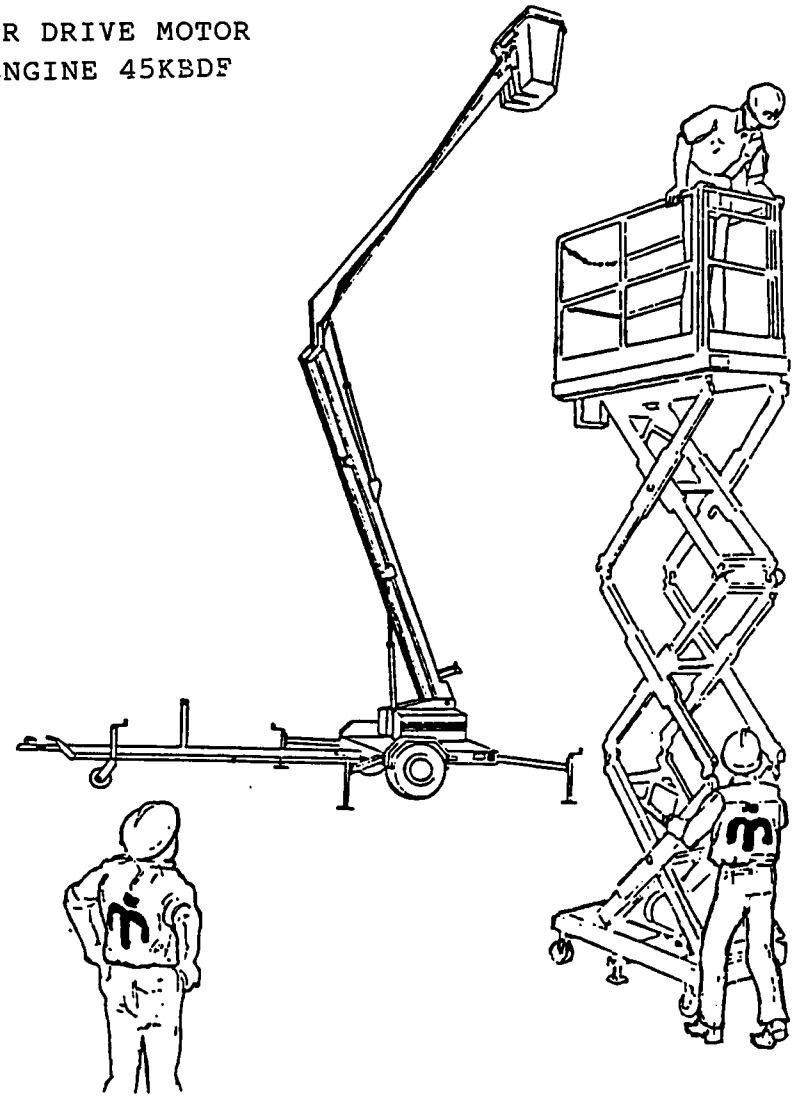
DRAWINGS NOT AVAILABLE THIS REVISION



THIS **VENDOR CHAPTER** DESIGNED AS:

SECTION 1	LESTER BATTERY CHARGER
SECTION 2	TROJAN BATTERY
SECTION 3	MICO DISC BRAKE
SECTION 4	ROSS GEAR DRIVE MOTOR
SECTION 5	NISSAN ENGINE 45KBDF





Lestronic II

BATTERY CHARGER

MODEL 7850
TYPE 36LC25-8ET

OPERATION AND REPAIR MANUAL



SPECIFICATIONS

A.C. VOLTS:	105-128
FREQ:	60
PHASE:	Single
A.C. AMPS:	13 Max.
D.C. OUTPUT:	36 Volts D.C. 25 Amps tapering to 8 Amps @ 45 Vdc
CONNECTIONS:	8½ ft. D.C. Cord with connecting plug standard. Optional plugs and cord lengths available.
DIMENSIONS:	10-1/16 H x 8-11/16 W x 9-1/2 D
MOUNTING:	Set on shelf, wall mount with keyholes or hang from ceiling securely.

FEATURES

- **Patented electronic timer monitors battery state of charge and automatically turns charger off at full charge.**
- **Line voltage compensation achieved by flux oscillator circuit applied to battery charger for high reliability "Minute Man" missile standby applications. Compensates automatically for AC supply voltage variations. Supply voltage variation ± 10% from nominal = ± 1% maximum battery voltage variation, decreasing to ± 1/2% at finish rate with constant electrolyte temperature. No taps or rate controls to set.**
- **Automatic taper of charge rate for superior battery life through good equalization of cells and low water use rate.**
- **Silicon diodes with inherent surge protection operated at a conservative percentage of their rating.**
- **Convection cooled design for maximum reliability and minimum maintenance.**

Form 00910
2M 8/85

Lester Electrical OF NEBRASKA 625 W. A St., Lincoln, Nebraska 68522
Pioneers in Motive Power Chargers

OPERATION OF LESTRONIC II BATTERY CHARGER MODEL 07850

⚠ **LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS BECOME ALERT — YOUR SAFETY IS INVOLVED. IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS, PERSONAL INJURY OR PROPERTY DAMAGE CAN OCCUR.**

FOR CORRECT OPERATION OF THE CHARGER IT IS IMPORTANT TO READ AND FAMILIARIZE YOURSELF WITH THIS ENTIRE MANUAL BEFORE INSTALLING AND OPERATING THE CHARGER.

DO NOT DISCARD THIS MANUAL AFTER READING. SAVE IT WITH YOUR OTHER IMPORTANT PAPERS.

INTRODUCTION

The Lestronic II battery charger is designed to recharge deep-cycle, lead-acid batteries. A ferroresonant transformer is used to provide a highly reliable, line compensating unit with a minimum of moving parts, designed for long trouble-free service. A patented electronic timer turns the charger on and off automatically. This electronic timer determines full charge of the batteries by measuring the rate at which the battery voltage increases during charge. When the voltage stops rising, the battery is fully charged and the charger turns off.

INITIAL INSTALLATION

The AC line to which the charger is to be connected must be capable of supplying 15 amperes to this charger.

⚠ **CAUTION: To reduce the risk of fire, use this charger only on circuits provided with a maximum of 20 ampere branch circuit protection (circuit breaker or fuse), in accordance with the National Electrical Code, ANSI/NFPA 70, and all local codes and ordinances.**

The use of an extension cord with the charger should be avoided. The use of an improper extension cord could result in a risk of a fire or electric shock. If an extension cord must be used, use a three conductor No. 12 AWG cord with ground, properly wired, in good electrical condition and keep it as short as possible. Make sure that the pins on the plug of the extension cord are the same number, size, and shape as that of the plug on the battery charger. Locate all cords so that they will not be stepped on, tripped over, or otherwise subjected to damage or stress.

Do not operate this charger if it has received a sharp blow, was dropped or otherwise damaged in any manner; refer to a qualified serviceman.

Provide adequate ventilation for the batteries and charger. The convection-cooled design requires an unobstructed flow of cooling air for proper operation. Keep all charger ventilation openings at least two (2) inches (5 cm) away from walls and other objects. Do not allow clothing, blankets, or other material to cover the charger.

⚠ **WARNING: Chargers can ignite flammable materials and vapors. Do not use near fuels, grain dust, solvents, or other flammables.**

⚠ **WARNING: To reduce the risk of an electric shock, keep the charger dry. Do not expose it to rain. For storage, keep the charger in a building.**

GROUNDING INSTRUCTIONS

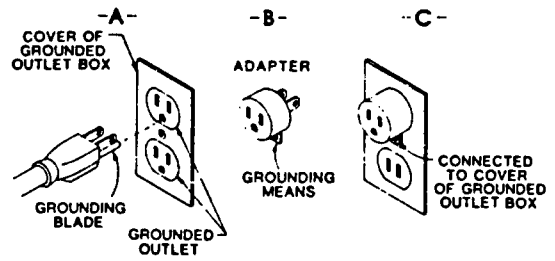
This battery charger must be grounded to reduce the risk of electric shock. This charger is equipped with an electric cord having an equipment-grounding conductor and a grounding type plug and is for use on a nominal 115 Volt, 60 Hertz circuit. This plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electrical Code and all local codes and ordinances.

⚠ **WARNING: Improper connection of the equipment-grounding conductor can result in a risk of an electric shock.**

The conductor with insulation having an outer surface that is green with or without yellow stripes is the equipment-grounding conductor. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding connector to a live terminal. Refer to a qualified serviceman.

A temporary adapter, as illustrated in Figures B and C, may be used to connect this plug to a two-pole outlet as shown in Figure C if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician. The green-colored rigid ear or lug extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box.

GROUNDING METHODS



NOTE: The use of the adapter shown in Figures B and C is not permitted in Canada.

NORMAL OPERATION

The instructions printed on the charger are for daily reference.

1. With the charger DC output cord disconnected from the batteries, connect the power supply cord to a 115 Volt, 60 Hertz outlet.

⚠ **WARNING: To reduce the risk of an electric shock, connect only to a properly grounded single phase (3 wire) outlet. Refer to grounding instructions.**

⚠ **CAUTION: Make sure the battery pack is a 36 volt, 18 cell, series connected lead-acid system with a capacity of 180 to 230 ampere-hours (20 hour rating) or 85 to 110 minutes (BCI rating). The finish on-charge battery voltage should be 2.5 to**

2.6 volts per cell. Damage to the charger and batteries may result if this charger is used on the wrong batteries.

⚠ WARNING: Do not touch the battery terminals or blades on the DC output plug. An electric shock could result.

⚠ WARNING: Make sure the DC output plug and battery receptacle are in good working condition.

DO NOT USE THIS CHARGER IF:

- The DC output plug is too loose or does not make a good connection.
- The DC output plug and receptacle feel hotter than normal.
- The DC output plug blades or receptacle contacts are bent or corroded.
- The DC output plug, receptacle or cords are cut, worn or have any exposed wires.
- The DC output plug, cords, charger or receptacle are damaged.

Using this charger with any of the above symptoms could result in a fire, property damage, or personal injury.

Have your distributor, dealer or other qualified serviceman repair or replace worn or damaged parts immediately. Repairs should not be attempted by people who are not qualified.

2. Connect the DC output plug to the battery receptacle by grasping the plug body or handle and pushing the plug straight into the receptacle. The charger will start automatically in three to five seconds.

⚠ WARNING: Do not disconnect the DC output cord from the battery receptacle when the charger is on. The resulting arcing and burning of the plug and receptacle could cause the batteries to explode. If the charger must be stopped, first disconnect the AC power supply cord from its outlet, then disconnect the charger DC output plug from the battery receptacle.

3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 20 to 29 amps depending upon the condition of the batteries and how much the batteries have been discharged.

   Slight variations in the initial charge rate may also result from AC input line voltages which are higher or lower than 115 Volts. Higher line voltages increase the initial charge rate while lower line voltages reduce the charge rate.

   If the batteries are heavily discharged and the AC input line voltage is higher than 115 Volts, the initial charge rate may exceed 30 amps and the ammeter needle will be pegged at 30 amps. Under normal conditions the charge rate will taper to less than 30 amps within 30 minutes. If the ammeter still reads 30 amps after 30 minutes, turn the charger off by disconnecting the power supply cord from its outlet. Refer to the Trouble Shooting Guide in this manual for additional information.

⚠ CAUTION: To prevent overheating damage to the charger, do not allow the charger to operate for more than 30 minutes with the ammeter reading 30 amps.

During charge the battery voltage increases gradually which causes the charge rate to decrease. Good battery cells should each rise to approximately 2.5 volts DC which will allow the charge rate to taper to less than 8 amps. Since each cell accepts charge at a slightly different rate, normal charging with the ammeter reading in the 4 to 10 amps area for the last few hours of charge is important to achieve equalization of all battery cells every time the batteries are charged.

The charger turns off automatically when the batteries are fully charged. The required charge time varies with battery size and depth of discharge. Allow sufficient time, as listed in the following chart, for normal charging.

Battery Capacity (Ampere-hours @ 20 hour rate)	Normal Charge Time (hours)
180	9
190	10
220	11
230	12

The normal charge times listed above are for batteries which have been discharged to 80% of their rated capacity. As much as 4 ADDITIONAL HOURS may be required to properly charge batteries under the following conditions:

1. Heavily discharged batteries (more than 80% discharged).
2. Charging new batteries (batteries with less than 50 discharge/charge cycles).
3. Charging cold batteries (ambient temperatures below 65 degrees F).

When charging new or cold batteries, a higher than normal finish charge voltage can be expected. This results in a low finish charge rate (4 to 6 amps), and additional time is required to achieve equalization of all battery cells. Refer to a qualified serviceman if the charger does not turn off within the specified time.

⚠ WARNING: Do not leave the charger unattended for more than two days in a row. Severe overcharging and possible damage to the batteries will result if the charger should fail to turn off.

As batteries age, individual cells may weaken resulting in a lower than normal finish charge voltage. As the finish charge voltage decreases, the charge rate will not taper into the 5 to 10 amps area on the ammeter. The electronic timer will, however, still determine when the batteries have reached full charge and turn the charger off. Even though they are properly charged, older batteries will gradually lose capacity, and should be replaced when they will no longer perform as required.

4. After the charger has turned off, disconnect the charger DC output plug from the battery receptacle by grasping the plug body or handle and pulling the plug straight out of the receptacle.

⚠ WARNING: To avoid damage to the charger cord, plug, and battery receptacle, DO NOT pull on the charger cord. DO NOT twist, rock, or pull the plug sideways.

BATTERY STORAGE MAINTENANCE

When the machine is not in use, charge the batteries once each week. Disconnect the charger DC output cord at the end of the charge.

PROPER CARE OF MOTIVE POWER BATTERIES

Motive power batteries are subjected to severe deep cycle duty on a daily basis. Although these batteries are designed to withstand such duty the following precautions must be observed to obtain good performance and maximum cycle life.

⚠ CAUTION: Always wear protective eye shields and clothing when working with batteries. Batteries contain acids which can cause bodily harm. Do not put wrenches or other metal objects across the battery terminal or battery top. Arcing or explosion of the battery can result.

1. When installing new batteries be sure the polarity of each battery and overall battery pack is correct. Due to the electrical characteristics of this charger it is possible to improperly hook up the batteries and not blow the fuse when charging. Battery and/or charger damage can result.
2. New batteries should be given a full charge before their first use because it is difficult to know how long the batteries have been stored.
3. Limit the use of new batteries for the first 20 cycles. New batteries and older batteries that have been in storage are not capable of their rated output until they have been discharged and charged a number of times.
4. Sulfation results when batteries in storage are not maintained in a charged active state. Internal self discharge can bring about the start of this condition in as little as three days in warm temperatures. Batteries allowed to sit unmaintained in storage self discharge, sulfate to various degrees and lose capacity. Repeated charging will generally result in the recovery of most of the battery's capacity, though some permanent loss can be expected.
5. DO NOT EXCESSIVELY DISCHARGE THE BATTERIES. Excessive discharge can cause polarity reversal of individual cells resulting in complete failure shortly thereafter. Heavily discharging (Over 60%) new batteries before they have been broken in (approximately 20 cycles) can cause permanent cell damage, resulting in reduced energy capacity and shortened life.
6. Maintain the proper electrolyte level by adding water when necessary. Never allow the electrolyte level to fall below the top of the battery plates. Electrolyte levels fall during discharge and rise during charge. Therefore, to prevent the overflow of electrolyte when charging, it is mandatory that water be added to cells AFTER they have been fully charged. DO NOT OVERFILL. Old batteries require more frequent additions of water than do new batteries.
7. When the temperature falls below 65 degrees F, the batteries should be placed on charge as soon after use as possible. Cold batteries require more time to fully recharge.
8. The tops of the batteries and battery hold-downs must be kept clean and dry at all times to prevent excessive self discharge and flow of current between the battery posts and frame.
9. Follow all operating instructions, cautions, and warnings as specified in this manual, on the charger, and in your vehicle owner's manual.

TROUBLE SHOOTING GUIDE

TO BE ABLE TO USE THE TROUBLE SHOOTING GUIDE SAFELY AND EFFECTIVELY IT IS IMPORTANT TO READ THIS GUIDE COMPLETELY BEFORE BEGINNING ANY TESTS.

⚠ CAUTION: REPAIRS BY QUALIFIED PERSONNEL ONLY. NOTE: Modifying this charger for use other than that for which it was intended, repairs by persons not qualified, or not using original equipment replacement parts will void the warranty and Lester liability.

⚠ CAUTION: DO NOT DISASSEMBLE THE CHARGER. TAKE IT TO A QUALIFIED SERVICEMAN WHEN SERVICE OR REPAIR IS REQUIRED. Incorrect assembly may result in a risk of electric shock or fire.

⚠ DANGER: HIGH VOLTAGE — With the charger on, the internal charger capacitor voltage is approximately 650 volts.

⚠ CAUTION: ALWAYS UNPLUG THE ELECTRICAL CORDS FROM THE AC OUTLET AND THE BATTERIES BEFORE ATTEMPTING ANY REPAIRS TO THE CHARGER.

⚠ WARNING: Do not operate the charger if it is malfunctioning. Personal injury or property damage could result.

The Lestronic II battery charger is a reliable, automatic charger designed for long, trouble-free service. If a malfunction should develop, identify the symptom and follow the associated test procedures.

MALFUNCTION SYMPTOM

SECTION		SECTION	
1	CHARGER DOES NOT TURN ON A. Relay does not Close. No Transformer Hum and Ammeter Does Not Register. B. Relay Closes But No Transformer Hum and Ammeter Does Not Register. C. Relay Closes and Transformer Hums But Ammeter Does Not Register. D. Electronic Timer Kit Replacement Instructions.	3	AMMETER READS 30 AMPS FOR MORE THAN 30 MINUTES
2	CHARGER FUSE BLOWS A. Single Fuse Link Blows B. Both Fuse Links Blow	4	CHARGER OUTPUT IS LOW
		5	CHARGER TURN OFF MALFUNCTIONS A. Charger Turns Off Too Soon. B. Charger Does Not Turn Off. C. Charger Runs Too Long But Does Turn Off.
		6	AC LINE FUSE OR CIRCUIT BREAKER BLOWS
		7	TRANSFORMER SHORT OR BURN-OUT

SECTION 1 — CHARGER DOES NOT TURN ON

In normal operation the charger DC output connector must be connected to the batteries in order to turn the charger on. A time delay of 2 to 5 seconds is provided to allow adequate time to make a secure connection before the charger turns on. After this time delay the power relay closes and an audible "click" should be heard. When the relay closes, AC power is supplied to the transformer primary coil. If operating properly the transformer should hum and the ammeter should indicate the charge rate. If the charger does not turn on properly refer to Part A, B or C for specific test procedures.

PART A— RELAY DOES NOT CLOSE, NO TRANSFORMER HUM AND AMMETER DOES NOT REGISTER.

Check to be sure the power supply cord is securely connected to a live outlet. Check the DC output connector and the battery connector for damage, dirt or corrosion that would prevent a good electrical connection.

⚠ WARNING: If the plug or receptacle is broken, twisted, bent or loose and does not make good electrical contact, have it replaced by a qualified serviceman immediately. DO NOT USE THIS CHARGER IN THIS CONDITION AS FIRE OR PERSONAL INJURY CAN RESULT.

Then disconnect the power supply cord from its outlet. With the DC output connector still connected to the battery connector, measure the voltage at the battery connector using a suitable DC voltmeter as shown in Figure 1.

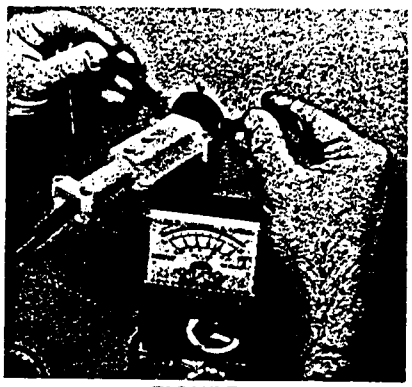


FIGURE 1
Battery DC Voltage Test

The voltage reading should be the same as the battery terminal voltage and must be between 24 and 50 volts DC in order to close the relay. If the DC voltage is within the above limits, remove the charger cover and verify that the charger is properly wired and you read the same voltage (24 to 50 Vdc) inside the charger where the white and black wires of the DC cord attach. (Fig. 4 and wiring diagram Fig. 8.) If the battery DC voltage measured inside the charger is now below the above limits or not present, the DC plug or cordset has an internal break and must be replaced. If the charger is wired correctly and a satisfactory battery DC voltage is measured inside the charger, a malfunction in the Electronic Timer Kit has probably occurred. Due to its complexity, do not attempt to make field repairs to any part of the Electronic Timer Kit. If a malfunction exists, simply remove the entire Electronic Timer Kit and replace it with a new one. Refer to Part D—"Electronic Timer Kit Replacement"—for correct procedure.

The Electronic Timer Kit may be bypassed in order to verify that a malfunction exists. First disconnect the charger power supply cord from its outlet and the DC output connector from the battery connector. Place a jumper wire between terminals #1 and #3 to bypass the Electronic Timer Kit as shown in Figure 2 and Figures 6 and 7.

The power supply cord is now connected directly to the primary transformer coil and the transformer should hum when the power supply cord is connected to a live outlet. The charger operation may be checked by first connecting the DC output connector to the battery connector, and then connecting the power supply cord to an outlet. If normal charging current is indicated on the ammeter the Electronic Timer Kit is defective and must be replaced.

⚠ CAUTION: DO NOT charge batteries with the Electronic Timer Kit bypassed. The charger will remain on as long as the power supply cord is connected to an outlet. Severe overcharging and eventual damage to batteries will result.

If the transformer does not hum and the ammeter still does not register with the Electronic Timer Kit bypassed, a continuity check of the charger AC circuit is necessary. Disconnect the power supply cord from its outlet and the DC output connector from the battery connector and, with a suitable continuity tester, check the circuit across the power supply cord prongs as shown in Figure 2. With the Electronic Timer Kit bypassed, the CIRCUIT SHOULD BE COMPLETE. If the circuit is not complete, individually check the continuity of the power supply cord, primary transformer coil and all connections.

PART B — RELAY CLOSES BUT NO TRANSFORMER HUM AND AMMETER DOES NOT REGISTER

Check to be sure the power supply cord is securely connected to a live AC outlet. When three-prong to two-prong adapters are used, they tend to work loose resulting in a poor connection. Check the AC line fuse or circuit breaker and, if possible, measure the AC line voltage at the outlet to be sure AC power is present. If necessary connect a functioning charger, utility light, or other electrical appliance to the outlet to verify the presence of AC power.

If AC power is present, disconnect the power supply cord from its outlet and the DC output connector from the battery connector. Bypass the Electronic Timer Kit as described in Section 1, Part A, and with a suitable continuity tester check the circuit across the power supply cord prongs as shown in Figure 2. With the Electronic

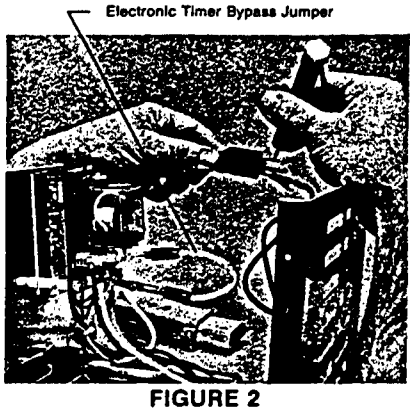


FIGURE 2
Charger AC Circuit Continuity Test
(Transformer removed for clarity)

Timer Kit bypassed, the CIRCUIT SHOULD BE COMPLETE. If the circuit is complete, refer to the wiring diagram in Figure 8, and check the relay wiring and all connections. If the circuit is not complete, check the wiring of the power supply cord, transformer primary coil leads and the Electronic Timer Kit. If the charger is wired correctly, individually check the continuity of the power supply cord, transformer primary coil and relay.

PART C — RELAY CLOSES AND TRANSFORMER HUMS BUT AMMETER DOES NOT REGISTER

If the relay closes and the transformer hums, the charger AC circuit and Electronic Timer Kit are functioning properly. If the ammeter does not register, a fault in the charger DC circuit exists and a continuity check must be performed. Disconnect the power supply cord from its outlet and the DC output connector from the battery connector, and check the charger fuse. If a fuse link is blown, refer to Section 2 — "Charger Fuse Blows" for further tests. If the fuse checks good, use a low voltage continuity tester to perform the following tests:

1. Connect the tester leads to the charger DC output connector as shown in Figure 3, and note the reading. Reverse the tester leads and check the output connector again. The circuit should be complete in only one direction. If the circuit does not conduct in either direction and the fuse is good, individually check the continuity of the DC output cord, ammeter, diodes, and all connections. If the circuit conducts in both directions, a "short" exists in the charger DC circuit. First check the DC output cord for a "short" between the two wires. It is more likely that one or both diodes have "shorted." Refer to Section 2 — "Charger Fuse Blows" for continuity test of diodes.

2. If the charger DC circuit test is good, a check of the capacitor is necessary. Disconnect the power supply cord from its outlet and the DC output connector from the battery connector. Then disconnect both transformer coil leads from the capacitor terminals. Use care when disconnecting the capacitor leads so the wires do not break. Using an ohmmeter, set the scale to R X 10K ohms and test the capacitor as follows:

   GOOD CAPACITOR—When the ohmmeter leads are connected to the capacitor terminals, the meter needle jumps to mid-scale and rapidly moves to high resistance (∞).

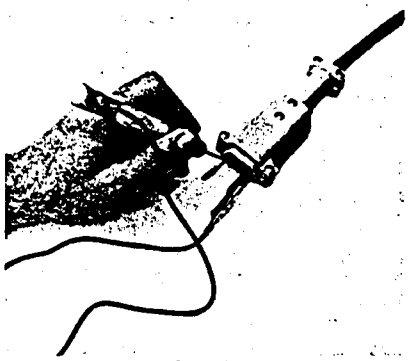


FIGURE 3
Charger DC Continuity Test

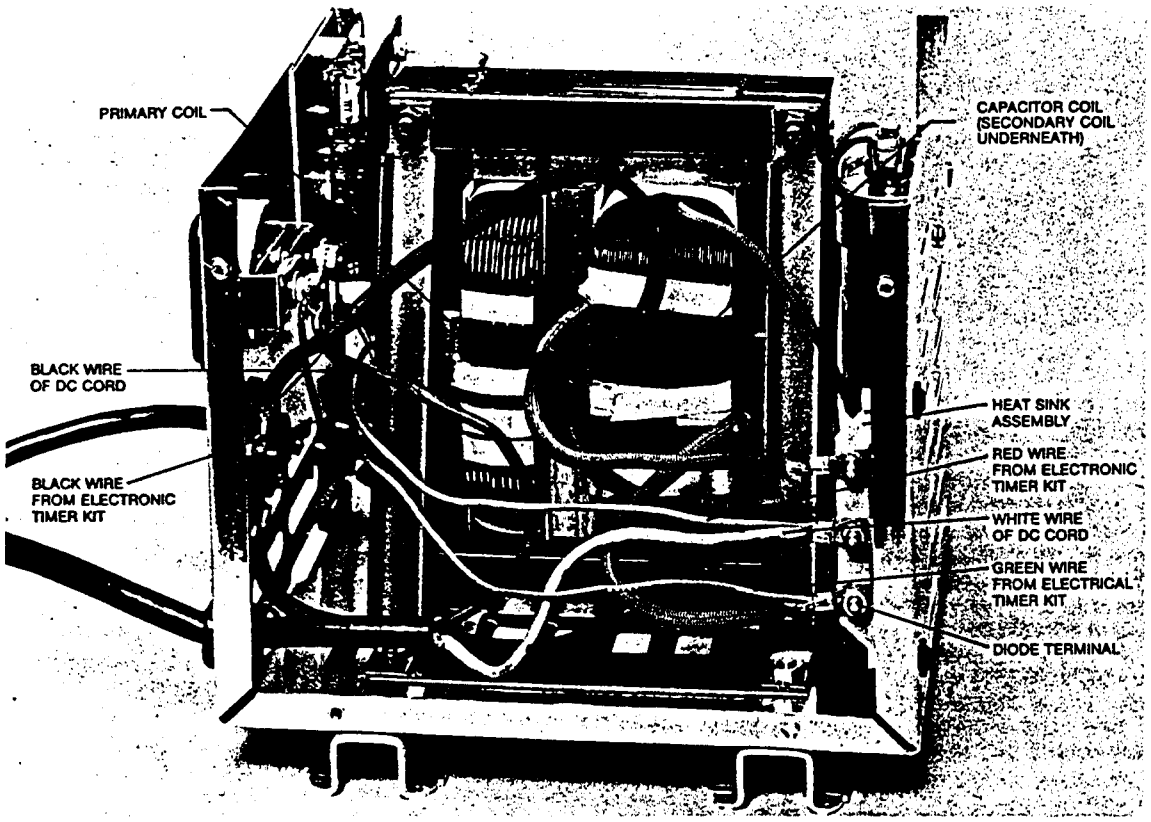


FIGURE 4
Electronic Timer Kit Wiring

OPEN CAPACITOR—When the ohmmeter leads are connected to the capacitor terminals, the meter needle does not move and stays at high resistance (∞). A bulge in the top of the capacitor may be visible if the capacitor has failed "Open."

SHORTED CAPACITOR—When the ohmmeter leads are connected to the capacitor terminals, the meter needle jumps immediately to zero ohms and remains there.

If the capacitor is "Open" or "Shorted" it must be replaced.

⚠ **CAUTION: Use only a 6 Mfd, 660 volt AC rated capacitor for replacement (Part No. 02390S). The use of a different value capacitor may result in improper charging, capacitor failure, transformer burnout, and/or battery damage.**

3. If the charger DC circuit and capacitor check good, a test of the transformer is necessary. Refer to Section 7 — "Transformer Short or Burn-Out" for test procedures.

PART D — ELECTRONIC TIMER KIT REPLACEMENT

The Electronic Timer Kit should always be replaced as a complete assembly. The tools required are a Phillips head screwdriver, 3/8" and 11/32" wrenches, and pliers. No soldering is required. To replace the kit follow the step-by-step procedures listed below.

1. Disconnect the charger power supply cord from its outlet and the DC output connector from the battery connector, and remove the charger cover.
2. Disconnect the green, black, and red wires of the Electronic Timer Kit as shown in Figure 4. Then remove the black and white leads of the power supply cord and both primary transformer coil leads from the Electronic Timer Kit terminal tabs. The Kit can be removed by removing the three mounting screws on the charger front panel. Save all hardware for reassembly.
3. Install the replacement Electronic Timer Kit by reversing the disassembly procedures described in Step 2. When reconnecting the wires to the Electronic Timer Kit terminal tabs support the terminal board to prevent damage to the electronic circuit board. Connect either transformer primary lead to terminal #2, and the remaining primary lead to terminal #3.

   Connect the black lead of the power supply cord to terminal #1 on the Electronic Timer Kit and the white lead of the power supply cord to terminal #2.

   Connect the red wire of the Electronic Timer Kit along with the white lead of the DC cord to the Heat Sink Assembly. Connect the black wire of the Electronic Timer Kit along with the black lead of the DC cord to the ammeter post. Do not allow the ammeter post to turn when tightening the nut. Reconnect the green wire of the Electronic Timer Kit along with the transformer secondary lead to the diode lead terminal.

⚠ **CAUTION: Be sure all connections are clean and tight. Also check to be sure all wires and terminals are positioned so they do not short together or to the charger case.**

4. Replace the charger cover and check the Electronic Timer Kit for proper operation as follows:
   a. With the DC output connector disconnected from the battery connector, insert the power supply cord into an outlet. The relay on the Electronic Timer Kit should not close. A DC voltmeter connected across the DC output connector should indicate zero volts.
   b. Disconnect the power supply cord from its outlet and connect the DC output connector to the battery connector. The relay on the Electronic Timer Kit should close with an audible "click" after a two to five second delay.
   c. If the Electronic Timer Kit does not operate as (a) and (b) above, refer to the wiring diagram in Figure 8 and check to be sure the charger is wired correctly. If the Electronic Timer Kit operates properly, the charger is ready for use. Always monitor the first charge cycle to verify that the charger is turning off properly.



FIGURE 5
Diode Continuity Test

SECTION 2 — CHARGER FUSE BLOWS

The charger fuse consists of two fusible links mounted in a single assembly on the charger front panel. Each fuse link is electrically connected in series with one diode to provide protection for the transformer in the event of a diode failure. Visually check the fuse to determine if one or both fuse links are blown and refer to Part A or B for appropriate test procedures. Note: Replace the complete fuse assembly (Part No. 08776S) if the fuse is blown. Do not attempt to repair the fuse link as inadequate charger protection may result.

PART A — SINGLE FUSE LINK BLOWS

This condition is normally caused by a short circuit failure of one diode. The fuse link will blow when the charger DC output connector is connected to the battery connector, regardless of whether the power supply cord is connected to an outlet. To check the diodes, disconnect the power supply cord from its outlet and the DC output connector from the battery connector, and then disconnect one transformer secondary coil lead from the diode terminal. Using a low voltage continuity tester, connect one tester lead to the diode mounting plate and the other tester lead to a diode terminal as shown in Figure 5.

Note the reading and then reverse the tester leads and check each diode again. If a diode conducts current in both directions, it is "shorted" and the complete Heat Sink Assembly with Diodes (Part No. 09653S) must be replaced.

On rare occasions a single fuse link may melt due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper torque on the fuse connector nuts is 20 Inch-Pounds (23 Cm-Kg).

PART B — BOTH FUSE LINKS BLOW

This is normally caused by a reverse polarity connection between the charger DC output connector and the battery connector. Check the battery pack and battery connector to be sure they are wired in the correct polarity. If possible check the voltage and polarity at the battery connector with a DC voltmeter. Also, check the charger DC output connector for the correct polarity. The white wire should be connected to the positive (+) contact, and the black wire to the negative (-) contact. If a reverse polarity connection is made between the charger and batteries, both fuse links will blow regardless of whether the power supply cord is connected to an outlet.

Another cause for both fuse links blowing is the short circuit failure of both diodes. Although this is rare, it may occur as the result of a lightning strike at the charging location. Excessive heat due to a loose connection may also cause both fuse links to melt. Refer to Part A — "Single Fuse Link Blows" for trouble-shooting procedures.

SECTION 3 — AMMETER READS 30 AMPS FOR MORE THAN 30 MINUTES

This condition normally results if the charger is connected to battery system which is less than 36 volts. If connected to a 12, 18, 24, or 30 volt battery system the charge rate will not taper below 30 amps within 30 minutes. Check to be sure all batteries are correctly wired, and also check the battery pack voltage at the battery connector using a DC voltmeter. For a 36 volt battery system, the measured voltage when charging at an indicated 30 amp rate should be 34 to 38 volts DC. Voltage readings, under charge, lower than this indicate an incorrect or failed battery pack.

⚠ CAUTION: DO NOT connect the charger to battery packs which are not 36 volt systems. Overheating and transformer burn-out will result.

SECTION 4 — CHARGER OUTPUT IS LOW

The most probable cause of low output is a single fuse link blowing as the result of a short circuit failure of one diode. Refer to Section 2 — "Charger Fuse Blows" for trouble-shooting procedures. On rare occasions a short circuit failure of the transformer coils may cause the output to be low. Refer to Section 7 — "Transformer Short or Burn-Out" for test procedures.

⚠ CAUTION: Do not use the charger if the output is low. Batteries will not reach full charge, thereby increasing the possibility of a harmful deep discharge during their next use.

SECTION 5 — CHARGER TURN OFF MALFUNCTIONS

The Electronic Timer Kit turns the charger off as well as on. Proper charge time is determined by many factors, but the main elements are: (1) Battery size, (2) Depth of battery discharge, and (3) Finish charge rate. Large severely discharged batteries require more time to reach full charge than do smaller lightly discharged batteries.

The charge rate, as indicated by current flow in amperes on the panel meter, is controlled by the batteries' rising voltage during charge. The higher the on charge voltage will rise, the lower the finish charge rate will be before the Electronic Timer terminates charging.

The following timer malfunctions are occasionally due to factors other than the charger's performance. To help isolate the problem it is often necessary to use the charger on a different set of batteries and the original set of batteries on another charger.

PART A — CHARGER TURNS OFF TOO SOON

Check to be sure the power supply cord is securely connected to a live outlet. If the power supply outlet is live proceed with the next step.

To determine if the charger did shut off too soon, disconnect and reconnect the charger D.C. output connector. This will restart the charger. Observe charger output on the ammeter.

1. The ammeter needle jumps smartly to between 20 and 25 amps and then tapers below 14 amps within 15 minutes. This indicates that the batteries were truly charged. The apparent short charging time is in response to the batteries' ability to accept charge and the electronic timer is performing properly.
2. The ammeter needle jumps smartly to between 20 and 25 amps, but does not taper below 14 amps within 15 minutes. If the batteries have been properly maintained and charged regularly, this generally indicates that the batteries were not fully charged. If possible, use a hydrometer to check the specific gravity of several battery cells. If the specific gravity readings are more than 30 points (.030) lower than normal full charge readings, the electronic timer has malfunctioned and the complete Electronic Timer Kit must be replaced. Refer to Section 1, Part D—"Electronic Timer Kit Replacement," for correct procedure.

   If the batteries have not been used or charged regularly, they may be sulfated and will not produce their full capacity. Repeated cycles (at least 5) of a light discharge followed by a full charge will generally result in the recovery of most of the battery's capacity. Do not interpret this reduced battery capacity as being caused by the charger turning off too soon. The charger is working properly if, after several charge cycles, the battery capacity increases to near normal. Sulfation occurs most often when the batteries have been stored without weekly charging. New batteries may also be sulfated due to extended shipment or storage time prior to sale.

   As batteries age, individual cells may weaken causing a reduction in battery capacity. This condition normally results in a finish charge rate higher than 10 amps and less time is required to fully charge the batteries. Do not interpret this shorter charging time and reduced battery capacity as being caused by the charger turning off too soon. The battery is aging naturally and the charger is working properly. When the batteries will no longer perform as required they should be replaced.

PART B — CHARGER DOES NOT TURN OFF

New batteries with all good cells should rise to at least 2.5 volts per cell. This will allow the finish charge rate to taper below 8 amperes. As batteries age individual cells may weaken and these cells may not reach 2.5 volts. This will result in finish charge rates greater than 8 amperes, and less time will be required for the batteries to reach full charge. At a finish charge rate of 8 amperes or less the charge time should not exceed 18 hours. At a finish charge rate greater than 8 amperes the charge time should not exceed 14 hours.

If the charger remains on longer than the specified maximum time, check to see if the charger turns on immediately when the D.C. output cord is connected without the normal two to five second delay. If the charger turns on instantly without the two to five second delay the Electronic Timer Kit has probably failed. This type of malfunction generally results in the charger not turning off and the complete Electronic Timer Kit must be replaced. Refer to Section 1, Part D — "Electronic Timer Kit Replacement," for correct procedures.

If the charger remains on longer than the maximum time specified and the two to five second delay is present, verify that the green wire from the Electronic Timer Kit and the secondary transformer coil lead are securely connected to the diode lead as shown in Figure 4. The charger will NOT turn off if the green wire is loose or disconnected. If the green wire is securely connected, the Electronic Timer has malfunctioned and the complete Electronic Timer Kit must be replaced.

If a precision digital type D.C. voltmeter is available, a test to verify that the Electronic Timer has malfunctioned can be made. Connect the charger to the batteries and allow to charge normally. After the charge rate has tapered to its lowest point, measure the battery terminal voltage using a D.C. voltmeter capable of reading in increments of .001 volts. Continue charging and check the battery voltage reading every hour. If the battery voltage increases less than .012 volts, or if the battery voltage decreases between successive hourly readings, the charger should turn off. If the charger does not turn off, the Electronic Timer has malfunctioned and the complete Electronic Timer Kit must be replaced.

PART C — CHARGER RUNS TOO LONG BUT DOES TURN OFF

In the event of A.C. power interruption when the charger is on, the charger will automatically restart when A.C. power is restored. This power outage can make the apparent charge time seem longer than the actual charge time. To check for A.C. power interruptions plug an electric clock into the same outlet to which the A.C. cord is connected. Charge normally and note any time difference between the test clock time and the actual time.

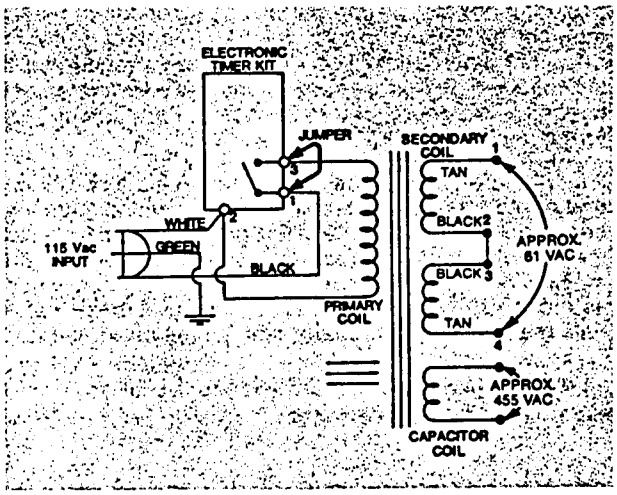


FIGURE 6
Transformer Coil Voltage Test
(without capacitor)

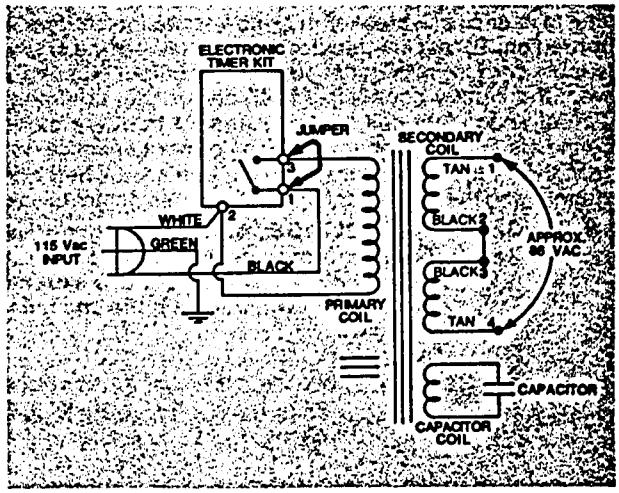


FIGURE 7
Transformer Coil Voltage Test
(with capacitor)

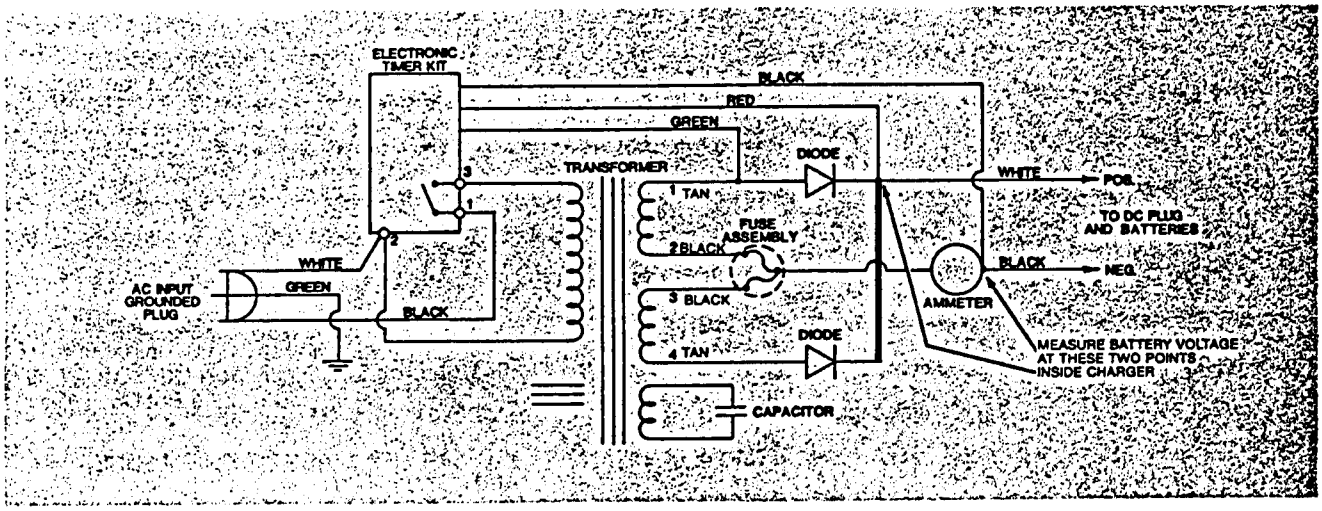
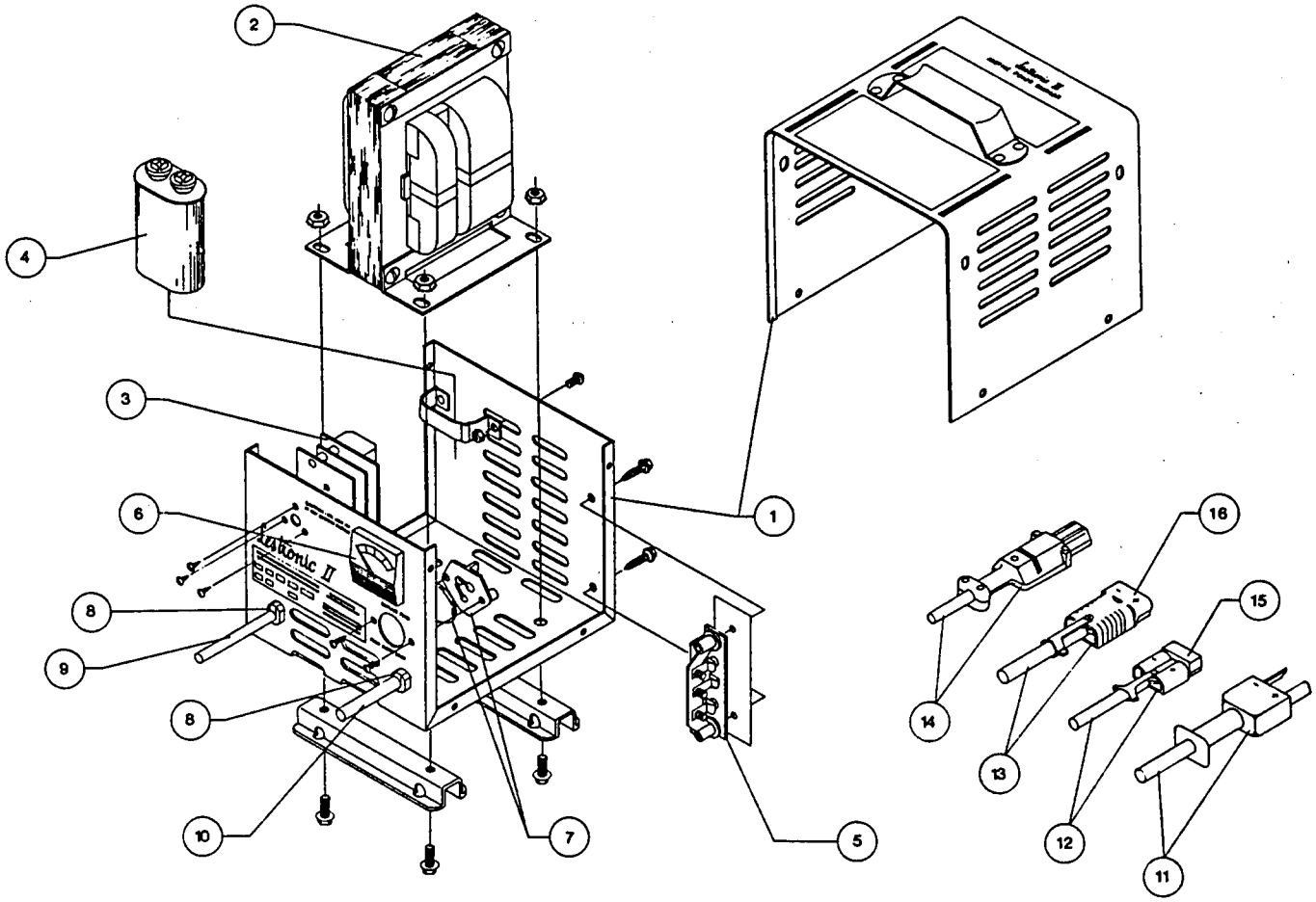


FIGURE 8
Charger Wiring Diagram



WARNING: All electrical repairs must be performed by qualified personnel only. Incorrect assembly may result in a risk of electrical shock or fire.

PARTS LIST FOR LESTRONIC II CHARGER

MODEL 7850

REF	PART NO.	DESCRIPTION
1	07684S	Case Assembly
2	09691S	Transformer Assembly
3	09560S	Electronic Timer Kit
4	02390S	Capacitor, 6 Mfd, 660 Vac
5	09653S	Heatsink Assembly, with Diodes
6	04127S	Ammeter, 0-30 Amps
7	08776S	Fuse Assembly
8	02028S	Bushing, 7W-2, for Cordsets
8	02008S	Bushing, 8P-2, for 10/2 Cords
9	02506S	AC Cordset, 6 ft.
9	02106S	AD Cordset, 9 ft.
10	08512S	DC Cordset, 12/2, 108", No Plug
11	12781S	DC Cordset, 12/2, 108", Neoprene Plug
11	12843S	DC Cordset, 10/2, 144", Neoprene Plug
11	12844S	DC Cordset, 10/2, 240", Neoprene Plug
12	08607S	DC Cordset, 12/2, 108", w/SB-50 Plug
12	10536S	DC Cordset, 12/2, 130", w/SB-50 Plug
13	08224S	DC Cordset, 12/2, 108", w/SB-175 Plug
14	08020S	DC Cordset, 12/2, 108", Lester Yellow Plug
15	08313S	Plug Assy., SB-50
16	02957S	Plug Assy., SB-175
Not Shown	08045S	DC Receptacle Assy., for Neoprene or Lester Yellow Plug

SECTION 6 — AC LINE FUSE OR CIRCUIT BREAKER BLOWS

If this occurs when the charger power supply cord is connected to an outlet, without the DC output connector connected to the battery connector, the charger power supply cord may be shorted. Disconnect the power supply cord from its outlet and the DC output connector from the battery connector, then check to be sure the Electronic Timer Kit is NOT bypassed. With a suitable continuity tester check the circuit across the power supply cord prongs as shown in Figure 2. THE CIRCUIT SHOULD NOT BE COMPLETE. If the circuit is complete, check the relay contacts to be sure they are open and have not welded closed. If the relay contacts are open, the power supply cord is shorted and must be replaced.

If the power supply cord checks good the transformer coils may be shorted. Refer to Section 7 — "Transformer Short or Burn-Out" for test procedures.

SECTION 7 — TRANSFORMER SHORT OR BURN-OUT

Failure of the transformer may be caused by natural aging or premature shorting of adjacent coil turns. A low or complete lack of output would be observed on the ammeter, however the transformer may hum or the AC line fuse or circuit breaker may blow when the charger is turned on. To test the transformer, disconnect the power supply cord from its outlet and the DC output connector from the battery connector. Then disconnect the transformer secondary coil leads #1 and #4 from the diode terminals and disconnect the transformer capacitor coil leads from the capacitor terminals. Use care when disconnecting the capacitor lead so the wires do not break.

⚠ DANGER—HIGH VOLTAGE: With the charger operating, the charger capacitor voltage is approximately 650 volts AC. Use extreme caution when working near the capacitor terminals.

In order to apply AC power directly to the transformer primary coil the Electronic Timer Kit must be bypassed. Refer to Section 1, Part A for bypass procedures. With the Electronic Timer Kit bypassed and taking care for personal safety, connect the power supply cord to an outlet. If the AC line fuse or circuit breaker blows, the transformer is shorted internally and must be replaced. If this does not occur, check the transformer secondary and capacitor coil voltages as shown in Figure 6, using a suitable AC voltmeter. If the measured voltages are substantially lower than those shown, the transformer is shorted internally and must be replaced.

If the transformer secondary coil voltage and capacitor coil voltage check good, disconnect the power supply cord from its outlet. Check the capacitor to be sure its rating is 6 Mfd, 660 volts AC, and then carefully reconnect the capacitor coil leads to the capacitor terminals. Then, taking care for personal safety, reconnect the power supply cord to an outlet and measure the transformer secondary voltage again. The correct voltage reading is shown in Figure 7. If the transformer secondary voltage reading is the same as measured with the capacitor disconnected, from Figure 6, the capacitor may be open, the capacitor coil may be open or the capacitor coil terminals may not be making proper electrical contact. Refer to Section 1, Part C, Item 2 for capacitor test procedures. If the voltage readings are correct, both the transformer and capacitor are good, refer to Section 1, Part C, Item 1 for further tests of the DC circuit.

If it should become necessary to replace a terminal on one of the transformer leads, the new terminal must be crimped AND soldered. NOTE: Some transformer leads may be aluminum wire and a solder must be used on these wires that is intended for use on aluminum, such as Alcoa #807 solder with Alcoa #69 flux. If these materials are not available locally, contact the Lester factory.

LESTRONIC II CHARGER "LIMITED WARRANTY"

Lester warrants each new Lestronic II Battery Charger for defects in material and workmanship for a period of two years from the date of manufacture of the complete unit.

Repairs can be made at the Lester factory. To do so, send the defective unit with transportation charges prepaid to:

Lester Electrical of Nebraska, Inc.
Attn: Repair Department
625 West "A" Street
Lincoln, NE 68522-1794

For repairs made at other than the Lester factory, Lester will provide only the replacement parts. Defective parts should be sent with transportation charges prepaid to the Lester factory at the previously mentioned address.

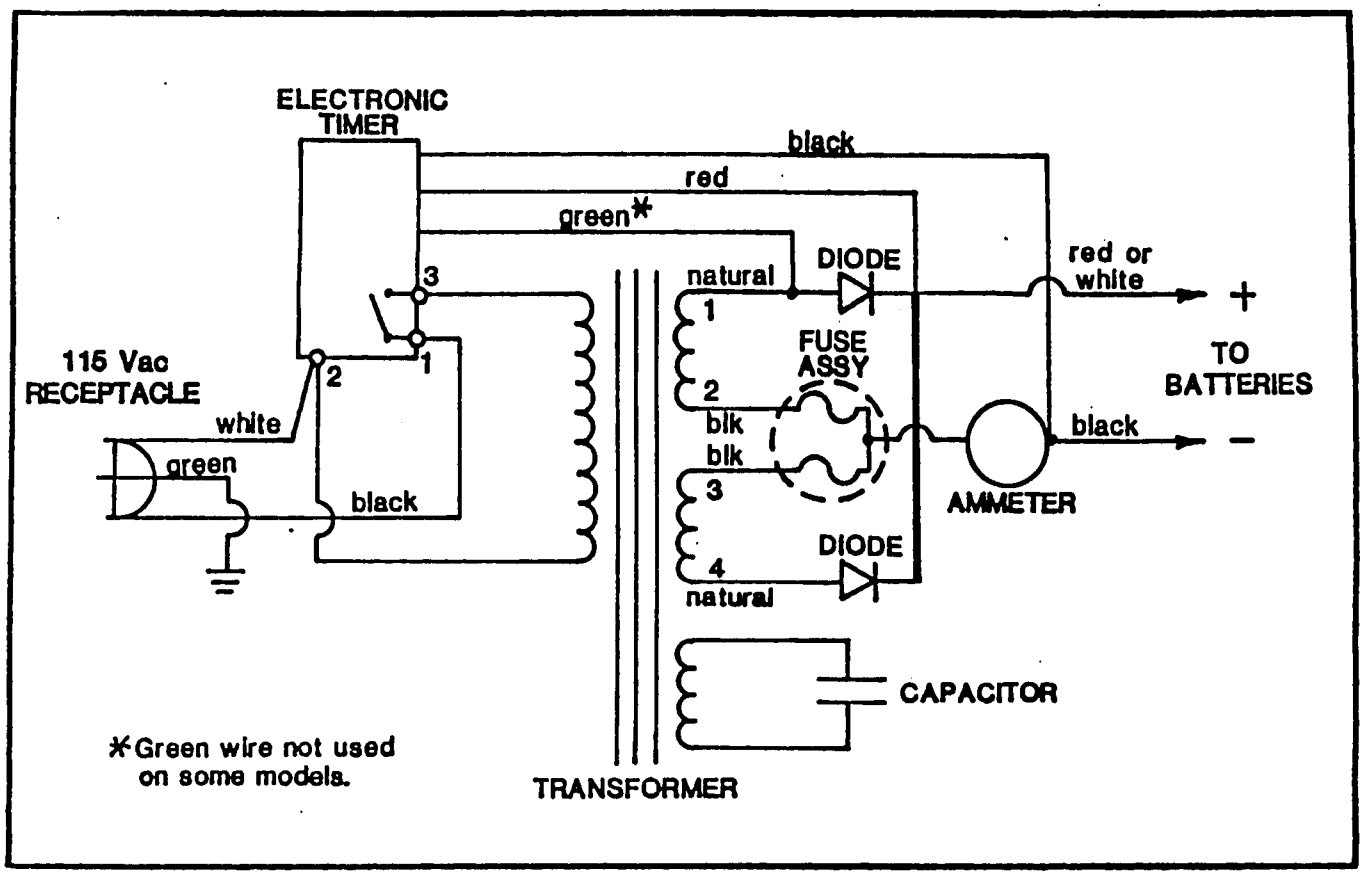
If the unit or parts are found in the reasonable judgement of Lester to be defective in material or workmanship, repair or replacement will be made by Lester without charge for parts or labor. Repair or replacement will be at the discretion of Lester, with replacements being made using current models or parts performing the equivalent function. Electronic timer kits that have failed and are unrepairable will be replaced as follows: If a year or more remains in the warranty period, the electronic timer kit will be replaced by a new kit. If less than a year remains in the warranty period, the electronic timer kit will be replaced by a factory rebuilt electronic timer kit having a one year warranty period. Labor charges other than those incurred at the Lester factory are not covered under this warranty. All expenses associated with delivering defective items to the factory and the expense of returning repaired or replaced items from the Lester factory to the owner will be paid for by the owner. All warranty work accomplished at the Lester factory will be completed within a reasonable time after receipt of defective items.

This warranty does not cover any semiconductor parts, such as diodes, which are vulnerable to electrical overloads beyond the control of Lester.

This warranty does not cover any charger that has been subject to misuse, neglect, negligence, or accident, or operated in any way contrary to instructions specified on the charger case and in the owner's manual. No claim of breach of warranty shall be cause for cancellation of the contract of sale of any Lester charger. Lester assumes no responsibility for loss of time, inconvenience or other damage, consequential or otherwise, resulting from a defective charger. All implied warranties (including merchantability) are limited in duration to the two year from date of manufacture warranty period.

Some states do not allow the exclusion or limitation of incidental or consequential damages; or limitations on how long an implied warranty lasts, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

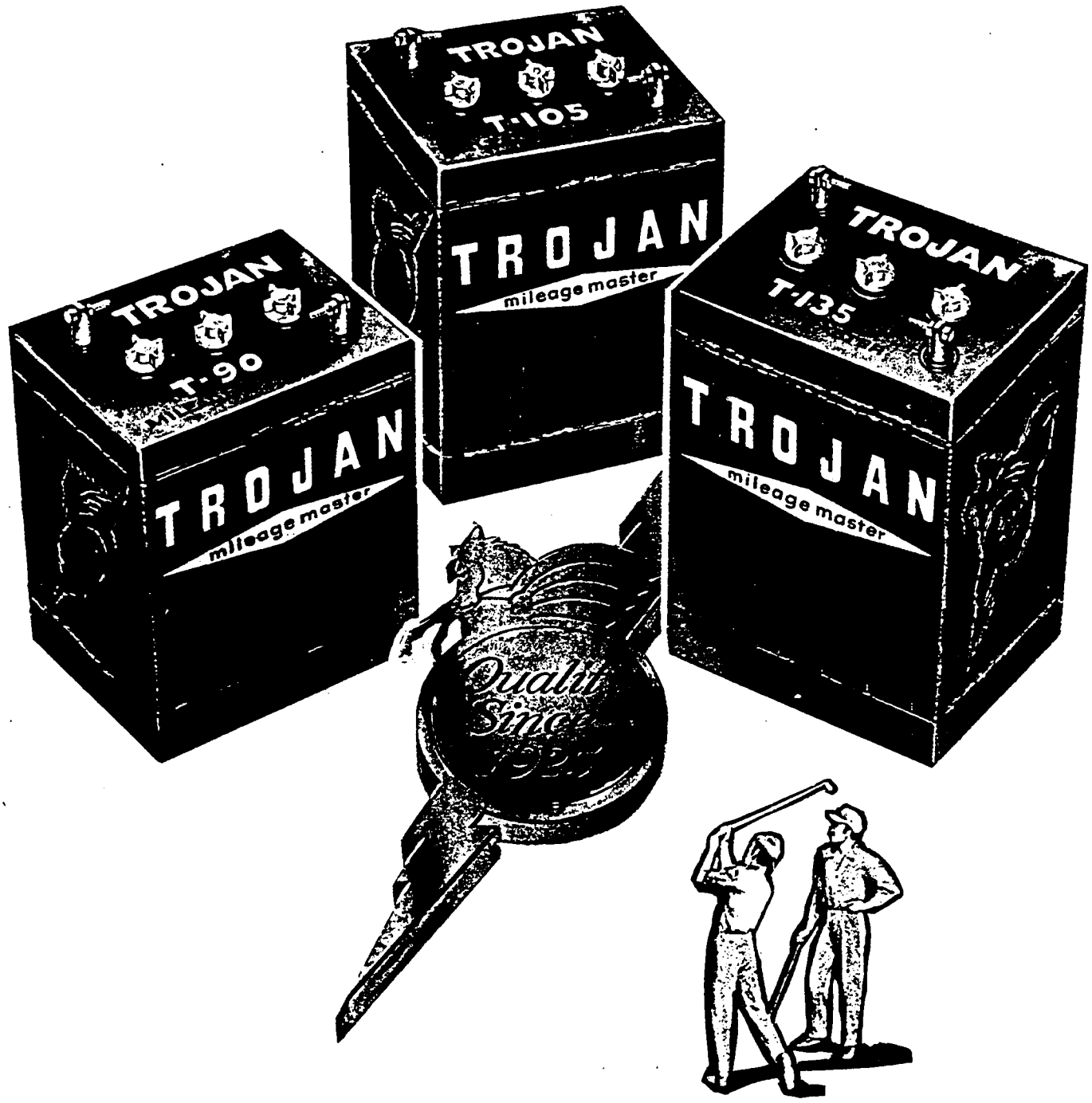
Lester's obligation under this warranty is strictly and exclusively limited to the repair or replacement of defective items. Lester issues this warranty in good faith and with full confidence in the workmanship and quality of Lester products.



PARTS LIST FOR LESTRONIC II CHARGER
MODEL 12935 TYPE 36LC40-8ET
115 VAC 60 HZ

PART NO.	QTY	DESCRIPTION
14911S	1	CASE ASSEMBLY
09749S	1	TRANSFORMER ASSEMBLY
09041S	1	HEATSINK ASSEMBLY, WITH DIODES
08849S	2	DIODE ASSEMBLY
02367S	1	AMMETER
09685S	1	ELECTRONIC TIMER ASSEMBLY
02390S	1	CAPACITOR, 6.0 MFD, 660 VAC
02008S	1	BUSHING, SP-2, INSULATOR FOR DC CORD
11813S	1	RECEPTACLE, MOTOR BASE, 125/15, HUBBELL
14963S	1	CORDSET, DC, 10/2, 86", NO PLUG
08774S	1	FUSE ASSEMBLY

TROJAN MILEAGE MASTER BATTERIES



TROJAN BATTERY COMPANY

12380 CLARK STREET • SANTA FE SPRINGS, CA 90670

(213) 946-8381 • (714) 521-8215 Toll Free (Outside Calif.) (800) 423-6569 (Excluding Alaska and Hawaii)

proper care and maintenance of electric vehicle

1. NEW BATTERY RECEIVAL AND INSTALLATION

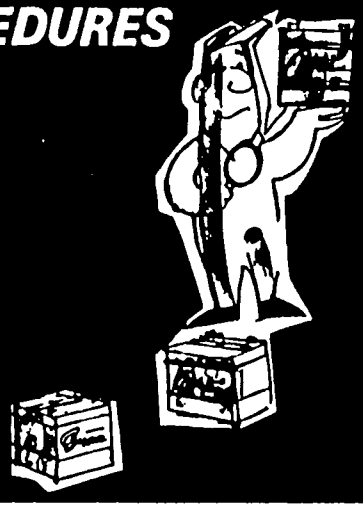


1. Always inspect incoming shipments of batteries for damage. Look for and pay particular attention for damage to or wet spots on the shipping cartons, examine those batteries for signs of breakage.
2. If damaged batteries are found secure acknowledgment of the damage from the carrier's representative and file a claim against the transportation company. Contact your supplier for battery replacement.
3. If batteries are received wet and not immediately placed in service, they must be charged at regular intervals as follows:

Storage Temperature	Charge
Below 40° F	None required
40° F to 60° F	Every 2 months
60° F and above	Once a month

4. Never stack one battery directly on top of another. Post damage and/or container damage can occur from improper stacking. If batteries are stored individually, place supporting boards between layers. Do not stack layers more than three (3) high and rotate stock so that the oldest batteries can be used first.
5. Dry charge batteries should be activated in accordance with instructions of the battery manufacturer.
6. Batteries should be installed in accordance with the vehicle manufacturer's instructions. Connections should be made tight enabling good contact between connector lugs and battery terminals. Always charge sets of batteries immediately after installation into the car.

2. MAINTENANCE-INSPECTION PROCEDURES



1. Water batteries at least once a week.
   a. Add only approved water to the cells. Distilled water is recommended, high mineral content water must not be used. Maximum allowable impurities in percent:Iron (.003), chloride (.004), fixed residue (.075).
   b. Remove vent caps and water batteries preferably after charging to prevent over flow of acid due to expansion.
   c. Fill all cells to the proper level. Do not overfill cells. Fill to level indicator or ½ inch over the top of the separators if there is no level indicator. Do not use a hose to water batteries.
   d. Spot check cells between weekly waterings to assure electrolyte is above separators. Excess water usage indicates the presence of any one or all of the following conditions which should be checked.
      1. Overcharging
      2. High temperature operation
      3. Nearing end of service life
   e. Do not allow the electrolyte level to drop below the top of the separators since this will lead to shortened battery life.
2. Clean batteries after weekly watering or when washing cars.
   a. Wash the tops of the batteries making sure the vent caps are in place. Do not allow water or other foreign matter to enter the cells.
   b. Use a solution of bicarbonate of soda and water to wash batteries if there is an accumulation of acid.
3. Inspection to insure good conditions which will give better battery service.
   a. When watering batteries inspect battery and other terminal connections for:
      1. Corrosion — If any exists, clean connection and apply a non-metallic grease or protective spray to retard further corrosion.
      2. Loose Connections — Be sure all connections are tight and that good contact is made between terminals.
      3. Broken or Frayed Cables — Be sure all cable connections are good and that no loose or broken wires are exposed. Replace any which look suspicious.
   b. Once a week after the batteries have been charged, spot check two (2) or more cells for specific gravity reading. Gravity should be 1.250 - 1.280. If low readings are noted:
      1. Check charger to insure that proper charge is being returned to the batteries.
      2. Check connections as specified under Inspection 3a.
      3. Check all cells to determine if batteries are near the end of life. This should be done to the same procedure as called for under Section IV covering "Trouble Shooting" of batteries.
   c. On a regular interval, check car as outlined in the instruction manual for:
      1. Brake drag
      2. Proper tire pressure
      3. Proper alignment
      4. Proper lubrication
      5. Proper operation of electrical system
      6. Proper operation of drive and transmission system
      7. Condition of charger plug and receptacle in car

      Any of these conditions which are detrimental to car operation will shorten battery life.

3. CHARGING PROCEDURE

1. Become familiar with instructions issued with the charger or car manual.
2. Batteries are to be charged after each day's use as soon as play has been completed. Charging between rounds is permissible if it is determined feasible to do so.
3. Do not charge batteries if car was not used that day.
4. Do not allow batteries to sit in discharged condition for prolonged periods of time.
5. Always be sure batteries are fully charged each day prior to starting play.

4. TROUBLE SHOOTING FOR WEAK OR BAD BATTERIES

When a car fails to operate properly performing less than one round of golf, the car is to be brought into the shop and the batteries examined as follows:

1. Check terminal connections for corrosion, loose connections and broken or frayed cables.
2. If terminal connections appear to be in good condition, check all cells with a hydrometer for variation in specific gravity among cells. A variation of .030 points or more between cells of a battery is cause for suspect. Mark the low cells.
3. Recharge the batteries as recommended by the manufacturer.
4. Read all gravities again after recharge. Be sure that batteries are fully charged at gravities of 1.260 to 1.280. If cells vary by .030 points or more it is an indication of possible trouble within that battery.
5. Connect a load tester to the set of batteries and discharge the batteries at 75 Amps and record the time to a terminal voltage of 31.5 volts. Testers are now available having an automatic Shut-Off at this voltage. New batteries should run a minimum of 75 minutes on this test.
   a. If the batteries run less than 40 minutes they have either reached the end of life or a defective battery is in the circuit. Battery replacement is then necessary.
   b. If batteries run 40-50 minutes they have lost capacity and may be nearing the end of their useful life. In golf car service one round of golf may be expected on an average golf course.
   c. If batteries run more than 50 minutes, they are in good condition and satisfactory for continued service. Prior to putting the car back in service it should be checked for the existence of other trouble as outlined in the instruction manual.

5. BATTERY REPLACEMENT

Defective Batteries (Premature Failures)

1. Defective battery can be determined either by observation of gravity variance at the end of the 75 Amp discharge (.030 or more points between cells of a battery) or by turning the discharge tester back on and determining the battery or cell which is defective by use of a voltmeter.
2. Mark the defective battery.
3. Recharge the batteries with the defective battery in the circuit.
4. Remove the defective battery and replace with new battery or battery of comparable age which is fully charged.

Worn Out Batteries

1. Remove old set of batteries.
2. Clean and recondition battery trays, holddowns and cables.
3. Inspect new batteries for broken containers and proper electrolyte level before installing in the car.
4. Install batteries in car being sure that they are properly held down, firm but not too tight.
5. Replace cables, being sure terminals and connectors are clean and connections are tight.
6. Apply a light coating of non-metallic grease or protective coating.

6. WINTER STORAGE OF WET BATTERIES

1. Prior to storing car, batteries should be cleaned, fully charged and properly leveled.
2. While in storage the batteries should be recharged to full charge at time intervals shown below:

Storage Temperature	Charge
Below 40° F	None required
40° F to 60° F	Every 2 months
60° F and above	Once a month

3. Check batteries after car has been removed from storage and before service begins. Follow inspection and trouble shooting procedures to determine the condition of the batteries.

Battery Council International

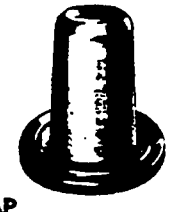
TROJAN MILEAGE MASTER BATTERIES

GROUP NUMBER	TYPE	VOLTS	REF. 20 HOUR RATE A.H.	75 AMPS TO 5.25 VOLTS AT 80° F MINUTES	OVERALL DIMENSIONS LENGTH	WIDTH	*HEIGHT	WEIGHT
GC-2	T-90	6	185	90	10-3/8	7-1/8	10-3/4	56
GC-2H	T-105	6	217	105	10-3/8	7-1/8	10-3/4	61
GC-2H	T-135	6	244	135	10-3/8	7-1/16	11-1/2	72

OTHER SPECIAL BATTERIES AVAILABLE FOR ELECTRIC VEHICLES.

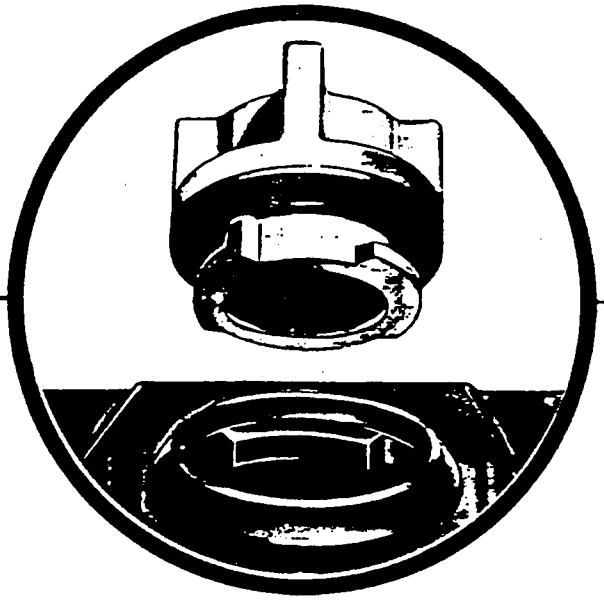
*TYPE OR TERMINAL WILL VARY HEIGHT SLIGHTLY

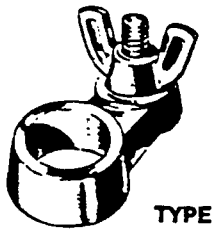
TROJAN "MILEAGE MASTER" TYPES FEATURE QUARTER-TURN VENT CAPS REDUCING SERVICE TIME 75%



TYPE AP

STRAIGHT POST



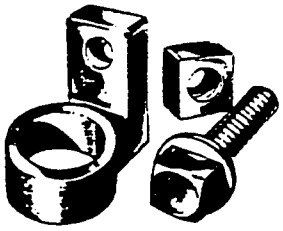


TYPE WT

WING NUT TERMINAL
3/16 or 5/16 Stud

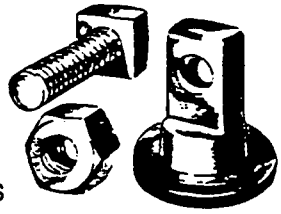
TYPE LT

ANGLE TERMINAL
5/16 Lead coated bolt



TYPE UT

UNIVERSAL TERMINAL



ALL BATTERIES COME WITH UNIVERSAL TERMINALS
UNLESS OTHERWISE SPECIFIED

DISTRIBUTED BY

MARK INDUSTRIES

TROJAN BATTERY COMPANY

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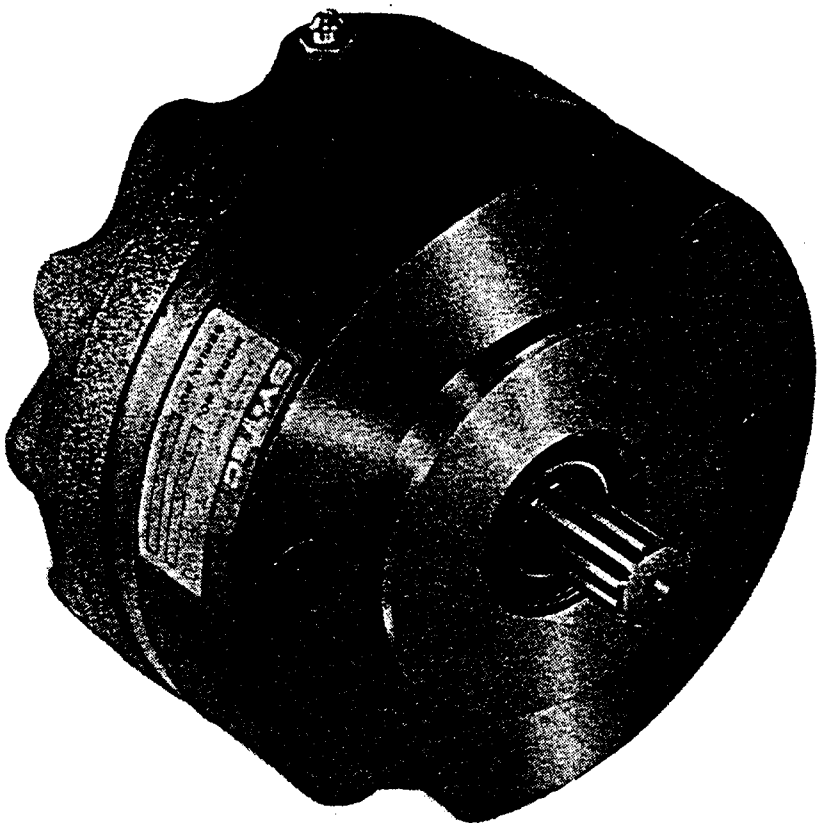
(213) 946-8381 • (714) 521-8215 Toll Free (Outside Calif.) (800) 423-6569 (Excluding Alaska and Hawaii)

SY·TEC SERIES

MULTIPLE DISC BRAKE

(dry design - SAE B size)

SERVICE MANUAL MICO



MARK INDUSTRIES Post Office Box 720, Long Beach, CA 90801

MICO INCORPORATED
MICO WEST / SY·TEC

MICO, INC.
1911 Lee Blvd., P.O. Box 2118, No. Mankato, MN U.S.A. 56002-2118
Phone: (507) 625-6426 / TELEX 910-565-2444

MICO WEST / SY TEC
701 East Francis St., P.O. Box 9058, Ontario, CA U.S.A. 91762-9058
Phone: (714) 947-4077 / TELEX 510-600-0132

FORM NO. 81-950-051 5/86

Printed in U.S.A.

REV.

TYPICAL BRAKE

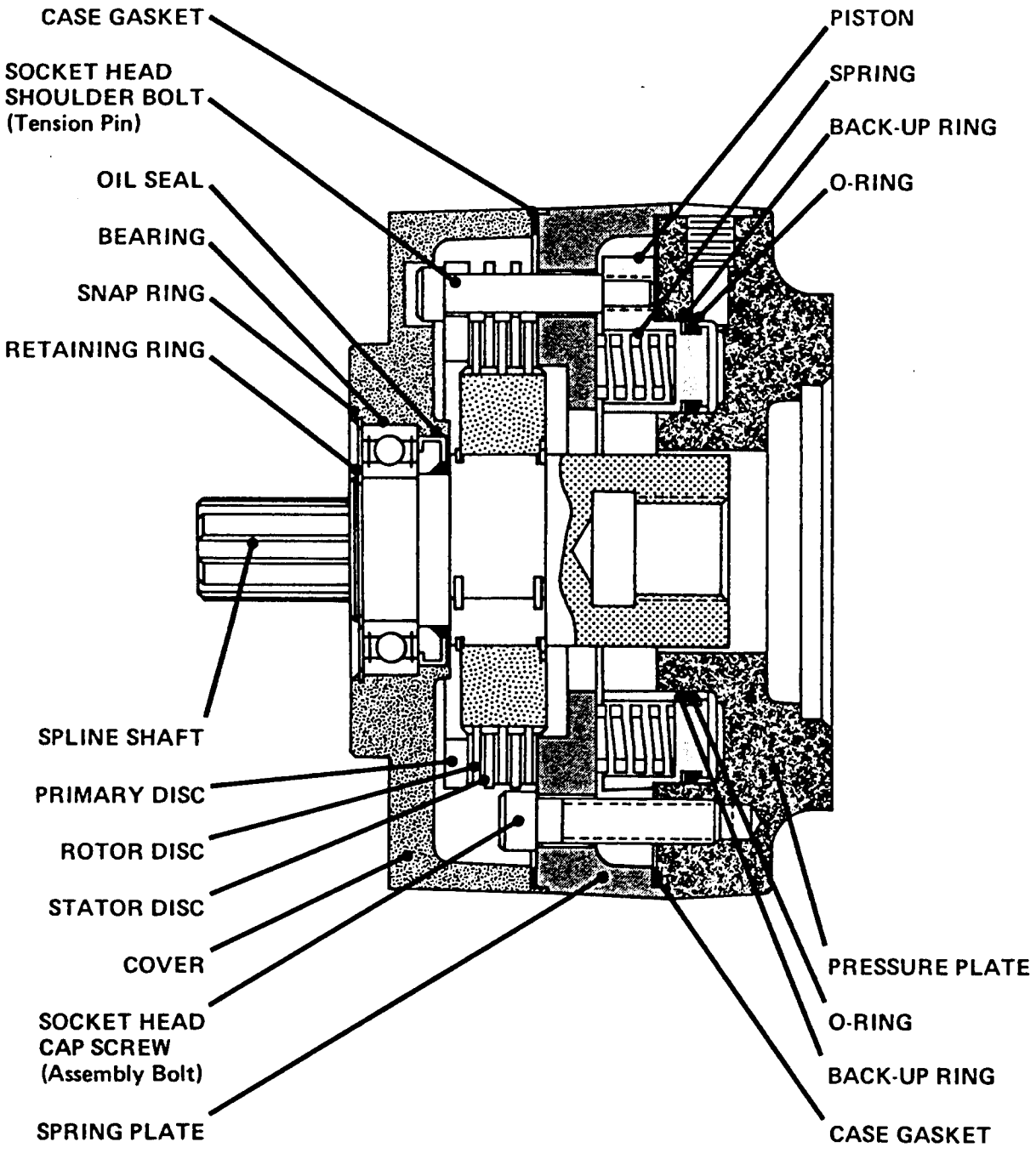


FIGURE 1

PRINCIPLES OF OPERATION

These brakes are spring-set, hydraulically release, multi-disc brakes. They are used primarily for holding loads, vehicles, conveyors, etc. in place when the hydraulic drive system is shut down or fails. Although the brakes are rated at 3,000 psi, they only require from 100 psi to 220 psi to make them function normally. The exact pressure required for operation is dependent upon the number of springs used to generate the torque necessary to hold the designed load. Thus, a brake with a full compliment of springs, will generate the highest level of torque and require approximately 220 psi to fully release the brake and provide adequate running clearance for the individual discs. A brake with 1/2 of the full spring compliment will have 1/2 as much torque and will require only 100 psi to fully release the brake. Consult catalog to choose the torque which best suits your design parameters.

It is very important to remember that any pressure on the brake's release piston will directly effect the level of torque.

Two application examples.

1. The brake has a release pressure of 200 psi. The actuation pressure is provided by a charge pump. During certain phases of the machine's operation, the charge pump pressure dips from 200 psi to 100 psi. At 200 psi, the brake runs free (zero torque) but at 100 psi the brake will generate slightly less than half of its rated torque. The brake will drag – failure may occur. In this case, a brake should be selected which has a lower release pressure.
2. A brake has a release pressure of 200 psi. The system is set up to hold a load when a variable pump is shifted into neutral. Everything is running fine until the filter clogs, causing a build-up of back pressure in the return line to the tank. At a pressure of 60 psi, the brake will lose 25% of its holding torque; thus the load may slip. The situation can be corrected by replacing the filter or adding an extra margin of safety to your required brake torque in the initial design.

These brake are designed to give thousands of trouble-free hours of service when set up correctly in the hydraulic circuit.

DESCRIPTION OF MODEL NUMBERS

B - [**] [**] [**] - [*] [*]

OUTPUT FACE
SAE B Mt. (2) Bolt

OUTPUT SPLINE
13–13T 16/32
06–1.0 Dia. 6B
25–1.25 Dia. Keyed

INPUT SPLINE
13–13T 16/32
06–1.0 Dia. 6B
25–1.25 Dia. Keyed

TORQUE

Code	Std.	High	Release
40		4000	190
28	2800		190
35		3500	150
24	2400		150
29		2900	135
19	1900		135
25		2500	120
16	1600		120
18		1800	100
12	1200		100

INPUT FACE
B–2-Bolt Mt.
A–MAB (4) Bolt &
SAE A2 Bolt

OPTIONS
S–Speed Sensor
Z–Wet
D–Double Bearing

DISASSEMBLY

1. Remove 2 flat head assembly bolts (items 1). A suitable holding fixtue is useful to keep brake in position.
2. Tap female end of spline shaft assembly (item 8) and spring plate (item 14) with soft mallet to separate cover. If sections will not separate, use a screwdriver to carefully pry sections apart.
3. Remove case gasket. (item 7) from cover (item 6).
4. Remove retaining ring (item 2) from spline shaft assembly (item 8).
5. Remove spline shaft assembly (item 8) from cover (item 6) by tapping male end of spline shaft assembly with soft mallet.
6. Remove snap ring (item 3) from cover (item 6) and press out oil seal (item 5) and bearing (item 4) if required.
7. Remove four socket head shoulder bolts (items 10). A suitable holding fixture is useful to hold brake in position.

   CAUTION: **Do not remove shoulder bolts without pressurization of brake (approx. 200 psi) or damage may result.**

8. Remove primary disc (item 11), three rotor discs (items 12) and two stator discs (items 13).
9. Remove 2 socket head cap screws (items 9).
10. Remove spring plate (item 14).
11. Remove case gasket (item 7) from spring plate (item 14).
12. Before removing springs (items 15), note pattern for reassembly purposes.
13. Remove piston (item 16) by carefully exerting hydraulic pressure through brake release port on pressure plate (item 21).
14. Remove outside and inside o-rings (items 18 & 20) and outside and inside back-up rings (items 17 & 19) from piston (item 16).

    CAUTION: **Care must be taken so as not to scratch or mar piston.**

ASSEMBLY

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Use an alkaline wash to clean parts before assembly.
2. Press oil seal (item 5) into bore until it is flush with bearing shoulder. Open side of oil seal must face toward the front side of cover (item 6).
3. Press bearing (item 4) into position until it bottoms out on oil seal borestep.
4. Install snap ring (item 3) into cover (item 6).
5. Press spline shaft assembly (item 8) into bearing (item 4) until shaft bottoms on shaft shoulder. Bearing innner race must be supported during this operation.
6. Install retaining ring (item 2) on spline shaft assembly (item 8).
7. Install back-up rings (items 17 & 19) on piston (item 16) toward spring pockets.
8. Install o-rings (items 18 & 20) on piston (item 16). Be sure o-rings are flat and all twists removed.

   CAUTION: **Care must be taken so as not to scratch or mar piston.**

9. Lubricate piston (item 16) with type fluid used in the system. Carefully press piston into pressure plate (item 21). Be sure piston is aligned correctly at all times and that there are no extrusions. Press piston until it bottoms on pressure plate (item 21).
10. Install six springs (items 15) according to pattern noted during disassembly. Different colored springs must be alternated.
11. Apply a bead of 3M-08001 adhesive on the spring plate (item 14), pressure plate (item 21) and cover (item 6) sealing surfaces. Affix case gaskets (item 7) to cover (item 6) and spring plate (item 14).
12. Place unit on a press. Using fixture, depress and install two oil dipped, socket head assembly bolts (item 9). Torque bolts to 40 ft. lbs. A suitable holding fixture is useful to hold brake in position.
13. Install stator discs (item 13) and rotor discs (item 12). Begin with a rotor disc (item 12) and alternate with stator discs (item 13).
14. Install primary disc (item 11).
15. Align discs and partially screw in four oil-dipped, socket head shoulder bolts (item 10). Inspect for free movement of stack. Pressurize brake release port (approx. 200 psi) to release discs. Torque shoulder bolts to 20 ft. lbs. and release pressure. A suitable holding fixture is useful to hold brake in position.
16. Install cover (item 6) using flat head assembly bolts (item 1). Torque bolts to 45 ft. lbs.

FOR REPAIR KIT INFORMATION REFER TO PAGE 7.

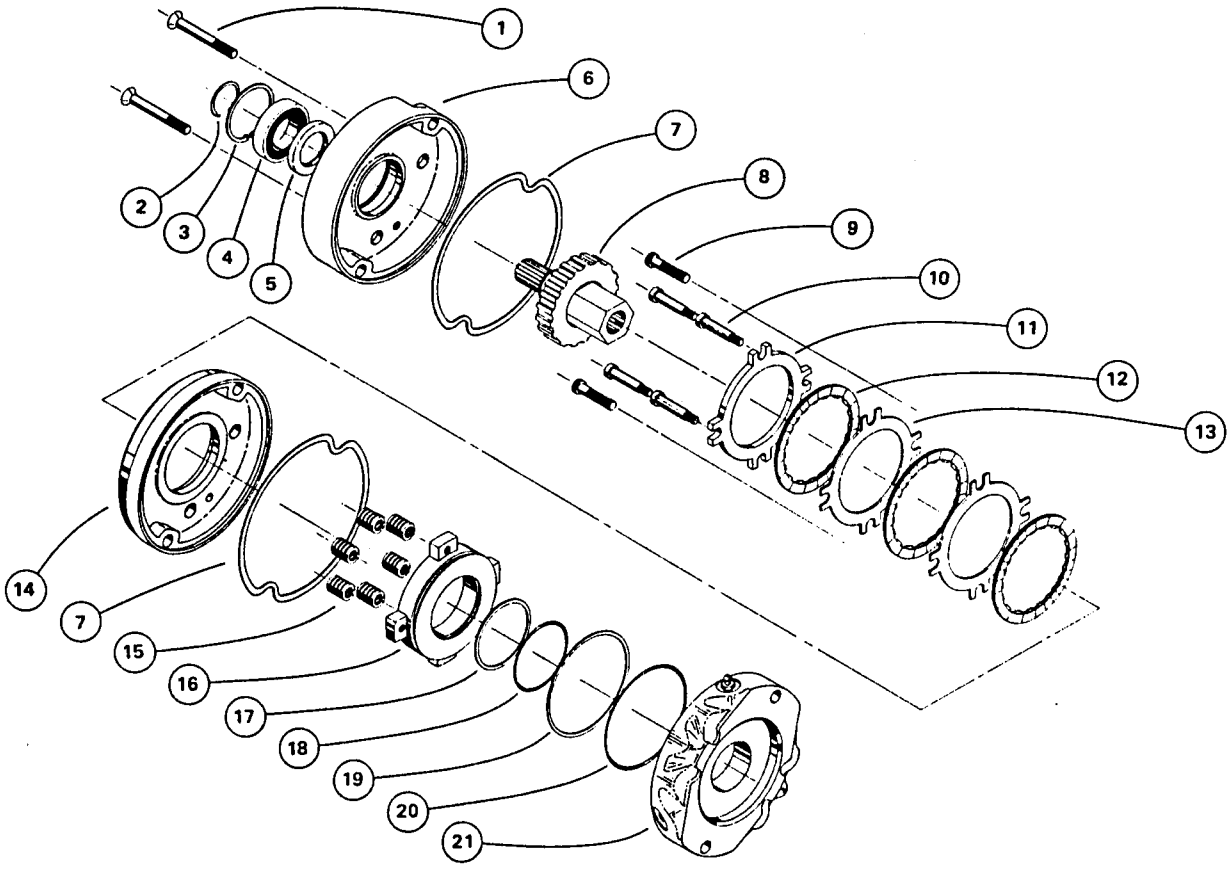


FIGURE 2

PARTS LIST

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	FLAT HEAD ASSEMBLY BOLTS (2)	11	PRIMARY DISC
2	RETAINING RING	12	ROTOR DISCS (3)
3	SNAP RING	13	STATOR DISCS (2)
4	BEARING	14	SPRING PLATE
5	OIL SEAL	15	SPRINGS (6)
6	COVER	16	PISTON
7	CASE GASKETS (2)	17	BACK-UP RING
8	SPLINE SHAFT ASSEMBLY	18	O-RING
9	SOCKET HEAD CAP SCREWS (2) (Assembly Bolts)	19	BACK-UP RING
10	SOCKET HEAD SHOULDER BOLTS (4) (Tension Pins)	20	O-RING
		21	PRESSURE PLATE

BLEEDING

1. Install brake in system and connect pressure lines.
2. Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi during bleeding.
3. Apply sufficient pressure to release brake and check for proper operation in system.

SERVICE DIAGNOSIS

PROBLEM	CAUSE	EXPLANATION	ACTION
Brake slips	A. Excessive pressure in hydraulic system	If there is back pressure in the brakes actuation line, the holding torque of the brakes is reduced.	Check filters, hose size, restrictions in other hydraulic components.
	B. Oil in brake if designed for dry use	Dry linings generate 66% more torque than linings saturated with oil. If the brake has oil in it, check the type of pil hydraulic or gearbox. 1. Gearbox oil 2. Hydraulic oil 3. Hydraulic oil	Replace oil seal in brake Check motor seal Check piston seals Note: Internal components will need to be inspected, cleaned and replaced as required.
	C. Disc plates worn	The thickness of the disc stack sets the torque level. A thin stack reduces torque.	Check disc thickness
	D. Springs broken or have taken a permanent set	Broken or set springs can cause reduced torque - a rare occurrence	Check release pressure (see spring replacement)
Brake drags or runs hot	A. Low actuation pressure	The brake should be pressurized to minimum of 20 psi over the specified release pressure under normal operating conditions. Lower pressures will cause the brake to drag thus generating heat.	Place pressure gauge in bleed port & check pressure with system on
	B. Bearing failure	If the bearing should fail, a large amount of drag can be generated	Replace bearing
	C. Oil in brake	Excess fill of oil in sump condition thru wet brakes can cause the unit to run hot. Also excessive rpm in sump condition.	Drain oil and refill as specified for brakes Switch to flow thru cooling.
Brake will not release	A. Stuck valve or clogged	Brakes are designed to come on when system pressure drops below stated release pressure. If pressure cannot get to brake, the brake will not release.	Place pressure gauge in bleed port - check for adequate pressure - Replace defective line or component
	B. Bad o-rings	If release piston will not hold pressure, brake will not release.	
	C. Discs frozen	Sy-Tec brakes are designed for only limited dynamic braking. A severe emergency stop or prolonged reduced release pressure operation may result in this type of damage.	Replace disc stack

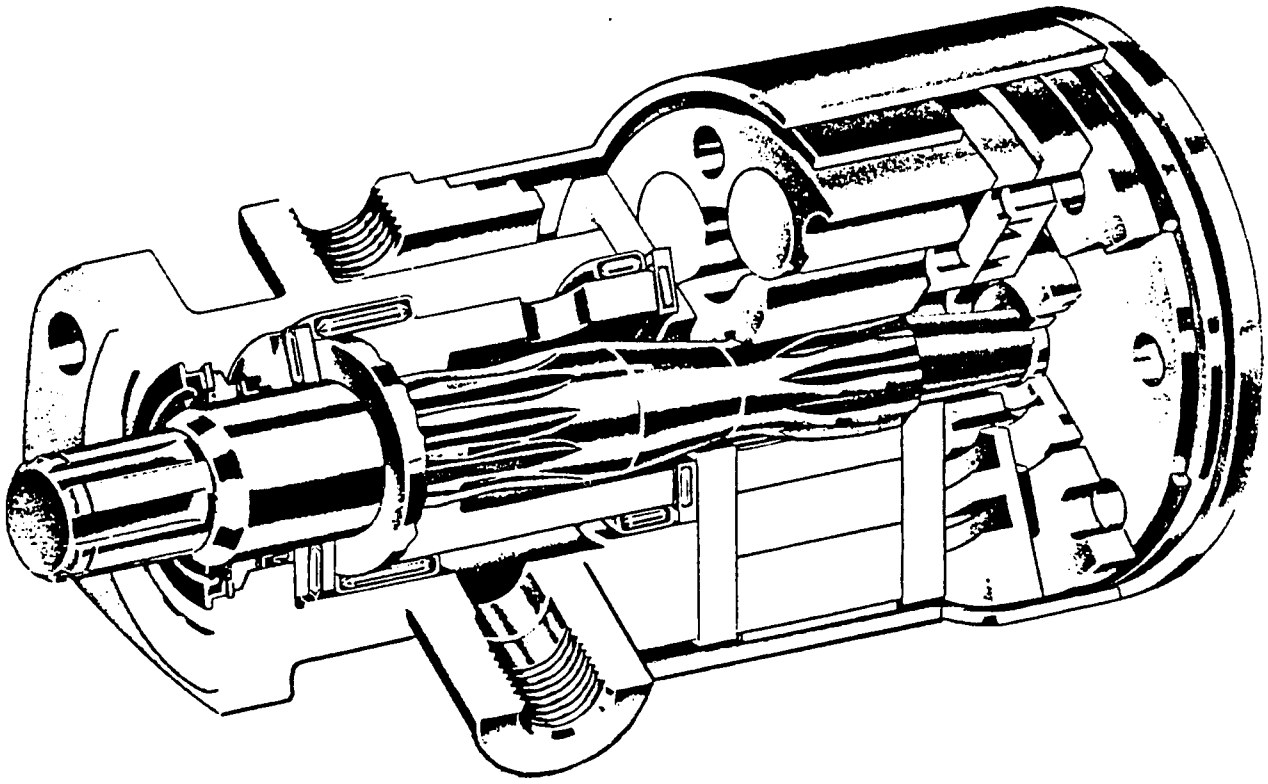
REPLACEMENT KITS

PART NUMBER	KIT DESCRIPTION	KIT INCLUDES
RK-1 plus your brake model number	Inspection Kit	Face Gaskets Case Gaskets
RK-2 plus your brake model number	Oil Seal & Gasket Replacement Kit	Face Gaskets Case Gaskets Oil Seal
RK-3 plus your brake model number	O-ring & Back-up Ring Replacement Kit	Face Gaskets Case Gaskets Oil Seal O-Rings Back-up Rings Loc-tite
RK-4 plus your brake model number	Lining Replacement Kit	Face Gaskets Case Gaskets Primary Disc Stator Discs Rotor Discs
RK-5 plus your brake model number	Bearing Replacement Kit	Face Gaskets Case Gaskets Bearing Oil Seal
RK-6 plus your brake model number	Spring Replacement Kit	Face Gaskets Case Gaskets Springs
RK-7 plus your brake model number	Pressure Override Seal Replacement Kit	Face Gaskets Case Gaskets Oil Seal

TORQMOTOR®

SERVICE PROCEDURE

MAB SERIES



TRW®
ROSS GEAR DIVISION
LAFAYETTE, INDIANA 47902

The *MAB* TORQMOTOR
- Low Speed,
- High Torque
- Hydraulic Motor.

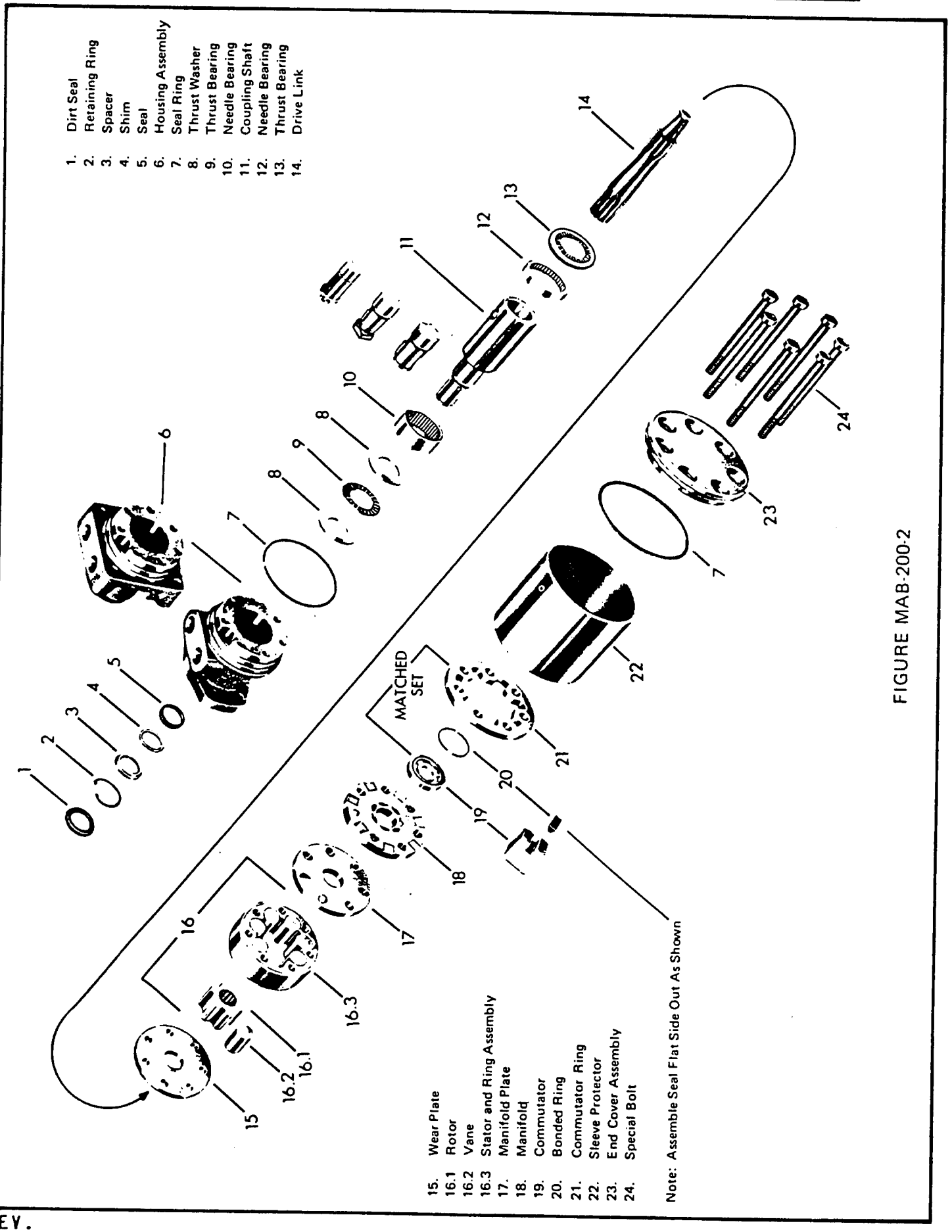


FIGURE MAB-200-2

SERVICE PROCEDURE

Preparation Before Disassembly

Remove port hole plugs before attempting to rotate shaft. Drain the motor assembly by turning the output shaft. Wash the complete motor in solvent and remove all particles of dirt from the exterior and blow dry before placing on work bench.

Clean Work Conditions

If it is necessary to disassemble the TORQMOTOR, make certain to use a clean work bench (a piece of clean wrapping paper makes an excellent and disposable top). The hands and tools of the repairman should be clean, and the operation should be carried out in a sheltered area free from drafts that may carry foreign material into the disassembled pieces. (Precision fits in the TORQMOTOR needs "white room" type care.)
Caution: Avoid wiping parts with a cloth, as lint and foreign particles may adhere to the working parts of the TORQMOTOR.

Handling

Care must be taken in handling the close fitting parts, as nicks and mutilations will result in serious damage.

REPLACEMENT OF HIGH PRESSURE SEAL (5) IN TORQMOTOR

(Reference Figure MAB-200-2)

1. Remove dirt seal (1) and retaining ring (2), if burr exists on retaining ring groove, remove with a scraping tool.
2. Set the motor with coupling shaft (11) down in a suitable clean can. Plug "A" port and connect "B" port to 120 psi air hose, or use a piston type hydraulic hand pump. Note: The air connection should be made with provisions for quick shut-off after the spacer (3), shim (4) and seal (5) have been ejected.
3. Apply clean grease to new seal (5) and assemble into housing assembly (6) with lip side inward.
4. Assemble shim (4), spacer (3) and retaining ring (2), be sure the rounded edge of the retaining ring is faced inward. Apply a small amount of clean grease to the back side of new dirt seal (1) and assemble into housing assembly (6).

TORQMOTOR DISASSEMBLY

(Reference Figure MAB-200-2)

1. In a vise, clamp down on the housing assembly (6) port bosses with the coupling shaft (11) pointed down.
2. Using wrench with a 12 point 9/16" socket, remove the seven special bolts (24) and place them on the work bench.
3. Remove the end cover assembly (23) and seal ring (7) by inserting screw driver between end cover assembly (23) and sleeve protector (22). Pry up end cover assembly (23) and lift from unit with seal ring (7) attached.
4. Remove seal ring (7) from end cover assembly (23) and discard.
5. Remove the commutator ring (21), commutator (19), bonded ring (20) and manifold (18) by using two of the special bolts (24) as a lifting tool, insert the two special bolts (24) into two holes and lift out the previously mentioned parts.
6. Remove bonded ring (20) from commutator (19) by using an air hose, blow air down into ring groove until bonded ring (20) is lifted out and discard.
7. Inspect manifold (18) for cracks and replace with new manifold if cracks are visible.
8. Remove manifold plate (17) by using the two special bolts (24) and method previously mentioned.
9. Remove rotor assembly (16), wear plate (15) and drive link (14) by using the two special bolts (24) and method previously mentioned.
10. Remove vanes (16.2) and rotor (16.1) from rotor assembly (16). Use caution not to drop these parts when handling.
11. Inspect rotor (16.1) outside lobes for pits and marks. If pits or wear marks are visible, discard rotor (16.1) and replace complete rotor assembly (16) with a new rotor assembly.
12. Remove thrust bearing (13).
13. Remove coupling shaft (11).
14. Remove sleeve protector (22) by inserting screw driver between sleeve protector (22) and housing assembly (6) and pry up. If rust exists on ends of sleeve protector (22), remove by sanding lightly.
15. Remove seal ring (7) from housing assembly (6) and discard.
16. Remove housing assembly (6) from vise, turn over and reclamp housing assembly in vise so that dirt seal (1) is pointed upward.
17. Remove dirt seal (1), retaining ring (2), spacer (3), shim (4) and seal (5) from housing assembly (6). Discard dirt seal (1) and seal (5). If burr exists on retaining ring groove, remove with a scraping tool.

18. Do not remove thrust washers (8), thrust bearing (9) and needle bearings (10) and (12) unless there is absolute evidence of damage. Needle bearings should be free to rotate and not show signs of surface breakdown. If needle bearing (10) requires replacement, use a 1.490 maximum diameter shaft and press out thrust washers (8), thrust bearing (9) and needle bearings (10) and (12). The housing assembly face should be placed on a block of wood during the pressing operation to protect it. Discard thrust washers, thrust bearing and needle bearings and replace with new parts as parts may have been damaged when being pressed out.

If needle bearing (12) needs replacement use a bearing puller to remove needle bearing, care should be taken to not damage the housing assembly (6) face with the bearing puller.

TORQMOTOR ASSEMBLY

(Reference Figure MAB-200-2)

Important: Before starting assembly, clean all parts with a clean petroleum base solvent and air dry. Do not wipe dry with rags. Be sure all dried paint lips have been removed from edges of lapped surfaces. Unless otherwise indicated, do not oil or grease parts before assembly. Note: Lubricate All Seals before assembly with SAE 10W-40 SD oil or clean grease.

1. In a vise, clamp down on the housing assembly (6) port bosses with the small bore end pointed up. Assemble new seal (5) with lip side inward, assemble shim (4), spacer (3) and retaining ring (2). Be sure the rounded edge of the retaining ring (2) is faced inward.

2. Apply a small amount of clean grease to the back side of new dirt seal (1) and assemble into housing assembly (6).

3. Remove housing assembly (6) from vise, turn over and reclamp in vise with large bore end up. (*** See Note.)

4. Apply "Scotch" tape around splines or keyway on coupling shaft (11) to prevent damaging seal (5). Assemble coupling shaft (11).

5. Assemble thrust bearing (13).

6. Assemble drive link (14).

7. Assemble wear plate (15).

8. Assemble rotor assembly (16) with counterbore in rotor (16.1) down.

9. Assemble manifold plate (17), manifold (18) and commutator ring (21).

10. Assemble commutator (19) and new bonded ring (20).

11. Assemble new seal rings (7) on housing assembly (6) and end cover assembly (23).

12. Apply a generous amount of "STP" to both ends on sleeve protector (22) and assemble over unit and onto unit and onto housing assembly (6). Make sure sleeve protector is setting in a non-cocked position.

13. Assemble end cover assembly (23) onto sleeve protector (22) in a non-cocked position.

14. Assemble seven special bolts (24) and screw in finger tight. Alternately and progressively tighten the seven special bolts to pull end cover assembly (23) and sleeve protector (22) down into place. (Torque the seven special bolts to 50 ± 5 ft. lbs.)

*** NOTE
If it was necessary to remove thrust washers (8), thrust bearing (9), needle bearing (10) and needle bearing (12), the following assembly procedure must be followed.

1. Assemble new thrust washer (8), new thrust bearing (9), new thrust washer (8) in this order into housing assembly (6).

2. Press in new needle bearing (10) with suitable tools to a 2.365 ± .030 dimension into housing assembly (6). Note: Bearing should indicate which side to press against.

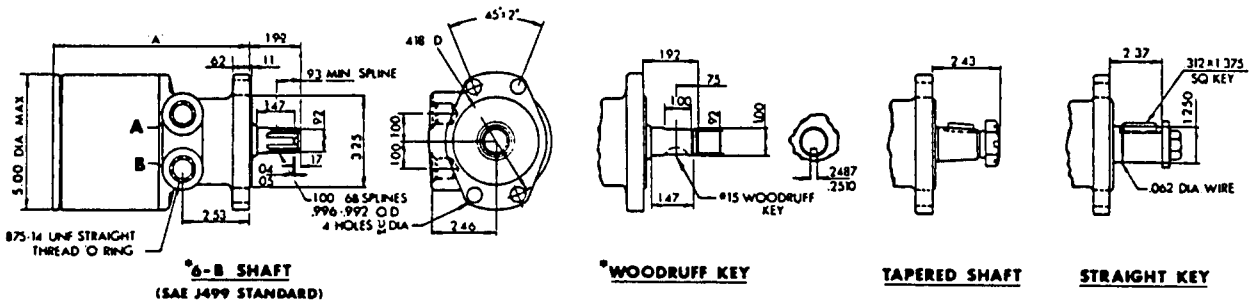
3. Press in new needle bearing (12) with suitable tools to a .18 ± .03 dimension into housing assembly (6). Note: Bearing should indicate which side to press against.

TROUBLE SHOOTING

Trouble	Cause	Remedy
Oil leakage	1. Hose fittings leaking	(a) Tighten fittings
		(b) Replace O ring in 7/8", 14 thread fitting
	2. Seal ring leak	(a) Replace seal ring by disassembling motor
	3. Special bolt leakage	(a) Tighten single bolt to 50 foot lbs.
	4. Faulty high pressure seal	Remove dirt seal, retaining ring and spacer. Blow out seal. Replace seal.
	5. Coupling shaft and high pressure seal	Replace coupling shaft and seal package.
High loss of speed, under load.	1. Lack of sufficient oil supply	(a) Adjust faulty pressure relief valve.
		(b) Repair worn pump.
		(c) Use correct oil for temperature of operation.
	2. High internal motor leakage.	(a) Replace worn rotor set with new rotor assembly
		(b) Replace worn commutator ring
		(c) Replace worn manifold
		(d) Replace worn wear plate.
Low mechanical efficiency or undue high pressure required to operate TORQMOTOR	1. Line blockage	(a) Replace blocked line.
	2. Internal Interference.	(a) Correct clearance of rotor set. (Replace rotor set)

PROVISIONING DATA

STANDARD MOUNT

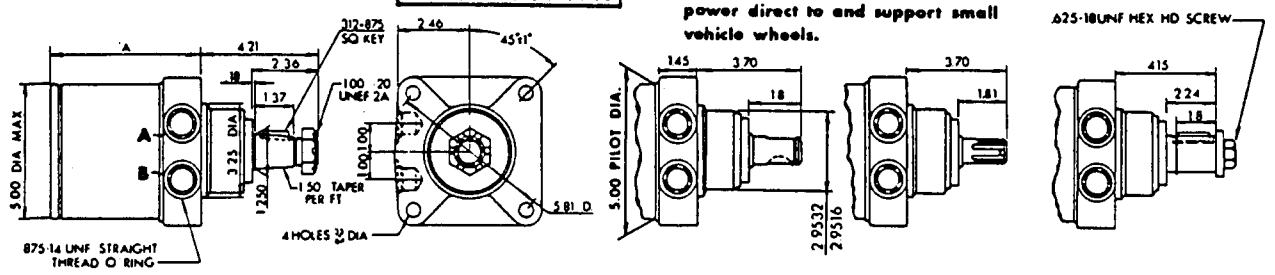


*6-B SHAFT (SAE J499 STANDARD) | *WOODRUFF KEY | TAPERED SHAFT | STRAIGHT KEY

WHEEL MOUNT

Use this design mounting when maximum side load is applied to the output shaft.

The Wheel Mount design (w/ 1-¼ taper output shaft) can be used to apply power direct to and support small vehicle wheels.



TAPERED SHAFT (SAE J501 STANDARD) | *WOODRUFF KEY | *6-B SHAFT | STRAIGHT KEY

*The 6-B Spline shaft and Woodruff Key shaft are machined for a WALDES TRUARC Snap Ring No 5100-100 (or equivalent)

MOTOR SERIES	DISPLACEMENT CU. IN. / REV.	DIMENSION "A" STD. MTG.	DIMENSION "A" WHL. MTG.	APPROX RPM WITH 10 GPM NO LOAD	APPROX. RPM WITH 10 GPM @1500 PSI	THEO. TORQUE IN. LBS/100 PSI	IN. LB TORQUE @ 1500 PSI STARTING	IN. LB TORQUE @ 1500 PSI RUNNING
MAB 08	5.9	7.409	5.630	400	365	94	1,040	1,250
MAB 16	11.8	7.910	6.131	200	180	188	2,150	2,850
MAB 24	17.7	8.410	6.631	130	115	282	3,600	4,150
MAB 40	29.6	9.410	7.631	78	65	470	6,050	6,800

Dimensional Values Shown Are Reference.

MAB TORQMOTOR

NOTE: System Relief Valve Setting from 2,000-3,000 PSI Require Prototyping and Evaluation by Sales Engineer.

SPECIFICATION & IDENTIFICATION TAG GUIDE

EXAMPLE: MAB 08 0 02

SERIES — MAB

ROTOR WIDTH IN $\frac{1}{16}$'S
- 08
- 16
- 24
- 40

MOUNTING & SHAFT
- 02 STD. MTG. 6-B SHAFT
- 03 WHL. MTG. TAPERED SHAFT
- 04 STD. MTG. TAPERED SHAFT
- 05 WHL. MTG. 6-B SHAFT
- 08 STD. MTG. WOODRUFF KEY
- 09 WHL. MTG. WOODRUFF KEY
- 10 STD. MTG. STRAIGHT KEY
- 11 WHL. MTG. STRAIGHT KEY

NISSAN ENGINE

OPERATION & MAINTENANCE MANUAL

MODEL A SERIES

15-A

Foreword

This booklet has been prepared to provide the necessary information for the operation, inspection and maintenance of the Nissan Engine.

We urge you to follow the recommendations contained in this booklet, so that the Nissan Engine will remain free of trouble throughout its working life. Please familiarize yourself with this booklet, and refer to it when necessary.

If you encounter any problems with your Nissan Engine, contact the authorized Nissan dealer in your area.

All information, specifications and illustrations in this manual are on a basis of the latest data obtainable at the time of the publication. Nissan reserves the right to make changes or improvements at any time without notice.

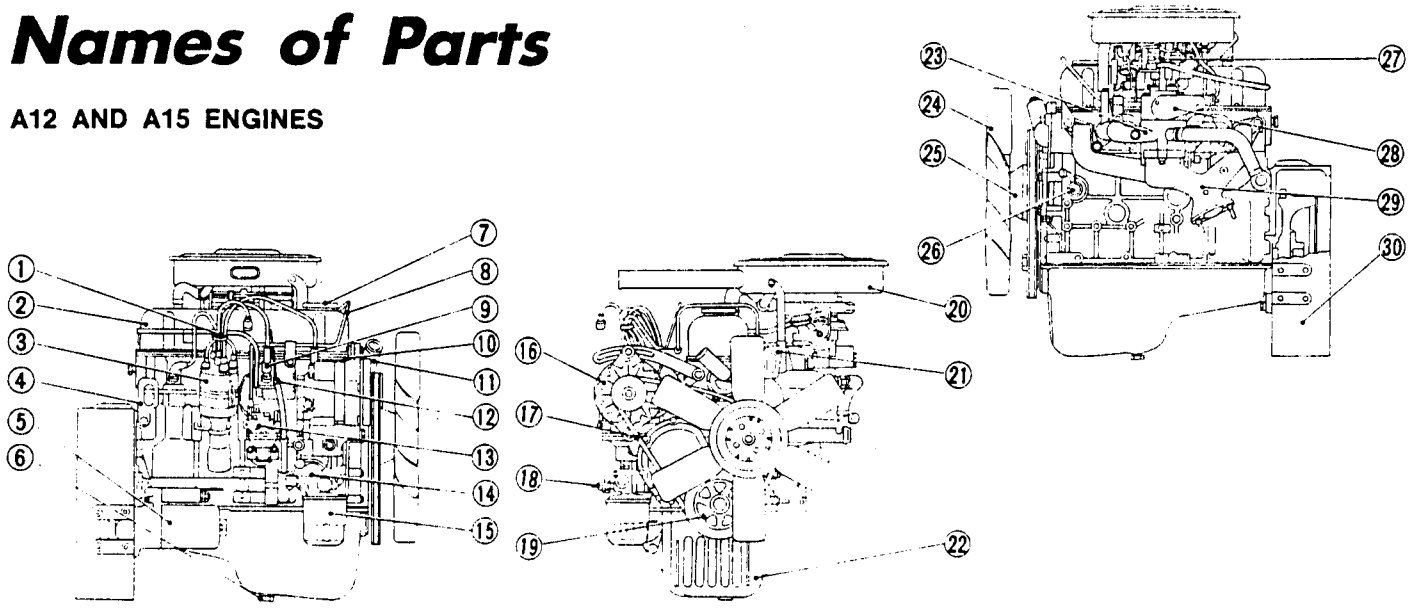
NISSAN

NISSAN MOTOR CO., LTD.
Tokyo, Japan

Printing: November 1985 (02)
Publication No. OM6E-A12NG0

Names of Parts

A12 AND A15 ENGINES



1 High tension cable
2 Rocker cover
3 Distributor
4 Rear engine slinger
5 Starter motor
6 Oil drain plug
7 Oil filler cap
8 Fuel pipe
9 Spark plug
10 Thermo sender
11 Water outlet
12 Oil level gauge
13 Fuel pump
14 Oil pump
15 Oil filter
16 Alternator
17 Fan belt
18 Oil pressure switch
19 Crank pulley
20 Air cleaner
21 Front engine slinger
22 Oil pan
23 Intake manifold
24 Cooling fan
25 Water pump
26 Water outlet
27 Carburetor
28 Governor
29 Exhaust manifold
30 Flywheel housing

Operation

HANDLING OF NEW ENGINE

The life and performance of an engine are greatly influenced by how it is handled and serviced during the initial period.

Operate the engine by observing the following the precautions during the initial 100 hours of operation.

Cautions in operation

1. After starting, warm the engine thoroughly by means of warning-up operation until the cooling water temperature rises above 50°C (122°F).
2. Never attempt to race the engine under non-loaded conditions.
3. Always maintain the operating speed of the engine below 70% of the maximum engine rpm.
4. Avoid overloading.

ENGINE HANDLING PRECAUTIONS

When handling the engine, be sure to observe the following precautions:

When starting the engine

1. Check the engine oil and coolant level, and refill if necessary.
2. After the engine starts, make sure that the oil and charge warning lamps are off.
3. Warm up the engine until it runs smoothly, emitting normal exhaust gases.
4. During this warming up operation, or when the cooling water the cooling water temperature is still low, never attempt to race the engine.

During engine operation

1. During operation, always make sure that the cooling water temperature and lubricating oil pressure are both normal. Normal cooling water temperature is 75 to 85°C (167 to 185°F).

   Oil pressure is normal if the "OIL" warning lamp remains OFF during engine operation.
2. Always be aware of the condition of the engine, paying attention to any abnormal vibration, noise or other unusual circumstances. If any abnormality is found, immediately stop the operation, examine the cause, and make the necessary correction.

When stopping the engine

Upon completion of operation, idle the engine for some time to lower its temperature before stopping. This procedure will help to extend the engine life.

Note that stopping the engine immediately after heavily loaded operation will deteriorate the engine because it is still in a very hot state.

Others

Perform periodical inspection and replacement of the following items:

Engine oil, oil filter, air cleaner element, fuel filter element.

ENGINE SPECIFICATIONS

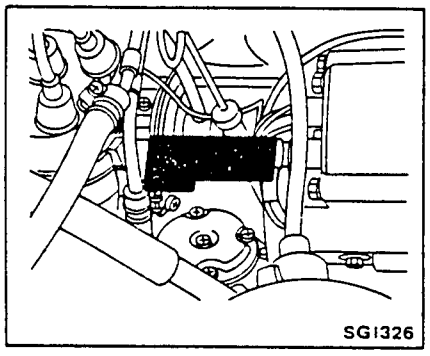
Item \ Engine model	A15
Engine general specifications	
Classification	Gasoline
Cycle	4
No. of cylinders and arrangement	4, in-line
Valve arrangement	O.H.V. (Overhead valve)
Bore x stroke in	2.99 x 3.23
Displacement cu in	90.80
Compression ratio	9.0
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Valve clearance (Hot) in	
Intake	0.014
Exhaust	0.014
Engine idle speed rpm	650
Ignition timing at idle speed B.T.D.C. degree/rpm	10°/650
Recommended minimum octane number (RON)	88
Engine oil capacity US qt	
With oil filter	3-3/8
Without oil filter	2-7/8

Item \ Engine model		A15
Lubrication system		
Oil pump type		Trochoid gear
Oil filter type		Paper element (Cartridge)
Cooling system		
Water pump type		Centrifugal
Thermostat operating temperature	°F	170 ... For tropical area 180 190 ... For cold area
Engine fuel system		
Carburetor type		Down draft, 1-barrel
Air cleaner		
Filter type		Dry paper
Alternator		
Model	MITSUBISHI	A1T24371
Capacity	Volts- Amps	12-35
Voltage regulator model	MITSUBISHI	RQB2220B5
Starter motor		
Model	MITSUBISHI	M2T20181
Capacity	kW	0.8
Ignition system		
Firing order		1-3-4-2
Ignition coil model	MITSUBISHI	HP5-13E10
Distributor model	MITSUBISHI	T3T03581
Spark plug	NGK	B4ES

ENGINE SERIAL NUMBER LOCATION

The engine serial number is stamped on the right side of cylinder block.

A15 – XXXXXX X
- Serial No.
- Engine model


SGI326

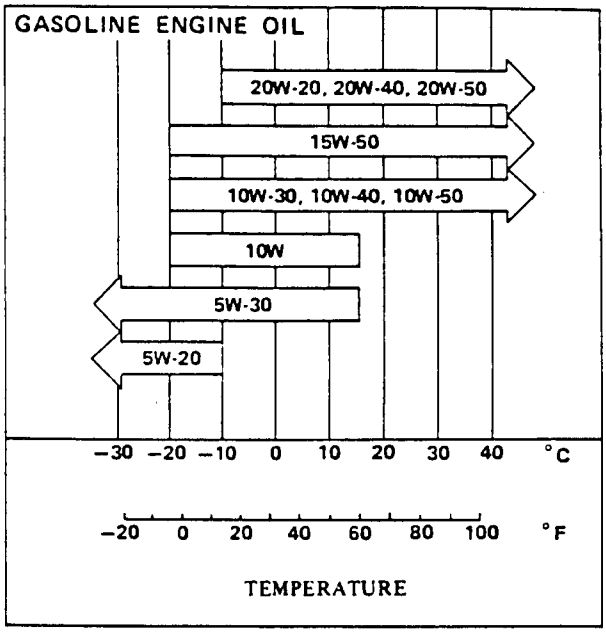
MAINTENANCE SCHEDULE

MAINTENANCE OPERATION		MAINTENANCE INTERVAL											
Periodic maintenance should be performed after specified intervals have elapsed in month or hours, whichever comes first.	Months	1	2	3	4	5	6	7	8	9	10	11	12
	Hundreds of hours	2	4	6	8	10	12	14	16	18	20	22	24
Retighten cylinder head bolts, manifolds & exhaust tube nuts & carburetor attaching nuts		X											
Adjust intake & exhaust valve clearance		X		X			X			X			X
Check drive belts for cracks, fraying, wear and tension		X	X	X	X	X	X	X	X	X	X	X	X
Change engine oil	(1)	X	X	X	X	X	X	X	X	X	X	X	X
Replace engine oil filter	(1)	X		X			X			X			X
Change engine anti-freeze coolant (L.L.C., Ethylene glycol base)													X
Change engine coolant (Soft water)													X
Clean radiator outside	(2)												
Check cooling system hoses & connections	(2)												
Clean or replace fuel strainer element	(2)												
Check or replace fuel strainer	(2)												
Check fuel lines (Hoses, piping, connections, etc.)	(2)												
Clean & replace air cleaner element (Dry paper type)	(1) Clean	X	X	X	X	X		X	X	X	X	X	
	(1) Replace						X						X
Check crankcase ventilation hose													X
Check & replace spark plugs	Check	X	X	X	X	X	X	X	X	X	X	X	
	Replace												X
Check distributor point, cap and rotor		X	X	X	X	X	X	X	X	X	X	X	X
Check ignition wiring													X
Adjust ignition timing		X	X	X	X	X	X	X	X	X	X	X	X
Adjust engine idle rpm		X	X	X	X	X	X	X	X	X	X	X	X

NOTE: (1) Under dusty or other dirty operating conditions, more frequent maintenance should be necessary.
(2) Follow the original equipment manufacturer's (O.E.M.) instructions.

Check: Check, correct and replace if necessary.

SAE VISCOSITY NUMBER



RECOMMENDED LUBRICANTS

LUBRICANTS

Lubricant	Specifications	Remarks
Gasoline engine oil	API SD or SE	For further details, refer to the recommended SAE viscosity chart.
Anti-freeze	–	Ethylene glycol base

INSPECTION AND ADJUSTMENT

Valve clearance (Hot)	in	
Intake		0.014
Exhaust		0.014
Drive belt deflection	in	(0.31 - 0.47)
Applied pushing force		22
Engine oil capacity	US qt,	
With oil filter		3-3/8
Without oil filter		2-7/8
Engine compression pressure	psi /rpm	
Standard		181 /350
Minimum		142 /350
Spark plug		
Type		L47PW B4ES
Gap	in	0.031 - 0.035
Distributor		
Point gap	in	0.018 - 0.022
Dwell angle	degree	49° - 55°
High tension cable resistance	Ω	Less than 30,000
Ignition timing/idle speed		A15 10° B.T.D.C./650 rpm
Maximum engine speed under no-load		Less than 3,450 rpm
Continuous rated engine speed		2,800 rpm

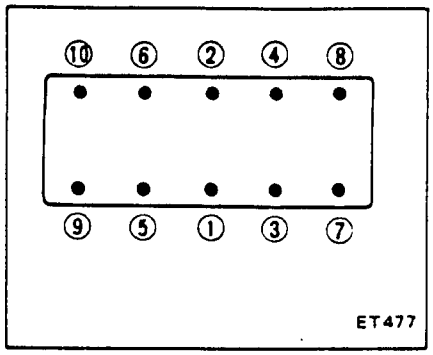
TIGHTENING TORQUE

Unit	ft-lb
Cylinder head bolt	51 - 54
Rocker shaft bracket bolt	14 - 18
Main bearing cap bolt	36 - 43
Flywheel fixing bolt	58 - 65
Connecting rod cap nut	23 - 27
Camshaft sprocket bolt	29 - 35
Locating plate bolt	3.6 - 5.8
Valve rocker adjusting nut	12 - 16
Oil strainer bolt	6.5 - 10.1
Oil pan bolt	2.9 - 4.3
Oil pan drain plug	14 - 22
Timing chain cover bolt	3.6 - 5.1
Crank pulley bolt	108 - 145
Water pump bolt	6.5 - 10.1
Fuel pump nut	6.5 - 10.1
Spark plug	11 - 14

ENGINE MAINTENANCE

RETIGHTENING CYLINDER HEAD

1. Warm up engine sufficiently.
2. Tightening should be made in the sequence shown.



51-54 ft.-(lb)

RETIGHTENING MANIFOLD CARBURETOR AND EXHAUST TUBE

Intake and exhaust manifold bolts and nuts, and carburetor nuts should be retightening to prevent air and/or exhaust gas leakage.

MANIFOLD NUT AND BOLT

6.5 - 10ft-lb.

EXHAUST TUBE NUT

14 - 19 ft.lb

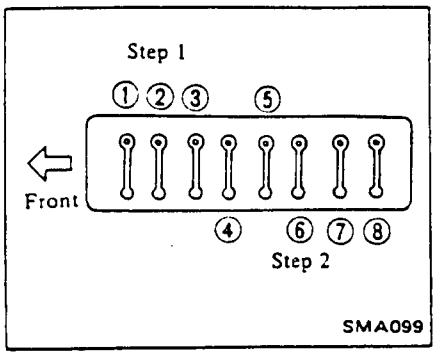
ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCE

Adjustment will be made while engine is warm but not running.

1. Start engine and warm it up until water temperature indicator points to middle of gauge. Then turn off engine.
2. Remove valve rocker cover.

3. Rotate crankshaft.

(1) Set No. 1 cylinder in top dead center on its compression stroke, and adjust valve clearances 1,2,3, and 5.
(2) Set No. 4 cylinder in top dead center on its compression stroke and adjust valve clearances 4,6, 7 and 8.



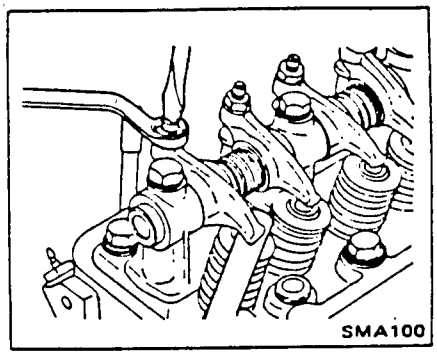
VALVE CLEARANCE (HOT):
INTAKE AND EXHAUST 0.014 IN.

If necessary adjust as follows: Loosen valve rocker adjusting screw lock nut and turn adjusting screw until specified clearance is obtained.

AFTER ADJUSTMENT, TIGHTEN LOCK NUT AND RECHECK CLEARANCE.

ADJUSTING SCREW LOCK NUT.

12 - 16 ft-lb

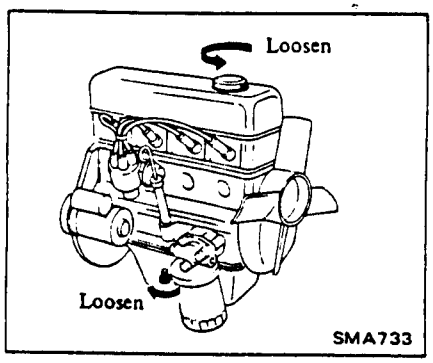


ENGINE MAINTENANCE

CHANGING ENGINE OIL AND REPLACING OIL FILTER.

1. Start engine and warm it up until water temperature indicator points to middle of gauge, then turn off engine.
2. Remove oil filler cap and oil pan drain plug, and allow oil to drain.

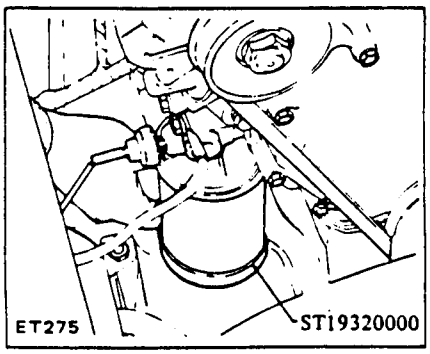
WARNING:
Use care as the engine oil is hot.



* **A MILKY OIL INDICATES THE PRESENCE OF COOLING WATER. ISOLATE THE CAUSE AND TAKE CORRECTIVE MEASURE.**

* **AN OIL WITH EXTREMELY LOW VISCOSITY INDICATES DILUTION WITH GASOLINE.**

3. Using oil filter wrench, remove oil filter.



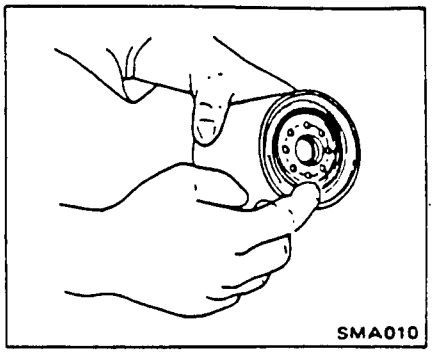
4. After draining engine oil, wipe oil pan drain hole with a clean rag.

5. Clean and install oil pan drain plug with washer.

Oil pan drain plug
14-22 ft-lb

6. Wipe oil filter mounting surface with a clean rag.

7. Smear a little engine oil on seal of new oil filter.



8. Install new oil filter by hand.

SCREW IN OIL FILTER UNTIL A SLIGHT RESISTANCE IS FELT, THEN TIGHTEN AN ADDITIONAL 2/3 BY HAND.

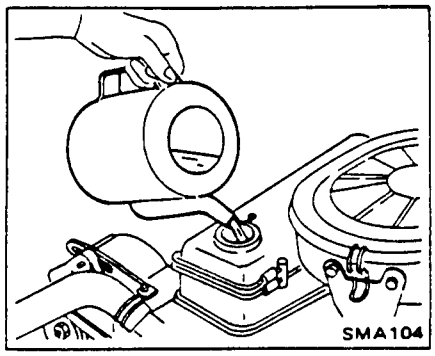
9. Refill engine with the appropriate new engine oil by referring to-
RECOMMENDED LUBRICANTS.

Check the oil level with dipstick.

OIL CAPACITY:

3.3/8 U.S. qt.
WITH OIL FILTER.

3-3/8 U.S. qt.
WITHOUT OIL FILTER.



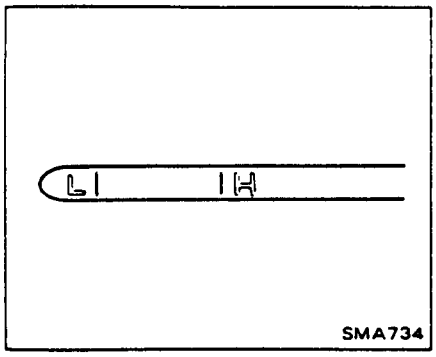
2-7/8 US qt.

ENGINE MAINTENANCE

10. Install oil filler cap and start engine.
11. Check area around drain plug and oil filter for any sign of oil leakage. If leakage is evident, retighten or replace.

12. Run engine until water temperature indicator points to middle of gauge. Then turn off engine and wait several minutes. Check oil level with dipstickk If necessary, add engine oil.

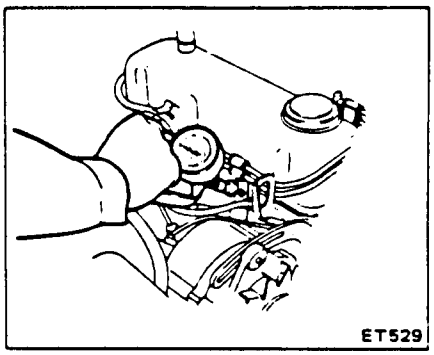
When checking oil level park on a level surface.



CHECKING ENGINE COMPRESSION PRESSURE

1. Warm up engine until water temperature indicator points to middle of gauge.
2. Remove all spark plugs.
3. Disconnect anti-dieseling solenoid valve connector.

4. Properly attach a compression tester to spark plug hole in cylinder being tested.



5. Depress accelerator to fully open throttle and choke valve.
6. Crank engine and read gauge indication.

* Run engine at about 350 RPM
* Engine compression measurement should be made as quickly as possible.

COMPRESSION PRESSURE:

	PSI/at RPM
NORMAL	181/350
MINIMUM	142/350

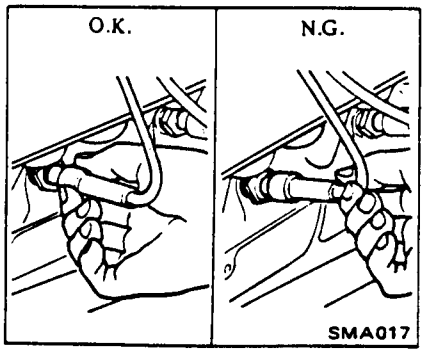
7. If cylinder compression in one or more cylinders is low, pour a small amountof engine oil into cylinders through the spark plug holes and retest compression.

* If adding oilhelps the compression pressure, chances are that piston rings are worn or damaged.
* If pressure stays low, valve may be sticking or seating improperly.
* If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage past the gasketed surface.

Oil and water in combustion chambers can result from this problem.

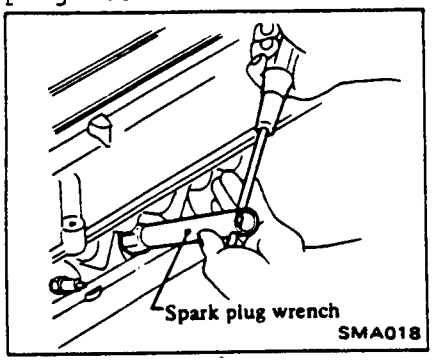
CHECKING AND REPLACING THE SPARK PLUGS

1. Disconnect spark plug wire at boot Do not pull on the wires.



ENGINE MAINTENANCE

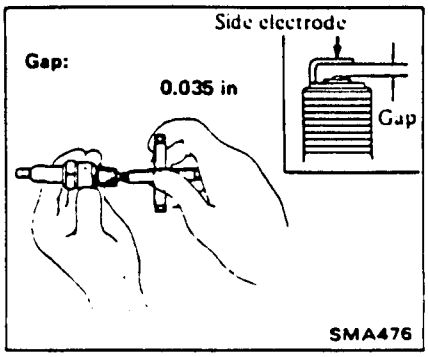
2. Remove spark plugs with spark plug wrench.



And inspect insulation for cracks or chips. If they are excessively worn, replace with new spark plugs.

4. Using feeler gauge, check spark plug gap.

If it is not within specified range, set gap by setting side electrode.



SPARK PLUG:
STANDARD TYPE B4ES

5. Install spark plugs. Reconnect high tension cables according to Nos. indicated on them.

SPARK PLUG

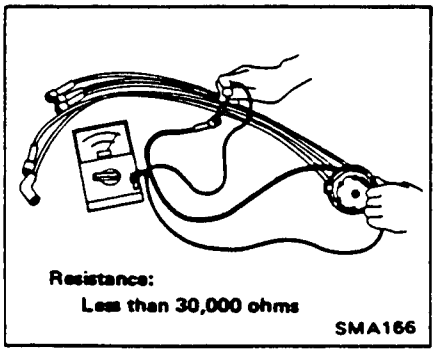
11-14 ft-lb

CHECKING IGNITION WIRING

1. Visually check wiring for cracks, and damaged and burned terminals.

2. Using ohmmeter, measure the resistance between cable terminal on the spark plug side and corresponding electrode inside cap.

SHAKE THE WIRE WHILE MEASURING RESISTANCE TO CHECK FOR INTERMITTENT BREAKS



CHECKING AND REPLACING DISTRIBUTOR BREAKER POINTS

Visual Check

1. Inspect points for excessive burning or pitting. Replace points if necessary.
2. Use a point file to clean contact area and remove scale from points. Filing is done for cleaning purposes only.

DO NOT ATTEMP TO REMOVE ALL ROUGHNESS.

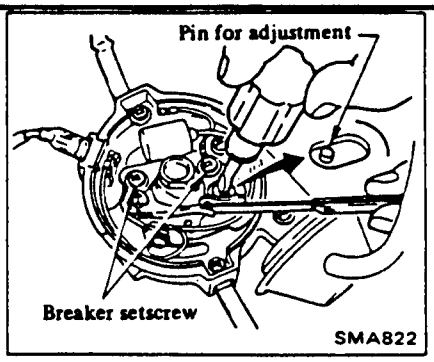
CHECKING POINT GAP

Check point gap with a feeler gauge. If necessary, adjust gap.

1. Loosen breaker point plate set-screw.

2. Move breaker point plate by pivoting it around projected pin so that contact point gap can be adjusted to the specified value.

DISTRIBUTOR POINT GAP:
0.018-0.022 in

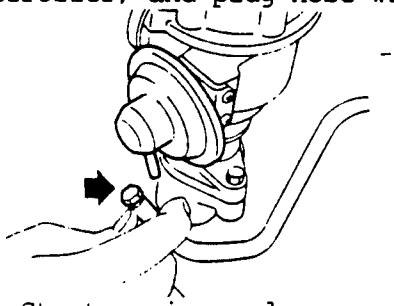


ENGINE MAINTENANCE

3. Tighten plate setscrew.

CHECKING DWELL ANGLE

1. Connect dwell meter.
2. Disconnect distributor vacuum controller, and plug hose with proper plug.

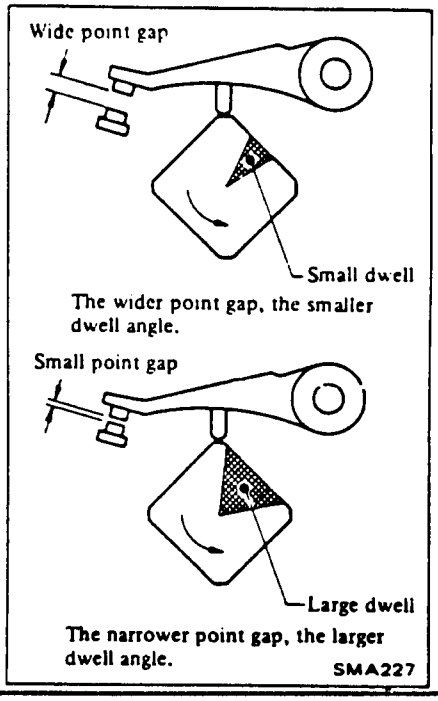


3. Start engine and warm up engine until water temperature indicator points to the middle of gauge.
4. Run engine at idle speed and measure dwell angle.

DWELL ANGLE:

49° - 55°

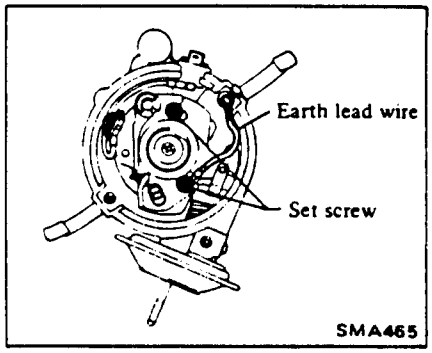
5. If dwell angle is not within the specified value turn off engine and adjust point gap.



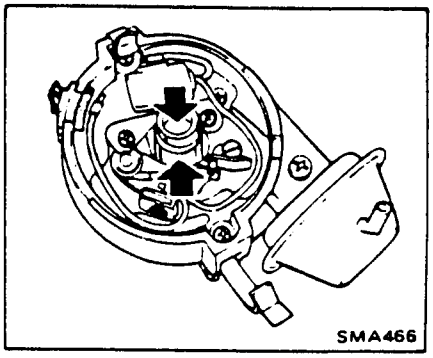
6. Recheck dwell angle.
7. Repeat this procedure until specified point gap and dwell angle are obtained. If dwell angle is not within the specified valve when point gap is correct, cam lobe is worn, replace cam.

REPLACING THE DISTRIBUTOR BREAKER POINT

1. Remove ground lead wire and set screws and then remove breaker point.



2. Install new breaker point. apply greased to distributor cam and head.



3. Check point gap and dwell angle. If necessary, adjust it.

THIS CHAPTER HAS BEEN PROVIDED TO KEEP **MARK INDUSTRIES** SERVICE BULLETINS THAT APPLY TO THE IMPROVEMENT OF YOUR **MARKLIFT.**